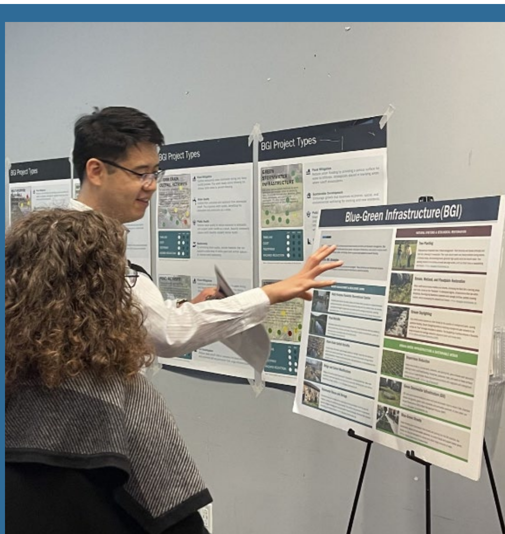
REGIONAL BLUE-GREEN INFRASTRUCTURE COMMUNITY ENGAGEMENT AND PLANNING STUDY (RBGI CEPP)

June 2025



Metropolitan Washington
Council of Governments

REGIONAL BLUE-GREEN INFRASTRUCTURE COMMUNITY ENGAGEMENT AND PLANNING STUDY

Prepared by the Metropolitan Washington Council of Governments, with financial support from the District of Columbia Homeland Security and Emergency Management Agency (HSEMA). The content reflects the views of the Metropolitan Washington Council of Governments and does not necessarily reflect the views of the HSEMA.
Adopted on June 30, 2025

ABOUT COG

The Metropolitan Washington Council of Governments (COG) is an independent, nonprofit association that brings area leaders together to address major regional issues in the District of Columbia, suburban Maryland, and Northern Virginia. COG's membership is comprised of 300 elected officials from local governments, the Maryland and Virginia state legislatures, and U.S. Congress.

COVER PHOTO CREDIT

CHPlanning

PROJECT TEAM

COG: Steven Bieber, Katherine Dyer, Heidi Bonnaffon, Sushanth Gupta
HSEMA: Kenya Troutman
ICF: Adam Parris, Amanda Vargo, Jasmyn Noel, Alex Milan
Straughan Environmental: Joe Arrowsmith, Larry Trout
CHPlanning: Charnelle Hicks, Richa Vuppuluri, Erin Jones, Leila Bahrami, Elisabetta Bieshline

ACKNOWLEDGEMENTS

This study was conducted by ICF and its subcontractors Straughan Environmental and CHPlanning under contract with COG, with financial support from HSEMA. The project stakeholder advisory group members below also provided continuous oversight:

Steven Bieber, COG
Katie Dyer, COG
Heidi Bonnaffon, COG
Phong Trieu, COG
Aubin Maynard, COG
Kenya Troutman, HSEMA
Lily Cheng, D.C. Department of Energy and Environment (DOEE)
Jackie Zidar, DOEE
Josh Burch, DOEE
Nick Bonard, DOEE
Erin Garnaas, DOEE
Adam Baron, D.C. Water
Lilantha Tennekoon, Prince George's County
Carole A. Barth, Prince George's County
Mary Abe, Prince George's County
Dawn Nixon, Prince George's County

ACCOMMODATIONS POLICY
Alternative formats of this document are available upon request. Visit www.mwcog.org/accommodations or call (202) 962-3300 or (202) 962-3213 (TDD).

TITLE VI NONDISCRIMINATION POLICY
The Metropolitan Washington Council of Governments (COG) operates its programs without regard to race, color, and national origin and fully complies with Title VI of the Civil Rights Act of 1964 and related statutes and regulations prohibiting discrimination in all programs and activities. For more information, to file a Title VI related complaint, or to obtain information in another language, visit www.mwcog.org/nondiscrimination or call (202) 962-3300.

El Consejo de Gobiernos del Área Metropolitana de Washington (COG) opera sus programas sin tener en cuenta la raza, el color, y el origen nacional y cumple con el Título VI de la Ley de Derechos Civiles de 1964 y los estatutos y reglamentos relacionados que prohíben la discriminación en todos los programas y actividades. Para más información, presentar una queja relacionada con el Título VI, u obtener información en otro idioma, visite www.mwcog.org/nondiscrimination o llame al (202) 962-3300.

TABLE OF CONTENTS

STAKEHOLDER ADVISORY GROUP AND COMMUNITY PARTNERS

COG would like to thank the Stakeholder Advisory Group (SAG) and community partners for their time and thoughtful input throughout this study.

The following SAG members provided continuous feedback on project direction, draft materials, and the overall vision and use case for this work:

- **Steven Bieber**, COG
- **Katie Dyer**, COG
- **Heidi Bonnaffon**, COG
- **Phong Trieu**, COG
- **Aubin Maynard**, COG
- **Kenya Troutman**, HSEMA
- **Lily Cheng**, DOEE
- **Jackie Zidar**, DOEE
- **Josh Burch**, DOEE
- **Nick Bonard**, DOEE
- **Erin Garnaas**, DOEE
- **Adam Baron**, D.C. Water
- **Lilantha Tennekoon**, Prince George's County
- **Carole A. Barth**, Prince George's County
- **Mary Abe**, Prince George's County
- **Dawn Nixon**, Prince George's County

The following community partners also provided valuable input through multiple workshop series, community tabling events, and a regional open house:

- Anacostia Parks and Community Collaborative (APACC)
- Anacostia Riverkeeper
- Anacostia Watershed Community Advisory Committee (AWCAC)
- Ancostia Watershed Society
- Capital Nature
- Casey Trees
- Chesapeake Bay Trust
- CHISPA (MD Land Conservation)
- Clean Water Action
- Clean Water Partnership – Prince George's County and Corvias Solutions
- Climate Central
- Constituent Services Worldwide
- DC Greens
- Deanwood Citizens Association
- Defensores de la Cuenca
- Earth Conservation Corps
- Eco Latinos
- Fairmount Heights Green Team
- Faunteroy Community Enrichment Center/ Resilience Hub
- Fort Washington Forward
- Friends of Oxon Run
- Friends of Quincy Run Watershed
- Friends of Sligo Creek
- Interfaith Partners for the Chesapeake
- Joes Movement Emporium
- Low Impact Development Center, Inc.
- Mount Rainier Nature Center
- Mount Rainier Green Team
- Nature Forward
- Neighborhood Design Center
- Piscataway Conoy Tribe
- Potomac Conservancy
- Potomac Riverkeeper Network
- Prince George's Master Gardeners - DOE & UMD Extension
- Schmidt Outdoor Education Center
- Sierra Club, MD Chapter
- Sierra Club, Prince George's County Group
- Sustainable Maryland
- The Green Scheme
- Ward 7 Resilience Hub Community Coalition
- Ward 8 Woods Conservatory
- Washington Parks and People

KEY TERMS

Blue-Green Infrastructure	Blue-Green Infrastructure (BGI) combines nature-based solutions for managing stormwater and flood risk. “Blue” elements, such as streams, rivers, and ponds, manage water above ground, while “green” infrastructure relies on vegetation and soils to capture, infiltrate, and filter runoff. In contrast to traditional “gray” infrastructure—such as pipes, drains, and underground storage—BGI seeks to work with natural systems to enhance resilience, improve water quality, and provide co-benefits to communities.
Blue-Green Infrastructure Project	Specific interventions to reduce flood risk, including small-scale (e.g., <1 acre bioswales, rain barrels, green roofs, tree plantings, etc.), and large scale (e.g., >1 acre flood restoration, flood protection, daylighting, setbacks, relocation, etc.).
Community Resilience	Communities can withstand, recover, and learn from past cumulative or compounding floods to strengthen future response and recovery efforts. Community resilience can include, but is not limited to, physical and psychological health of the population, social and economic equity and community well-being, effective risk communication, integration of organizations (governmental and nongovernmental) in planning, response, and recovery,
Framework	Overall model for engagement, analysis, prioritization, and plan development.
Focus Areas	Clearly defined subwatersheds within the three study watersheds: Arundel Canal, Watts Branch, and Oxon Run.
Watershed	Three watersheds, defined by the flow of water, are included in this study: Arundel Canal, Watts Branch Watershed, and Oxon Run Watershed.

TABLES

FIGURES

EXECUTIVE SUMMARY

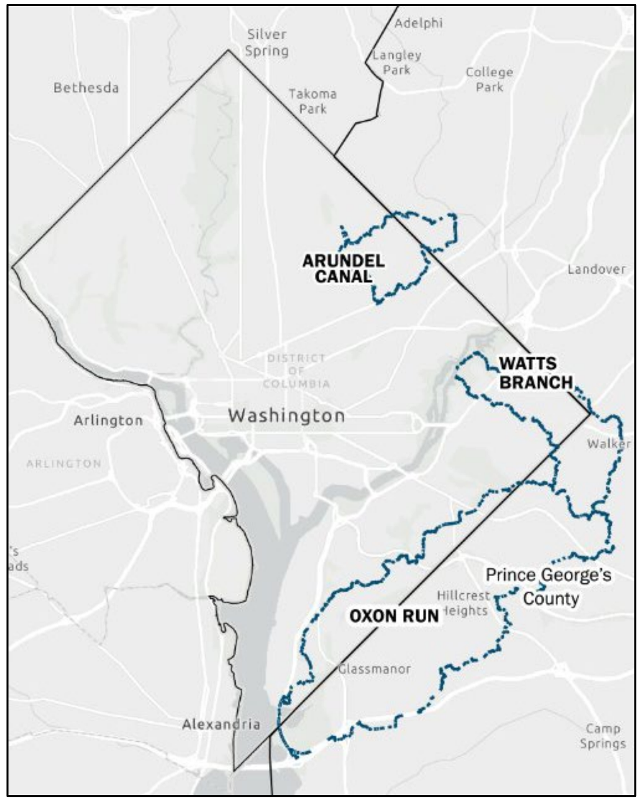


Figure 1: Arundel Canal, Watts Branch, and Oxon Run watersheds.

The Regional Blue-Green Infrastructure Community Engagement and Planning Study was conducted by the Metropolitan Washington Council of Governments (COG) to address flood concerns across jurisdictional boundaries in the District of Columbia (D.C.) and Prince George's County, Maryland, by identifying Blue-Green Infrastructure (BGI) solutions. The study focuses on three watersheds: Arundel Canal, Watts Branch, and Oxon Run (Figure 1), which include traditionally disadvantaged communities in flood-prone areas. The study used community engagement and flood analyses to identify BGI projects that can assist in the mitigation of flood impacts. By integrating community feedback, leveraging data-driven analysis, and prioritizing strategic interventions, **this study lays the groundwork for a resilient and sustainable approach to flood management. Further community engagement and design planning is needed to refine and implement BGI concepts necessary for funding opportunities.** The framework developed through the study can assist in mitigating flood risks while enhancing the quality of life for residents, promoting environmental justice, and fostering a stronger, more connected community.

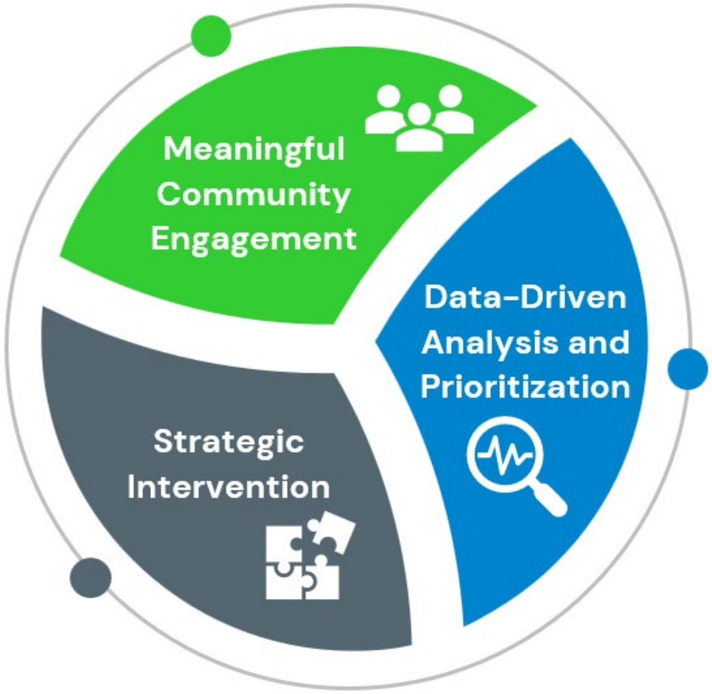
Regional Collaboration

This study was grounded in the idea that water knows no boundaries. This study employs a regional watershed approach to foster flood resilience, particularly where projects in one location benefit the entire watershed. The three watersheds are particularly unique and challenging given that each crosses the jurisdictional boundary between the District and Prince George's County.

What sets this study apart is its ability to plan at the watershed-level and identify projects that will benefit both jurisdictions. Projects located in upstream neighborhoods provide co-benefits to those communities, while reducing flood risk for downstream neighborhoods, fostering collaborative investment and benefits across jurisdictional boundaries. This regional approach solves challenges that often originate upstream or outside a given agency's control.

A watershed-based, regional approach considers the entire watershed or floodplain to address both upstream and downstream impacts and foster investment and collaboration across jurisdictional boundaries.

This innovative study and its supporting materials provide a **scalable, flexible, and technically grounded roadmap for implementing BGI** in other watersheds facing similar challenges. The key components of this study are summarized below:



Meaningful Community Engagement
Workshops, tabling events, and virtual meetings were conducted to gather input from residents, community-based organizations (CBOs), and local stakeholders. This feedback was instrumental in shaping the BGI strategies and ensuring they align with community needs and priorities.

Data-Driven Analysis and Prioritization
Regional and local datasets were used to identify and prioritize BGI projects based on their impact and other key factors. A prioritization framework was ultimately created to support transparent, equitable, and actionable flood resilience planning across the study area and other watersheds.

Strategic Intervention
The study focused on BGI projects that provide the greatest benefit to the watershed and are aligned with broader regional goals. This involved selecting sites that offer the highest potential for flood mitigation, ecological restoration, and community co-benefits.

Key Findings and Recommendations

1. Design Engagement for Flexibility and Fit

- **Engage Community-Based Organizations (CBOs) Throughout:** Initiate collaborations with CBOs early and maintain continuous engagement at every step.
- **Adapt Strategies:** Tailor engagement methods to fit the unique needs and capacities of local stakeholders, including municipal agencies, community-based organizations (CBOs), and residents.
- **Build Trust:** Maintain transparency, acknowledge prior engagement, adapt based on community readiness, and lay the groundwork for continued engagement beyond the project's funding period.

2. Centering Watersheds as the Scale of Analysis

- **Create Project Focus Areas:** Divide watersheds into smaller focus areas to facilitate targeted implementation strategies aligned with community values and priorities.
- **Use Data-Driven Analysis:** Incorporate regional and local datasets to identify and prioritize BGI projects.
- **Map Existing and Ongoing Projects:** Collect information on parallel projects to support cross-jurisdictional support and avoid duplicating efforts.

3. Develop Fundable Concept Plans

- **Emphasize Community Co-Benefits:** Work with residents and local partners to define appropriate co-benefits through a collaborative, community-led process.
- **Assess Watershed Influence:** Understand how the selected project area functions within the broader watershed to set meaningful objectives.
- **Plan Site Visits:** Verify mapped data, evaluate conditions on the ground, and identify potential opportunities and constraints.
- **Select Specific BGI Practices:** Narrow down the inventory of potential BGI practices to those that are viable, meaningful, and aligned with stakeholder goals.
- **Develop Plan Views:** Create annotated, scaled graphics that show the location, extent, and type of proposed improvements.
- **Estimate Storage Potential and Costs:** Generate preliminary estimates of flood storage potential and implementation cost.

Guide To This Report

The report is divided into five key sections and concludes with recommendations for future efforts and transferable lessons learned.

Flooding in the Region provides an overview of the flooding challenges faced by the District of Columbia and Prince George's County and introduces the three watersheds and their communities.

Meaningful Watershed-based Engagement *describes* our community-driven and adaptive approach to engagement.

Prioritization Within Watersheds summarizes the methodology to describe the process of using data, analysis, and community input to identify and prioritize the type and location of BGI projects within each watershed.

Demonstration Concepts and Recommendations summarizes fundable concepts for BGI projects are and includes a detailed case study on BGI concepts in Watts Branch.

BGI Funding provides an overview of funding sources for BGI, offering recommendations for developing a comprehensive funding strategy that combines multiple sources to maximize financial support.

Several ***supporting appendices*** provide additional details and resources to conduct watershed-based engagement and identify and plan for BGI projects:

Appendix A: Existing and Ongoing Projects
Appendix B: BGI Typical Details, Images, and Sections
Appendix C: BGI Opportunities Mapping
Appendix D: Prioritization Framework
Appendix E: BGI Site Visit Checklists and Templates
Appendix F: Concept Plans for Each Watershed
Appendix G: Watts Branch Case Study
Appendix H: Outreach Toolbox

FLOODING IN THE REGION

Flooding is a common climate hazard in the District and Prince George's County, Maryland. In late summer 2020, heavy rainfall caused flash flooding that damaged homes and overwhelmed wastewater treatment plants, activating emergency response. At least two similar flooding events have occurred in the area since 2020, serving as a reminder that many neighborhoods, including those with high-density public housing, are within elevated flood risk[1] and regulatory flood-hazard zones. D.C. and Prince George's County are proactively responding to combat the impacts of stormwater, riverine, and coastal flooding.

Urban drainage systems in cities and urban areas are designed to manage rainfall runoff, especially where development has created hard surfaces like roads and buildings that prevent water from naturally infiltrating the ground. During storms, water flows from one neighborhood to the next through storm drains and streets, often leading to flooding when the system's capacity is exceeded. The combination of heavier rainfall due to climate change and the increased runoff from urbanization significantly raises the flood risk. However, this risk is not evenly distributed.

Flooding impacts some communities more severely than others, largely due to historic planning practices that have resulted in racial and economic disparities. The region is proactively undertaking flood resilience efforts with these considerations. Tools including the District Department of Energy and Environment's (DOEE) Resilience Focus Area Strategy, COG's Equity Emphasis Areas, and the Maryland Department of Environment's (MDE) Environmental Justice Screening Tool are instrumental in identifying areas in need. Moreover, D.C. and Prince George's County are actively involving community leaders and CBOs, to support strong community-to-community relationships and cleaner environments for residents.

BGI not only helps reduce flooding but also provides additional benefits like improved air quality and recreational spaces. BGI helps capture and store runoff where it starts, directing it away from homes and other infrastructure. As a longstanding partner to D.C., Maryland, and the region, COG worked with the D.C. Homeland Security and Emergency Management Agency (HSEMA), DOEE, and Prince George's County to obtain funding for the **Regional Blue-Green Infrastructure Community Engagement and Planning Study** to advance community-driven, adaptive, and environmentally-friendly flood resilience efforts.

BGI is the combination of 'blue' water-related functions with 'green' nature-based solutions such as vegetation and parks. This flooding resilience strategy addresses critical urban challenges including flooding and climate change by leveraging natural solutions, enhancing urban biodiversity, improving air quality, and creating recreational spaces that make cities healthier and more resilient.

D.C. and Maryland recognize that the root causes of flooding span multiple neighborhoods crossing jurisdictional boundaries. Consequently, COG, HSEMA, DOEE, and Prince George's County formed a Stakeholder Advisory Group (SAG) including multiple public agencies and planning bodies from both D.C. and Maryland. The SAG played a crucial role in this initiative, bringing together representatives

[1] *In this report, "flood risk" refers to areas with documented or modeled flood hazard—such as FEMA Special Flood Hazard Areas (SFHAs), Blue Spot analysis, or HEC-based flood modeling. This usage is consistent with FEMA and regional planning conventions. It does not imply a full actuarial risk assessment that includes asset vulnerability or damage probability.*

from various jurisdictions to collaborate on flood risk management, helping to ensure actionable outcomes for communities.

The purpose of the study is to engage traditionally disadvantaged communities in flood-prone areas to identify BGI projects that can assist in the mitigation of flood impacts. Expected outcomes include the development of a regional framework to reduce flood risk, enhance stormwater management capabilities, and increase recreational green spaces. This framework will be designed to be replicable throughout metropolitan Washington. Communities along the jurisdictional line that are most impacted by flooding—yet often left out of planning—were at the core of the conversation. Through community-driven efforts, the project seeks to ensure that the voices of these communities are heard, and that actionable, equitable solutions are implemented.

The Watersheds

The study focused on three watersheds that cross the jurisdictional boundary between D.C. and Prince George's County (Figure 2): Arundel Canal, Watts Branch, and Oxon Run.

These watersheds are a part of D.C.'s Resilience Focus Area Strategy and COG's Equity Emphasis Areas and rank high in MDE's Environmental Justice Screening Tool. They include historically underserved communities—spanning Wards 5, 7, and 8 in D.C. and Councilman Districts 2 and 7 in Prince George's County, MD. The neighborhoods in these areas face persistent flood risk, infrastructure gaps, and environmental burdens. Most of the residents in the project areas identify as Black or African American (on average 50%-92% of total population by watershed).[2] This reflects a rich, multi-generational history of African American communities in Prince George County and Wards 7 and 8, which have been historically marginalized through practices such as racially restrictive housing covenants and urban renewal programs. Centering these watersheds allowed the project to prioritize equity and community-centered experience in shaping BGI.

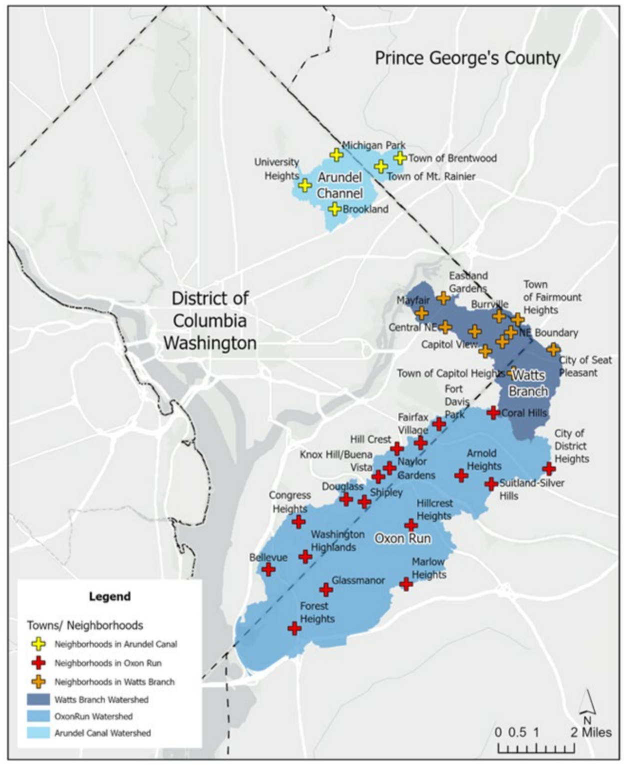


Figure 2: Map of neighborhoods in the study area's three watersheds.

ARUNDEL CANAL

Arundel Canal is a tributary of the Northwest Branch of the Anacostia River, located within central Ward 5 in D.C., and northeast Prince George's County. Neighborhoods in this watershed include University Heights, Brookland and Michigan Park in D.C. and Brentwood, and Mount Ranier in Prince

---

[2] United States Census Bureau. (n.d.). 2020 Census Demographic Data Map Viewer. Retrieved from https://maps.geo.census.gov/ddmv/map.html.

George's County. The watershed features a mix of residential, commercial, and industrial areas, contributing to varied sources of pollution and runoff. The northwest portion of the watershed is within the FEMA Special Flood Hazard Areas with 1% and 0.2% annual chances of recurrence. Many of these areas are listed as protected by levees along the Northwest Branch of the Anacostia River but still suffer flood risk from interior drainage challenges.

WATTS BRANCH

The Watts Branch watershed spans the northeast corner of Ward 7 in D.C. and east Prince George's County, draining into the Anacostia River. The area includes several large historically overburdened communities including Grant Park, Capitol View, Lincoln Heights, Eastland Gardens in D.C. and Fairmount Heights, Capitol Heights, and Seat Pleasant in Prince George's County. Areas along the Watts Branch are located within the FEMA Special Flood Hazard Area with a 1% annual chance of recurrence. Additionally, there is concern for more frequent stormwater or surface flooding outside the regulatory floodplain due to short duration, intense rainfall events. The DOEE Resilience Focus Area Strategy identified the area along Watts Branch as the 2nd highest priority within the District due to severe flood risk, high concentration of vulnerable populations, and a high number of community assets.[3]

OXON RUN

The Oxon Run watershed spans the southeast corner of Ward 7 and Ward 8 in D.C. and east Prince George's County and drains into the Potomac River. The area includes Oxon Run Park and several large, historically overburdened communities such as Congress Heights, Bellevue, and Washington Highlands in D.C. and Hillcrest Heights, Suitland-Silver Hills, Forest Heights, District Heights in Prince George's County. While the flood risk in this area is primarily riverine, the watershed also experiences significant stormwater flooding due to urbanization and inadequate drainage infrastructure. The DOEE Resilience Focus Area Strategy identified the area along Oxon Run as the 3rd highest priority within the District due to the high concentration of vulnerable populations and high number of assets serving them.[4]

This report summarizes the two central elements of the BGI Planning Study – **meaningful community engagement** within and across the three watersheds, and **evidence-driven BGI project development.**

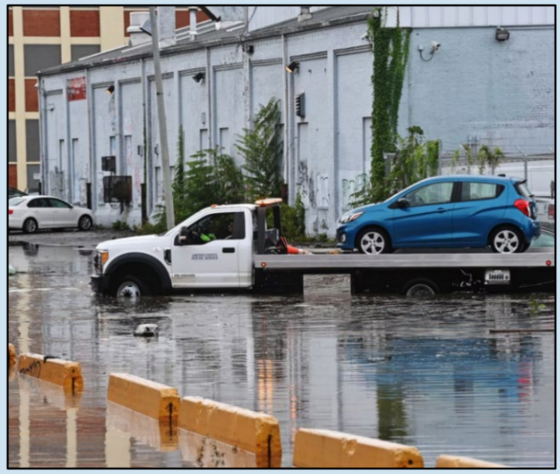
---

[3] DC Department of Energy and Environment. (2023). Resilience Focus Area Strategy. Retrieved from https://doee.dc.gov/sites/default/files/dc/sites/doee/service_content/attachments/Resilience%20Focus%20Area%20Strategy_FINAL.pdf.

[4] Ibid.

Recent Flood Events in the Watersheds

In the Arundel Canal area, intense rainfall in 2020 overwhelmed local drainage systems, causing street and basement flooding that remains a defining event for many residents. In Brentwood, chronic interior drainage issues persist in levee-protected neighborhoods, where low-lying areas often have limited outlets for stormwater to escape.[5]



Flash flooding at Rhode Island Avenue NE (Arundel Canal) on Sept. 10, 2020 (Washington Post)

Along Watts Branch, hundreds of homes lie within the 100-year floodplain, and flood risk is expected to grow as urban runoff increases. Due to the watershed's steep slopes and dense development, flood events tend to occur rapidly with little warning—posing acute safety risks for residents. The September 2020 storm demonstrated this vividly, as more than three inches of rain in under two hours caused widespread street and basement flooding, particularly in neighborhoods along Hayes Street and Nannie Helen Burroughs Avenue.[6]

Flash flooding at Clay St. NE (Watts Branch) in 2020. (Washington Post)

In Oxon Run, while recent events are less frequently reported, many homes and community facilities remain within mapped floodplains. The existing concrete channel, constructed by the U.S. Army Corps of Engineers in the 1980s, was intended to reduce flood extent but now limits opportunities for more natural floodplain function. These conditions helped catalyze the ongoing Oxon Run Stream Restoration project[7], which aims to reduce flood risk on both sides of the jurisdictional boundary. Together, these examples demonstrate that while the drivers and frequency of flooding may differ, the risks are tangible—and the solutions must be responsive to each community's specific needs.

---

[5] Charles P. Johnson & Associates. (2025). Flooding and Stormwater Hazard and Risk Management Analysis for the Towns of Brentwood and North Brentwood, Maryland. Retrieved from https://www.pgplanning.org/wp-content/uploads/2025/05/Brentwood-North-Brentwood-Flood-Hazard-Study-Presentation-050125.pdf.

[6] District of Columbia Silver Jackets. (2021). Watts Branch Flood Risk Management Study: Final Report. Washington, DC: U.S. Army Corps of Engineers and DOEE. Retrieved from https://www.dropbox.com/scl/fi/b0sanqutmp9rfhova4bz7/Watts-Branch-FRM-Study-Final-Report_-April-2021.pdf?rlkey=hemiqpvxoemjcdlwdxnpllgam&e=3&dl=0.

[7] D.C. Department of Energy and Environment. (n.d.). Oxon Run Stream Restoration Project. Retrieved from https://doee.dc.gov/service/oxon-run-stream-restoration.

MEANINGFUL WATERSHED-BASED ENGAGEMENT

This study aimed to model an integrated, cross-jurisdictional approach to flood resilience. The engagement approach evolved through intentional phases: starting with building relationships and listening to CBO partners, refining tools and methods for inclusivity and clarity, and culminating in watershed-wide activities designed to educate, gather input, and foster cross-jurisdictional learning. Figure 3 summarizes key engagement touchpoints, described in detail in this section.

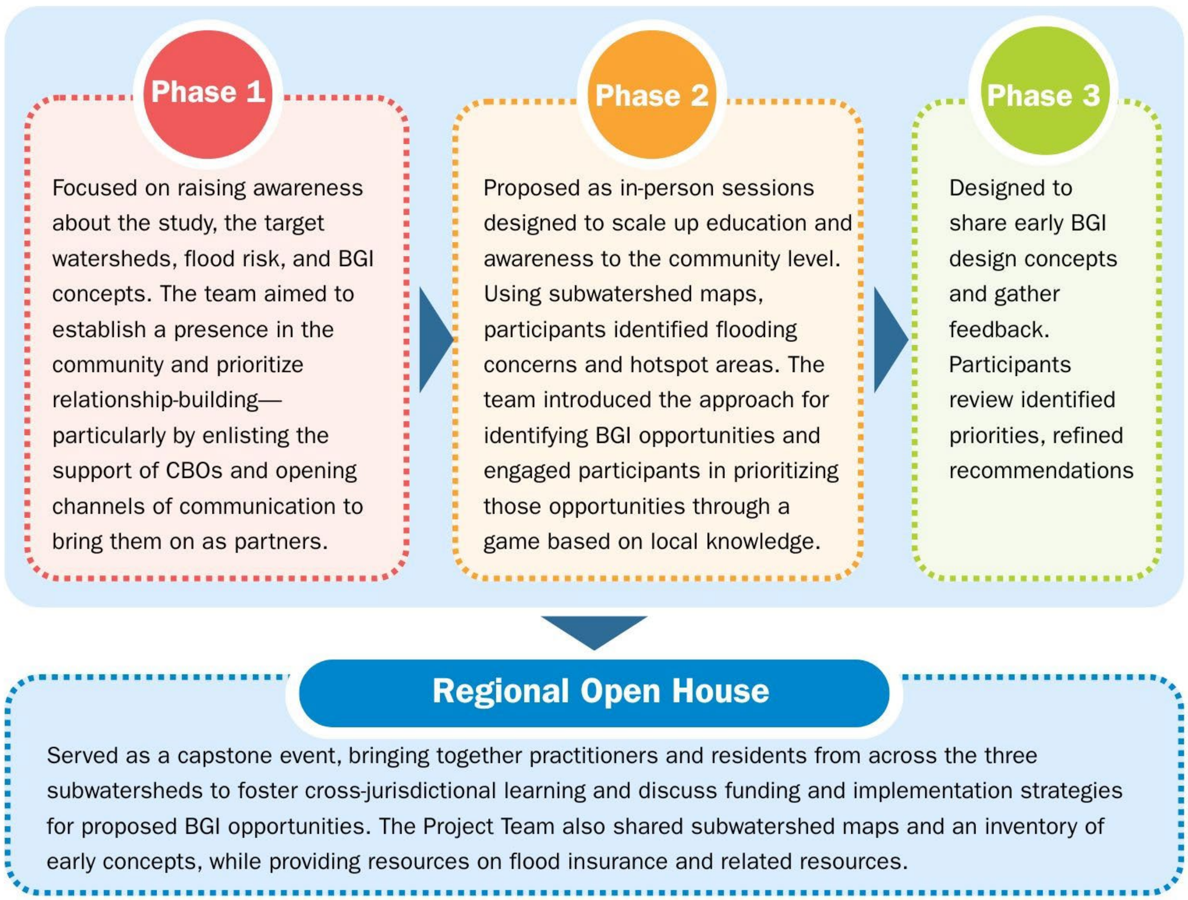


Figure 3: Overview of key engagement touchpoints.

Forming an Engagement Strategy and its Evolution

A Regional BGI Engagement Strategy was designed to address the unique complexities of a cross-jurisdictional, watershed-based study covering the Arundel Canal, Watts Branch, and Oxon Run watersheds. The approach prioritized understanding the distinct needs, capacities, and concerns of local stakeholders—including municipal agencies, community-based organizations (CBOs), and residents. Core principles were flexibility, relationship-building, and meeting stakeholders where they were—in terms of geography, organizational capacity, and in their awareness of flood resilience issues.

To build a representative foundation for engagement, the team conducted stakeholder mapping and concurrent relationship-building. A working list of stakeholders was developed, categorized by jurisdiction, watershed, and level of anticipated BGI participation: **Collaborate, Involve, and Inform** (see Figure 4 for details). This framework can be useful to further clarify the expected roles of partners, from leading or implementing BGI efforts to providing input or helping disseminate information. The SAG helped shape this list, ensuring intentional and comprehensive outreach.

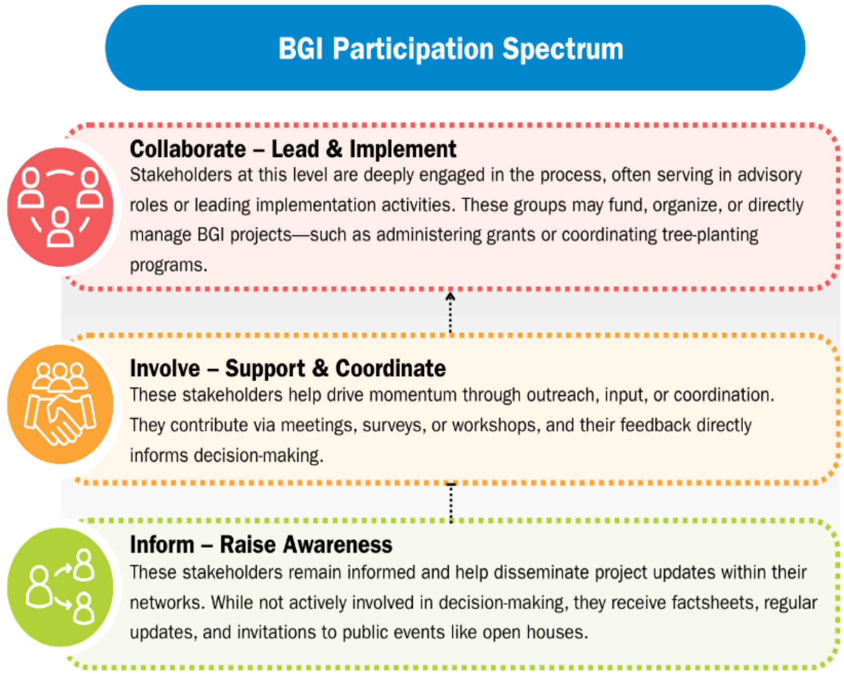


Figure 4: Framework for BGI participation.

One-on-one and small group meetings were held with agency partners, CBOs, and local governments, to introduce the study, identify overlaps with existing resilience initiatives, and shape the outreach approach. Early conversations revealed the need to avoid engagement fatigue (particularly in parts of the District with recent planning efforts), the importance of using clear, consistent terminology, and the critical role of CBO voices in reaching residents.

FORMING RELATIONSHIPS WITH CBOS

CBOs are essential partners in achieving meaningful, equitable engagement. Early relationship building included attending key community events: the **Rise Above Workshop Series**, hosted by Nature Forward in partnership with the **Ward 7 Resilience Hub Community Coalition (W7RHCC)**, **The Green Scheme,** and the **Washington Interfaith Network (WIN).** These events allowed the team to listen, observe community-driven organizing around environmental and flooding issues, and understand priorities from the ground up.

Through these relationships, CBO partners provided insights to identify hyper-local flooding hotspots, reveal co-benefits that matter most to residents (like shade, safety, and walkability), and refine messaging to avoid jargon and build trust. CBOs were viewed as **long-term partners** in stewarding and implementing BGI, not just participants in a planning process.

Practitioners for BGI

CBOs emerged as primary collaborators and part of a broader group of “practitioners” who serve as intermediaries between agencies and residents in various capacities. The broader practitioner group includes local government staff, professional experts (such as planners, engineers, and designers), CBOs, and philanthropic or funding groups - each playing a distinct role from building trust to advancing implementation pathways.

ADAPTING THE MODES OF ENGAGEMENT

The engagement strategy evolved to foster inclusivity, interactivity, and responsiveness to community realities. Adjustments included when and where outreach occurred, how information was shared, what tools were used, and whose perspectives were centered.

To create welcoming, low-barrier spaces for participation, the team introduced:

- Large-scale watershed maps used for place-based input.
- A BGI prioritization game to help residents evaluate different project types.
- A visually engaging digital BGI booklet that explained key terms and strategies.
- Mural boards used during virtual breakout sessions to facilitate dialogue and gather feedback.
- Awareness dot exercises for educational display boards to encourage informal learning.
- Family-friendly resources like flood-related coloring books that encouraged multigenerational participation.

Language and tone were carefully managed to avoid using technical jargon, use plain speech and offer translated, culturally sensitive materials (e.g., Spanish versions, visuals suitable for varying literacy levels). Flyers, social media copy, factsheets, and event reminders (Figure) were distributed via CBO partners and tailored to jurisdictional context.

Figure 5: Participants interacting with the study map at the Prince George's County 10th Annual Green Summit tabling event on October 19, 2024.

Figure 6: Social media post from the Regional Open House.

Figure 7: Clockwise from top left: BGI Guide, Factsheet, BGI Project Types Resource, BGI Prioritization Board Game.

PHASED APPROACH TO ENGAGEMENT

In response to early input from the SAG and CBOs, a phased, adaptable engagement strategy was designed to reduce duplication, improve relevance, and reach residents more effectively across watersheds and jurisdictions. Each phase was designed to build upon the last, creating a consistent learning arc. The engagement process unfolded in three phases, supported by the Regional Open House as the capstone event:

- **Phase 1 (Fall 2024):** A tabling event and virtual workshop for CBOs across the region to build awareness of the study, gather cross-watershed concerns, and identify shared priorities.
- **Phase 2 (Winter 2025):** A series of three in-person watershed workshops held at community venues in Prince George's County, strategically located near D.C. neighborhoods. Each workshop focused on one watershed, allowing participants to identify local risks, evaluate opportunities, and co-develop BGI design ideas.
- **Phase 3 (Spring 2025):** One virtual workshop covering all three watersheds, along with two tabling events to share refined concepts, validate neighborhood-scale strategies, and support advocacy efforts.
- **Regional Open House (May 2025):** An in-person event held at a central location on the D.C. side, accessible and equidistant for both D.C. and Prince George's County residents. It brought together practitioners and residents from all three watersheds and featured invited panel speakers discussing implementation strategies for proposed BGI opportunities.

The **Regional BGI engagement strategy was never static**—it evolved in real time from direct resident outreach to targeting local champions and CBOs. By listening early and adjusting often, the study created a more inclusive, grounded, actionable and community-responsive watershed-based approach to flood resilience.

Implemented Engagement and Insights

The engagement strategy included a mix of virtual and in-person workshops, an open house, and targeted tabling events. Workshops were used as a central platform to surface local knowledge, build trust, and ensure that CBOs and residents had meaningful opportunities to shape the direction of the study.

To broaden the strategy's reach, the team prioritized tabling at high-visibility community gatherings. These events served a dual purpose: raising awareness about the Regional BGI Planning Study and gathering real-time insights into how residents respond to flood-related messaging and BGI concepts. Each interaction helped test tools, adapt approaches, and strengthen relationships with both residents and CBOs. The team selected formats based on the intended audience and whether the focus was on a specific watershed or the broader region—details of which are outlined in the phases below.

PHASE 1

Phase 1 engagement kicked off with a tabling event followed by a virtual workshop for CBOs across the region.

Tabling Event: Green Summit

The first tabling event was a broad outreach effort held at the Prince George's County 10th Annual Green Summit on October 19, 2024, at David C. Driskell Community Park, MD. It served as the most impactful early touchpoint for both community learning and CBO relationship-building. Over 50 people visited the project table, including residents, councilmembers, and staff from major environmental and resilience organizations. The team met many CBOs who were also present as exhibitors and later participated in the study's engagement activities. The team used a regional map that displayed all three watersheds.

Key Takeaways from the Green Summit

- **Broaden BGI Messaging:** Highlight co-benefits like clean air, shade, and water quality to engage residents not unaffected by flooding.
- **Engage Council Members Early:** Involve Council Members at the start to build support and visibility.
- **Bridge Cross-Jurisdiction Gaps:** Strengthen outreach to D.C. residents and find ways to encourage cross-jurisdiction participation.
- **Go Digital:** Use QR codes and online materials—attendees preferred digital access over paper handouts.
- **Prioritize Language Access:** Provide Spanish-language materials to reach more residents and meet community needs.

Virtual Workshop 1

The first watershed-based workshop took place virtually on November 14, 2024, and marked the formal launch of Phase 1 of the community engagement strategy. This virtual session was a critical first step that shifted the study from planning to public-facing implementation, and the feedback gathered helped shape the design of the next workshop series.

OBJECTIVES

- Introduce the study background and planning timeline.
- Explain the goals and co-benefits of BGI.
- Begin surfacing neighborhood-level concerns and priorities within the three watersheds.

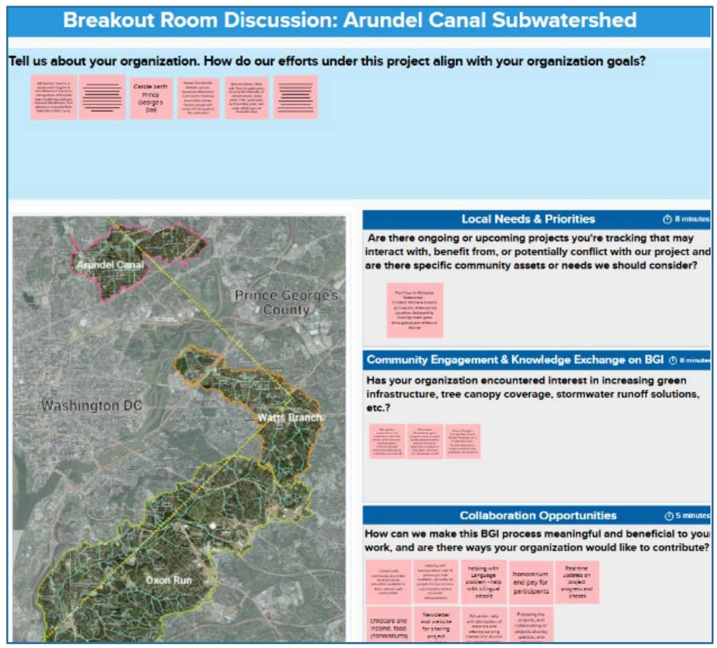


Figure 8: Snapshot of the breakout room Mural board from Virtual Workshop 1.

WORKSHOP FORMAT AND AUDIENCE

The session convened **38 total participants**, including representatives from **17 CBOs.** Participants were divided into **breakout rooms by watershed** (Arundel Canal, Watts Branch, and Oxon Run) allowing for more focused discussion. Interactive tools like Mural allowed participants to reflect on flooding experiences, identify priorities, and surface early ideas for solutions.

Key Takeaways from Virtual Workshop 1

- **Address Barriers to Participation:** Tackle Transportation, language, and funding gaps to support community participation.
- **Work Through Trusted CBOs:** Partner with community organization to build connections and reach residents effectively.
- **Build Trust: Ensure transparency**, follow-through, and clear communication to foster long lasting relationships.
- **Support Residential-Scale BGI initiative**: Expand education and incentives for homeowners and renters unfamiliar with environmental infrastructure.

PHASE 2

Phase 2 included three in-person workshops—one each in Arundel Canal, Watts Branch, and Oxon Run—during March 2025.

Three In-Person Workshops

These workshops marked a shift from broad virtual outreach to more localized, neighborhood-level engagement, offering participants interactive ways to shape flood resilience strategies through BGI. Each workshop followed a consistent format featuring three interactive stations. These activities helped root technical planning in lived experience. Participants voiced concerns about health, displacement, funding, and long-term stewardship—many of which CBOs were already addressing in their advocacy work.

OBJECTIVES

- **Center Lived Experience:** Gather firsthand accounts of flooding from residents to ground technical analyses in real community impacts.
- **Identify Community Priorities:** Engage participants in identifying flood-prone locations, open space opportunities, and BGI co-benefits that matter most in their neighborhoods.
- **Facilitate Hands-On Participation:** Offer interactive tools—like community mapping, small-group discussions, and site-based exercises—to help participants visualize BGI solutions.
- **Build Trust and Momentum:** Reinforce relationships built during the virtual workshop and at pop-up events and continue fostering community ownership over the planning process.

Figure 9: Flyer for Phase 2 watershed workshops.

WORKSHOP FORMAT AND AUDIENCE

Each workshop ran from 6:00–8:00 PM at a local venue and began with a brief presentation and Q&A, followed by interactive breakout stations. Materials, refreshments, and gift card incentives were provided. Attendees included residents, CBO representatives, municipal partners, and local leaders.

Engagement Stations:

- **BGI Education and Project Types:** Introduced BGI concepts and encouraged participants to share their awareness and reactions.
- **Prioritizing Your BGI Projects:** A hands-on game where participants ranked sample interventions based on feasibility and community relevance.
- **Mapping Community Experiences:** Participants marked areas of concern and shared site-specific insights on flooding and environmental challenges.

Each event closed with a summary of next steps, evaluation survey, and gift card distribution in appreciation of participants' time and input.

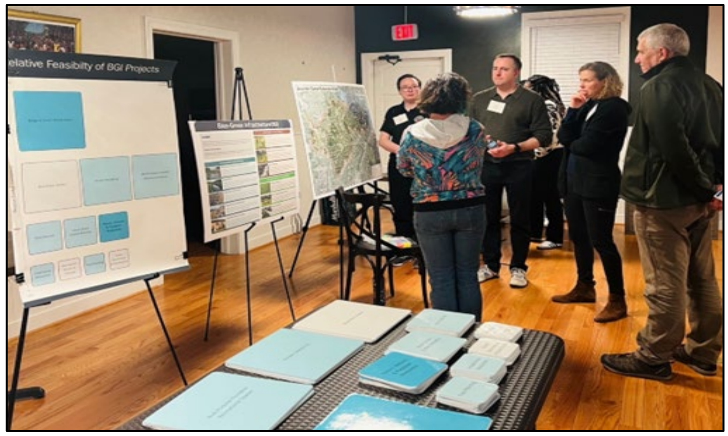


Figure 10: Arundel Canal workshop on March 3, 2025.


Figure 11: Watts Branch workshop on March 4, 2025.

Figure 12: Oxon Run workshop on March 10, 2025.

REFLECTIONS AND ADAPTATION

A total of 15 residents participated across all three workshops. While participant feedback was productive and the educational materials were well-received, the low turnout prompted a reassessment of the engagement approach and format. It became clear that in-person events, especially in early March, lacked a strong enough draw for residents. Colder weather, insufficient lead time, and limited coordinated promotion from project partners—such as through newsletters or email blasts—may have contributed to lower visibility and awareness. Another key insight that reaffirmed the engagement team's understanding was that residents may not be the primary audience for planning-stage input events—at least not in standalone formats. While resident voices are essential to informing the study, the workshops outcome confirmed that the value proposition for attendance was not compelling enough to drive in-person turnout. As a result, Phase 3 shifted focus to meeting residents where they already are. This included tabling at high-foot-traffic community events in April aligned with Earth Month in D.C. and Prince George's County, as well as hosting a consolidated virtual meeting to ensure broader accessibility and participation. These changes reflected a deeper understanding of community rhythms and a strategic pivot toward more embedded, relationship-based outreach.

Key Takeaways from Watershed Workshops in Phase 2

- **Prioritize Flood Solutions:** Residents shared experiences with flooding and expressed strong interest in flood insurance, costs, and property-specific solutions.
- **Use Visual Tools:** Watershed maps and flood photos helped participants connect flooding patterns through their neighborhoods.
- **Community Involvement & Trust-Building:** Flexible engagement formats, such as virtual sessions, evenings and weekend meetings, and partnerships with trusted organization are key to build trust and long-term ownership.
- **Workforce Development & Local Partnerships:** Support job creation by collaborating with local businesses and organizations for long-term BGI care.
- **BGI Design Considerations:** Protect existing green spaces and use local data for context-sensitive BGI planning.
- **Implementation Clarity and Barriers:** CBOs and residents want clarity on project funding, timelines, and implementation challenges like limited public land, or archaeological requirements on federal land.
- **Sustain Partnership:** Long-term collaboration with local groups and agencies is essential for long-term support, shared ownership, and continuity beyond the planning phase.

PHASE 3

The third and final phase of the engagement process included a combination of a virtual workshop and two hyper-local tabling events held in spring 2025. This phase aimed to validate concept designs, gather final community feedback, and continue building momentum toward implementation. These engagements emphasized accessibility, visual tools, and real-time input on the draft priority areas.

Virtual Workshop 2

This workshop on April 10, 2025, brought together 11 participants, including CBO representatives and engaged community members from across the three watersheds. The session included a recap of the project's goals, concept area overviews, and breakout discussions organized by watershed.

Figure 13: Snapshot of flyer from the April virtual workshop.

Key Takeaways from Virtual Workshop 2

- **Arundel Canal:** Emphasized the importance of faith-based outreach, green teams, and tree programs; discussed strategic flood diversion and emergency route planning.
- **Watts Branch:** Advocated building on momentum from Marvin Gaye Park restoration; flagged issues like water contamination and gray infrastructure limitations; stressed the need for maintenance accountability.
- **Oxon Run:** Highlighted downstream impact awareness; mixed opinions on permeable materials and tree planting; called for plain-language outreach and green job programs; connected flood resilience to public health and environmental justice.

Participants supported the need for demonstration projects, clearer communication, and continued coordination between D.C. and Prince George's County.

Tabling Events

Two neighborhood tabling events offered informal, low-pressure opportunities to engage with a broader cross-section of residents, many of whom may not attend traditional planning workshops. The team used more localized, watershed-specific maps to highlight areas of focus and gather place-based feedback from residents. These intentionally selected as hyper-local opportunities aligned with Earth Day celebrations in neighborhoods within the study's watershed areas:

- **Mount Rainier Nature Day on April 12, 2025,** focused on communities in and around the Arundel Canal watershed. This event offered a more relaxed, family-friendly setting where residents engaged at their own pace. Over the course of the event, approximately 35–40 individuals visited the table, with around 25 participants engaging in more detailed conversations about flooding, environmental priorities, and how they could be involved in future study activities. The tabling team focused on **storytelling and conversation,** using visuals and simple language to draw in passersby.

Figure 14: Mount Rainier Community Day, April 12, 2025, attendee (left) and BGI project table with engagement team (right).

- **Seat Pleasant Day on May 3, 2025,** at Goodwin Park targeted upstream communities within the Watts Branch and Oxon Run watersheds, particularly in and around the City of Seat Pleasant. As a high-energy, festival-style event, Seat Pleasant Day allowed the team to engage with residents of all ages. The team focused on **interactive, visual engagement tools** to draw people in and spark curiosity. Approximately 44 people visited the project table.

Figure 15: Seat Pleasant Day station (left) and map with participant markings (right).

Key Takeaways from Phase 2 Community Tabling

- **Strong Interest in Tree-Related Co-Benefits:** Residents expressed high interest in trees and shade, planting strategies, native species, and maintenance responsibilities.
- **Strong Engagement with BGI Prioritization Game:** The BGI prioritization game attracted considerable interest. It prompted meaningful discussions around native tree planting, retrofitting ponds with fountains, and reducing impervious surfaces in new development.
- **Personal Flood Stories Mapped:** Several attendees shared firsthand flooding experiences and marked them on the watershed map, helping validate priority areas identified in the study.
- **Affirmed Value of Low-Pressure Engagement:** Both events reinforced the effectiveness of informal, relationship-first outreach. Residents who were unfamiliar with BGI or new to planning processes felt more comfortable engaging in relaxed, community-driven settings.
- **Celebratory Setting Enhanced Participation:** The lively atmosphere with music, food, family activities, and senior programming boosted participation and made it easier to discuss serious topics in an approachable, trust-building environment.
- **Need for Clearer Language and Accessible Formats:** Some residents found planning language confusing. For example, a participant familiar with maintaining bioretention ponds was unfamiliar with the term "BGI." This underscored the importance of using plain language, clearer visuals, and accessible formats like handouts.
- **Raffle Increased Engagement:** Light-touch incentives, like the raffle at Seat Pleasant Day, effectively encouraged participation and built interest in ongoing study communications.
- **Opportunities for Future Collaboration:** Both events surfaced potential partnerships with community gardens, youth educators, and local environmental groups.

REGIONAL OPEN HOUSE

Throughout the study, the watershed workshop series served as a critical platform for surfacing local knowledge, building relationships, and ensuring that CBOs and residents had meaningful opportunities to shape the work. The final regional workshop—structured as an open house—marked a transition point from planning to action. It served not only as a public-facing summary of the study but also as a forum to advance next steps, bringing together practitioners—CBOs, agencies, and other partners—to focus on funding strategies and implementation partnerships.

Event Overview

The Regional Open House, held on Thursday, May 22, 2025, at the Marvin Gaye Recreation Center, marked the final major engagement event of the study. Hosted from 4:30 to 7:30 PM, the event brought together 43 attendees, including residents, invited speakers, CBOs, local and regional agency partners, and project team members.

Figure 16: Regional Open House flyer snapshot.

Format and Engagement Activities

The event followed an open-house format, encouraging participants to explore four themed engagement stations before and after the main presentation:

- Station 1: BGI Education – Facilitated by ICF, this station offered an overview of BGI concepts, types of projects, and associated community benefits.
- Station 2: Let's Find Your Project – Led by Straughan Environmental, this station used large maps and watershed booklets to help attendees explore potential BGI implementation opportunities in their neighborhoods and focus areas of interest.
- Station 3: BGI Participation Spectrum – Hosted by CHPlanning, this interactive station invited participants to identify local organizations that could be informed, involved, or collaborate in BGI efforts.
- Station 4: Flood Insurance Resource Table – Provided by the District Department of Insurance, Securities and Banking (DISB), this station shared educational materials on flood insurance and personal preparedness resources.

Key study outputs included:

- Consolidated flood risk mapping.
- Watershed prioritization maps by focus area or subwatershed.
- A repeatable method for identifying BGI opportunities.
- A site-ranking tool incorporating equity, flood risk, actionability, and watershed impact.

The team also discussed how local governments, stewardship groups, and residents could use the study's findings to support funding proposals and collaborative implementation. The presentation outlined the study's goals, engagement process, and anticipated outcomes. They emphasized BGI as a strategy to integrate natural systems into urban infrastructure, manage stormwater, and strengthen long-term community resilience.

Key Takeaways from Panel Discussions

Panel 1: Funding in Uncertain Times
Focused on identifying and securing resources for BGI investment, panelists emphasized the importance of cross-sector partnerships, community-led metrics, and disaster framing to unlock federal mitigation dollars. They also acknowledged the challenges small CBOs face in accessing complex funding streams and called for stronger support in building organizational capacity.

Panel 2: Implementation Partnerships
Brought CBO voices to the forefront. Panelists explored what it means to “meet people where they are”—from adjusting language and expectations to respecting community members’ time, trust, and trauma. They shared experiences with leading outreach, stewarding projects post-construction, and resisting green gentrification through design choices that reflect local identity. The conversation reaffirmed that successful implementation requires not only technical coordination but also emotional and cultural alignment with the communities BGI is meant to serve.

Through the workshop series and the Regional Open House, the team ensured that CBOs were not just part of the audience but active contributors to the study’s findings, framing, and recommendations. The event reinforced the replicability of the BGI framework and created space for future partnerships and shared ownership of BGI priorities across jurisdictions. The resulting recommendations are integrated into the following section and throughout this report, with the aim of advancing the study’s outputs into action.

Figure 17: Regional Open House on May 22, 2025.

Lessons Learned and Recommendations

Engagement is not just for input—it creates shared meaning. This study showed that the most impactful engagement happens when communities and practitioners make sense of issues together. Being responsive and adaptive is essential; learning from less successful efforts and building momentum through small but meaningful steps is critical to the process.

Design Engagement for Flexibility and Fit

No single format fits every geography, jurisdiction, or community timeline. The team's willingness and ability to let structure follow function, rather than forcing a rigid public meeting model was critical. Engagement methods shifted from broad outreach to trusted, local champions and CBOs where direct resident access was limited. Formats varied widely from unstructured tabling at festivals to facilitated group mapping in rec centers, depending on the context, community readiness and prior engagement. The flexibility avoided overburdening some communities while directing energy where interest and capacity were highest.

- Shift engagement from standard demographic outreach to **identifying those most impacted by flooding** and exploring where regional solutions could originate through the watershed-based approach.
- Adapt strategies based on **participant awareness and influence**, building trust through targeted formats rather than one-size-fits-all events.

1. Build Trust

The team quickly recognized engagement fatigue and adjusted the strategy to reflect community readiness and capacity. Focusing on trusted intermediaries, building on previous efforts, and being intentional about when and where to engage.

- **Maintain transparency,** acknowledge prior engagement, and adapt based on community readiness.
- **Build trust** by following through on feedback, sharing outcomes even if small, and being selective with asks.

2. CBOs are our friends: Center CBOs as Implementation Partners

CBOs played an essential role in this study—not just for their outreach, but for their ability to bridge technical planning with lived experience. They are positioned at the intersection of trust, local knowledge, and implementation capacity. CBOs in all three watersheds were active, receptive to BGI, and willing to work together. To build on this momentum:

- **Engage CBOs early and consistently**—as partners in shaping and delivering BGI solutions.
- **Fund CBOs for more than outreach**—support their roles in education, design, and long-term stewardship.
- **Use microgrants or small contracts** to reduce barriers to participation and support capacity-building.
- **Co-develop proposals** collaboratively.

CBOs are not just messengers—they are long-term partners in implementation who ground regional strategies in community realities. Key feedback from both CBOs and residents was frustration that engagement often ends when project funding does. This underscores a broader challenge for jurisdictions like DC and Prince George's County, as well as for COG's regional efforts: the need to institutionalize sustained community engagement beyond individual project cycles—especially for long-term issues like flooding that require sustained collaboration.

3. Align Across Jurisdictions

To advance Regional BGI, jurisdictional alignment is essential. The core SAG—formed of COG, with key project partners D.C. HSEMA, DOEE, and Prince George's County DOE provided early strategic direction. However, engagement during the planning process highlighted the need for an extended SAG to include major landowners and infrastructure agencies (e.g., the Maryland-National Capital Park and Planning Commission (M-NCPPC), District Department of Transportation, and Maryland Department of Natural Resources).

- **Engaging these stakeholders early** can ensure they are informed of opportunities, aligned on messaging and funding goals, and positioned to collaborate with CBOs and technical partners.
- This broader cross-sector alignment could help the planning effort naturally progress toward **implementation-ready partnerships** rooted in shared ownership of the planning process.
- **Clarifying roles for project partners (and local municipalities)** throughout the planning process—not just keeping them informed or involved—is essential to sustaining momentum and preparing for scalable impact.

4. Determine Value: What was Most Meaningful to Residents

Throughout this process, the most meaningful engagement came not from delivering technical information but from shaping how the residents understood their relationship to BGI. The key was not only to make the topic accessible, but personal, tactile, and participatory.:

- **Connect BGI to a personal inconvenience or memory** (e.g., standing water near a bus stop, a flooded basement, or heat on a treeless sidewalk).
- **Ground engagement in day-to-day concerns**, not just a future flood scenario.
- **Prioritize community education that persists after project installation** building on the same materials or messaging formats that residents responded to throughout the project (e.g., maps, visuals, hyperlocal events).

5. Use Tools that Fuel Engagement

Building on the tools outlined earlier (see textbox), the study demonstrated that the most effective formats were those that made engagement both tangible and reflective.

- **Develop an adaptable outreach toolkit** using tested study materials.
- Continue simplifying language and using interactive tools **tailored to diverse audiences.**
- **Design engagement settings holistically**—consider timing, needs of children and seniors, food, and accessible venues to ensure inclusive participation.

Key Tools for Engagement:

- **Maps** enabled participants to locate themselves within the watershed and identify local concerns or opportunities—many were unaware of watershed boundaries and found this visual connection valuable.
- **Dot exercises** prompted self-reflection and helped ease participants into deeper conversations, priming them for tools like the BGI prioritization game.
- **Games and visuals** translated technical information into relatable choices, while coloring books invited children and multigenerational participation.

6. Work Tactically Within the Limits of Regional Engagement

While regional-scale engagement offers a unique opportunity to align across jurisdictions, it also comes with limitations—particularly around the depth and reach of community input. Door-to-door outreach was not feasible, and it became clear that the most effective engagement came through trusted intermediaries like CBOs. Not all neighborhoods could be equally engaged within the study's time and resource constraints—this imbalance is inherent at the regional scale.

- **Use replicable elements of this engagement model**—such as maps, games, and CBO partnerships—as a starting point for future efforts.
- **Build a working stakeholder list** and adapt it to local contexts.
- **Prioritize small group and one-on-one outreach** with other key stakeholders.
- **Expand engagement** to include schools and CBOs, which can connect with broader youth and community populations.

7. Form Implementation Partnerships

The Regional Open House included a panel on implementation partnerships, which explored what meaningful collaboration looks like between agencies, nonprofits, and communities and offered a roadmap for more equitable and lasting implementation. The following recommendations from that panel represent not only what to do, but why these approaches matter to the long-term success, equity, and replicability of BGI initiatives across the region.

- **Meet people where they are.** Use formats that reflect how people already gather—in person, virtually, through churches, community centers, or schools. This builds trust and makes participation more accessible.
- **Center CBOs as co-creators—not just outreach partners.** Empower local organizations to shape project design, delivery, and monitoring. Their insights lead to more grounded, community-responsive BGI outcomes.
- **Design against displacement.** Ensure BGI reflects community identity and does not contribute to green gentrification. This includes involving residents in the design process and clearly communicating anti-displacement intentions.
- **Invest in long-term relationships.** Effective implementation is rooted in trust and continuity. Panelists emphasized consistency over time, not just one-off engagement efforts.
- **Leverage trusted institutions.** Churches, civic associations, and longstanding local organizations hold deep social capital and intergenerational reach—making them ideal partners in outreach and education.
- **Reduce barriers to participation.** Provide food, childcare, stipends, and materials in multiple languages and formats to ensure equitable access and reduce burden on residents.
- **Create physical and social infrastructure for engagement.** Community-serving facilities like Resilience Hubs can anchor BGI work in familiar, multifunctional spaces while also offering workforce training and resource access.
- **Use accessible and culturally relevant language.** Avoid jargon and translate materials into formats that are legible to residents of different ages, languages, and literacy levels.
- **Support youth leadership.** Panelists encouraged creating entry points for youth and emphasized their eagerness to contribute when engaged meaningfully.

- **Observe who's missing.** Practitioners were urged to be attentive to who isn't showing up—and actively find ways to include underrepresented voices.
- **Be consistent and respectful of time.** Start and end meetings on time, follow through, and show up regularly. This builds credibility and helps sustain engagement.

These recommendations signal a shift from one-way engagement to co-ownership, and from infrastructure-as-installation to infrastructure-as-relationship. Together, they offer a framework for advancing BGI implementation in ways that are equitable, fundable, and community-centered.

PRIORITIZATION WITHIN WATERSHEDS

Understanding of Existing Projects and Infrastructure

SOLICITING DATA FOR PLANNING

Flood resilience work is underway in all three watersheds. The study built upon the foundation of ongoing work, including local initiatives, and to use existing data strategically. Early in the study, a comprehensive data request was developed to inform a targeted and efficient analysis.

The data request helped identify the full range of agencies and organizations involved in relevant flood risk management, infrastructure, and planning activities. Primary data requests were sent to project partners in D.C. and Prince George's County, along with outreach to smaller municipalities and quasi-governmental entities, including the regional sewer authority and utility providers. The project team worked closely with the SAG to refine and prioritize the most critical data needs. Data solicitation also served as an early form of stakeholder mapping, helping to understand where key information was housed and where collaboration would be most valuable.

The prioritized data request focused on three core areas essential for planning BGI to reduce flood risk:

- **Existing hydrologic and hydraulic models**, which provide a baseline for flood behavior and the impact of different mitigation strategies.
- **Floodplain boundaries**, which define areas most at risk and guide project siting and design.
- **Stormwater and green infrastructure asset locations**, which reveal where capacity exists and where gaps remain.

Follow-up conversations were conducted with SAG members, particularly around non-critical datasets. These discussions helped determine the relevance of secondary information (e.g., whether 311 drainage complaint data could be reliably tied to flooding) and ensured the team remained focused on data that would add value to the study.

Among the most critical datasets received for this study were recent (approximately 2017) hydrologic and hydraulic models provided by U.S. Army Corps of Engineers (USACE) through the SAG. These included updated hydrologic models for the full Oxon Run and Watts Branch watersheds developed using the Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) platform and one-dimensional hydraulic models for both watersheds developed in HEC-River Analysis (HEC-RAS). Together, these models provided an understanding of water flow, peak flood levels and extents, and the connection between upstream conditions and downstream flooding for a range of conditions.

Key data was provided by Prince George's County, including detailed storm drain and pipe network information as well as the locations of existing stormwater facilities. D.C. provided sections of the District of Columbia's Integrated Flood Model (IFM), a dual drainage model developed in InfoWorks ICM through interagency collaboration between DOEE and D.C. Water. Given the scale of the IFM, which covers the entirety of the District, only the portions relevant to the study areas were shared to ensure the data remained focused and manageable. From this model, storm drainage infrastructure data was extracted for use in assessing baseline capacity and identifying opportunities for BGI integration.

Supplemental datasets included drainage complaint records and partial FEMA flood insurance claim data from Prince George's County, as well as documentation of existing levee systems along the Arundel Canal from USACE. Anecdotal evidence of flooding was reviewed, including local media reports and direct input from SAG members. Collectively, the qualitative observations offered important context to supplement quantitative data from the models.

In addition to datasets received directly from project partners, extensive supplemental research was conducted to incorporate publicly available data. These sources were essential for building a comprehensive understanding of watershed conditions, infrastructure, environmental context, and social equity across the study area. Public datasets helped fill gaps, validate findings, and support analyses at both local and regional scales.

Key sources of supplemental data included:

- **Open Data D.C. GIS Portal** – Provided detailed information on infrastructure, land use, property ownership, and socio-economic indicators for D.C.
- **PGAtlas** – Served as the primary source of geospatial data for Prince George's County, including infrastructure networks, zoning, parcel data, and environmental layers.
- **FEMA Flood Mapping** – Offered official delineations of floodplains and Special Flood Hazard Areas (SFHAs).
- **Chesapeake Conservancy Land Use/Land Cover Data** – Provided high-resolution landscape classifications critical for understanding forest cover and impervious surface patterns.
- **U.S. Geological Survey (USGS) Watershed Data** – Supported watershed boundary delineation and stream network verification.
- **U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soils Data** – Informed evaluations of infiltration potential and suitability for different types of BGI.

This comprehensive, multi-source data approach provided a consistent foundation for cross-jurisdictional analysis and ensured the study's recommendations were grounded in the best available information.

Filling Gaps: Developing A New Hydrologic Model for Arundel Canal

While partner-provided and publicly available data covered most of the study area, a key gap existed in the Arundel Canal watershed: no existing hydrologic model was available to simulate baseline conditions or evaluate BGI opportunities. To ensure analytical consistency across all three watersheds, the project team developed a new model tailored to the Arundel Canal.

To delineate the watershed, USGS Hydrologic Unit Code (HUC-16) mapping was used to establish a drainage boundary appropriate to the scale of this study. With the watershed boundary defined, the project team developed a new existing conditions hydrologic model using the WinTR-55 Small Watershed Hydrology application. This enabled runoff simulations across multiple storm scenarios, providing a planning-grade baseline for BGI performance evaluation.

The resulting model served as a baseline tool for Arundel Canal, functionally equivalent to the HEC-HMS models used for Watts Branch and Oxon Run. While developed in different software platforms, both WinTR-55 and HEC-HMS are hydrologic models that simulate rainfall-runoff response using the

SCS Curve Number method to represent land use and soil conditions. Both tools are widely used and accepted by agencies at all levels, producing comparable outputs essential for watershed-scale planning. By developing this model in-house, the project team was able to maintain a consistent methodology across watersheds and ensure that BGI opportunities could be assessed equitably and effectively throughout the study area.

Key Modeling Gap Addressed

No existing hydrologic model was available for Arundel Canal. A new watershed-scale model was developed using WinTR-55 to simulate runoff and evaluate BGI performance—ensuring consistency with other watersheds and enabling equitable cross-jurisdictional analysis.

MAPPING EXISTING AND ONGOING PROJECTS

Urban watersheds are in a constant state of change. While the Arundel Canal, Watts Branch, and Oxon Run watersheds are considered fully developed, each continues to evolve through redevelopment, capital improvement, and public works projects. Understanding this dynamic context is essential for regional flood planning, particularly when watersheds span multiple jurisdictions and involve a diverse set of actors.

To support cross-jurisdictional coordination, ongoing projects were mapped across all three watersheds. This effort was supported through SAG coordination—particularly for public infrastructure initiatives—as well as independent research using publicly available planning records and capital project databases. Input was also gathered continuously through community outreach, which surfaced several projects not previously captured through formal channels.

To make the resulting information more usable for planners and decision-makers, mapped projects were organized into the following standardized categories:

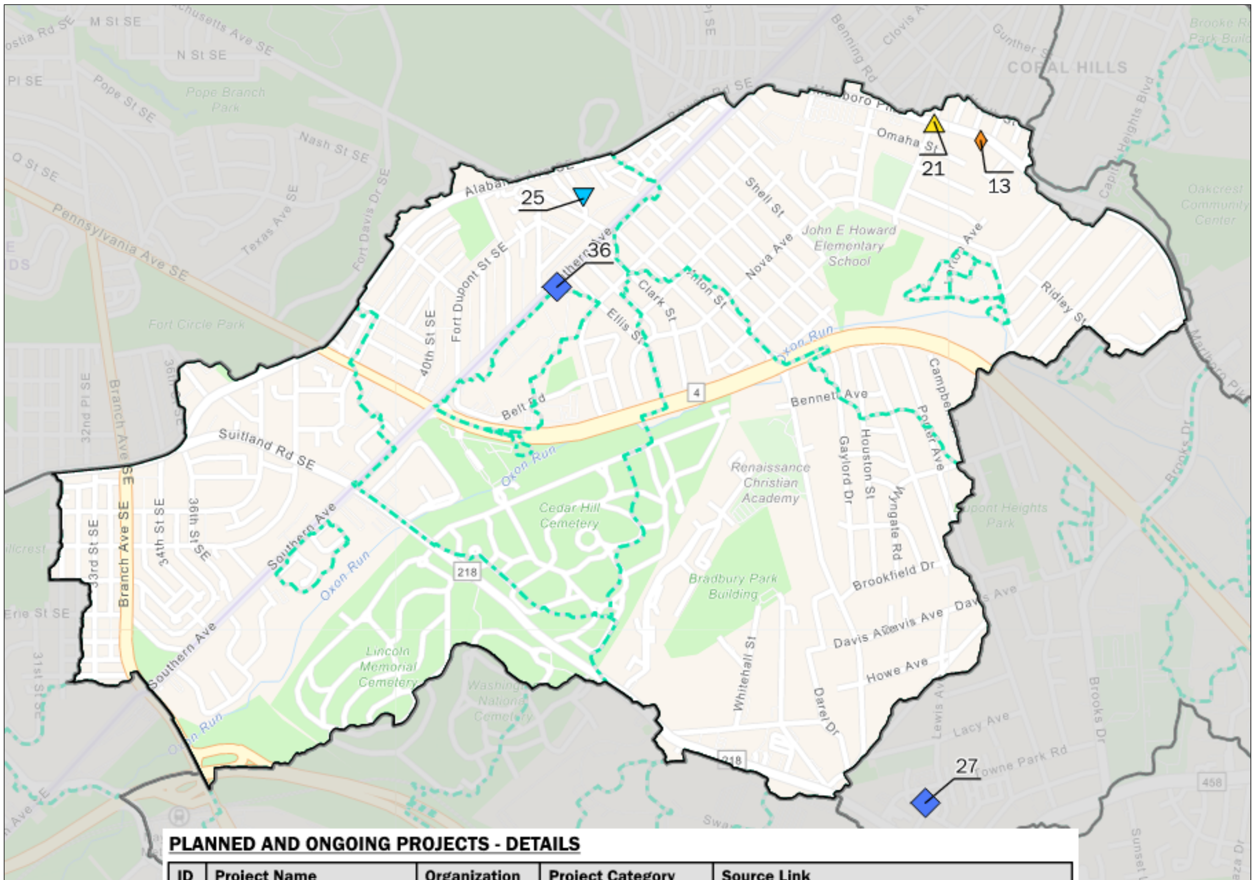
- **Blue/Green Centric** – Includes plantings, stormwater management, stream restoration, and Best Management Practice (BMP) construction, retrofitting, or rehabilitation.
- **Community Facility** – Encompasses improvements and rehabilitation of schools, recreation centers, or other community centers.
- **Development** – Covers private and public land development, including residential, retail, mixed-use, and neighborhood revitalization plans.
- **Drainage Improvement** – Includes drainage infrastructure rehabilitation, retrofitting, and new construction.
- **Pedestrian Centric** – Encompasses improvements to pedestrian crossings, infrastructure, and safety.
- **Sanitary** – Includes sanitary sewer system installation, maintenance, and rehabilitation.
- **Solid and Hazardous Waste** – Includes landfill use and remediation activities.
- **Transportation** – Covers roadway and traffic signal improvements, including safety enhancements.
- **Water Supply** – Encompasses improvements to water supply systems, including installation, maintenance, and rehabilitation of water lines.

The categorized mapping effort helps planners quickly understand the type, scale, and location of activities underway in the watershed. It also serves several key planning functions:

- Identifying parallel or complementary projects already in motion (e.g., stream restoration or flood mitigation).
- Recognizing redevelopment trends that may open opportunities for BGI.
- Avoiding conflicts with planned or ongoing infrastructure.
- Maximizing co-benefits by aligning BGI with public investment is already underway.

To help visualize this information, a sample map is provided in Figure 18, highlighting a selection of planned and ongoing projects within the Oxon Run watershed. The map includes project locations, categories, and source links, and is representative of the mapping products developed across all three watersheds. The full set of maps is included in Appendix A and is intended to serve as a practical resource for planners and decision-makers working across jurisdictional boundaries.

An initial version of the mapping was delivered to SAG members for review in Fall 2024, with subsequent updates made throughout the course of the study. While comprehensive efforts were made to collect data through the SAG and across jurisdictions, the project team was not positioned to conduct detailed outreach to every independent municipality or private developers within Prince George's County. As a result, some local-level projects may not be fully captured beyond what was available through public sources.



PLANNED AND ONGOING PROJECTS - DETAILS

ID	Project Name	Organization	Project Category	Source Link
13	Marlboro Pk. Pedestrian Safety Improvements, Ph. 2	Prince George's County DPW&T	Pedestrian Centric	https://www.princegeorgescountymd.gov/departments-offices/public-works-transportation/projects/capital-roadway-and-bridge-projects
21	Marlboro Pk., Glacier Ave. Intersection Traffic Signal Project	Prince George's County DPW&T	Transportation	https://princegeorges.maps.arcgis.com/apps/webappviewer/index.html?id=c13928ea8a2946acba51feb034088ce3
25	Rehabilitation of Elevated Water Storage Tanks	DC Water	Water Supply	https://www.dcwater.com/resources/open-data-portal/capital-improvement-dashboard
27	Towne Square at Suitland Federal Center	Prince George's County RDA	Development	https://www.princegeorgescountymd.gov/departments-offices/redevelopment-authority/current-development-projects
36	The Ascent	Montage Development Group	Development	https://www.montagedevgroup.com/

Figure 18: Sample map page of planned and ongoing projects in the Oxon Run watershed.

The final set of maps—provided in Appendix A—represents a valuable case study in regional information-sharing and coordination. Although the current product is static, this type of resource could be further enhanced through ongoing updates and broader participation. As a core member of the project team and a regional convener, COG is well positioned to host and maintain this information to support continued cross-jurisdictional collaboration.

FOREST COVER ANALYSIS

Forest cover plays a critical role in mitigating stormwater runoff and reducing flood risk, particularly in urbanized watersheds where natural infiltration is limited. To understand how land use affects hydrologic response, a comparative analysis was conducted using current land cover data and modeling scenarios across the Arundel Canal, Watts Branch, and Oxon Run watersheds.

Forest is not uniformly distributed across the study area. In Oxon Run and Watts Branch, forested areas are more prevalent in upstream headwater regions, particularly outside D.C. These areas offer important opportunities to preserve or expand natural cover to reduce downstream flood risk.

To explore the hydrologic consequences of land use change, a hypothetical modeling exercise was conducted simulating a 10% increase in impervious cover across each watershed. While not tied to a specific forecast, this scenario reflects an extreme, but plausible redevelopment trajectory and serves as a stress test to understand how incremental densification could affect runoff patterns. In the simulation, 90% of the land cover retained its existing condition, while 10% was reassigned as impervious land. The analysis was conducted using the TR-55 hydrologic model for Arundel Canal and the HEC-HMS hydrologic models for Watts Branch and Oxon Run.

The results of this modeling scenario are shown in Figure 19, Figure 20, and Figure 21 below, which highlight changes in peak flow under an “increased impervious” future scenario.

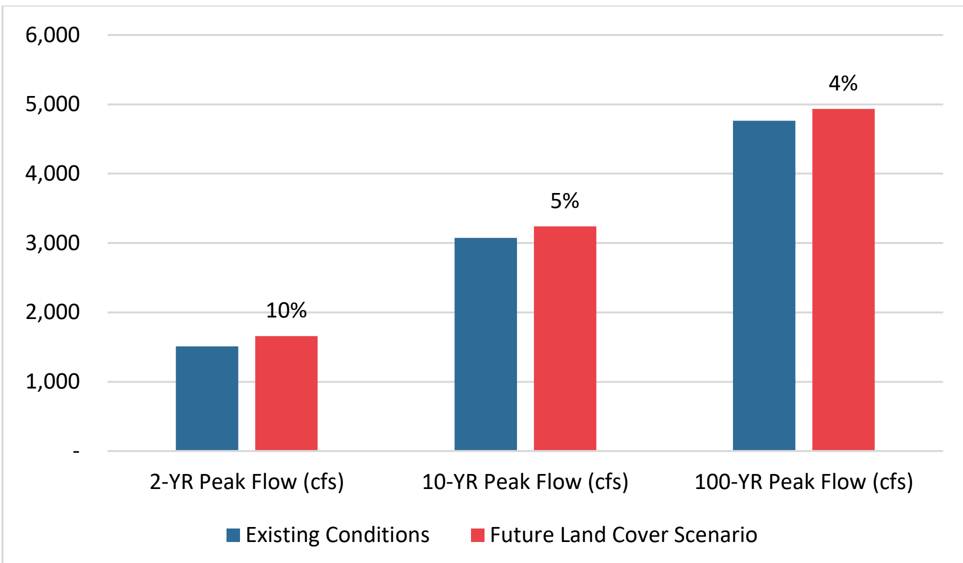


Figure 19: Arundel Canal land use, showing the effect of increasing impervious by 10% on peak flow. Percentages above the red bar indicate the precent increase in peak flow.

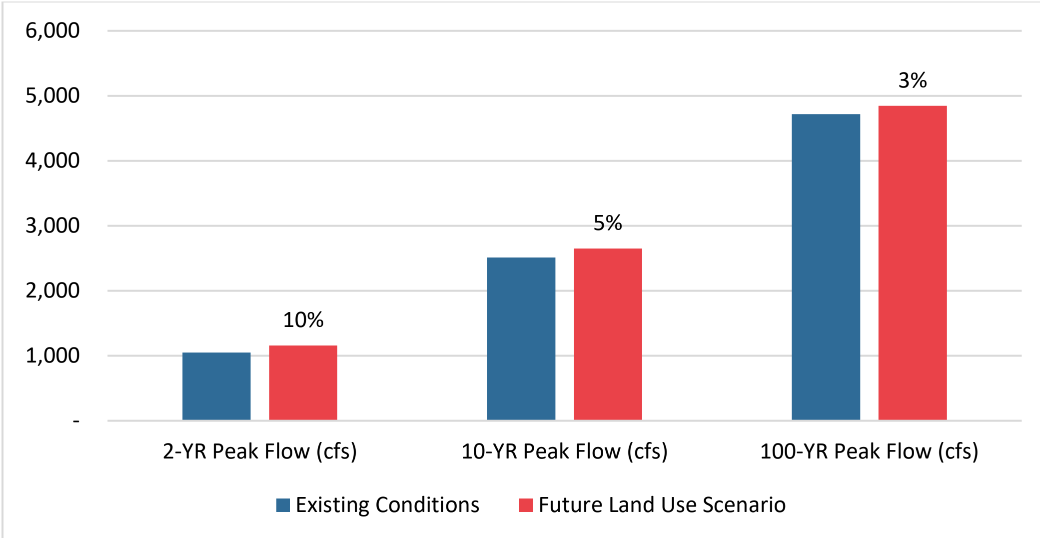


Figure 20: Watts Branch land use, showing the effect of increasing impervious by 10% on peak flow. Percentages above the red bar indicate the precent increase in peak flow.

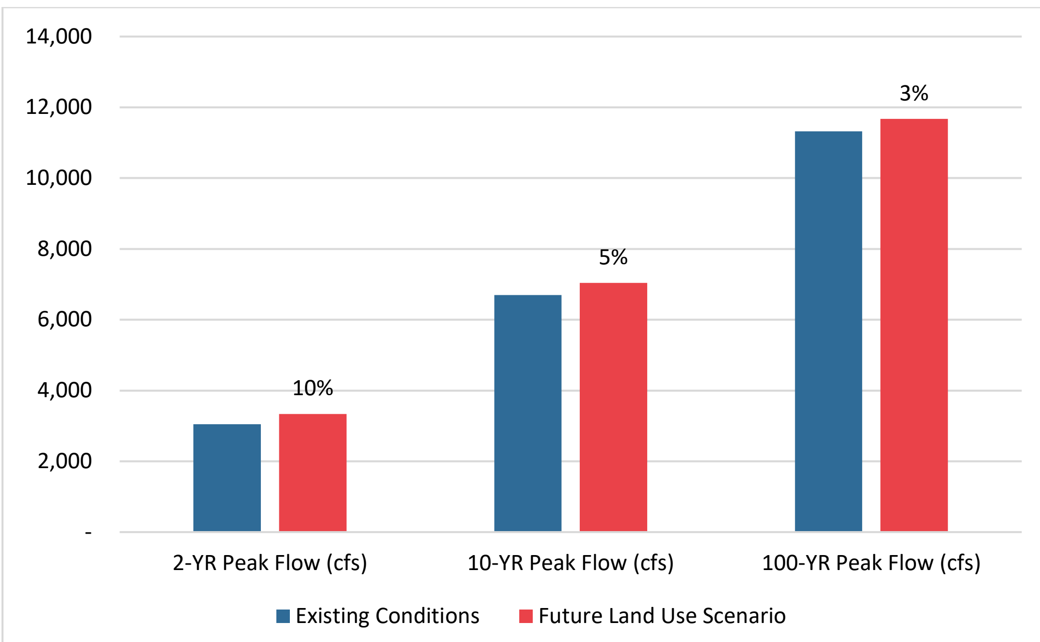


Figure 21: Oxon Run land use, showing the effect of increasing impervious by 10% on peak flow. Percentages above the red bar indicate the precent increase in peak flow.

Across all three watersheds, the relative impact of added impervious cover is most pronounced for smaller, more frequent storm events:

- 2-year storm: 10% increase in peak flow.
- 10-year storm: 5% increase in peak flow.
- 100-year storm: 3–4% increase in peak flow.

The consistency of these results—despite the use of different modeling platforms—reinforces confidence in the analysis and suggests strong alignment in underlying assumptions, methods, and inputs. This also demonstrates the proportional sensitivity of peak discharge to impervious surface area, especially for frequent storm events that drive nuisance flooding and infrastructure stress.

These findings underscore the importance of land use management in shaping local and regional flood risk. Even modest increases in imperviousness can meaningfully raise runoff volumes and accelerate stormwater delivery. They also highlight the value of BGI practices, including reforestation and afforestation. Forested areas not only enhance infiltration but also slow runoff by increasing surface roughness, intercepting rainfall, and extending time to concentration. Preserving and expanding forest cover—particularly in the headwaters of Oxon Run and Watts Branch—should be a central strategy for reducing downstream flood risk and maintaining overall watershed function.

Figure 22: Forested wetland in Capitol Heights, MD within the Oxon Run watershed.

BGI Project Types

BGI combines nature-based solutions for managing stormwater and flood risk. "Blue" elements, such as streams, rivers, and ponds, manage water above ground, while "green" infrastructure relies on vegetation and soils to capture, infiltrate, and filter runoff. In contrast to traditional "gray" infrastructure—such as pipes, drains, and underground storage—BGI seeks to work with natural systems to enhance resilience, improve water quality, and provide co-benefits to communities.

While BGI is widely referenced in stormwater and flood resilience planning, the term is not universally defined nor regulated as a fixed set of practices. As a result, its meaning can vary across jurisdictions, disciplines, and communities. Through stakeholder engagement and SAG discussions, the project team identified the need to establish a shared understanding of what BGI means in the context of this study supporting clear communication, public education, and consistent stakeholder understanding.

In collaboration with stakeholders, the project team developed a focused list of BGI practices that align with local conditions and planning priorities. These practices were intentionally chosen for their ability to reduce flooding by slowing down and soaking in stormwater—using storage, infiltration, and other natural processes. Without this focus on reducing the volume of runoff, BGI would have limited ability to deliver meaningful flood relief. These practice types also represent those for which performance modeling and opportunity analysis could reasonably be conducted within the scope of this planning study. They are illustrated in greater detail in two companion resources developed for this report: a digital outreach booklet summarizing each practice for community engagement (Appendix H), and a set of typical detail drawings and sections developed to support concept design (Appendix B).

Multi-Purpose Floodable Recreational Spaces
Floodable public spaces—such as parks, plazas, and athletic fields—can be designed to store and slowly release floodwater during extreme events, while remaining functional and accessible under normal conditions. For example, athletic fields can be retrofitted to improve everyday drainage while also providing temporary storage and encourage infiltration to reduce downstream flood peaks.

Green Stormwater Infrastructure (GSI)
GSI uses natural processes to store, infiltrate, and treat stormwater close to where it falls. Examples include rain gardens, bioswales, green roofs, and permeable pavement. GSI is also referred to as Low Impact Development (LID) or Best Management Practices (BMP) and is often integrated into streetscapes, open spaces, and redevelopment sites.

Bridge and Culvert Modifications
Bridges and culverts often create pinch-points in the landscape, constraining flow and elevating flood risk. Many of these structures were designed prior to full watershed development and may now be undersized. Modifying or replacing them can alleviate flooding by improving flow conveyance, timing, and overall watershed connectivity.

Blue-Green Streets
Blue-Green Streets integrate GSI into the public right-of-way by redirecting stormwater from roads and parking areas into bioretention, permeable surfaces, and underground storage. These projects improve water management, encourage infiltration, reduce pollutant loads, and support native landscaping, often in conjunction with gray infrastructure upgrades.

Impervious Surface Reduction
Reducing impervious cover—such as concrete or asphalt—minimizes runoff and lowers flood volumes. Strategies include replacing traditional pavement with permeable alternatives or converting

underutilized surfaces into green space. These measures also help reduce pollutant transport into local waterways.

Pond Retrofits

Stormwater ponds provide storage and water quality treatment. Many existing ponds can be retrofitted to increase capacity, encourage infiltration, enhance ecological value, and improve aesthetics. In some cases, pond retrofits include automated controls that release water prior to storm events to maximize functional storage.

Storm Drain Outfall Retrofits

Storm drain outfalls mark the discharge point of urban drainage systems into streams or open channels. These locations are ideal for interventions that reduce runoff velocity and volume before it reaches downstream floodplains. Outfall retrofits can include small ponds, step-pool systems, or other GSI techniques.

Stream Daylighting

Stream daylighting restores piped or buried waterways to the surface, reestablishing them as visible, functioning stream channels. This reduces stress on underground infrastructure, creates opportunities for stormwater storage and infiltration, and improves ecological and community outcomes.

Stream, Wetland, and Floodplain Restoration

Restoration efforts reshape low-lying areas to better store, slow, and filter stormwater. These projects involve regrading floodplains, stabilizing streambanks, and reintroducing native vegetation, including wetland systems, to improve resilience and habitat quality.

Tree Planting

Trees intercept rainfall, promote infiltration, and reduce erosion. Their canopies slow precipitation, while roots stabilize soil and absorb water. Tree planting—from individual street trees to reforestation—supports both localized and watershed-scale stormwater management. Tree planting in this study is presented on a larger scale and paired with soil decompaction and amendment to maximize the infiltrative capacity of the new forest.

While many other practices—such as green roofs or urban agriculture—may be considered BGI measures in other contexts, this study focused on the practices listed above. This focus reflects input from the SAG, practices most suitable for the study area and those for which the project team could provide robust modeling and analysis. By establishing a clear and shared definition of BGI, this study supports more consistent communication, more effective stakeholder engagement, and stronger planning outcomes across jurisdictions.

Project Opportunity Mapping

A spatial analysis framework was developed to identify where BGI could be implemented across the study area. This section outlines the methods used to locate, categorize, and communicate BGI opportunities—beginning with how potential sites were prioritized and ending with the maps and datasets delivered to regional partners.

A WATERSHED-WIDE APPROACH TO VOLUME CAPTURE

Traditional flood resilience planning often begins with a predefined design storm—modeling how a watershed responds to a particular rainfall event—and then works backward to identify localized interventions that mitigate flooding under those specific conditions. While effective in some contexts, this reactive, storm-centric approach can limit flexibility, scalability, and long-term impact.

In contrast, the project team employed a fundamentally different methodology for identifying BGI opportunities—one that is comprehensive, proactive, and purpose-built for adaptability. Rather than starting with a single flood scenario, a top-down search was conducted for *all* theoretically feasible locations where BGI could be implemented across the study watersheds. This included every parcel, right-of-way, and site feature that could physically accommodate one or more BGI practices, regardless of jurisdictional boundaries or existing funding constraints.

This comprehensive inventory of possibilities marks a significant shift in flood planning. By beginning with the full set of spatial opportunities and working backward, the analysis empowers planners, decision-makers, and community stakeholders to select projects based on what matters most to their goals—whether that be reducing localized flooding, restoring ecological function, advancing equity, or meeting the eligibility criteria of specific grant programs.

The scale of implementation is also flexible. Some users may choose to pursue a single meaningful BGI opportunity aligned with their organizational mission, while others—such as Prince George's County and D.C.—may advance networks of BGI projects coordinated at the watershed or jurisdictional scale.

This approach ensures that the opportunity mapping serves more than just a single storm, jurisdiction, or agency. It is intentionally structured to support a diverse range of end-users, including CBOs, who may use the outputs to champion localized interventions that align with their community's priorities. In doing so, the project fosters broader ownership, more equitable outcomes, and greater regional resilience.

DIVIDING WATERSHEDS INTO NEIGHBORHOOD SCALE UNITS

To improve the clarity, usability, and relevance of project opportunity mapping, each watershed was organized into logical, neighborhood-scale planning units referred to as Focus Areas. These Focus Areas provide a framework for communicating results, grouping BGI opportunities, and facilitating targeted implementation strategies aligned with community character and hydrologic function.

This organization was necessary due to the complexity and irregularity of existing watershed sub-divisions in the available hydrologic models. The USACE HEC-HMS models for Watts Branch and Oxon Run divide each watershed into numerous sub-basins and drainage polygons, some of which represent very small stormwater features such as ponds or stream segments. While these granular divisions serve an important purpose in modeling, they are too fragmented and inconsistent in scale for effective planning.

In the HEC-HMS model, Watts Branch is divided into 26 sub-basins and Oxon Run is divided into 78. To create units better suited to planning, adjacent sub-basins were manually grouped into larger, more meaningful Focus Areas. This process relied on the expertise of staff hydrologists, who considered neighborhood boundaries, land use character, and hydrologic connectivity, particularly the organization of sub-basins along shared tributaries. Although Focus Area boundaries remain irregular, they reflect a more intuitive and community-relevant geography. The final organization includes 11 Focus Areas in Oxon Run and 6 Focus Areas in Watts Branch.

The Arundel Canal watershed, by contrast, is significantly smaller. Six HUC-16 subwatershed boundaries were consolidated into 2 Focus Areas, aligning conveniently with the District boundary to support jurisdictional clarity.

Figure 23, Figure 24, and Figure 25 present the Focus Area boundaries for all three watersheds. Each map illustrates the planning units used to group and communicate BGI opportunities throughout this report. These Focus Areas serve as the foundation for mapping and presenting BGI opportunities in the next stage of the study. By balancing hydrologic integrity with planning practicality, they help bridge technical analysis with actionable implementation.

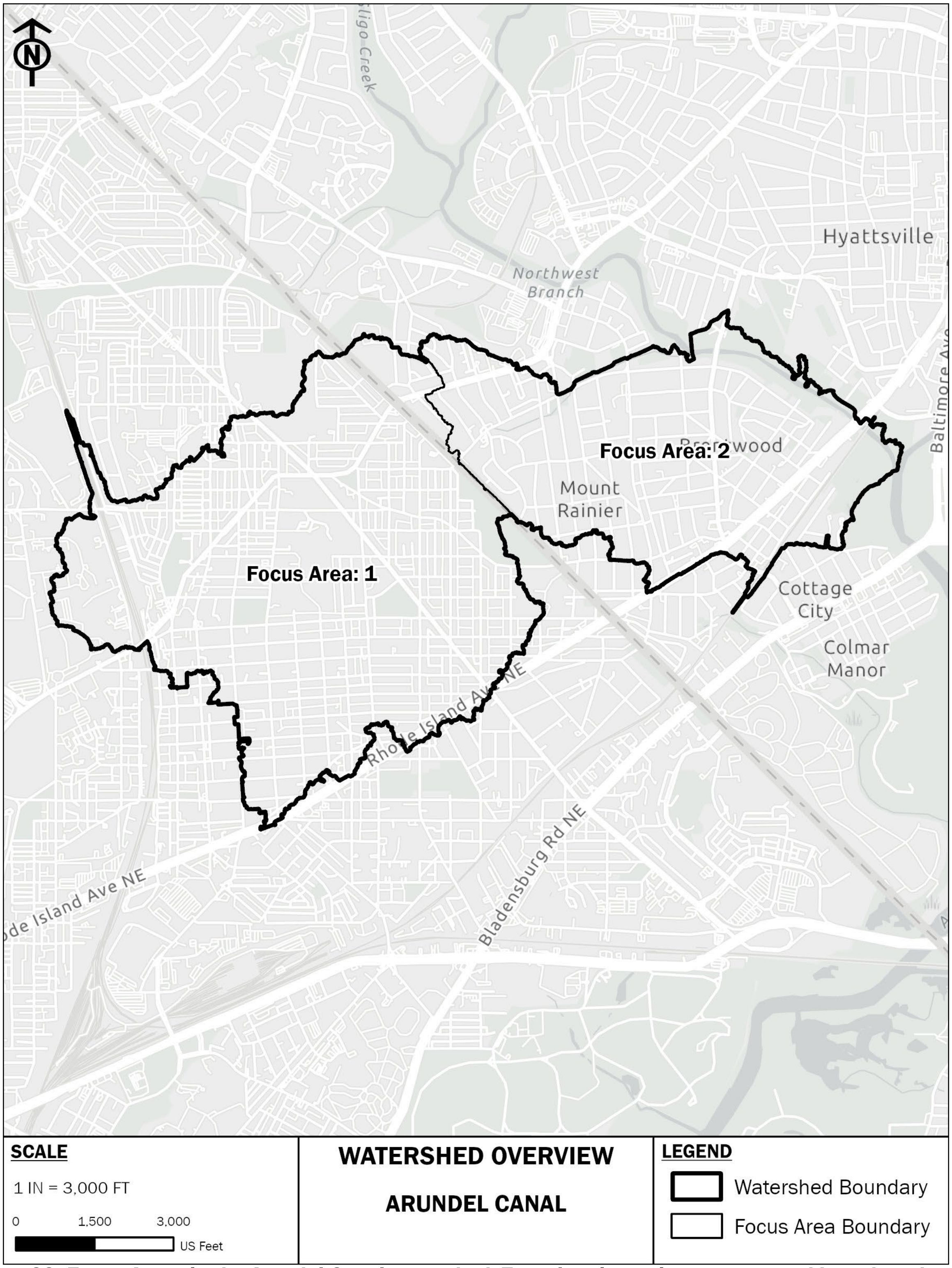


Figure 23: Focus Areas in the Arundel Canal watershed. Two planning units were created based on the HUC-16 boundaries and the District–County line.

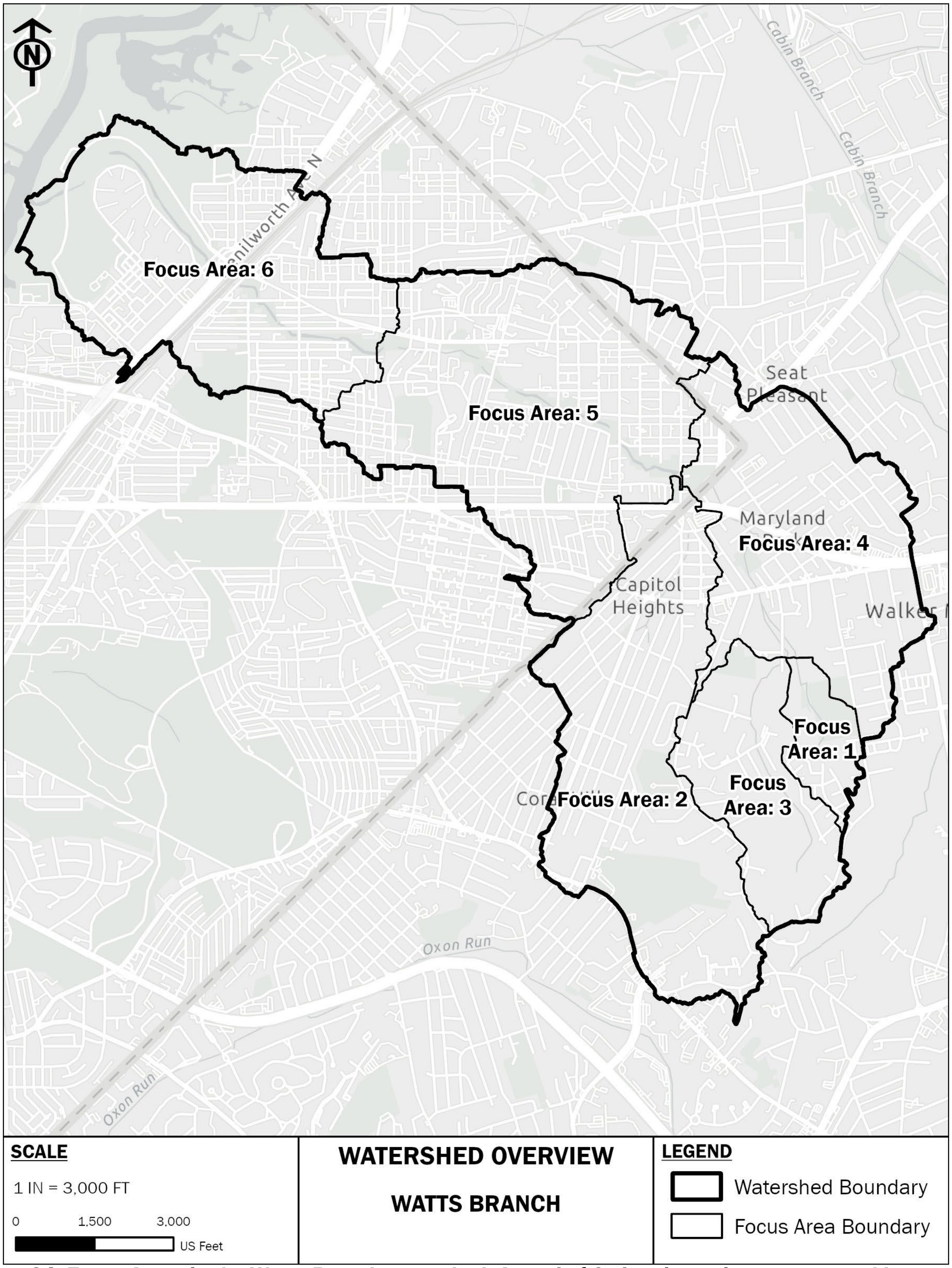


Figure 24: Focus Areas in the Watts Branch watershed. A total of 6 planning units were created by grouping HEC-HMS sub-basins based on hydrology and community character.

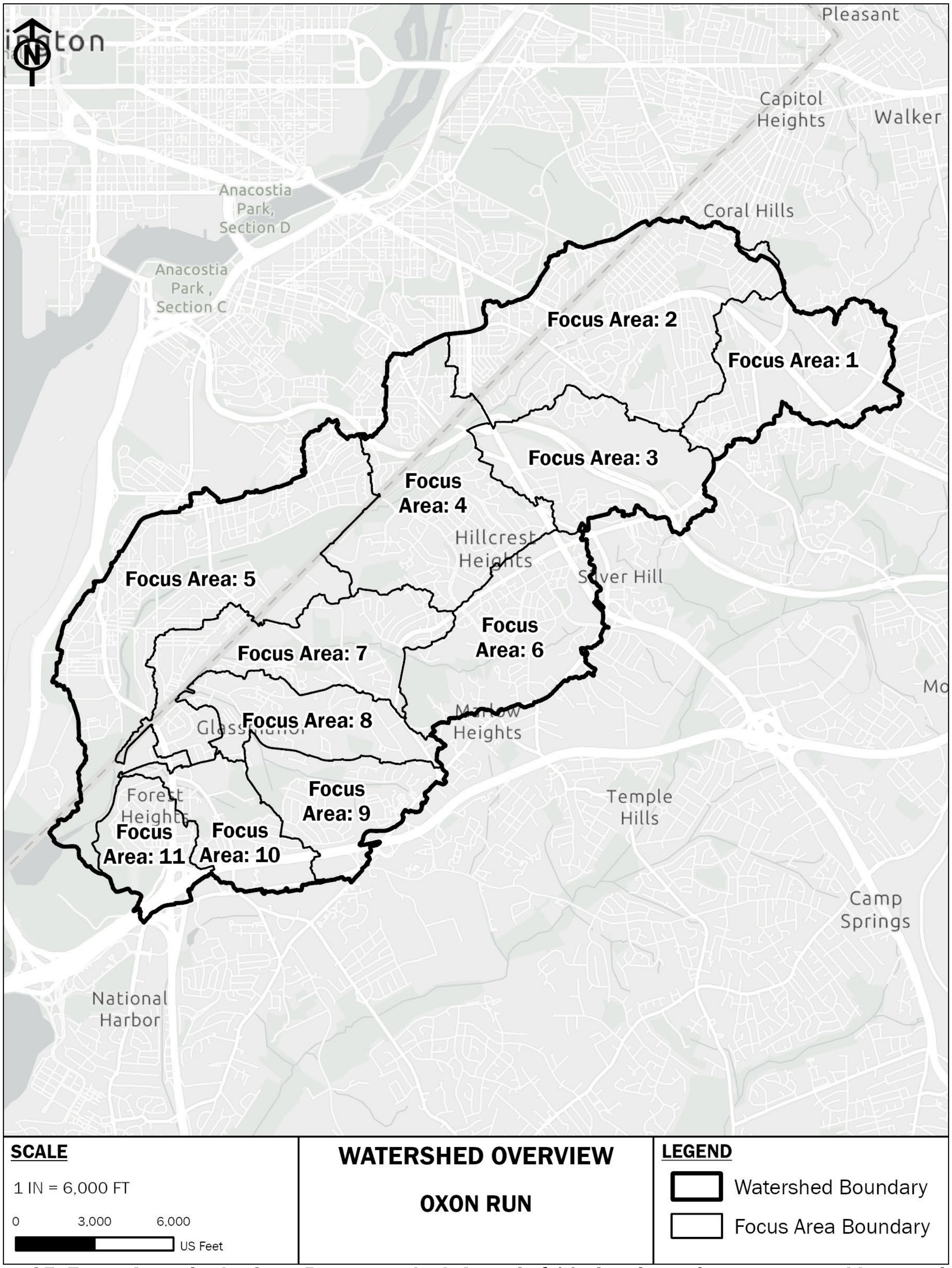


Figure 25: Focus Areas in the Oxon Run watershed. A total of 11 planning units were created by grouping HEC-HMS sub-basins based on hydrology and community character.

FINDING AND MAPPING OPPORTUNITIES

Once the study watersheds were organized into Focus Areas, a comprehensive set of maps was developed for each unit. These maps served two critical functions: first, to summarize existing and known flood risks; and second, to act as the analytical canvas for identifying and locating BGI opportunities.

Mapping Existing Flood Risks

For each Focus Area, a map of existing flood conditions was created using a compilation of previously available data (e.g. FEMA or USACE data), and new analyses conducted by the project team. In both the District of Columbia and Prince George's County, FEMA's 100-year floodplain boundaries were mapped to provide a baseline regulatory reference. In addition, Prince George's County maintains its own countywide floodplain mapping dataset, which was also incorporated to provide a more localized perspective on flood risk.

Recognizing that many flood-prone areas fall outside formal floodplain boundaries—particularly in upland neighborhoods where interior flooding can result from undersized or overwhelmed drainage systems—the study also sought to identify areas at risk for pluvial flooding. To support this, two main data sources were used.

First, an open-source GIS analysis known as Blue Spot Modeling was conducted using a tool developed by the University of Copenhagen. This method uses high-resolution bare-earth LiDAR and building footprint data to identify local depressions and drainage impoundments that are likely to accumulate runoff during heavy storms. Blue Spot analysis was completed for both the D.C. and Prince George's County.

Later in the study, the project team also received output from the District's IFM—a high-resolution, dual-drainage model developed collaboratively by DOEE and D.C. Water. The IFM simulates direct rainfall and drainage network behavior and the provided model snippets include 15-year storm event outputs across all three study watersheds. The project team decided to replace Blue Spot modeling in the District with the IFM outputs, which offer greater accuracy and detail for identifying pluvial flood risk.

Each map also includes the storm drain network, showing the location of stormwater pipes across both jurisdictions. This contextual layer helps communicate the relationship between surface flooding and underground drainage capacity and is especially valuable when evaluating retrofit or overflow storage options.

All data were presented in a colorful, high-resolution GIS format, overlaid on current aerial imagery. This approach ensured that maps would be both technically informative and visually intuitive, enabling planners, agency staff, and community stakeholders to quickly identify patterns, hotspots, and context for BGI opportunities.

While not every dataset was shown directly on the maps, many additional layers—including existing stormwater facilities, green infrastructure assets, and property ownership information—were used to inform the analysis. The project team sought to balance completeness with clarity, emphasizing map elements that best supported communication, prioritization, and decision-making.

Figure 26 provides an example map developed for a single Focus Area, showing flood risk data layers including storm drain infrastructure, Blue Spot analysis, and potential urban flood zones.

Figure 26: Example flood risk mapping within a Focus Area. Layers shown include storm drain infrastructure, Blue Spot analysis, and aerial imagery. In the District, similar maps used IFM outputs in place of Blue Spot data to better capture interior flood risk. Darker shades of blue represent potentially higher depth of inundation.

Targeting Effective Locations for Volume-Based BGI

To maximize flood mitigation benefits, volume-based BGI practices—such as Pond Retrofits, Blue-Green Streets, and Multi-Use Floodable Spaces—should be sited where they can intercept and store the greatest amount of runoff. These practices are designed to physically capture and hold stormwater, reducing the volume of flow that moves downstream during a storm event. This distinguishes them from land-use-based practices—such as Tree Planting or Impervious Surface Reduction—which reduce runoff indirectly by increasing infiltration or altering surface conditions but do not store water in a defined space. Volume-based practices are most effective when placed along primary drainage corridors, where they can manage larger contributing drainage areas, rather than being distributed arbitrarily across available green space.

A stepwise spatial approach applicable to each Focus Area was used to guide the search for high-impact BGI sites. This process significantly narrows the search area and prioritizes locations most likely to deliver meaningful hydrologic benefits:

1. **Identify the Focus Area outlet** and the network of mapped streams and floodplains that define the area's primary drainage system.
2. **Trace the flow corridor upstream** using mapped storm drain infrastructure, extending the drainage network into upland areas and following major storm drain trunklines.
3. **Prioritize known flood-prone areas** or pinch points along the corridor, including road crossings, narrow valleys, or infrastructure bottlenecks. Use existing flood risk mapping for guidance.
4. **Identify contributing areas with high impervious cover**, which contribute a disproportionate share of runoff. These areas are strong candidates for GSI practices or impervious surface reduction.
5. **Search for stormwater ponds** located near the drainage corridor. Close proximity enables opportunities for retrofits or rerouting of drainage flows to improve storage.
6. **Evaluate roads and rights-of-way** along the corridor for Blue-Green Street opportunities. Medians, parking strips, and underused curbside space can often support surface-level detention or bioretention practices.
7. **Identify open green spaces, parks, and fields** adjacent to the drainage corridor. These spaces are especially valuable as candidates for Multi-Purpose Floodable Recreational Spaces due to their visibility, public benefit, and proximity to flow paths.

Together, these landscape features—stream valleys, storm drain corridors, ponds, roads, and recreational land—form the backbone of the opportunity search for volume-based practices. They also support a more targeted, context-sensitive, and hydrologically-informed approach to BGI planning. This targeting framework provided the foundation for the expert-guided search process described in the next section.

Figure 27 illustrates the primary drainage corridor within a representative Focus Area. Orange arrows show the surface and subsurface flow direction, highlighting the concentrated runoff pathway and adjacent areas prioritized for project identification.

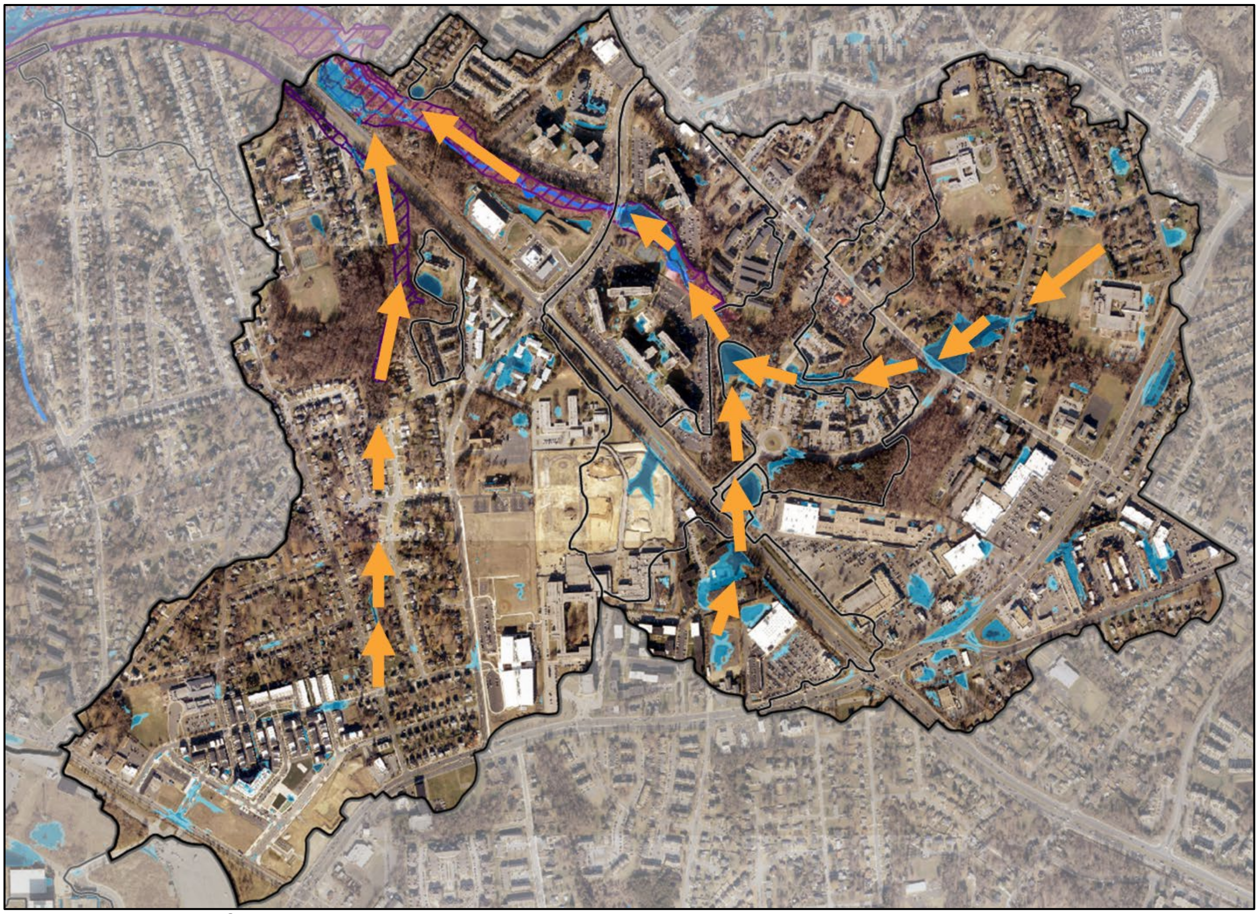


Figure 27: Primary flood and drainage corridor within a representative Focus Area. Orange arrows indicate the surface and stormwater flow direction. Adjacent green spaces, ponds, and public rights-of-way are prime search zones for volume-based BGI practices.

Identifying BGI Opportunities Through Expert-Guided Search

Building on the spatial prioritization strategy described above, experts reviewed and identified specific BGI opportunities across each watershed. While many planning studies rely on automated or algorithmic screening tools, this approach emphasized professional judgment, feasibility, and context sensitivity. Using GIS tools, hydrologic models, and aerial imagery, the team curated opportunities that are not only theoretically viable but also practically implementable. Expert review allowed the team to account for on-the-ground realities—such as parcel ownership patterns, access constraints, maintenance considerations, and local land use dynamics—that are often overlooked or misrepresented in automated approaches. This helped ensure that the opportunities identified were more closely aligned with real-world conditions and implementation pathways.

Opportunities were identified by engineers and planners with experience in flood risk management, supported by GIS specialists familiar with urban land use and planning constraints. Each set of results was reviewed by senior engineers to verify technical feasibility and ensure consistency across watersheds and jurisdictions.

High-resolution aerial photography, elevation data, stormwater infrastructure layers, and land use overlays were used to search for opportunity areas corresponding to each defined BGI practice. Where possible, opportunities were prioritized in locations with public or community-serving land ownership. However, consistent with the project's comprehensive approach, opportunities were also identified on private land where conditions allowed—acknowledging that meaningful flood mitigation will require a mix of public and private action.

The following summarizes the search method and GIS structure used for each BGI practice:

1. Multi-Purpose Floodable Recreational Spaces

GIS Format: Polygon
Description: Public parks, school grounds, community centers, and other open green spaces were evaluated for their suitability to detain and store stormwater during flood events. Polygons were digitized using aerial imagery and edited to exclude buildings, pavement, and heavily forested areas.

2. GSI

GIS Format: Polygon and Point
Description: Open green spaces near storm drain inlets or upstream stormwater nodes were evaluated for practices like rain gardens and bioretention. Cul-de-sacs and dead ends were flagged as "alternative turnaround" opportunities. Areas with existing BMPs were excluded.

3. Bridge and Culvert Modifications

GIS Format: Point
Description: Bridges and culverts with upstream flooding potential or backwater effects (based on HEC-RAS model data) were reviewed for feasibility of retrofit or enlargement. Each location was screened using aerial imagery, modeled flood levels, and field context such as right-of-way width.

4. Blue-Green Streets

GIS Format: Polyline
Description: Streets aligned with major storm drain trunklines or intersecting areas of modeled flooding (e.g., IFM or Blue Spots) were prioritized. Roads with green medians or wide right-of-way were also flagged. Google Street View was used to verify feasibility.

5. Impervious Surface Reduction

GIS Format: Polygon
Description: Large parking areas (typically >2 acres) that appeared underutilized were identified as candidates for removal or conversion to permeable surfaces. Commercial lots such as shopping centers were a primary focus.

6. Pond Retrofits

GIS Format: Polygon
Description: Existing stormwater ponds—both modeled and unmapped—were digitized and evaluated for retrofit potential. Blue Spot analysis helped identify smaller depressions suitable for conversion or enhancement.

7. Storm Drain Outfall Retrofits

GIS Format: Point
Description: Storm drain outfalls with clear surface connection to floodplains or streams were mapped and assessed for retrofit potential. Locations lacking clear energy dissipation or headwalls were prioritized.

8. Stream Daylighting
GIS Format: Polyline
Buried storm drain segments longer than 500 linear feet, located near natural streams or within floodplains, were identified potential daylighting sites. Spatial proximity to open channels guided feasibility screening.

9. Stream, Wetland, and Floodplain Restoration
GIS Format: Polyline
Description: Stream corridors with lateral floodplain space (based on contour data and floodplain mapping) were assessed for restoration. Segments were prioritized where modeled backwater, limited confinement, or ecological benefit made restoration feasible.

10. Tree Planting
GIS Format: Polygon
Description: Open green spaces of significant size (typically 0.25 acres or greater) were identified for tree planting, particularly in upland areas. Forested areas were excluded. Tree planting is often paired with soil amendment and compaction relief to maximize infiltration.

This structured, expert-guided process enabled the project team to evaluate each site based on real-world conditions and practical feasibility. By applying consistent criteria across jurisdictions and engaging technical staff familiar with local constraints, the opportunity inventory reflects a high level of planning detail. For example, in several locations, sites that initially appeared suitable in GIS screening were excluded after expert review identified known access issues, maintenance burdens, or overlapping projects that would limit feasibility. While not intended as final designs, the identified opportunities offer a strong foundation for future analysis, stakeholder engagement, and concept development.

Mapping and Communicating BGI Opportunities

The BGI opportunity mapping process culminated in a set of clear, visually accessible maps designed to support planning, outreach, and project development across the study area. These maps translate the technical search process into an intuitive format, allowing users to explore potential BGI interventions geographically and at multiple scales.

The BGI search methodology described in this report was applied to all three study watersheds, with one exception. During the course of SAG meetings, D.C. shared that a similar BGI siting effort was already underway for the Watts Branch watershed. To avoid redundancy, Watts Branch Focus Areas 5 and 6 were excluded—both of which fall primarily within the D.C.—from further BGI opportunity mapping. This decision was communicated during stakeholder discussions and supported by District agency partners.

For the remaining Focus Areas, a series of 11x17 maps were created and organized by watershed and focus area. Each set includes:

- **A Focus Area overview map** providing context within the watershed.
- **An existing conditions map** showing storm drain infrastructure, FEMA and local floodplains, and areas of elevated flood risk.
- **Ten BGI opportunity maps**, one for each practice type defined in this study.

Mapping each BGI practice separately allows for flexible interpretation and comparison. Many locations could support multiple types of BGI, and separating practices avoids conflating options. For example, an open space may be appropriate for either Tree Planting or GSI depending on site priorities, maintenance capacity, or funding source. Individual maps give planners and stakeholders the ability to weigh those tradeoffs and select the best fit.

The maps are presented using high-resolution aerial imagery, bright and accessible color schemes, and labeling that supports building- and block-level orientation. They are optimized for readability when printed at scale or viewed digitally. A sample map is included in Figure 28. All final maps are provided in Appendix C.

It is important to note that while every Focus Area includes a full set of 10 BGI Opportunity maps for consistency, not all areas contain viable opportunities for every practice. For example, Focus Area 1 of the Arundel Canal watershed contains no open stream segments and therefore includes no mapped opportunities for Stream, Wetland, and Floodplain Restoration. In such cases, the map is still included but intentionally blank. This structure supports ease of navigation and allows users to quickly confirm whether opportunities exist for each practice.

The mapped opportunities presented in Appendix C also serve as critical inputs into the prioritization framework, which evaluates Focus Areas based on feasibility, vulnerability, equity, and potential watershed-wide benefit.

Figure 28: Sample BGI Opportunity Map for GSI in Oxon Run Focus Area 4. Bright color symbology highlights potential sites, which include public rights-of-way, open green space, and cul-de-sac conversions. This map is one of ten practice-specific maps included for each Focus Area.

Prioritization Framework

A prioritization framework was developed to support transparent, equitable, and actionable flood resilience planning across the study area. The framework reflects values identified during stakeholder engagement, incorporates regional and local datasets, and aligns with community concerns around equity, visibility, and feasibility of BGI implementation.

DEVELOPING THE FRAMEWORK

The framework builds upon a model developed by the District DOEE in its *Resilience Focus Area Strategy and Appendices* (2023). The original model scores areas based on Vulnerable People, Vulnerable Assets, and Actionability. Several modifications were made to adapt this framework for a cross-jurisdictional context, including expanding the scoring categories and standardizing data inputs to cover both the D.C. and Prince George's County.

The revised framework assigns equal weighting to three primary categories: Social Vulnerability and Equity, Asset Vulnerability, and Actionability, each worth 30 points. A fourth factor, Watershed-Wide Impact, contributes 10 points and reflects a central theme of the study—reducing downstream flooding through coordinated upstream intervention. Scores for each metric were calculated using values normalized by Focus Area acreage to support comparability. Appendix D includes the full scoring results and is accompanied by a user note highlighting how community priorities and project-specific co-benefits can be integrated into future decision-making.

Watershed-Wide Impact

Flooding is often more severe in downstream communities, yet meaningful mitigation frequently depends on implementing solutions upstream. This reality informed the original selection of the three study watersheds and was reinforced throughout SAG meetings and community outreach. To capture this relationship in the scoring model, the project team added a Watershed-Wide Impact factor.

Focus Areas were categorized by position within each watershed and assigned accordingly: 10 points for headwaters, 5 for midstream, and 0 for downstream. While no points were deducted from downstream areas, upstream Focus Areas were intentionally favored to incentivize projects that reduce runoff closer to the source.

Actionability

The Actionability score quantifies the number and concentration of viable BGI opportunities in each Focus Area. Projects were tallied or measured by type—area (acres), length (linear feet), or count—and normalized by Focus Area size. Practices like Pond Retrofits, Multi-Purpose Floodable Public Recreational Spaces, and GSI were scored by area; linear practices like Blue-Green Streets and Stream Daylighting

How the BGI Opportunity Mapping Informs Prioritization

The Actionability score in this framework is grounded in the mapped opportunities identified during the BGI analysis phase. For each Focus Area, the project team measured the number, length, or area of viable opportunities for each BGI practice. These measurements were normalized by acreage and used as proxies for implementation potential and likely volume reduction.

This method ensures that the prioritization framework builds directly on the earlier work of expert-guided BGI siting. It also maintains consistency across jurisdictions and allows for a flexible foundation that can evolve as more detailed design information becomes available.

by length; and discrete interventions such as Storm Drain Outfall retrofits or Bridge and Culvert Modifications by count.

Although direct runoff modeling was not performed, the scoring system was designed to approximate flood storage potential. For example, mapped area of pond retrofits or GSI serves as a practical surrogate for volume, assuming a typical depth. Since the BGI opportunities were identified in hydrologically strategic locations—such as primary drainage corridors—they are also well-positioned to intercept meaningful runoff. These assumptions make Actionability a strong planning-level proxy for volume reduction.

Social Vulnerability and Equity

This scoring category evaluates population and equity indicators to help direct flood resilience investment toward socially vulnerable communities. Metrics include:

- CDC Social Vulnerability Index (SVI) and COG Equity Emphasis Areas (EEAs), weighted by acreage within each Focus Area.
- Count of facilities serving vulnerable populations, including affordable housing, senior living, and childcare centers.
- Total population and population density, based on Census block group data.

These indicators ensure that planning efforts remain inclusive and responsive to those most at risk.

Asset Vulnerability

Asset Vulnerability assesses the physical exposure of buildings, infrastructure, and facilities to flooding. Metrics include:

- Mapped flood hazard areas, using FEMA and Prince George's County floodplains.
- Blue Spot and IFM flood modeling, capturing local surface water accumulation and urban flooding risk.
- Buildings and roadways within flood-prone areas, adjusted by land use and building type.
- Critical and community-serving facilities, including schools, emergency services, and transportation assets, weighted by function.

All values were normalized by Focus Area acreage to enable consistent scoring across the study area.

Community Input

Community feedback informed the development of the prioritization framework, particularly during the series of regional workshops where the project team deployed a "BGI Prioritization Game" to help participants evaluate different practice types and share feedback. While initial participation was limited, the outreach strategy evolved, identifying CBOs as key partners and potential users of the study's outputs and prioritization tools.

Participants generally expressed stronger support for visible, familiar practices such as Tree Planting and Impervious Surface Reduction. However, public preferences were highly dependent on-site context. Some practice types, like Multi-Purpose Floodable Recreational Spaces, received limited support as abstract concepts but would likely be better received when linked to specific, recognizable locations.

Although the initial scoring framework explored ways to reflect community preference by favoring certain BGI practices, the project team ultimately applied even weighting across all BGI practice types. This decision reflects the limited specificity of input received on where particular practices should be prioritized and avoids introducing bias in the absence of clearer consensus. Even weighting also allows for greater flexibility: future users of the framework can adjust the practice-level weights based on evolving community priorities, site-specific engagement, or jurisdictional goals without needing to rework the underlying structure.

In practice, the Prioritization Framework can support a range of uses beyond initial screening. Agencies applying for grants with equity or climate resilience criteria may use the tool to highlight areas of elevated need, while practitioners with pre-identified sites can compare how well their project aligns with regionally significant indicators. As community partnerships deepen and specific co-benefits emerge—such as improved park access, urban cooling, or school-based stewardship—those priorities can inform both project selection and future refinements to the framework.

Framework Use and Adaptation

The prioritization framework is best understood as a screening tool—designed to help identify where to focus BGI work across the three watersheds. It allows users to compare Focus Areas using consistent, data-supported criteria: flood vulnerability, equity status, and the concentration of viable project opportunities. In that sense, it provides a rational foundation for early decision-making, especially for agencies determining where to begin planning or for applicants seeking to strengthen funding proposals.

While the framework does not explicitly score co-benefits—such as access to green space, heat island mitigation, or recreational improvements—those considerations remain critical to the success of BGI. Many co-benefits are best evaluated at the concept level, when specific practices and locations are known and community engagement has begun. Still, the framework can support funding alignment by identifying Focus Areas that score highly on criteria often tied to grant eligibility, such as equity or flood exposure.

Future users are encouraged to view the framework as a flexible tool. While its core structure is designed for transparency and comparability, it can be adapted to reflect local priorities. For example, users may choose to overlay additional data layers or supplement the framework with community-identified needs. Guidance on how to navigate the spreadsheet and interpret the scores is provided in Appendix D, along with a note on adapting the tool to evolving program goals.

DEMONSTRATION CONCEPTS AND RECOMMENDATIONS

With BGI opportunities mapped and prioritized by Focus Area, the next step is to illustrate how these opportunities can be translated into actionable, fundable, and measurable projects. This section presents three demonstration concepts—one from each watershed—designed to showcase how site-scale BGI planning can support community resilience, infrastructure performance, and cross-jurisdictional coordination.

Each concept was developed using inputs from the BGI Opportunity Mapping, informed by local flood risk data, and shaped to reflect the unique conditions of the selected Focus Area. The goal is not only to advance real projects within the study area, but also to provide a replicable model that stakeholders and partners can use to develop their own concepts elsewhere. Each concept includes planning-level visuals and strategies to support grant applications, agency coordination, or community engagement, while also serving as a step-by-step model that can be adapted to other Focus Areas or regional planning efforts.

Selecting Demonstration Concept Locations

The demonstration concepts presented in this section were selected to reflect the goals of the study and the values expressed through SAG meetings, community outreach, and ongoing local planning efforts. While the prioritization framework developed as part of this project offers a powerful tool for evaluating Focus Areas, it was developed in parallel with the demonstration concepts and was not available at the time site selection began. Instead, the study relied heavily on qualitative feedback from the SAG and input from local agency partners to guide site selection.

In particular, the following themes emerged as key considerations in selecting demonstration sites:

- **Projects should reduce runoff from one jurisdiction into another.** Priority was placed on upstream Focus Areas that could help mitigate downstream flooding in neighboring jurisdictions. As a result, the selected concepts are all located in headwater Focus Areas and represent upstream opportunities to address regional flood challenges. This emphasis also reflects a key priority voiced by CBOs, who consistently highlighted the importance of addressing upstream drivers of flood risk to protect more vulnerable downstream neighborhoods.
- **Demonstration concepts should complement, not duplicate, ongoing efforts.** Site selections were made with full awareness of other active planning initiatives and focused on areas where demonstration concepts would add the most value.

Focus Area Selection Rationale:

The selected Focus Areas are shown in Figure 29.

- **Arundel Canal – Focus Area 1 (District of Columbia):**
  The Arundel Canal watershed contains only two Focus Areas, one in each jurisdiction. Focus Area 1, which covers the D.C. portion of the watershed, was selected based on its headwater position and its potential to reduce runoff entering Prince George's County. The project team also considered ongoing planning in Focus Area 2, including the Mount Rainier Green Infrastructure Plan and the North Brentwood Drainage Study, and sought to avoid duplicating those efforts.

- **Watts Branch – Focus Area 2 (Prince George's County):**
  Focus Area 2 was identified as a priority based on feedback from the SAG, which emphasized the Chamber Avenue concrete channel as a key opportunity for future BGI investment. In addition, the District is actively advancing BGI planning in Focus Areas 5 and 6. By focusing on an upstream area in Prince George's County, the demonstration concept reinforces the role of coordinated upstream actions in mitigating downstream flood risks.
- **Oxon Run – Focus Area 1 (Prince George's County):**
  Focus Area 1 was selected for its headwater position, diversity of mapped BGI opportunities, and previous use in SAG meetings as a planning and visualization example. Ongoing major investments in Oxon Run Park were also considered, including stream restoration and park master planning efforts led by D.C. In response, the Team prioritized a complementary site upstream in Prince George's County. Input from District agencies and other SAG members helped shape the focus and content of this concept.

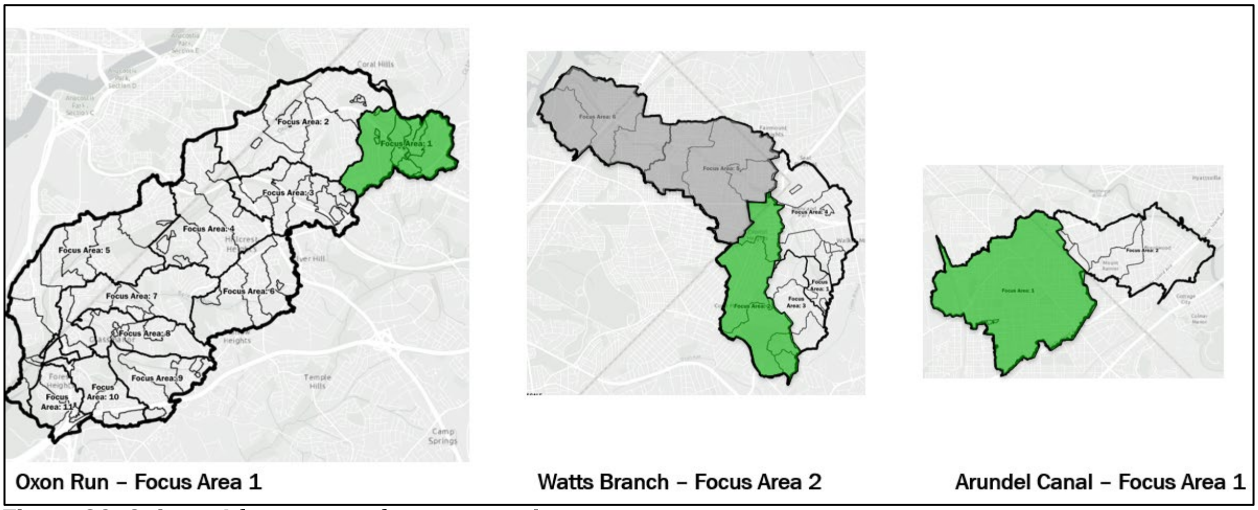


Figure 29: Selected focus areas for concept plans.

While only one Focus Area per watershed was selected for demonstration, these choices should not be interpreted as prioritizations to the exclusion of others. Flood risk is rarely solved by isolated projects. Instead, these concepts are intended to supplement and reinforce existing efforts, demonstrate replicable methods, and highlight opportunities for multi-site, multi-jurisdictional coordination.

Developing Fundable Concept Plans

This section provides a practical, step-by-step guide for transforming BGI opportunity data into actionable, fundable project concepts. While the demonstration concepts presented in this study were developed by the project team, this guidance is intended to help other users—including government agencies, non-profits, and CBOs—replicate the process using the data, tools, and methods established in this report. This process is designed to support a range of users—from agencies and technical partners refining identified opportunities, to CBOs using the mapping to explore ways to use BGI to meet community needs.

Before beginning, users must first select a project area. This decision may be shaped by organizational priorities, available funding, or community needs. To support this selection, the report includes a prioritization framework and detailed opportunity mapping for each Focus Area to help identify locations with the greatest need or potential impact.

The steps outlined below form an adaptable scope of work. They can be scaled to different project sizes and tailored to fit the resources and objectives of the sponsoring organization. At its core, the process emphasizes feasibility, transparency, and defensible planning assumptions to support future implementation and grant success.

While concept planning does not require final design detail, it should demonstrate a realistic understanding of project constraints, clearly communicate proposed improvements, and include cost and volume estimates sufficient to support early-stage decision-making. These outputs are designed to help users secure resources, engage stakeholders, and advance BGI concepts toward implementation.

Centering Community in Concept Planning

While this section provides a step-by-step guide for translating mapped BGI opportunities into concept plans, successful implementation depends on more than technical performance or cost-efficiency. Concept plans must be grounded in community values, priorities, and lived experience. This is particularly important when upstream projects are designed to reduce downstream flood risk—local benefits must still be clear and compelling.

As outlined in the *Meaningful Watershed-Based Engagement* section of this report, effective engagement connects BGI to everyday concerns such as recreation access, heat relief, and neighborhood identity. The demonstration concepts included here are now ready for the next phase: direct community engagement. Future planners can use the tools, lessons, and relationships developed through this study to initiate that process—whether advancing these concepts or developing new ones. Bringing concept plans to the community early and collaboratively is essential to refining design, building trust, and ensuring lasting project success.

STEP 1: ASSESS WATERSHED INFLUENCE

A critical early task in concept planning is to understand how the selected project area functions within the broader watershed. Not all Focus Areas contribute equally to downstream flooding. A site's hydrologic position—whether in the headwaters, midstream, or downstream—strongly influences the scale and type of benefit that BGI can provide.

Before selecting and designing specific practices, it is important to assess the potential influence of the Focus Area on watershed-scale runoff and flood behavior. This step helps to set expectations, establish meaningful objectives, and right-size the resulting concept plan.

Why This Step Matters

Runoff and flooding are shaped by a variety of factors, including land cover, soil characteristics, impervious surface area, topography, and the timing of stormwater flows. These variables interact in complex ways, meaning that Focus Area size alone does not determine influence. Some small but strategically located areas may exert a larger effect on downstream conditions than larger areas with less hydrologic connectivity.

Estimating how much runoff originates in the Focus Area, and how that runoff contributes to downstream flood peaks, provides valuable context. This understanding helps define whether the concept plan should prioritize localized benefits, contribute to broader watershed goals, or support both.

How to Conduct this Analysis

Available hydrologic models—such as HEC-HMS or TR-55—can be used to test the theoretical influence of the Focus Area. One recommended method is to simulate design storm events with and without the Focus Area included in the model. By “removing” the area from the simulation, the analysis can estimate the upper bound of peak flow and runoff volume reduction that could result from full-scale intervention.

While this approach does not reflect a realistic design outcome, it offers a useful planning baseline. It clarifies the proportion of total watershed runoff contributed by the Focus Area and helps to define the maximum mitigation potential.

Recommended Output

To support planning and communication, consider preparing a short technical summary that includes:

- The modeled storm events (e.g., 2-, 10-, and 100-year).
- Peak flow and total runoff volume with and without the Focus Area.
- Key observations on timing, contribution to downstream peaks, or storage significance.

This step provides important insight to inform concept goals, outreach narratives, and funding proposals with a clear, data-supported rationale.

STEP 2: PLAN SITE VISITS

Once the Focus Area’s watershed role is understood, the next step is to conduct site visits to verify mapped data, evaluate conditions on the ground, and identify potential opportunities and constraints. Fieldwork adds essential context that cannot be captured through remote analysis alone, especially when refining BGI concept plans.

Figure 30: Site visit data collection.

Purpose of This Step

Site visits help confirm the accuracy of mapped flood risks and opportunity areas, while also identifying real-world challenges such as access limitations, utility conflicts, land use constraints, and community preferences. They provide a crucial reality check for translating BGI potential into feasible, fundable designs.

Recommended Approach

Site visits are most efficient when guided by pre-visit planning. Recommendations include:

- Review BGI Opportunity Maps, Blue Spot/IFM modeling, and storm drain infrastructure layers to understand potential flood behavior and infrastructure layout.

- Identify and prioritize areas with known or modeled flooding, and cross-reference with opportunity locations to plan a route that maximizes coverage.
- Use preformatted field forms (included in the appendix) tailored to each BGI practice type to guide consistent and thorough data collection.
- Use GPS-enabled mobile tools, if available, to geotag observations and store data directly in a centralized database.

Recommended Field Observations

At each potential site, it is helpful to document:

- Current land use and surface conditions.
- Visible utility infrastructure (e.g., manholes, poles, valves).
- Drainage features or evidence of past flooding.
- Proximity to regulated resources (e.g., streams, wetlands, forest).
- Existing stormwater management features and their apparent function (e.g., bioretention cells, stormwater ponds, curb inlets, or underground storage systems).
- Access constraints (e.g., fences, terrain, traffic).
- Opportunities for co-benefits (e.g., shade needs, public use, erosion control).

Each site should be photographed and linked to its mapped location using a clear naming or ID system for easy reference later in the planning process.

Timeframe

For this study, site visits typically required 2–4 days per Focus Area, depending on size, access, and complexity. Advance preparation and use of digital tools significantly reduced field time and improved data quality.

Key Takeaway

Site visits bridge the gap between mapping and implementation. They help filter and refine the list of BGI opportunities and ensure that concept plans reflect real-world site conditions, rather than theoretical assumptions.

STEP 3: SELECT SPECIFIC BGI PRACTICES

With mapped opportunities reviewed and field conditions verified, the next step is to select a set of BGI practices that best fit the physical, organizational, and community context of the project area. At this point, planning objectives, feasibility, and on-the-ground insight begin to converge into a focused concept.

Purpose of this Step

This step narrows the full inventory of potential BGI practices down to those that are viable, meaningful, and aligned with stakeholder goals. The selection process is informed by the observed site conditions, community priorities, partner input, and technical considerations.

Recommended Approach

Begin by evaluating the mapped BGI opportunities within the Focus Area using field data and aerial imagery. Apply the following filters and considerations:

- **Eliminate opportunities with unworkable constraints.** Remove locations where implementation is not feasible due to major utility conflicts, ownership limitations, access barriers, or environmental restrictions.
- **Identify sites that provide added value.** Prioritize opportunities that:
    - Address documented flood challenges
    - Overlap with exposed or vulnerable infrastructure
    - Are located on public or mission-aligned private land
    - Support known community needs (e.g., heat relief, erosion control, recreational upgrades)
- **Recognize shared value opportunities.** Look for co-benefits such as:
    - Parks with outdated athletic facilities that could double as flood storage
    - Streets in need of resurfacing or utility upgrades
    - Sites near schools or places of worship
    - Shaded gathering spaces in areas lacking canopy coverage
- **Consider implementation timing.** Some opportunities, particularly on private land or recently redeveloped public spaces, may not be ready for immediate investment. While still important for long-term planning, these may be better suited for future phases.
- **Aim for diversity and flow path alignment.** A strong concept typically includes multiple practice types that work together. Aim to intercept runoff near its source (e.g., tree planting or GSI), store volume in central locations (e.g., ponds or floodable fields), and improve conveyance along the primary drainage corridor (e.g., Blue-Green Streets or Stream, Wetland, and Floodplain Restoration).

Balance Vision and Realism
Effective concept planning finds a balance between ambition and practicality. The most transformative projects often reshape the landscape to serve multiple purposes, but it is equally important to remain responsive to site constraints and community preferences. A strong concept demonstrates both creativity and credibility.

Key Takeaway
Practice selection is about more than identifying what is possible, it is about defining what is meaningful and achievable. This step sets the foundation for developing a compelling concept that integrates technical feasibility with community benefit and implementation potential.

STEP 4: DEVELOP PLAN VIEWS
Once BGI opportunities have been selected, the next step is to translate the concept into a plan view. Plan views are annotated, scaled graphics that show the location, extent, and type of proposed improvements overlaid on a base map. They serve as a foundational tool for stakeholder engagement, grant applications, and early coordination with implementation partners.

Purpose of this Step
Plan views visually communicate the proposed scope of work. They support clarity, consensus, and early feasibility checks, while demonstrating to funders and reviewers that the project has been thoughtfully scoped and realistically sited.

Recommended Approach

Use high-resolution aerial imagery as a base and overlay BGI features with distinct, color-coded symbology. Draw features to scale and clearly label each practice type. Include a legend and road names for orientation. Follow these general tips for effective plan view development:

- **Clearly show practice boundaries** with polygon or line features sized according to mapped opportunity areas and site constraints.
- **Use consistent symbols and colors** for each BGI practice type, matching conventions used in earlier mapping to maintain continuity.
- **Label practices directly on the map**, including practice type and a unique identifier that ties to any supplemental tables with size and cost summaries.
- **Include a simple, readable legend** and compass/north arrow. Road names and landmarks help orient viewers to the surrounding context.
- **Avoid overdesigning.** Plan views should reflect planning-level (15% design) concepts—showing location, size, and function—without committing to final design details such as grading, materials, or drainage connections.

Balance Accuracy and Flexibility

Concept plans should reflect realistic constraints and opportunities while remaining adaptable. This level of design is not intended to finalize specific engineering decisions, but to demonstrate feasibility and facilitate productive conversations with stakeholders and funders.

Key Takeaway

Plan views transform abstract ideas into visible, understandable concepts. They are essential for early-stage communication, helping audiences visualize the project, understand its potential, and evaluate its alignment with broader planning and funding goals.

STEP 5: ESTIMATING STORAGE POTENTIAL AND COSTS

With a clear concept and plan view in hand, the final step in concept development is to generate preliminary estimates of flood storage potential and implementation cost. These estimates are not intended as detailed engineering calculations, but they are essential for demonstrating feasibility and securing funding.

Purpose of this Step

Volume and cost estimates help funders and stakeholders evaluate the scale and impact of the proposed concept. They support informed decision-making, strengthen grant applications, and help compare alternatives based on expected benefit and required investment.

Background Information on Cost Estimation

Construction cost estimates were developed based on recent project experience, regional pricing references (the Maryland Department of Transportation State Highway Administration Price Index), and representative design assumptions for each BGI practice. Estimates were prepared in-house by professional engineers with current design and construction experience in Prince George's County and the District.

Each BGI practice was estimated from the ground up, using key construction components—such as excavation, soils, plantings, and structural elements—and normalized to a scalable unit (e.g., per linear foot or per acre).

Estimates reflect construction costs only. Soft costs such as design, permitting, engagement, and long-term maintenance are not included. While these costs are essential to implementation, they are highly variable and project-specific. As a general planning reference, design and permitting typically add 10–25% to construction costs, depending on jurisdiction, scale, and delivery method. Long-term maintenance planning is beyond the scope of this study, but should be addressed early in project development.

All cost estimates include a 40% contingency to reflect planning-level uncertainty and account for incidentals not itemized at this stage, such as mobilization, traffic control, construction surveying, and erosion and sediment control. These figures represent a snapshot of current market conditions at the time of this study.

Recommended Approach

Use the refined practice footprints developed in the plan view to estimate total storage volume and construction cost. The assumptions below reflect "typical" conditions for each practice type. Actual project costs may vary significantly based on design complexity, site access, scale, and urban context. For example, a simple floodable field may be relatively low-cost, while a hardscaped plaza with floodable features could be significantly more complex. Smaller projects may also face proportionally higher costs due to reduced economies of scale. Use judgement to adjust and scale prices accordingly.

For this study, the following assumptions were used to estimate volume and cost by BGI practice type:

Multi-Purpose Floodable Recreational Spaces

- Volume estimated using surface area and an assumed 2-foot average depth, plus limited infiltration through an underground sand filter.
- **Estimated cost:** $160 per square yard for athletic field retrofit with sand filter underdrain system.

Blue-Green Streets

- Volume estimated by treatment configuration (e.g., sidewalk, parking lane, or travel lane) multiplied by total linear feet.
- **Estimated cost:** Ranges from $744 to $1,284 per linear foot, depending on street width and treatment type.

Pond Retrofits

- Volume estimated assuming 3 feet of additional storage depth within the existing pond footprint (27 cubic feet per square yard).
- **Estimated cost:** $196 per square yard, based on excavation and retrofit of a sand filter base.

Stream, Wetland, and Floodplain Restoration

- Volume estimated using typical valley width and reconnection of the floodplain, informed by site-specific topography.
- **Estimated cost:** $1,400 per linear foot, reflecting complexity typical of urban/suburban stream restoration.

GSI

- Volume not directly modeled in this study but may be approximated using footprint and assumed media depth.
- Performance was modeled using a curve number reduction to represent increased infiltration.
- **Estimated cost:** $590 per square yard.

Tree Planting

- Volume reduction modeled as a CN shift, not through direct storage.
- Cost includes soil amendment and compaction relief for reforestation-scale planting.
- **Estimated cost:** $80,000 per acre ($1.84 per square foot).

Other Practices (Bridge/Culvert Modifications, Stream Daylighting, Outfall Retrofits)

- Storage volumes and construction costs are highly site-specific and not estimated in this study.
- For planning purposes, use cost benchmarks from similar practices (e.g., stream restoration or GSI) as placeholders.
- Future design phases should develop refined estimates for these practices.

How to Use These Estimates

These planning-level estimates reflect construction costs and are intended to support early-stage project development. Estimates can be used to:

- Compare options across BGI practices or Focus Areas
- Communicate scale and investment in grant proposals and early outreach
- Understand typical unit costs (e.g., per acre, per linear foot) for common practice types
- Frame funding needs for stakeholder discussions

These figures do not include soft costs such as design, permitting, engagement, and long-term maintenance. Actual costs may vary based on project scope, site conditions, and timing.

Key Considerations

- All volume and cost assumptions are intended for planning purposes only and reflect general market conditions at the time of this study.
- Actual costs may vary significantly based on site conditions, utilities, permitting, and labor/material markets.
- These estimates are most useful for comparing options and framing grant proposals—not for final budgeting.
- Soft costs and long-term maintenance are real and important considerations but were outside the scope of this study. Future implementers should budget for these items based on project-specific needs.

Key Takeaway

Preliminary volume and cost estimates bring structure and credibility to early-stage planning. By applying consistent and defensible assumptions, concept developers can demonstrate the scale, value, and investment needed to move projects forward—while maintaining the flexibility required for future refinement.

STEP 6: ENGAGE THE COMMUNITY

Once a preliminary concept has been developed, the next step is to engage local stakeholders, residents, and community-based organizations to refine the plan and build shared ownership.

Purpose of This Step

Successful concept plans reflect both watershed-scale priorities and community-level needs. Engagement at this stage is critical for aligning design with lived experience, surfacing site-specific insights, and identifying co-benefits that extend beyond modeled flood reduction.

Recommended Approach

Use the outreach tools, lessons, and strategies outlined in the *Meaningful Watershed-Based Engagement* section of this report to guide the process. Engagement should be tailored to the specific context of each Focus Area and coordinated with landowners and implementation partners.

Effective engagement connects BGI to tangible, everyday needs and values. In many cases, addressing small but persistent inconveniences can become one of the most meaningful co-benefits of BGI implementation. Whether by resolving a drainage issue, improving pedestrian safety, or upgrading underused space, concept refinement should seek out opportunities to solve problems that matter to residents.

Key Takeaway

The demonstration concepts presented in this study are ready for the next phase of engagement. Future planners can use the materials and relationships developed through this project to move forward—whether building on these examples or creating new concepts. Community engagement at this stage is essential to refining design, strengthening trust, and ensuring project success.

Demonstration Concepts by Watershed

CONNECTING CONCEPTS TO COMMUNITY VALUES

The demonstration concepts in this section reflect priority locations for BGI implementation, identified through a combination of mapped flood risk, opportunity areas, and alignment with regional resilience goals. While the concepts were developed primarily through physical and spatial analysis, they are deeply informed by the values that guided this study—equity, climate resilience, and actionability—and grounded in the belief that effective infrastructure must also serve the communities that host it.

Each selected Focus Area ranked highly in the Prioritization Framework, including indicators such as Social Vulnerability and Equity, Asset Vulnerability, Actionability, and Watershed-Wide Impact. These areas emerged as strong candidates even before the Framework was finalized, reflecting both the project team’s regional understanding and the strength of agency, institutional, and community relationships built over the course of the study.

These demonstration concepts are not final designs. They are starting points for partnership—offering preliminary strategies for flood volume capture and peak flow reduction, organized into clusters that reflect real-world site conditions, land ownership, and implementation feasibility. Many concepts were shaped with early input from local stakeholders during the outreach phase of this study. Moving forward, these concepts should be refined through co-development with residents, land stewards, and CBOs to ensure projects deliver both technical value and meaningful community outcomes.

Importantly, many of the neighborhoods where BGI is proposed are not the most acutely flood-prone areas. The value of these projects must be tangible and visible—through improved recreation spaces, better-maintained landscapes, cooling shade, community gathering areas, or educational opportunities. In some cases, these benefits may become the primary value of the project from the community's perspective.

The co-benefits described in the following concepts—including enhancements such as shade structures, play spaces, and community gathering features—represent ideas that may emerge through future engagement. While these elements illustrate the types of outcomes that can strengthen community value and support, new structural or hardscape features beyond the scale of BGI are not included in the planning-level cost estimates provided in this report. Planners may wish to allocate additional funding to accommodate these elements as concepts advance. Final features and costs will ultimately be shaped through design development and community partnership. These concepts are intended as flexible foundations—not fixed project scopes.

EQUITY CONSIDERATIONS IN BGI CONCEPT PLANNING

The demonstration concepts presented in this report reflect more than mapped flood risk—they represent an intentional investment in neighborhoods that have historically been underserved. All three watersheds included in this study were designated as Resilience Focus Areas by DOEE, based on overlapping indicators of environmental risk and social vulnerability. These same communities scored highly in the study's prioritization framework, confirming that strategic flood interventions can and should be used to advance environmental justice.

But equitable planning goes beyond siting—it demands relationship. At the Regional Open House, community leaders emphasized that trust, continuity, and shared authorship are essential to the success of Blue-Green Infrastructure. Key strategies included meeting people where they already gather, partnering with trusted institutions like churches and schools, and embedding projects within community-serving facilities such as Resilience Hubs. These spaces are not just sites for infrastructure—they are anchors for participation, education, and stewardship.

This approach is being modeled within the Oxon Run Stream Restoration project, which overlaps with the study area. There, community engagement is being paired with a Master Park Plan to ensure that flood mitigation is integrated into a broader vision for public space—one that reflects local priorities, improves public safety, and enhances recreational access. That project illustrates how BGI can deliver both environmental outcomes and visible community value when shaped in partnership with those most affected.

The demonstration concepts in this report are designed to follow that same ethic. Each is a starting point for deeper collaboration—not a finished product. Moving forward, these projects can create equitable access to clean water and green space, support youth and workforce development, and offer lasting public benefit—provided they are co-developed with the communities they are meant to serve.

In the pages that follow, each concept includes:

- An assessment of the Focus Area's watershed-scale flood influence;
- A description of proposed BGI practices, organized by cluster;
- And a discussion of potential community co-benefits and implementation partnerships.

While tailored to the distinct needs and opportunities of each location, the concepts reflect a consistent approach grounded in regional resilience, local investment, and cross-jurisdictional partnership.

DEMONSTRATION CONCEPT: ARUNDEL CANAL, FOCUS AREA 1

Assessing Focus Area Influence

To assess the influence of Focus Area 1 on downstream conditions, the project team removed the Focus Area from the TR-55 hydrologic model developed for this study. Model results showed a reduction in peak flow of approximately 65% across the 2-, 10-, and 100-year storm events at the watershed outlet. This confirms that Focus Area 1 plays a critical role in shaping flood behavior in Arundel Canal.

Flood patterns in this watershed are complex. While projects in Focus Area 1 positively influence downstream conditions, much of the runoff is conveyed through the concrete-lined Arundel Canal, which is confined by levees. Consequently, the proposed BGI interventions are expected to:

- Reduce pressure on the levee system.
- Lower flood levels during storm events, thereby decreasing overtopping frequency.
- Improve drainage network performance by reducing backwater effects and facilitating discharge into the canal system.

However, flooding in Focus Area 2 is primarily driven by interior drainage challenges in areas protected by the levee systems of both Arundel Canal and Northwest Branch. While upstream improvements will reduce some pressure on this network, additional infrastructure upgrades within Focus Area 2 remain a priority for long-term flood risk reduction.

Description of Concept Design

The proposed concept for Focus Area 1 consists of four spatial clusters of BGI strategies:

CLUSTER 1: BUNKER HILL TRIANGLE PARK AND SURROUNDING STREETS

This concept proposes retrofitting Bunker Hill Triangle Park, owned by the District Department of Parks and Recreation (DPR), into a Multi-Purpose Floodable Recreational Space. The park currently includes passive open space, a small plaza, and storm drain infrastructure beneath its footprint. The park's flat topography, central location, and proximity to flooding, identified IFM results for the 15-year flood, make it well-suited for flood storage. The concept also includes Blue-Green Street retrofits along Michigan Avenue Northeast (NE), 18th Street NE, and Bunker Hill Road NE to capture road runoff and provide transitional treatment between paved surfaces and green space.

The concept for Arundel Canal, Cluster 1, is shown in Figure 31.

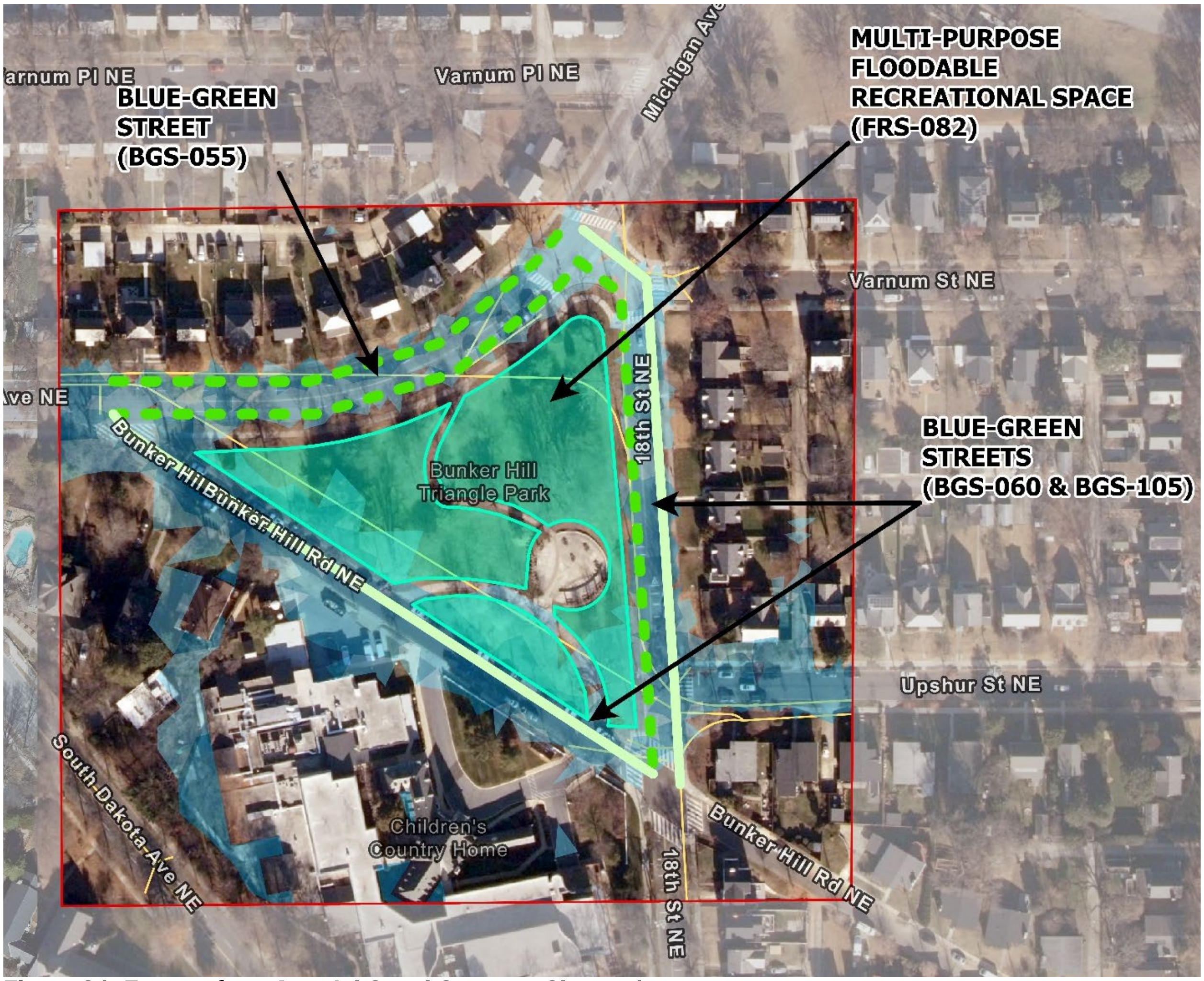


Figure 31: Excerpt from Arundel Canal Concept, Cluster 1.

Potential Co-Benefits

While the park is not currently a high-profile neighborhood landmark, it serves as a quiet green refuge with several large trees, professional landscaping, and seating areas—making it well-positioned to support additional community-serving amenities. The proposed concept could enhance that function by blending stormwater infrastructure with shade plantings, added trees, and an improved buffer between the park and nearby traffic. Blue-Green Streets improvements could strengthen the park's sense of enclosure and identity, while strategic enhancements—such as a shaded pavilion or small amphitheater—could introduce new opportunities for use. A key early engagement step will be coordinating with DPR to understand existing maintenance needs or plans, and to identify opportunities for collaboration. Outreach should also explore how to strengthen the park's role as an accessible, welcoming open space—particularly for nearby users such as the neighboring pediatric care facility operated by Children's National Hospital.

CLUSTER 2: EASTERN AVENUE AND FORT CIRCLE PARK CORRIDOR

This cluster targets median and roadside retrofits along Eastern Avenue near the D.C.–Maryland border, between Michigan Avenue NE and Varnum Street. The medians, which are part of Fort Circle Park and managed by the National Park Service (NPS), contain low-lying grass areas interspersed with mature trees. The proposed concept includes Blue-Green Streets along Eastern Avenue, Sherwood Street NE, Varnum Street NE, 21st Street NE, and Upshur Street NE. These streets align with mapped flooding and storm drainage features. The concept also identifies opportunities to engage with Northeastern Presbyterian Church to explore the potential for GSI and upgrades to recreational space on church-owned land, pending future engagement and interest from the congregation.

The concept for Arundel Canal, Cluster 1, is shown in Figure 32.

Figure 32: Excerpt from Arundel Canal Concept, Cluster 2.

Potential Co-Benefits

This area presents a high-opportunity setting for effective flood storage while addressing known infrastructure gaps. A successful project could alleviate long-term burdens on NPS by redirecting and funding maintenance responsibilities through local government partners. Blue-Green Streets and GSI improvements should prioritize visual appeal and pedestrian comfort, transforming currently underutilized medians into assets for the surrounding community. As part of the historic Fort Circle Park system, enhancements could also strengthen neighborhood identity by incorporating educational signage to highlight the area's connection to a broader legacy of public space. Nearby, engagement with Northeastern Presbyterian Church offers a chance to align site improvements with faith-based environmental stewardship. With the congregation's input, enhancements could serve both ministry goals and practical needs—such as outdoor gathering spaces or improved access.

CLUSTER 3: CHURCH OF OUR SAVIOR AREA

This cluster addresses a mapped flood risk area near Irving Street NE, at the sump condition near Fort Place NE. Drainage in this area is constrained by storm drain capacity, creating flood risk to adjacent buildings. The proposed project includes potential opportunities on property owned by the Church of Our Savior, where large open lawn areas may support GSI or Multi-Purpose Floodable Space. Outreach to the church would be required to understand site usage, assess interest, and explore partnership opportunities to align project benefits with congregational goals.

The concept for Arundel Canal, Cluster 3, is shown in Figure 33.

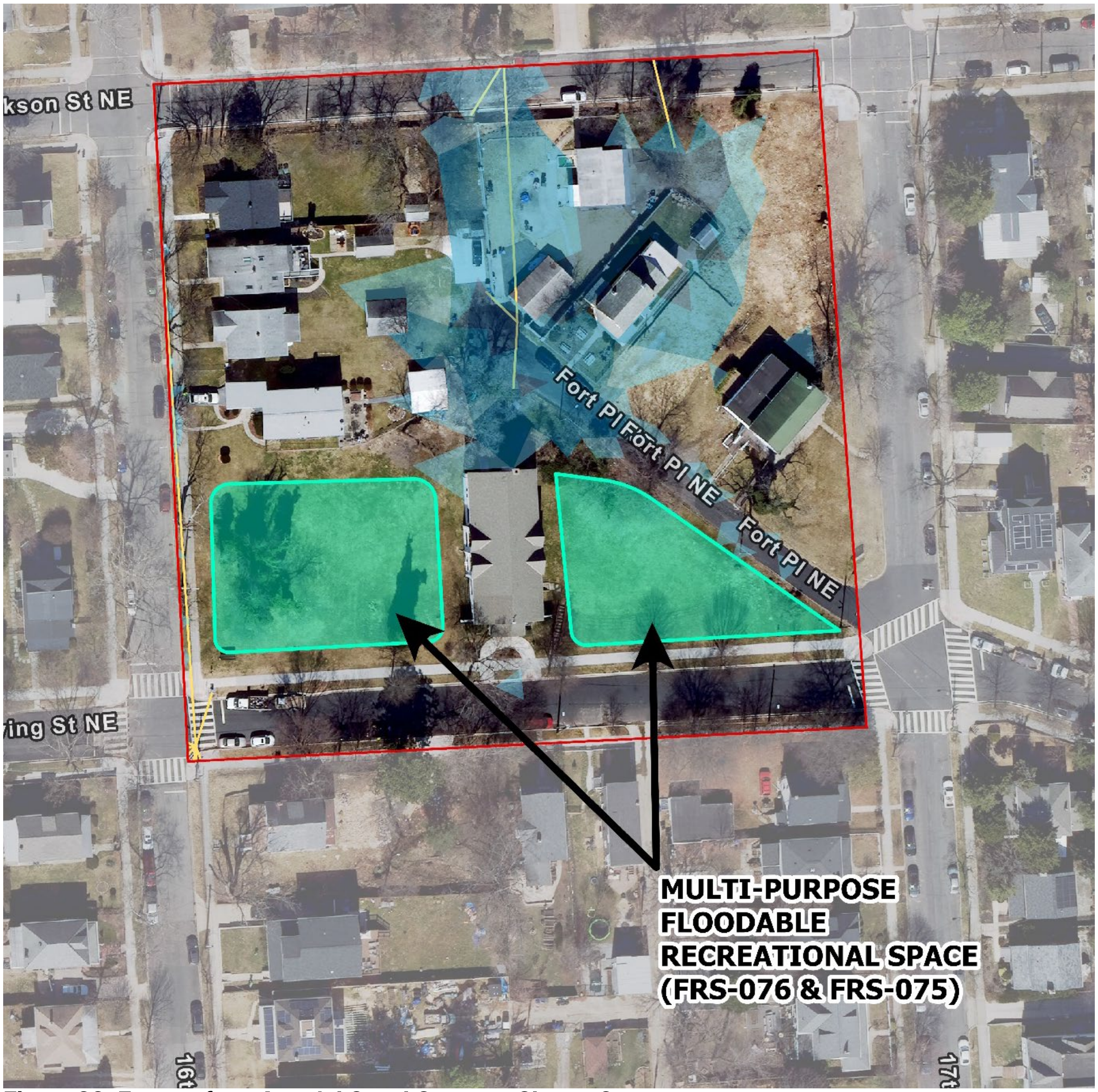


Figure 33: Excerpt from Arundel Canal Concept, Cluster 3.

Potential Co-Benefits

This location offers a rare opportunity to pair meaningful community partnership with direct local flood risk reduction. Improvements on the Church of Our Savior property could help intercept runoff and alleviate flooding that currently affects nearby residential buildings at the sump low point. Like other faith-based institutions in the study area, the church may be interested in aligning improvements with stewardship goals, while also gaining functional site enhancements—such as usable green space, shaded gathering areas, or educational features. Engagement would be essential to understand church operations and explore mutually beneficial outcomes. A successful partnership could make this site a local model of both flood mitigation and community-centered design.

CLUSTER 4: TURKEY THICKET RECREATION CENTER COMPLEX

This cluster identifies the baseball field, tennis courts, and surrounding park space at Turkey Thicket Recreation Center as high-priority locations for Multi-Purpose Floodable Recreational Spaces, Tree Planting, and GSI retrofits. The complex lies immediately upstream of known flood hazards along Michigan Avenue NE. Proposed Blue-Green Streets on Randolph Street NE and John McCormack Road NE address flood-prone segments. While the site has undergone recent upgrades (including a new recreation center in 2013 and multiple field reconstructions), it remains a strategic candidate for future flood storage improvements aligned with facility maintenance cycles. Early engagement with DPR is recommended to assess alignment with long-term capital improvement planning.

The concept for Arundel Canal, Cluster 4, is shown in Figure 34.

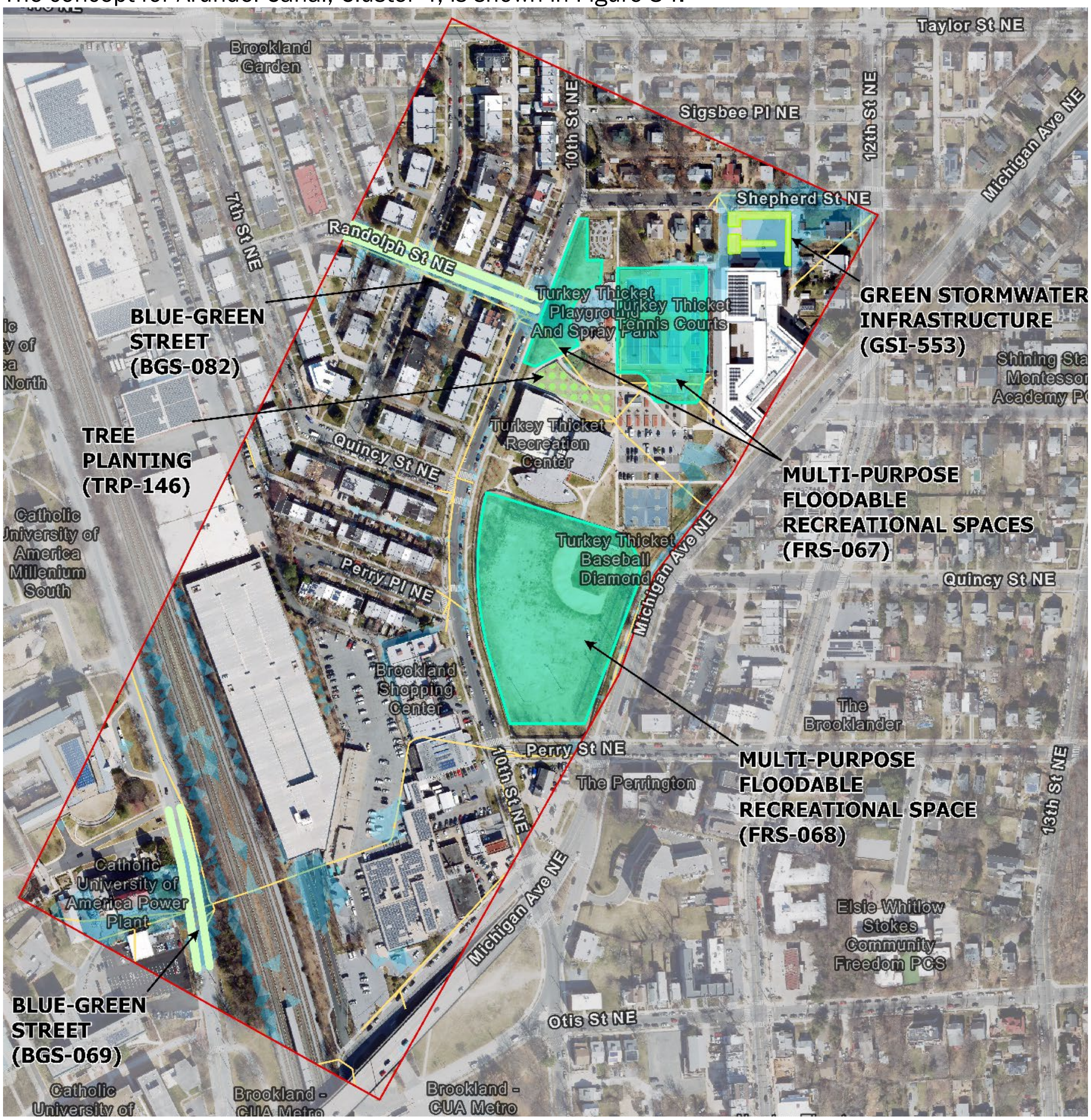


Figure 34: Excerpt from Arundel Canal Concept, Cluster 4.

Potential Co-Benefits

This concept offers a clear opportunity to elevate and extend the value of existing community amenities. A successful project would not replace recreation with flood storage, but instead use BGI improvements to enhance drainage, durability, and comfort. The multi-purpose athletic field, for example, could be made more playable with improved stormwater management and potentially artificial turf. Tree planting would expand shaded recreation and help mitigate urban heat. Meanwhile, Blue-Green Streets along Randolph Street could serve as a welcoming gateway, improving walkability and access to the playground and courts. Continued coordination with DPR would ensure alignment with ongoing capital investments and allow BGI enhancements to support the long-term vitality of this well-used facility.

Summary of Cost and Performance

Table 1: Planning level cost estimate for the Arundel Canal concept.

Arundel Canal			
Multi-Purpose Floodable Recreational Spaces			
Quantity (ea.)	Total Project Area (ac)	Total Storage Volume (cf)	Total Estimated Construction Cost of Practice
9	7.91	919,320.90	$ 6,128,806.00
Blue-Green Streets			
Quantity (ea.)	Total Length (lf)	Total Storage Volume (cf)	Total Estimated Construction Cost of Practice
10	6955.91	471,030.16	$ 11,678,973.24
Green Stormwater Infrastructure			
Quantity (ea.)	Total Project Area (ac)	Total Contributing Drainage Area (ac)	Total Estimated Construction Cost of Practice
3	2.76	12.41	$ 7,874,817.84
Tree Planting			
Quantity (ea.)	Total Project Area (ac)		Total Estimated Construction Cost of Practice
1	0.21		$ 17,001.00
		Grand Total:	**$ 25,699,598.1**

Interpreting Cost and Volume Estimates

The planning-level estimates presented in the concept summary tables reflect each BGI practice as an individual project, using assumptions based on contributing drainage area and typical design parameters. While this allows for flexibility—enabling portions of each cluster to advance independently—it does not reflect the enhanced performance that can result from implementing a network of BGI practices in concert. In practice, strategically connected interventions can improve runoff timing, increase total storage efficiency, and provide greater cumulative benefits than the sum of their parts. As concepts move into design and modeling phases, there will be opportunities to optimize these networks to maximize both flood reduction and community value.

For detailed cost estimate and performance information organized by cluster, refer to Appendix F.

DEMONSTRATION CONCEPT: WATTS BRANCH, FOCUS AREA 2

Assessing Focus Area Influence

To evaluate the hydrologic influence of Focus Area 2, the relevant subcatchments were removed from the USACE HEC-HMS model for Watts Branch. The analysis confirmed that Focus Area 2 contributes substantial runoff volume and exerts measurable influence throughout the downstream watershed:

- Peak flows at the watershed outlet decreased by approximately 27% across all modeled storm events following the removal of Focus Area 2.
- The influence is most pronounced immediately downstream of the D.C. line, where peak flows decreased by 50–57% across storm events.
- The impact gradually tapers moving downstream but remains detectable at all junctions.

These results reinforce the strategic role of Focus Area 2 as a high-leverage location for flood volume management and confirm the value of investing in upstream interventions to benefit both Prince George's County and the District of Columbia.

Description of Concept Design

The concept for Watts Branch, Focus Area 2, includes three clusters of BGI interventions. These clusters span the downstream, middle, and headwater portions of the Focus Area and were informed by stakeholder priorities, mapped flood risk, and opportunities for partnership.

CLUSTER 1: CAPITOL HEIGHTS BOULEVARD AND CENTRAL AVENUE CORRIDOR

This cluster focuses on a network of BGI practices aligned with the Watts Branch stream corridor near Capitol Heights Boulevard, Chamber Avenue, and Central Avenue. This area was identified by representatives from the Prince George's County Department of the Environment as a strategic priority, particularly in reference to the concrete-lined section of Watts Branch.

Key elements of this cluster include:

- Stream, Wetland, and Floodplain Restoration to convert the existing concrete channel into a more naturalized system capable of providing flood storage and ecological uplift. Proposed improvements span from Davey Street to Emmet Street.
- Tree Planting on nearby public parcels to provide upland infiltration and urban canopy benefits.

- Blue-Green Street retrofits along Central Avenue, paired with GSI opportunities on properties owned by First Baptist Church of Capitol Heights and the Capitol Heights Police Department.
- Potential evaluation of Bridge and Culvert Modifications at Fay Street, Emmet Street, and Dole Street to address known hydraulic pinch points.

This cluster is centered on publicly owned land and rights-of-way, with additional outreach needed to engage institutional partners regarding stewardship and co-benefits.

The concept for Watts Branch, Cluster 1, is shown in Figure 35.

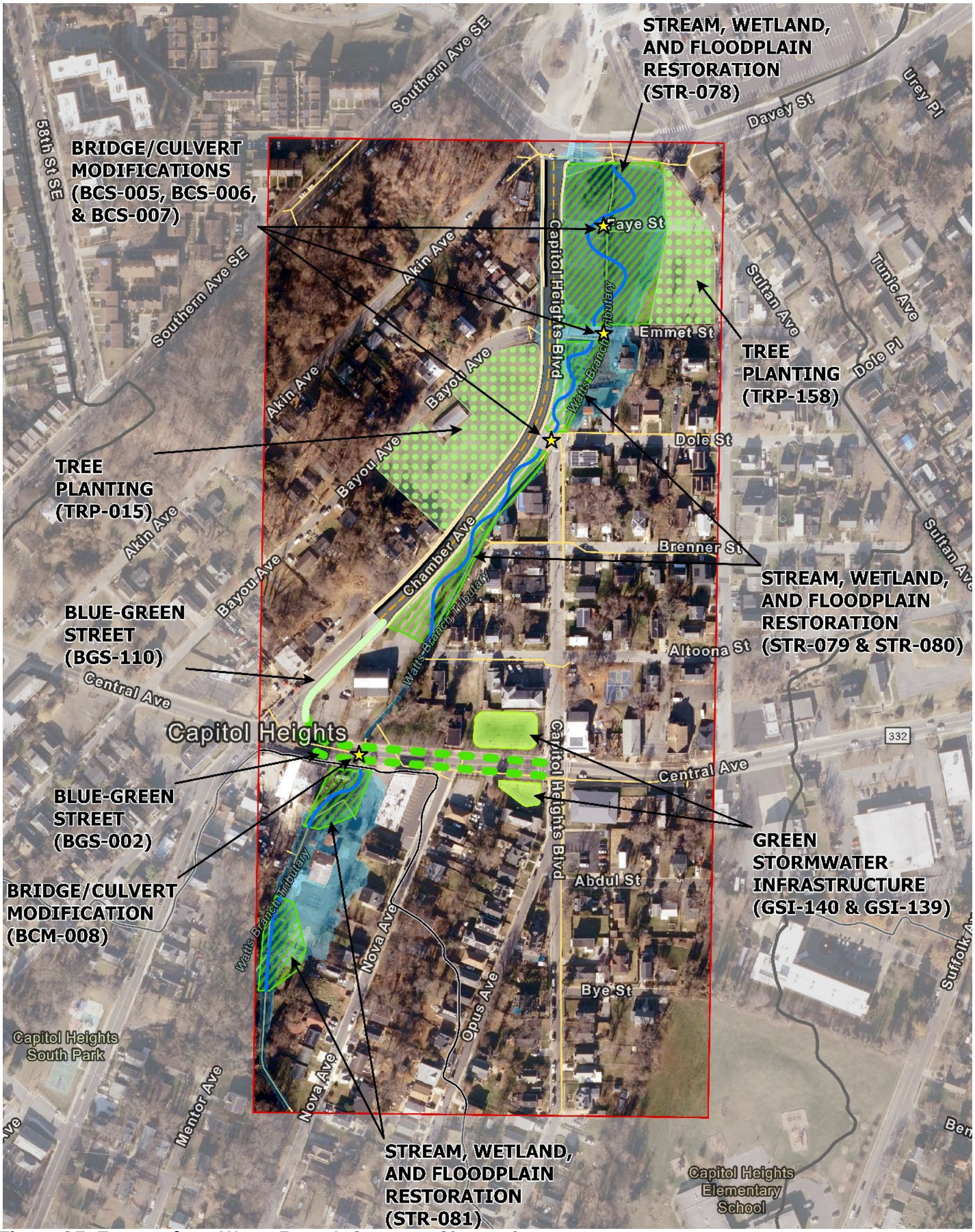


Figure 35: Excerpt from Watts Branch Concept, Cluster 1.

Potential Co-Benefits

This cluster offers a transformative opportunity to convert a neglected concrete channel into a visible, functional, and celebrated green corridor. Naturalizing Watts Branch in this location could create a nature park with ecological and aesthetic value—bringing shaded walking trails, educational signage, and restored habitat into daily view of metro riders, cyclists, and local drivers. The existing concrete channel is a barrier to pedestrian connectivity along Chamber Avenue, and the proposed restoration could remove that barrier directly. Blue-Green Streets and GSI treatments would enhance site character and improve pedestrian safety, while adjacent institutions like First Baptist Church and the Capitol Heights Police Department could benefit from coordinated site improvements. Tree planting would expand the urban canopy and provide heat relief. Engagement with the Town of Capitol Heights and neighborhood partners will be essential to align the project's character with local priorities—particularly in determining whether the restored space should remain a quiet natural refuge or become a high-profile demonstration site for regional climate resilience.

CLUSTER 2: OAKCREST COMMUNITY CENTER AND BROOK ROAD PARK

The second cluster targets upland opportunities for storage and conveyance. Major components include:

- Multi-Purpose Floodable Recreational Spaces at Oakcrest Community Center and Brook Road Park of M-NCPPC, where athletic fields and open areas offer flood-compatible uses.
- Tree Planting and GSI retrofits to enhance infiltration across large, underutilized open spaces.
- Stream, Wetland, and Floodplain Restoration on parcels owned by M-NCPPC and a small number of private landowners, designed to slow and store runoff before it exits the Focus Area.

This cluster leverages the availability of large public lands and natural channels to maximize flood volume capture near the headwaters. Restoration efforts here are expected to deliver measurable benefits to downstream communities.

The concept for Watts Branch, Cluster 2, is shown in Figure 36.

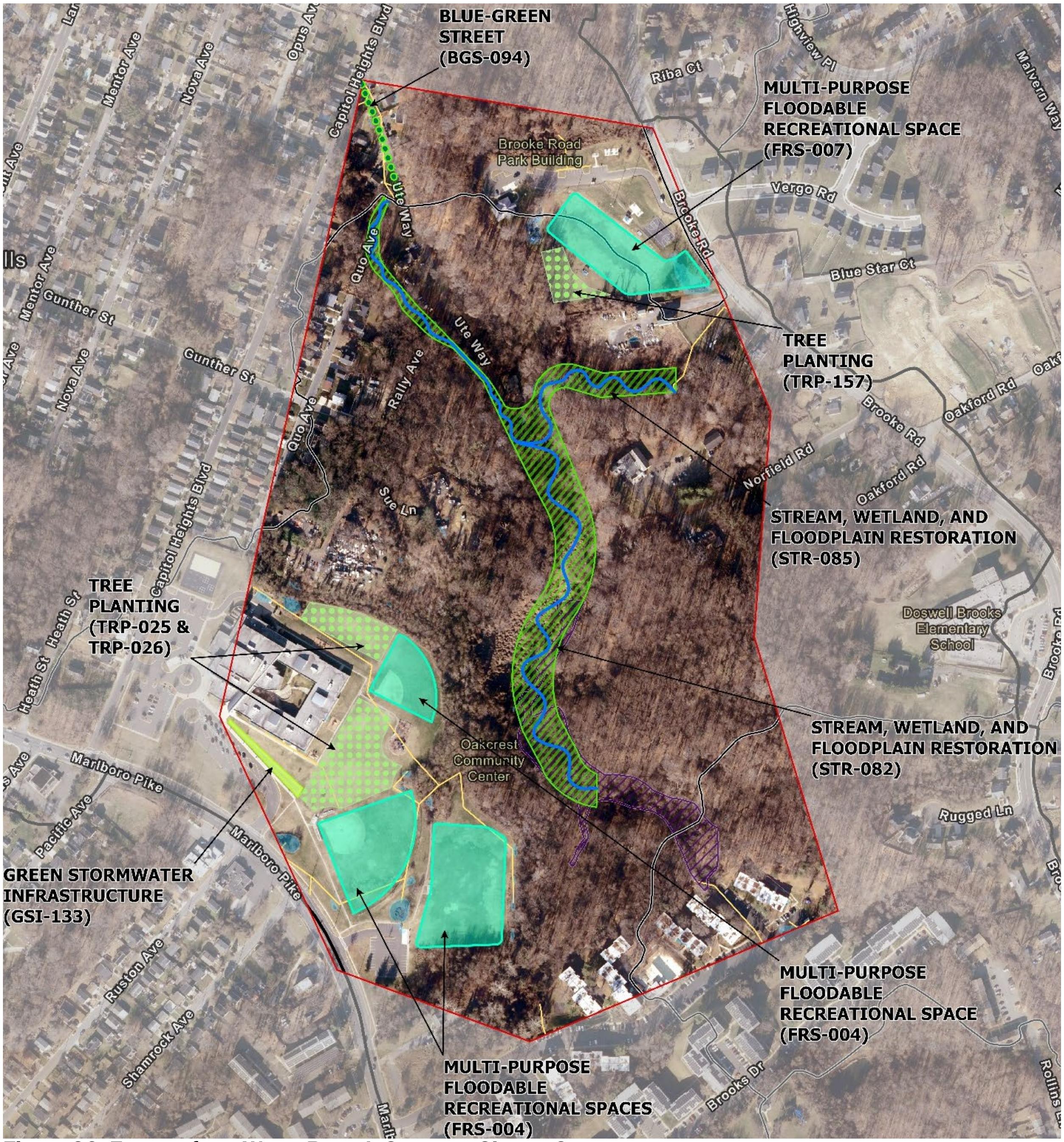


Figure 36: Excerpt from Watts Branch Concept, Cluster 2.

Potential Co-Benefits

This cluster presents an opportunity to unify a patchwork of recreational and natural spaces into a continuous, water-focused green corridor. By coordinating closely with M-NCPPC—the principal landholder across both active and passive park areas—this project can enhance the usability of athletic fields, introduce educational green spaces, and establish a cohesive park identity rooted in stormwater resilience. Stream and floodplain restoration offer co-benefits such as invasive species removal, improved habitat, and long-term forest health, while also enabling potential partnerships with WSSC Water to protect vulnerable sanitary sewer infrastructure.

Equally important is direct engagement with nearby residents, who are the primary users and stewards of these parklands. Outreach should focus on understanding existing park usage, uncovering unmet needs, and identifying opportunities to improve access, safety, and quality of experience. Community members can help shape a vision for how these green spaces support not just flood resilience, but also neighborhood identity, recreation, and environmental education.

CLUSTER 3: BROOKSQUARE SUBDIVISION AND ADJACENT UPLANDS

The third cluster focuses on community-scale opportunities within the Brooksquare subdivision. Proposed elements include:

- GSI retrofits to address localized Blue Spot flooding.
- Retrofit of an existing stormwater pond, currently under private management, to increase storage and performance.
- Outreach to the local HOA to align flood mitigation strategies with community goals, particularly in areas prone to nuisance flooding.

This cluster presents an opportunity to pilot neighborhood-scale retrofits in partnership with residents, building both flood resilience and community buy-in.

The concept for Watts Branch, Cluster 3, is shown in Figure 37.

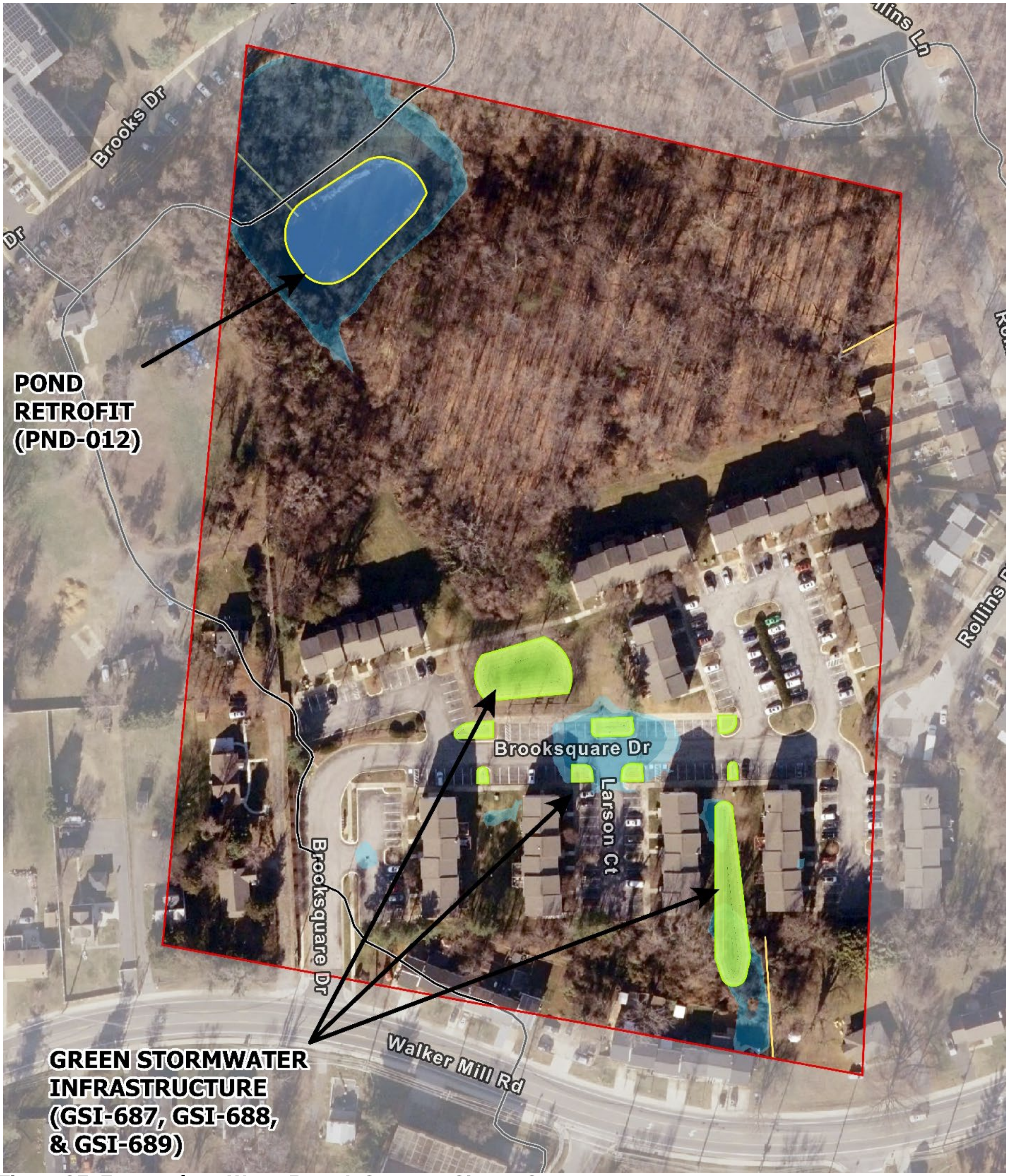


Figure 37: Excerpt from Watts Branch Concept, Cluster 3.

Potential Co-Benefits

This cluster presents a unique opportunity to advance neighborhood-scale flood resilience through direct partnership with a homeowners association (HOA). Community buy-in will be critical—not only to ensure that improvements address localized concerns such as nuisance flooding, but to identify mutually beneficial enhancements that add value for residents. These could include resurfacing or drainage improvements to shared parking areas or internal roadways, paired with support for maintaining or upgrading the existing stormwater pond. As a potential demonstration of public-private collaboration, this concept offers a compelling model for how targeted investment can strengthen infrastructure and livability at the neighborhood scale. Early outreach should focus on understanding HOA priorities and maintenance challenges, with an emphasis on co-creating solutions that reflect community input and ownership.

Summary of Cost and Performance

Table 2: Planning level cost estimate for the Watts Branch concept.

Watts Branch			
Stream, Wetland, and Floodplain Restoration			
Quantity (ea.)	Total Project Area (ac)	Total Length (lf)	Total Estimated Construction Cost of Practice
6	8.72	5,354.79	$ 7,496,706.00
Multi-Purpose Floodable Recreational Spaces			
Quantity (ea.)	Total Project Area (ac)	Total Storage Volume (cf)	Total Estimated Construction Cost of Practice
2	6.36	738,275.55	$ 4,921,836.98
Blue-Green Streets			
Quantity (ea.)	Total Length (lf)	Total Storage Volume (cf)	Total Estimated Construction Cost of Practice
3	1222.00	54,302.24	$ 1,522,432.82
Green Stormwater Infrastructure			
Quantity (ea.)	Total Project Area (ac)	Total Contributing Drainage Area (ac)	Total Estimated Construction Cost of Practice
6	0.77	25.09	$ 2,190,146.87
Tree Planting			
Quantity (ea.)	Total Project Area (ac)		Total Estimated Construction Cost of Practice
5	4.65		$ 372,320.57
Pond Retrofit			
Quantity (ea.)	Total Project Area (ac)	Total Contributing Drainage Area (ac)	Total Estimated Construction Cost of Practice
1	0.26	27.52	$ 248,968.35
Bridge/Culvert Modifications			
Quantity (ea.)	Total Estimated Construction Cost of Practice		
4	$ 1,680,000.0		
		Grand Total:	**$ 18,432,411.58**

For detailed cost estimate and performance information organized by cluster, refer to Appendix F.

DEMONSTRATION CONCEPT: OXON RUN, FOCUS AREA 1

Assessing Focus Area Influence

To assess watershed-scale influence, Focus Area 1 was removed from the USACE HEC-HMS model developed for this study. The resulting change in peak flow at the watershed outlet was minimal—generally 0–2% during the 100-year storm. However, upstream impacts were more pronounced.

Focus Area 1 demonstrated significant hydrologic influence on adjacent downstream areas, particularly Focus Area 2. In this subwatershed, peak flow reductions from the removal of Focus Area 1 reached approximately 20% across all storm events, with influence observable as far downstream as the confluence with the Barnaby Run tributary near Naylor Road. These findings underscore that while Focus Area 1 alone cannot substantially affect flooding at the watershed outlet, it plays an important role in shaping conditions within middle reaches of Oxon Run.

These findings align with the project team's expectations, based on watershed size and timing of upstream and tributary flows. Given the large size of the Oxon Run watershed, peak runoff is strongly influenced by the timing of multiple tributaries. Focus Area 1 is positioned within the headwaters and contributes runoff earlier in the storm event. While the hydrologic signature is diluted by downstream inflows, its upstream position remains strategic for targeting flood volume reductions in nearby, flood-vulnerable neighborhoods.

The demonstration concept for Focus Area 1 includes three primary clusters of BGI interventions, tracing the Oxon Run mainstem and key tributaries from the headwaters downstream toward Brooks Drive.

CLUSTER 1: PENNSYLVANIA AVENUE CORRIDOR AND TRIBUTARY JUNCTION

This cluster centers along Pennsylvania Avenue (MD-4), between Quarter Avenue and Brooks Drive. Mapped FEMA floodplains and Blue Spot analysis identify this area as highly flood-prone. The concept proposes Stream, Wetland, and Floodplain Restoration across public and private parcels, including lands owned by Prince George's County and several private property holders. Key objectives include:

- Increasing floodplain storage and slowing the timing of runoff to reduce downstream peak flow.
- Alleviating backwater conditions at the Quarter Avenue crossing, where floodwaters currently threaten residential structures.

The project also identifies two privately owned stormwater ponds for retrofit. Both facilities are managed by community associations or other private owners. Additionally, the concept proposes BGI enhancements at DuPont Heights Park of M-NCPPC, including potential conversion of underutilized space into a Multi-Purpose Floodable Recreational Space. Outreach to private owners and partnership-building will be essential to advance this cluster.

The concept for Oxon Run, Cluster 1, is shown in Figure 38.

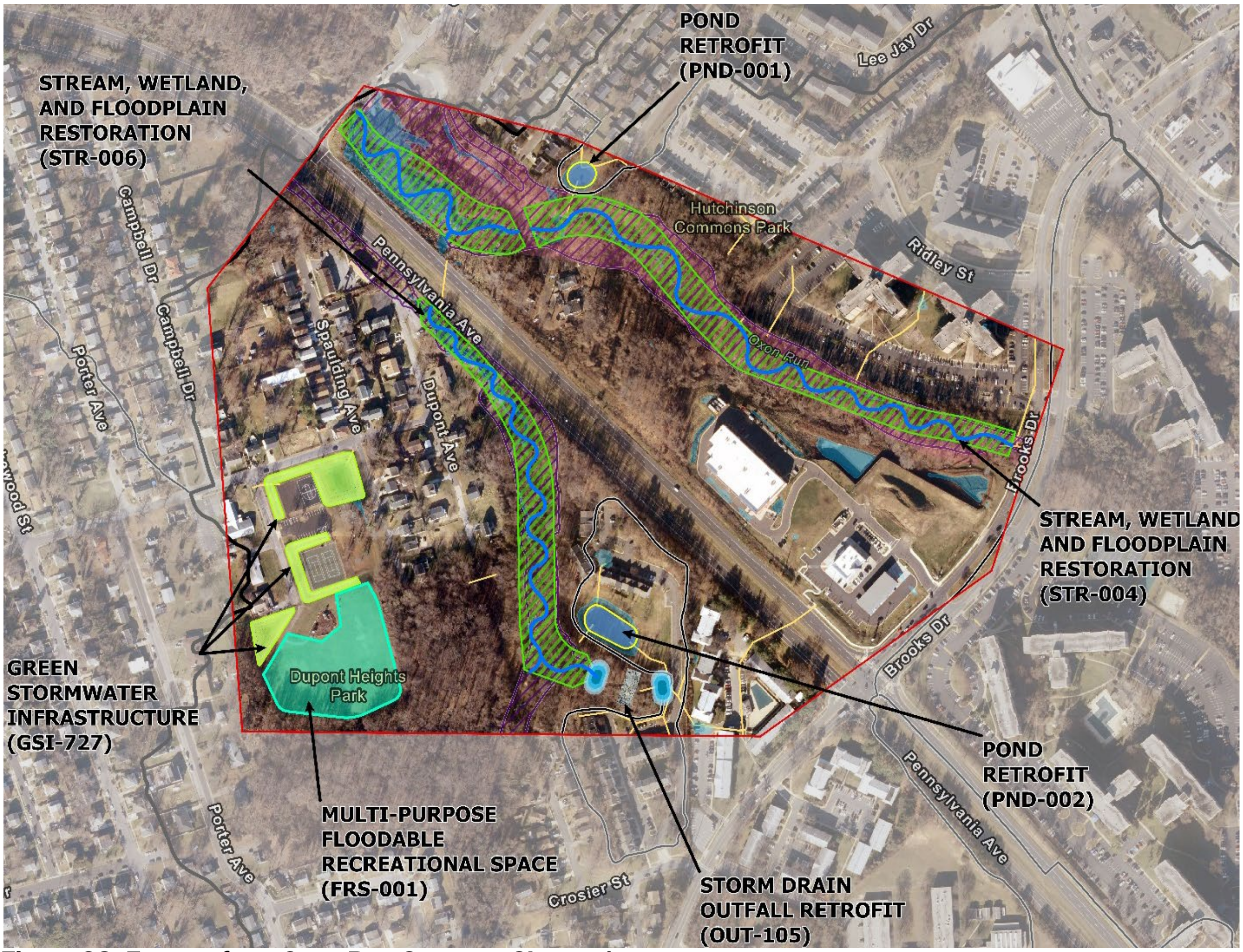


Figure 38: Excerpt from Oxon Run Concept, Cluster 1.

Potential Co-Benefits

This cluster presents a strong opportunity for public-private partnership, with two stormwater ponds under private management offering potential mutual benefit. Coordination with M-NCPPC at DuPont Heights Park will also be essential, particularly given the availability of underutilized green space. With community input, this area could be transformed into a valued local asset—possibilities include shaded picnic areas, athletic fields, reforestation zones, outdoor classrooms, or a nature-focused amphitheater. Thoughtful engagement will help align site improvements with neighborhood priorities, allowing flood mitigation investments to enhance quality of life for residents.

CLUSTER 2: OXON RUN THROUGH MULTI-FAMILY HOUSING CORRIDORS

This cluster focuses on the segment of Oxon Run located between Marlboro Pike and Brooks Drive, where the stream traverses a corridor of high-density residential development. Multiple mapped flood zones affect apartment complexes such as Oakcrest Towers and Holly Spring Meadows. The concept includes:

- Stream, Wetland, and Floodplain Restoration along Oxon Run and an unnamed tributary to reduce water surface elevations and mitigate risk to nearby buildings and parking areas.

- Retrofit of two existing stormwater management ponds associated with private development.
- Installation of GSI on privately owned open spaces.

The floodplain in this area is owned by a small number of corporate landowners, offering a strategic opportunity to engage key stakeholders around shared benefits and stewardship. As with Cluster 1, partnership with private stormwater facility owners could yield mutual value by reducing future maintenance burdens while advancing regional flood resilience.

The concept for Oxon Run, Cluster 2, is shown in Figure 39.

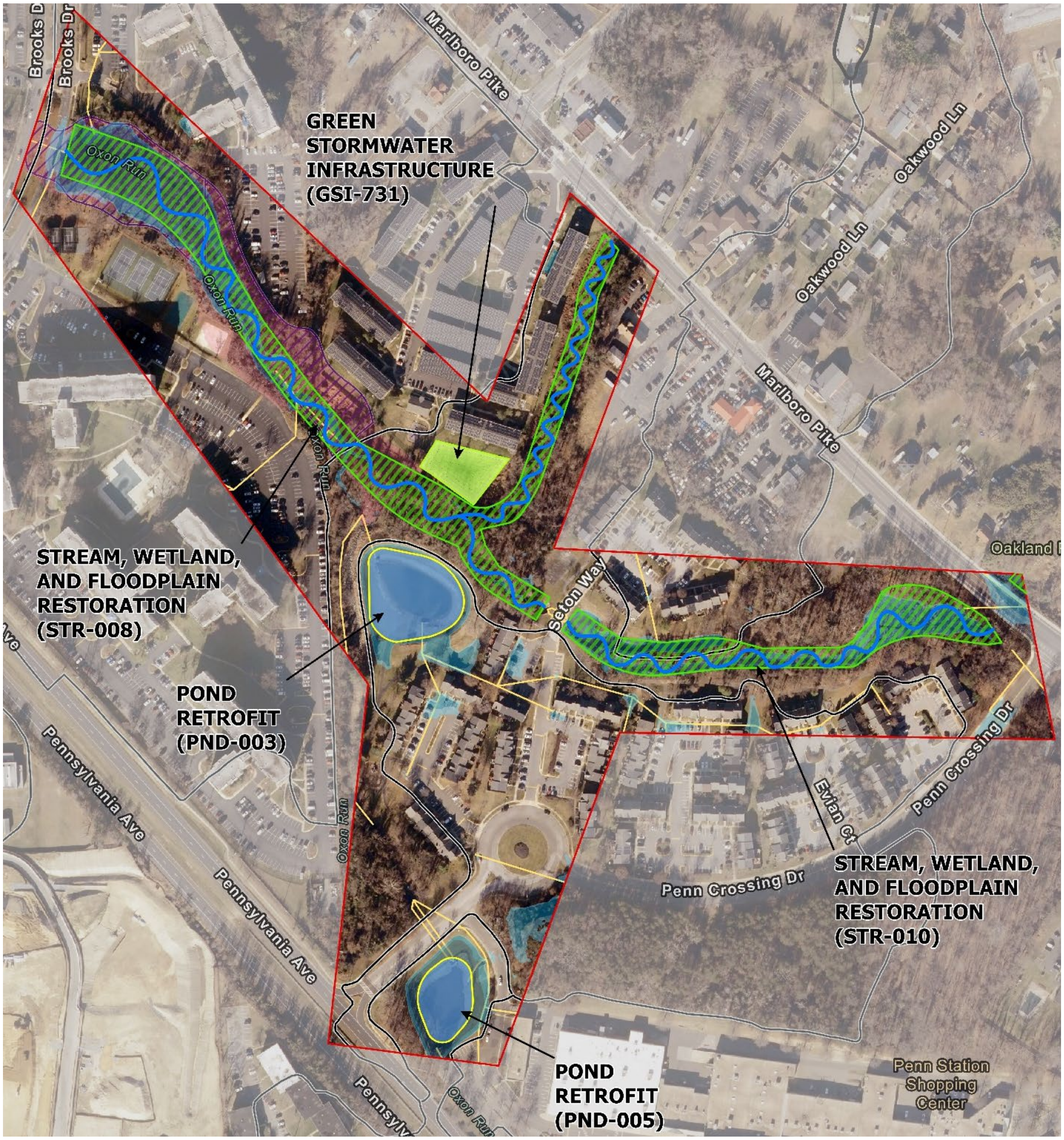


Figure 39: Excerpt from Oxon Run Concept, Cluster 2.

Potential Co-Benefits

This cluster presents a unique opportunity to advance flood resilience and visible neighborhood enhancements within a high-density residential corridor. Stream and pond retrofits can reduce flood risk to apartment buildings and parking areas, while GSI installations can double as professional landscaping—offering shade, beautification, and improved outdoor space for residents. These improvements may also enhance climate resilience by mitigating urban heat and improving stormwater infiltration. Because land ownership is concentrated among a small number of private entities, initial outreach should focus on building partnerships with property managers and tenant associations to ensure resident needs are reflected in the design. With thoughtful engagement, this cluster can demonstrate how flood mitigation and quality-of-life improvements can go hand in hand.

CLUSTER 3: UPPER HEADWATERS

Upstream of Marlboro Pike, the third cluster targets available floodplain and upland areas along Oxon Run and its tributaries. This includes:

- Stream, Wetland, and Floodplain Restoration between Marlboro Pike and Weber Drive, in an area highlighted by the Blue Spot analysis as offering substantial flood storage potential.
- Floodable field retrofit and Tree Planting at Francis Scott Key Elementary School, where athletic fields are currently disconnected from stormwater systems and offer meaningful retrofit potential.
- Tree Planting on adjacent parcels, including undesignated grassed lands owned by Bradburn Memorial Bible Church, Inc.

As with other clusters, these sites combine public and private ownership. The Francis Scott Key campus offers a strong opportunity for partnership with Prince George's County Public Schools, while engagement with the church will be required to assess stewardship interest and potential for collaboration.

The concept for Oxon Run, Cluster 3, is shown in Figure 40.

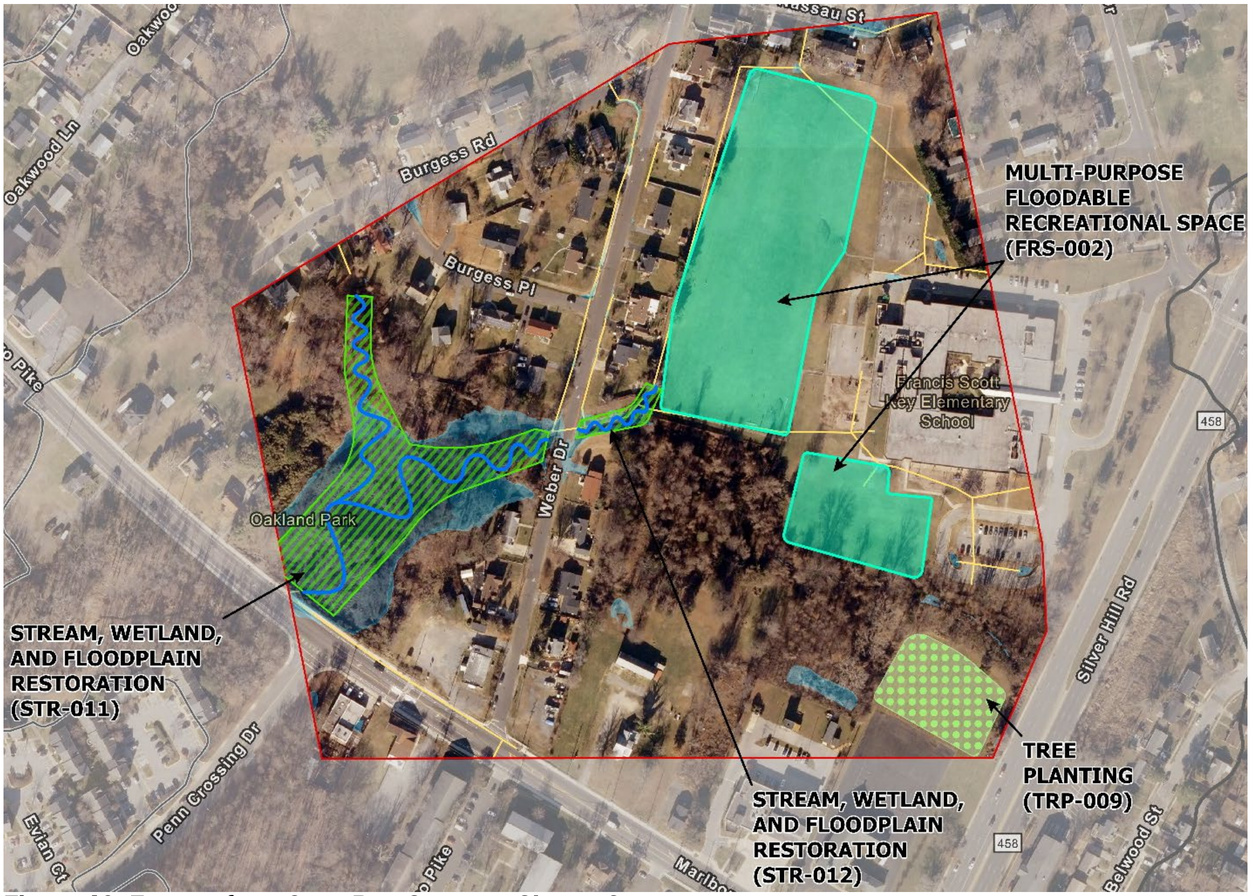


Figure 40: Excerpt from Oxon Run Concept, Cluster 3.

Potential Co-Benefits

This cluster presents a compelling opportunity to align flood resilience goals with education and school-centered improvements. At Francis Scott Key Elementary, the retrofit of athletic fields can both improve drainage and enhance student access to outdoor recreation, turning underused space into a green asset. Tree Planting and GSI features can support environmental literacy while creating shaded, comfortable places for learning, play, and community events. Projects on school grounds require early coordination with Prince George's County Public Schools, including facilities and curriculum stakeholders. Adjacent planting areas—such as those near Bradburn Memorial Bible Church—offer potential for neighborhood greening and faith-based stewardship, rounding out a network of BGI that benefits both public institutions and surrounding residents.

Summary of Cost and Performance

Table 3: Planning level cost estimate for the Oxon Run concept.

Oxon Run			
Stream, Wetland, and Floodplain Restoration			
Quantity (ea.)	Total Project Area (ac)	Total Length (lf)	Total Estimated Construction Cost of Practice
7	16.32	9,113.80	$ 12,759,320.00
Multi-Purpose Floodable Recreational Spaces			
Quantity (ea.)	Total Project Area (ac)	Total Storage Volume (cf)	Total Estimated Construction Cost of Practice
3	7.38	857,807.81	$ 5,718,718.76
Green Stormwater Infrastructure			
Quantity (ea.)	Total Project Area (ac)	Total Contributing Drainage Area (ac)	Total Estimated Construction Cost of Practice
2	1.55	7.13	$ 4,431,168.78
Tree Planting			
Quantity (ea.)	Total Project Area (ac)		Total Estimated Construction Cost of Practice
1	0.77		$ 61,508.59
Pond Retrofit			
Quantity (ea.)	Total Project Area (ac)	Total Contributing Drainage Area (ac)	Total Estimated Construction Cost of Practice
4	1.79	11.42	$ 1,693,636.87
Storm Drain Outfall Retrofits			
Quantity (ea.)	Total Length (lf)		Total Estimated Construction Cost of Practice
1	208.93		$ 292,502.00
		Grand Total:	**$ 24,956,854.99**

For detailed cost estimate and performance information organized by cluster, refer to Appendix F.

FROM CONCEPTS TO COLLABORATIVE IMPLEMENTATION

Together, these demonstration concepts showcase a range of BGI approaches suited to diverse urban contexts—from recreation centers and stream corridors to faith institutions, schools, and residential neighborhoods. They highlight the importance of working across jurisdictions, land ownerships, and community priorities to deliver flood mitigation that also strengthens local identity and livability. As these concepts advance, their real value will emerge through continued coordination, shared stewardship, and place-based design—ensuring that each project serves not only as infrastructure, but as an investment in the people and communities it protects.

Detailed Case Study: Evaluating Concept Performance in Watts Branch

OVERVIEW: WHY FOCUS AREA 2?

Focus Area 2 in the Watts Branch watershed advanced into a detailed modeling case study. Located in the headwaters of Watts Branch within Prince George's County—near the Town of Capitol Heights—this area includes a mix of residential neighborhoods, community-serving institutions such as schools and churches, public parks, and remnant natural areas. It spans from the Capitol Heights Metro Station to Oakcrest Community Center and the Brooksquare subdivision. An overview of the Focus Area and Concept locations is included in Figure 41.

This Focus Area was selected for detailed hydrologic modeling because it exemplifies how a connected network of upstream BGI projects can deliver measurable watershed-scale performance. It was identified as a priority by Prince George's County during early stages of the study, particularly in relation to the concrete-lined section of Watts Branch near Chamber Avenue—a known infrastructure challenge and a candidate for transformation into a community-serving asset. The area features cooperative public landowners, diverse land uses, and multiple documented opportunities for restoration, making it highly actionable in the near term.

This case study also builds on a strong foundation of prior and ongoing investment. The USACE previously identified this corridor as a priority through the Silver Jackets program, and the District is currently advancing a complementary BGI implementation effort in the downstream reaches of Watts Branch. Advancing a concept in Prince George's County strengthens regional momentum and reinforces the value of upstream–downstream coordination.

Focus Area 2 also offered an ideal technical setting. It is small enough to conceptualize real-world projects at the site level, yet large enough to evaluate how BGI performs when deployed as a system. Because BGI is often associated with water quality more than flood control, this site provided a valuable opportunity to test how strategic design and placement can influence peak flow and runoff volume. The availability of Corps-developed hydrologic and hydraulic models further strengthened its viability for advanced performance evaluation.

The modeling presented in the following section quantifies potential reductions in runoff volume and peak flow that could result from implementing the demonstration concept described earlier in this report—helping to inform future design decisions, funding strategies, and community engagement efforts.

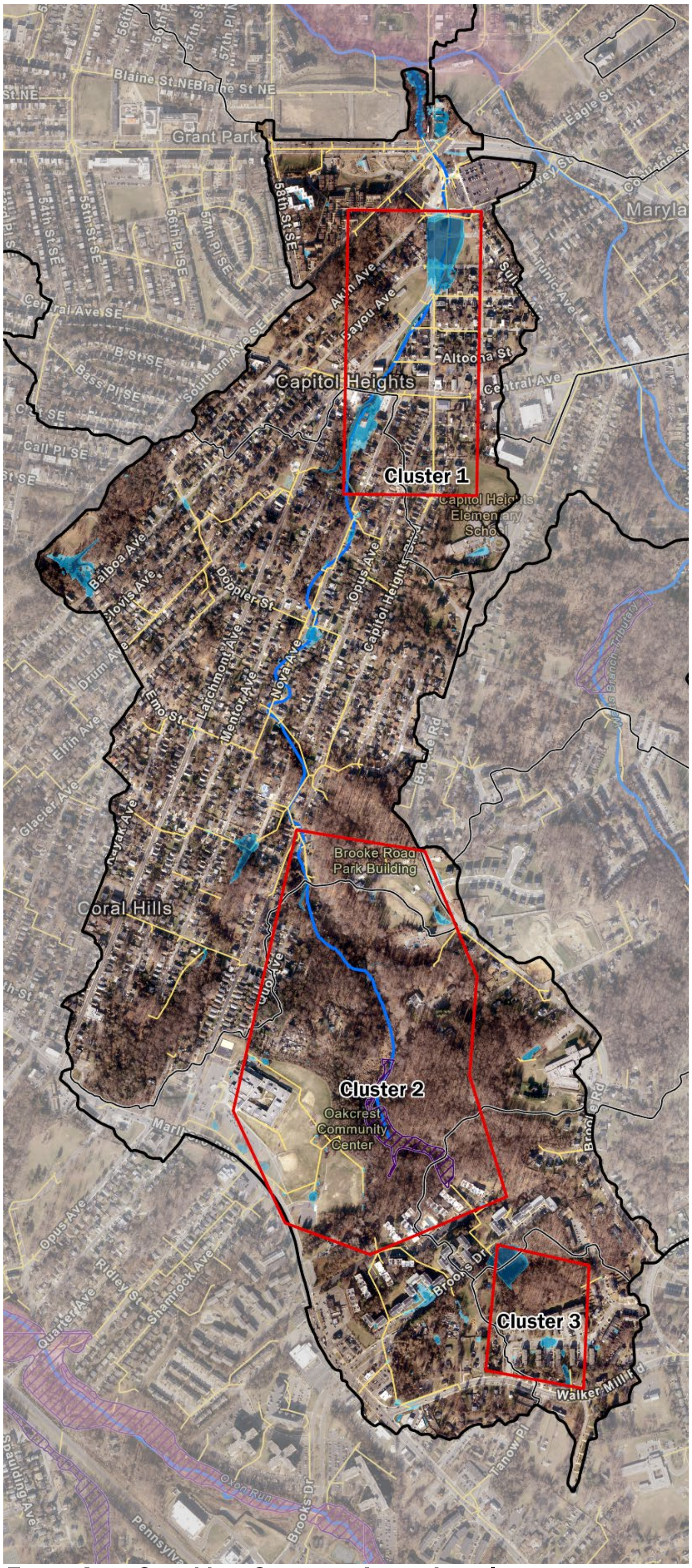


Figure 41: Overview of Focus Area 2 and key Concept cluster locations.

USING HYDROLOGIC TOOLS TO MEASURE PERFORMANCE

The USACE HEC-HMS model was used to simulate the impact of proposed BGI projects on stormwater runoff. Each practice in the concept plan was spatially placed in the model and assigned a drainage area and storage or infiltration mechanism based on its design. A key benefit of using the HEC-HMS model is that it incorporates both the position of each practice in the watershed, and the timing of flow moving through the network. This is true to real-world conditions and more detailed than approaches that solely focus on volume.

BGI practices were modeled using the following hydrologic assumptions:

- Multi-Purpose Floodable Recreational Spaces were modeled as reservoirs with site-specific storage characteristics. Infiltration losses were incorporated through an underdrain and soil infiltration component.
- Blue Green Streets were represented in the concept model as individual reservoirs with dedicated drainage areas connected to their nearest junction.
- Pond Retrofits were modified in the existing model to include 3 additional feet of storage, by updating existing rating tables.
- Tree Planting and GSI were represented by adjusting the land cover values within affected subbasins to reflect increased infiltration and canopy interception.
- Stream, Wetland, and Floodplain Restoration areas were modeled by modifying reach routing methods to reflect a cross-section with greater access to floodplain, and higher roughness. Each routing section was based on site-specific restoration potential. Additionally, the project team inserted a volume diversion for each stream restoration practice and developed a rating curve to detain additional runoff, representing the volume of runoff held and infiltrated in the floodplain.

These practices were distributed across the watershed following the plan view footprints developed in the Watts Branch concept. Site placement aligned with mapped drainage features and elevation to ensure feasibility. The updated model was run for the 2-, 10-, and 100-year storm events to compare performance between baseline and concept conditions.

RESULTS: REDUCTIONS IN PEAK FLOW

To evaluate the impact of the proposed BGI concept on peak discharge within Watts Branch, the project team compared modeled peak flows across the 2-, 10-, and 100-year storm events under baseline and concept conditions. Results were analyzed at four key junctions along the stream corridor to track how flood reductions attenuate downstream:

- Immediately downstream of Focus Area 2, peak flow reductions were substantial:
    - 2-year storm: 48% reduction
    - 10-year storm: 33% reduction
    - 100-year storm: 23% reduction
- At the East Capitol Street crossing near the D.C. line, reductions remained significant:
    - 2-year storm: 35% reduction
    - 10-year storm: 29% reduction
    - 100-year storm: 17% reduction
- At the 50th Street culvert, reductions were smaller but still measurable:
    - 2-year storm: 23% reduction

    - 10-year storm: 19% reduction
    - 100-year storm: 12% reduction
- At the confluence with the Anacostia River, representing the watershed outlet, the concept produced:
    - 2-year storm: 15% reduction
    - 10-year storm: 12% reduction
    - 100-year storm: 9% reduction

These results suggest that the proposed suite of concepts is capturing roughly 30% of the theoretical maximum reduction identified in the watershed influence analysis.

These results confirm that the BGI concept for Focus Area 2 has a measurable and beneficial impact on reducing peak flows, with the greatest effect seen in subwatersheds immediately downstream. The model suggests that the concept achieves approximately 30% of the theoretical maximum benefit estimated in the watershed influence analysis. While impacts attenuate with distance from the project area, peak flow reductions remain evident at the watershed outlet.

This pattern reflects the core principle of this study: that targeted upstream interventions can mitigate flooding in lower, more vulnerable downstream communities. See Figure 42 for a visualization of peak flow reductions at each modeled junction.

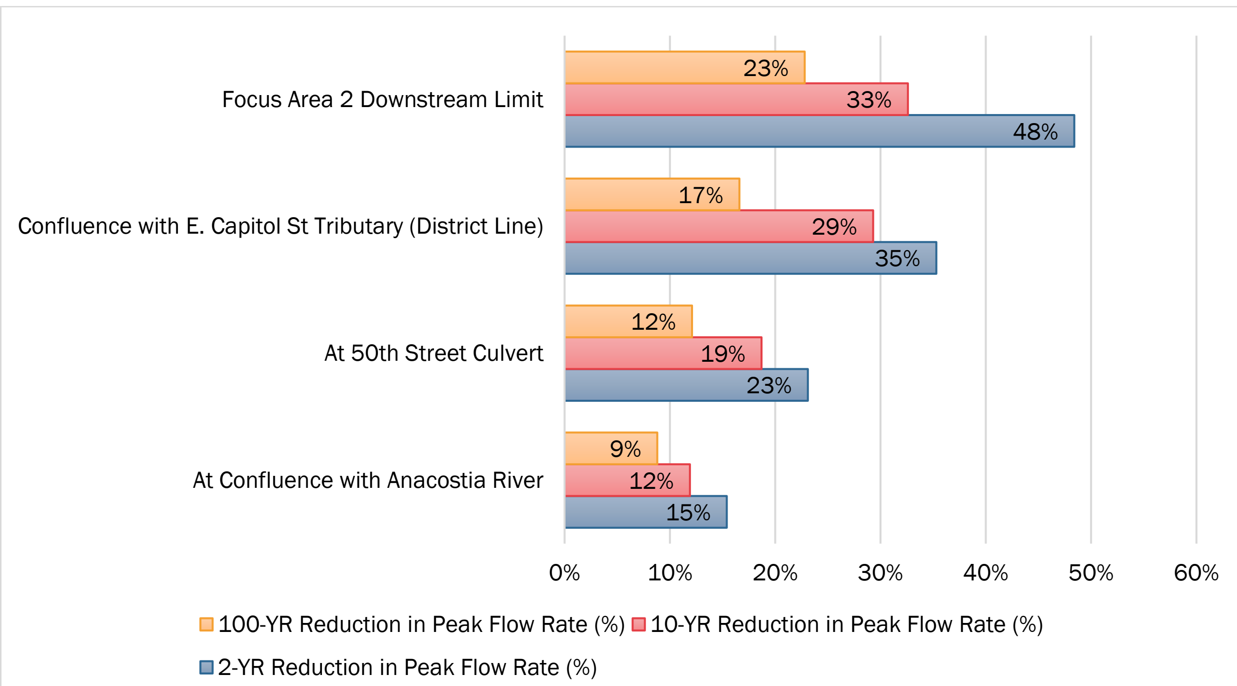


Figure 42: Watts Branch concept reductions in peak flow.

USING HYDRAULIC TOOLS TO MEASURE FLOOD REDUCTIONS

A one-dimensional hydraulic model of Watts Branch originally developed by the USACE was used to evaluate the effect of the proposed Focus Area 2 concept on downstream flooding. The model was designed to simulate floodplain conditions along Watts Branch within D.C. and was developed in tandem with the HEC-HMS hydrologic model used earlier in this study.

For this analysis, the 100-year peak flow rates were modified within the HEC-RAS model to reflect the reductions predicted by the Focus Area 2 concept scenario. All other model components—including cross-sections, channel roughness, and hydraulic structures—were held constant. This approach enabled an isolated assessment of how upstream peak flow reductions could affect flood elevations and building exposure along the stream corridor.

The output was mapped using high-resolution LiDAR and compared it against mapping of building footprint data sourced from D.C.'s Open Data portal. Buildings include parking garages, ruins, monuments, and buildings under construction, along with residential, commercial, industrial, apartment, townhouses, duplexes, etc. All structures greater than 100 square feet were included in the analysis.

Modeled Changes in Flood Elevation and Exposure

The comparison between existing conditions and concept implementation for the 100-year storm event revealed the following:

- Flood elevations decreased throughout the modeled reach, with average reduction of 0.7 feet, and up to 2.2 feet in select locations.
- Building exposure decreased notably. Under existing conditions, 425 buildings intersected the 100-year floodplain. Under the concept scenario, this number dropped to 361 buildings—a reduction of 64 structures exposed to flooding.

A visualization of flood reductions is shown in Figure 43 and Figure 44. This analysis confirms that the upstream BGI concept delivers measurable reductions in flood elevation and structure exposure within D.C. While flood risks are not fully eliminated, the mitigation benefits are concentrated in highly vulnerable areas and directly align with the regional goals of this study.

As a note, there are multiple other recently developed flood models covering this portion of D.C. The USACE also maintains a hybrid one and two-dimensional hydraulic model that is more complex, but likely more accurate at modeling flooded conditions. D.C. also recently completed the IFM which includes this area. While the project team did not directly evaluate the project using those tools, the data from this study could be inserted into those models for further evaluation.

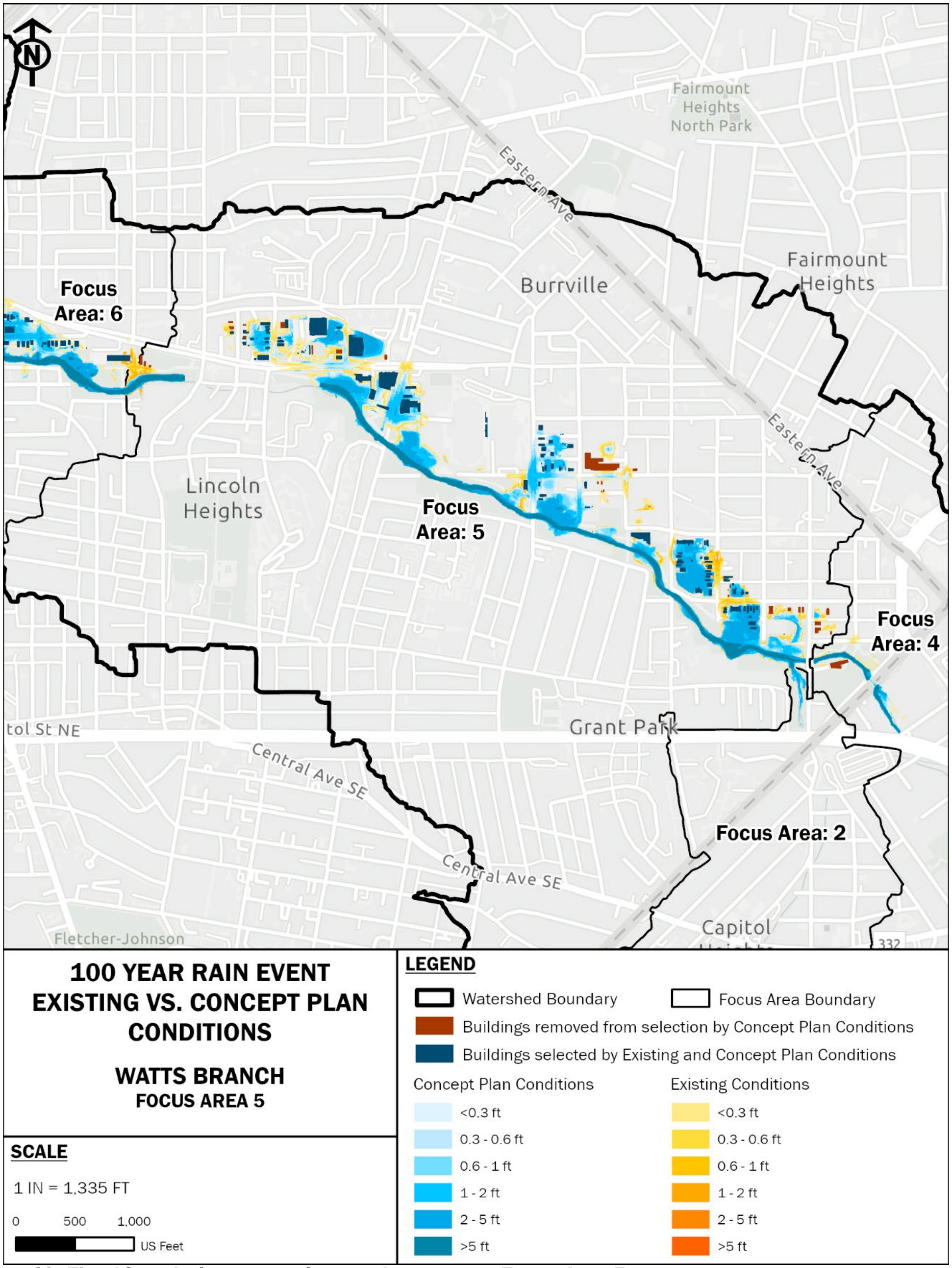


Figure 43: Flood inundation comparison at downstream Focus Area 5.

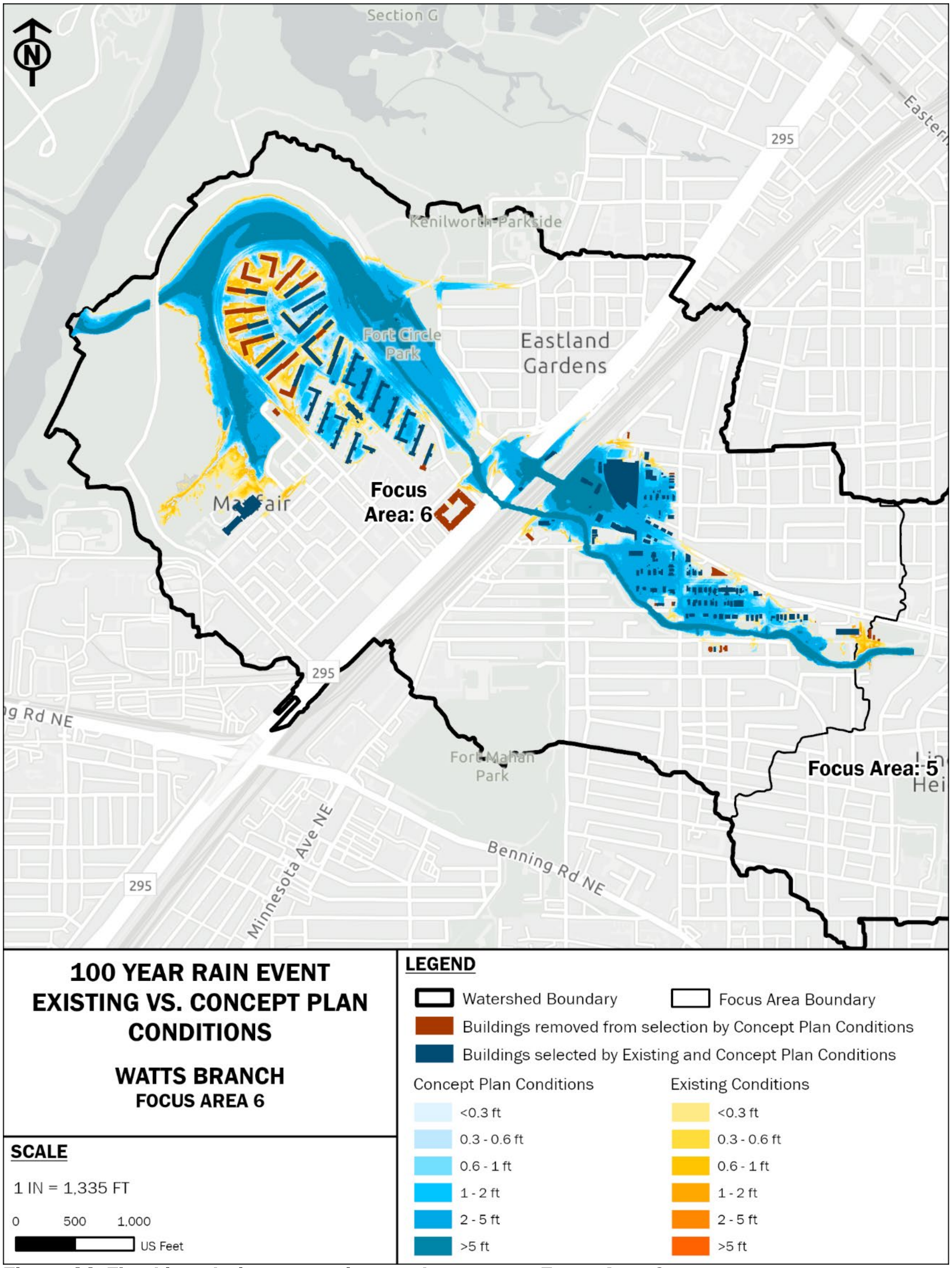


Figure 44: Flood inundation comparison at downstream Focus Area 6.

EVALUATING CLIMATE MITIGATION POTENTIAL

The project team assessed how well the concept design would mitigate projected increases in flood risk under climate change scenarios for the 2080s. To ensure consistency with existing efforts, the Team used the same 2080s flow rates developed by the USACE in the HEC-HMS model prepared for the Watts Branch Flood Risk Management Study (DC Silver Jackets, 2021)[8]. These flows were based on DOEE's future precipitation projections and reflect more frequent and intense storm events. The study found substantial increases in flood exposure under 2080s conditions, reinforcing the importance of evaluating how proposed BGI concepts perform under plausible future scenarios.

With the concept in place, peak flows compared to 2080 conditions were significantly reduced:

2-Year Storm (2080 Conditions with Concept)

- 41% reduction at the Focus Area 2 downstream limit.
- 32% at the E. Capitol St. Tributary confluence.
- 20% at 50th Street Culvert.
- 13% at the Anacostia confluence.

100-Year Storm (2080 Conditions with Concept)

- 14% reduction at the Focus Area 2 downstream limit.
- 8% at the E. Capitol St. Tributary.
- 6% at 50th Street Culvert.
- 6% at the Anacostia confluence.

A visualization of results is shown in Figure 45 and Figure 46. These results suggest that the concept plan offers a partial but meaningful buffer against climate-driven increases in flood peaks.

[8] District of Columbia Silver Jackets. (2021). Watts Branch Flood Risk Management Study: Final Report. Washington, DC: U.S. Army Corps of Engineers and DOEE. Retrieved from https://www.dropbox.com/scl/fi/b0sanqutmp9rfhova4bz7/Watts-Branch-FRM-Study-Final-Report_-April-2021.pdf?rlkey=hemiqpvxoemjcdlwdxnpllgam&e=3&dl=0.

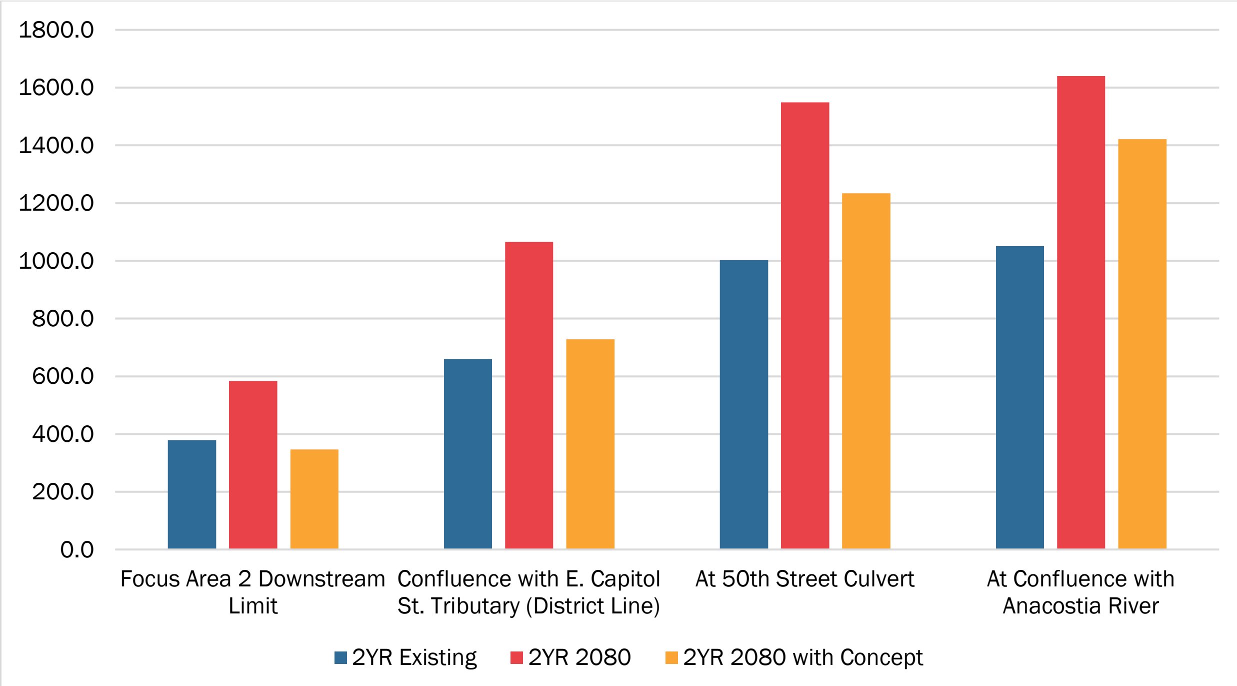


Figure 45: Influence of the concept on 2-year, 2080s peak flow.

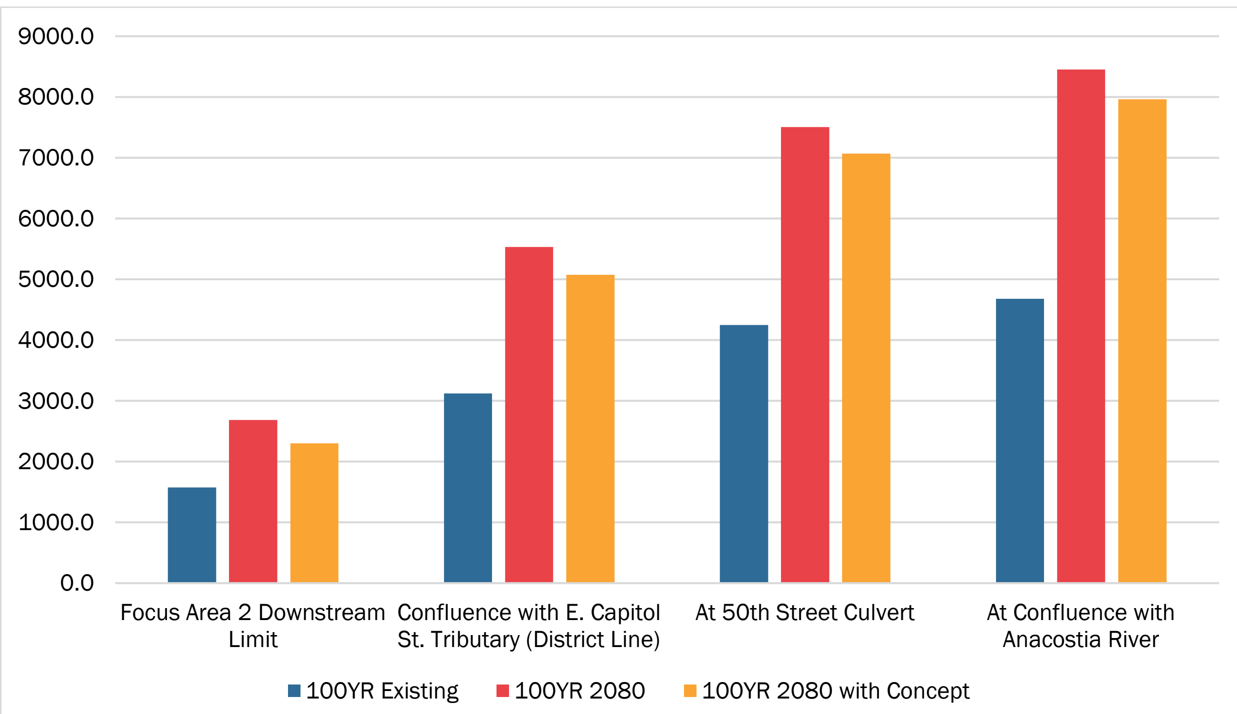


Figure 46: Influence of the concept on 100-year, 2080s peak flow.

ASSESSING FLOOD FREQUENCY REDUCTION

Beyond reducing peak flow volumes, the concept also shifts **flood frequency curves**, meaning flood events occur less often for a given storm size. For example:

- A 10-year storm under existing conditions would generate similar runoff to a 25-year storm after project implementation.
- This shift implies that high-impact flooding will occur less frequently, delivering measurable resilience benefits to residents and infrastructure.

A graphical representation of the frequency shift is shown in Figure 47.

This suggests that should the proposed concept be executed, the frequency of flooding during significant storm events will be reduced and the damage associated with flooding will occur less frequently.

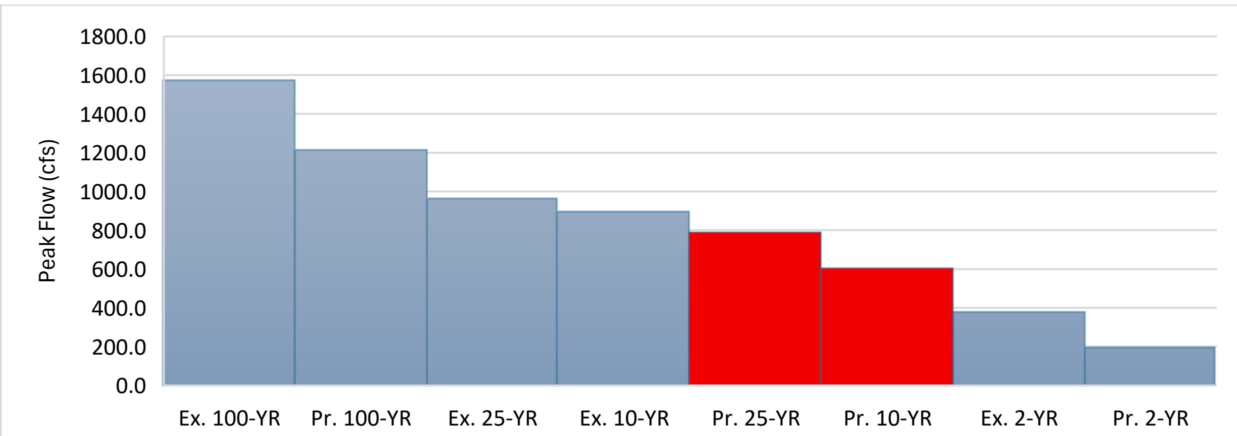


Figure 47: Shifts in flood frequency at Focus Area 2 downstream limit. The figure shows that the proposed project reduces flooding associated with the 25-year and 10-year storms (shown in red) to a lower frequency than the existing 10-year event.

SUMMARY AND IMPLICATIONS

The Watts Branch concept demonstrates how targeted, upstream BGI can:

- Substantially reduce peak runoff volumes.
- Lower flood elevations and reduce structure inundation.
- Provide measurable benefit under future climate scenarios.
- Decrease flood event frequency for a given storm size.

This case study validates the feasibility of regional BGI strategies and offers a replicable model for detailed flood mitigation planning using watershed-based hydrologic and hydraulic tools. It also reinforces the importance of investing in upstream headwater areas to maximize cross-jurisdictional impact.

BGI FUNDING

Funding the implementation of resilience projects remains a significant challenge. Cities, states, and regional partners are addressing this challenge by drawing on a diverse range of sources. The relevance of these funding sources differs across strategies. Some sources are better suited for planning and preparedness, while others are geared toward implementation. However, fewer funding sources focus on the latter, making it crucial to identify and leverage the most appropriate funding opportunities for each stage of resilience project development.

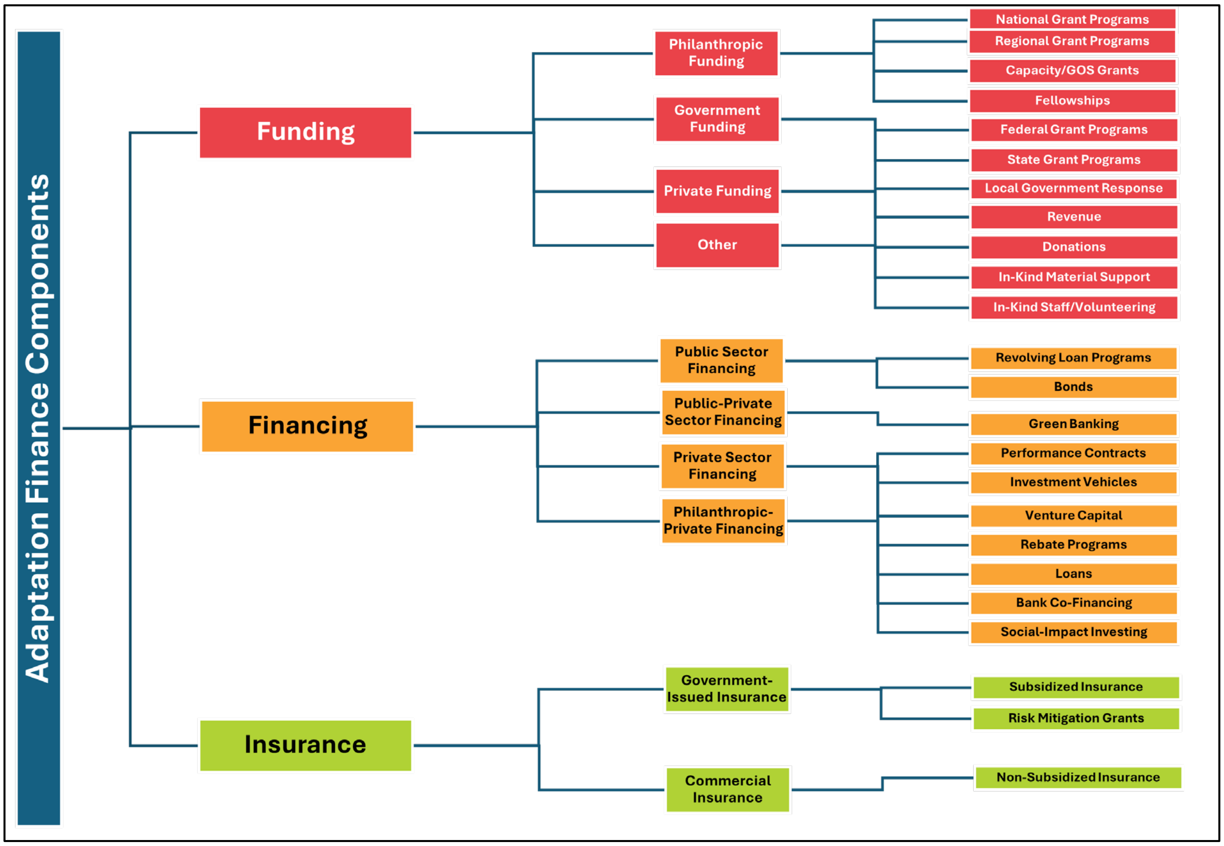


Figure 48. Financing components for resilience. Adapted from Moser et al. 2018.

In 2019, as part of the USACE Watts Branch Flood Risk Management Study, the Georgetown Climate Center produced an exhaustive compendium of federal, state, and non-governmental funding sources for BGI and reviewed their applicability to Watts Branch. Like other regions of the United States, FEMA's Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Building Resilient Infrastructure and Communities (BRIC) programs were among the largest sources for project implementation. This resource identified 24 other federal and regional sources related to clean water and flood risk management projects.[9]

[9] District of Columbia Silver Jackets. (2021). Watts Branch Flood Risk Management Study: Final Report. Washington, DC: U.S. Army Corps of Engineers and DOEE. Retrieved from https://www.dropbox.com/scl/fi/b0sanqutmp9rfhova4bz7/Watts-Branch-FRM-Study-Final-Report_-April-2021.pdf?rlkey=hemiqpvxoemjcdlwdxnpllgam&e=3&dl=0.

In recent months, FEMA funding for resilience projects has dramatically changed, placing an increasing emphasis on diverse sources of funding. Here, we summarize considerations related to eligibility and recent changes in federal funding sources that might impact where to pursue funding.

Key Considerations for Resilience Funding

Applicant Eligibility: Different funding sources have specific eligibility criteria, often requiring applicants to be government entities, non-profits, or CBOs.
Type of Project: Funding programs may prioritize certain types of projects, such as those that address flood risk, improve water quality, or enhance community resilience.
Cost-Benefit Analysis (CBA): Many funding sources require a CBA to demonstrate the economic viability of the project. This can be challenging for BGI projects, which offer multiple co-benefits that are not always easily quantifiable.

Recommendations to Develop BGI Funding Strategy

To navigate the evolving landscape of resilience funding for BGI, the following recommendations are proposed:

1. **Conduct an Analysis of Federal Funding Impacts**: Identify federal programs that are less impacted by recent changes and continue to offer robust support for resilience projects. Examples include FEMA's Hazard Mitigation Grant Program and Flood Mitigation Assistance programs, and HUD's Community Development Block Grant program. This is important to ensure that funding strategies remain aligned with stable and reliable sources, minimizing the risk of funding disruptions.
2. **Pursue State and Local Funds**: Explore state and local funding opportunities, such as DOEE's Clean Water Construction Grant Program and MDE's Comprehensive Flood Management Grant Program. Leveraging state and local funds can provide additional financial support and demonstrate local commitment, which can be attractive to federal funders.
3. **Leverage Non-Governmental Sources**: Engage with non-governmental organizations and private foundations that support environmental and resilience initiatives. Non-governmental sources can offer flexible funding options and often support innovative projects that may not fit traditional funding criteria.
4. **Develop a Comprehensive Funding Strategy**: Create a strategy that combines multiple funding sources to maximize financial support and reduce dependency on any single source. A diversified funding strategy enhances financial resilience and ensures that BGI projects can proceed even if one funding source becomes unavailable.
5. **Pursue Regional Collaboration:** Foster cross-sector partnerships between government, nonprofits, academia, and private-sector actors. Diverse partnerships can bridge silos, build trust, and add credibility to funding applications. Coordinated multi-jurisdictional projects are typically seen as cost-effective and more competitive for federal funding, particularly when aligned around shared infrastructure vulnerabilities.

6. **Use Disaster Mitigation Framing:** Structure BGI projects within the context of disaster mitigation to unlock long-term funding sources and align with federal and state priorities. This framing strengthens the case for BGI by connecting it to measurable risk reduction and cost savings.
7. **Tie Funding to Measurable Outcomes:** Ensure that funding is linked to measurable outcomes grounded in lived experience. Metrics should reflect both technical performance such as reduced flood claims, and community impact including health, safety, pride of place).
8. **Invest in Community Capacity:** Focus on building community capacity, not just capital projects. Funders value stability and delivery capacity. Supporting small CBOs through grants, training, and administrative support allows them to grow into effective implementation partners.
9. **Foster Cross-Sector Partnerships:** Encourage partnerships between government, nonprofits, academia, and private-sector actors. Diverse partnerships can bridge silos, build trust, and add credibility to funding applications.
10. **Strategically Align with Existing Plans and Frameworks:** Embedding BGI efforts into regional hazard mitigation plans, resilience strategies, and local land use policies enhances fundability and accountability.
11. **Balance Co-benefits with Core Goals:** While public health, biodiversity, and workforce outcomes are compelling, these should enhance—not distract from—the flood resilience mission.
12. **Strengthen Organizational Readiness**: Funders are increasingly evaluating whether applicants have the staffing, systems, and long-term planning in place to steward BGI infrastructure.
13. **Use Volunteer Networks and Small Grants:** Local grants and engaged volunteers can maintain momentum and build readiness for larger investments.
14. **Demonstrate Avoided Costs:** Emphasize how BGI reduces strain on emergency services and disaster recovery systems (e.g., Federal Emergency Management Administration (FEMA), National Flood Insurance Program (NFIP) claims) to make a stronger fiscal case for investment.

These recommendations aim to enhance the financial sustainability of BGI projects and ensure that diverse funding opportunities are effectively utilized to support resilience efforts across the region.

CONCLUSION

This study was grounded in the idea that **water knows no boundaries.** While flooding impacts are highly localized, the solutions must be regional—especially when upstream interventions reduce downstream risk. A cross-jurisdictional, watershed-based approach was critical to addressing this complexity. This study achieved the following outcomes, while focused on conducting meaningful engagement and identifying BGI solutions at both the local and watershed-scale:

Engaged over 100 participants in meaningful, watershed-based events	Identified dozens of effective and evidence-driven potential BGI project opportunities	Developed demonstration concepts for 3 priority subwatersheds
Demonstrated the effectiveness of using BGI to address downstream flooding	Built a strong foundation to continue to move potential projects forward to implementation	Provided a replicable model and tools to other communities facing similar challenges and needs

This study is highly useful for **future planning, grant development, and cross-jurisdictional coordination.** The data findings reinforce a central truth in flood resilience planning that **addressing downstream flooding requires action in the upstream watershed.** Future rainfall patterns and increased urbanization will likely exacerbate flooding, placing a greater emphasis on reducing the volume of runoff wherever possible. Regional collaboration between the District and Prince George's County is therefore essential to building flood resilience in these watersheds. Reflections to support future planning and implementation of BGI include:

- **Lean into the shared value of BGI:** The study areas included several underserved communities, some of which may not be directly affected by flooding but could still host BGI projects to benefit downstream areas. In these cases, **community co-benefits**—like tree canopy, green space, and safety—are essential to demonstrate shared value. Engagement showed that residents understand and resonate with both measurable flood impacts and broader quality-of-life improvements. The **approach is regional, but the impact must be local**—and for watershed-scale interventions to succeed, they must be framed in ways that resonate locally.
    - Communities in all three watersheds were active and engaged stewards. For more lessons learned and recommendations related to engagement, see the Meaningful Watershed-based Engagement section.
- **Emphasize BGI as a multi-dimensional and adaptive strategy**: BGI includes a variety of interventions that can be tailored to different contexts and community priorities within each watershed. Compared to other stormwater measures, BGI can be adaptively managed over time. For example, in the Watts Branch case study, the concept includes multiple pond retrofits, new

floodable park spaces, and expanded vegetated corridors—demonstrating how BGI can be deployed in complementary ways to capture, store, and slow runoff at a systems level. Unlike many conventional infrastructure solutions, these practices can be phased in, adjusted over time, and designed to deliver co-benefits beyond flood control.

- **Prioritize BGI options with intention:** Prioritization is a continual process that can promote stewardship across neighborhoods and is intended to benefit all parties. Communities downstream benefit from the reduced runoff while communities upstream receive the environmental and community co-benefits such as increased green spaces. As concepts are advanced into fundable designs, the prioritization framework can be used to emphasize community-defined co-benefits—such as cooling, clean air, and access to green space—alongside flood risk reduction, helping ensure BGI investments serve both upstream and downstream communities.
    - A prioritization framework is available in Appendix D that provides adjustable weightings for a variety of prioritization factors to meet a given community or study's needs.
- **Demonstrate effectiveness:** The detailed Watts Branch case study demonstrates that even within a dense, highly urbanized watershed, BGI can reduce flood peaks by up to 48% locally and 15% at the watershed outlet. It also reduces building exposure by dozens of structures. This is a strong validation of BGI as an effective engineering solution when designed, planned, and placed strategically. Using BGI upstream can have a real impact downstream.
- **Build the collective capacity of CBOs:** Sharing lessons learned from this study and future BGI planning and implementation efforts will help build the collective capacity of CBOs and other partners (e.g., funders, government agencies, technical partners) to successfully pursue additional BGI projects. CBOs can become better equipped to scope feasible and effective BGI projects and pursue funding to implement those projects, reducing the pressure on government agencies to carry responsibility for stewardship in every neighborhood.

The study's processes and lessons learned provide a **scalable, flexible, and technically grounded roadmap for implementing BGI in other watersheds** facing similar challenges. It invites not only engineers and planners, but also community groups and funders, to participate in the co-creation of resilient, BGI solutions.