Wake County Stormwater and Green Stormwater Infrastructure Best Practice Summary

Introduction

The purpose of this document is to summarize best practices for stormwater management and Green Stormwater Infrastructure (GSI) based upon expertise of stormwater practitioners represented on the Wake County Water Partnership. This document is intended to be used as a resource for jurisdictions seeking to advance stormwater management programs, with a particular focus on integrating GSI. Information covers a range of topics including policies, modeling, maintenance as well as GSI incentive programs and project examples. This document is not intended to be all inclusive but is a living document that will continue to evolve as science and stormwater policies evolve.

The GSI Subcommittee will reevaluate this document on an annual basis to update information based upon the current state of knowledge and local practice applications.

Policies

Existing

- Holly Springs: Drainage Policy requires developers to update basin Hydrology and Hydraulic (H&H) model as new development projects are proposed upstream or downstream of known drainage concerns.
- Cary: Peak flow attenuation rules moved to floodplain ordinance rather than water quality/stormwater ordinance so that peak flow attenuation will not be impacted by changing state regulations. Stormwater Policies updated in 2022 to form basis for incorporating additional GSI. The LDO Environmental Regulation chapter encompasses: Tree Clearing Certificate, Urban Transition Buffers, Illegal Discharges to the Storm Sewer System, Soil Erosion and Sedimentation Control, Nuisance and Hazard Control Standards, and the Flood Damage Prevention Ordinance which is aligned with the Community Rating System (CRS) program. GSI is incorporated into 2040 Community Plan.
- Raleigh: Lead by Example Policy requires evaluation of GSI on City's development and improvement Projects.
- Asheville, NC policy: Permeable pavement whenever above minimum parking lot requirement.
- Garner: Developed comprehensive design manual for streets and stormwater.

In Development

- Knightdale: Stormwater as focal features; stormwater features serve as amenity and bring to forefront.
- Wilmington, NC: Looking at removing wet ponds, incentivizing GSI.
- Cary: Pursues Public/Private Partnerships with developers to address legacy stormwater issues with new development. Basin models provide shovel ready projects that compliment new development, easing the burden rezoned cases can manifest allowing a comprehensive approach to stormwater in a cost-effective manner.
- Raleigh: GSI Master Plan in development in 2025.

Incentives

- Raleigh Rainwater Rewards: Program provides cost-share funding for GSI projects. Applicants may receive up to 90% cost-share funding depending on location in watershed. A subsidy program added in April 2023 also provides 100% funding for GSI projects on private property for eligible community members that fall within disproportionately impacted areas and meet income/rental thresholds.
- Cary GSI Grant Program: Program encourages the use of GSI on new development and redevelopment projects and aims to lead by example by incorporating GSI measures for projects on Cary-owned properties and within the public right-of-way. The GSI grant program launched in April 2024 and is designed for property owners who wish to install GSI on their property. The program provides reimbursement of up to $5,000 for eligible GSI measures that are installed on privately owned properties or lots within subdivisions that don't have an existing stormwater control measure.

Modeling

- Holly Springs: See Drainage Policy above. Developers update existing models and provide data to Town as new developments initiated.
- Cary: Development of basin models support infrastructure and SCM maintenance and open space initiatives for flood mitigation. Completed Walnut Creek model and 90% complete model for the Swift Creek basin. Leverage modeling data to fix known infrastructure and SCM issues as redevelopment occurs. Promotes cost-efficient solutions without slowing the permitting process, fosters partnerships with developers. Installation of sensors and rain gauges in the basins supports model calibration and helps identify GSI opportunities within basins.
- Morrisville: Stormwater Drainage System Inventory Map used to help build town-wide model and develop capital project list.
- Durham: Watershed Stormwater Management Models (SWMM/PCSWMM) models as part of Watershed Improvement Plans to evaluate areas of pollutant loading and perform scenario analysis. Models developed for: Eno River, Little

Lick Creek, New Hope Creek and Little Creek, Ellerbe Creek, Northeast and Crooked, Third Fork Creek watersheds.
- UNC Chapel Hill: Campus-wide SWMM model to support stormwater management for existing and future development.

Planting

- Raleigh: Coordinated with gardeners and maintenance staff to identify plants for City-led projects in parks and right-of-way; developed design charette and supporting resources.
- Cary: Developed table of plant species and best placement.

Maintenance

- Cary- Maintenance shifted to the Stormwater Division allowing greater flexibility in expanding the GSI initiative. Cary promotes and maintains new development non-regulatory GSI in right-of-way as part of public-private partnership.
- Raleigh: Centralized stormwater maintenance for City projects under Stormwater Department. Dedicated staff for GSI Maintenance located with Parks Dept. and funded with Stormwater Fees.
- All Jurisdictions follow NCDEQ Stormwater Control (SCM) Design Manual: NCDEQ Stormwater Control Measure (SCM) Design Manual used for design and maintenance

Data Mapping

- Morrisville: Stormwater Drainage and System Inventory Map
- Holly Springs: Stormwater Complaint Map
- Cary: Storm drainage system mapped in ESRI ArcMap, AGOL, and ArcPRO. Mapped SCMs support post-construction management of over 1,400 SCMs.

Partnerships

- Cary: Cary promotes partnerships early in the planning phase using basin modeling and developer agreements. New developments incorporate regulatory and non-regulatory GSI (through developer agreements).
- NC Department of Transportation (NCDOT): NCDOT partners with Wake County and municipalities to construct SCM retrofits. Cary and NCDOT are partnering on a GSI project using Cary owned property on NCDOT road. NCDOT will plan and build the facility and Cary will maintain once complete.
- Walnut Creek Watershed Action Team (WAT): Federal, state and local partners participate in WAT to promote floodplain/stormwater and water quality improvement in the Walnut Creek watershed. Participants include Cary, Raleigh, Wake County, NC State University, NC Water Resources Research Institute

(WRRI), NC Dept. of Environmental Quality, NCDOT, Partners for Environmental Justice (PEJ) and Carolina Wetlands Association.

- Walnut Creek Community Partnership: Collaborative effort that supports community engagement and watershed improvement. The Conservation Fund is supporting through Parks with Purpose initiative. Online Watershed Action Plan identifies and tracks project opportunities.

Example Projects

- Morrisville: Large, constructed wetland SCM across from Town Hall to support future priorities. Stormwater wetland serves as amenity and aesthetic; incentive for developers coming into downtown so developers don't have to build SCM directly with development.
- Wake County: Beech Bluff County Park designed to meet Sustainable SITES certification; considers landscape in site plan and design; incorporates GSI at design phase; design includes integrated stormwater management-grass swales, bioretention, permeable pavers, rainwater harvesting and education.
- Downtown South Project: Establishment of Riparian Corridor Fund as part of rezoning conditions. Fund used as matching grant funds for water quality improvement/flood mitigation projects in larger watershed. Local stakeholders key to establishment of fund.
- Garner: Incorporating GSI into Yeargan Park design.
- City of Durham: Pursuing Equitable Green Infrastructure Project.
- Cary: Regional stormwater wetland in Swift Creek watershed near downtown will help mitigate existing flooding issue. Permanent drainage associated with stormwater wetland helps address runoff associated with new development. Cary has 5 additional GSI projects in downtown leveraging Public/Private partnerships.
- NC Water Resources Research Institute (WRRI): WRRI is partnering with NCSU Bio & Ag and local hotel in Cary to install Low Impact Development (LID) with support from NCDWR 319(h) grant. An underground infiltration device will be studied as part of grant.
- Cary: Awarded a $1.9 million grant to improve stormwater management and water quality in the Walnut Creek corridor from the downtown park to Cary Towne Boulevard by incorporating open space, riparian buffer, stormwater management, floodplain management, tree canopy, GSI, linear park and greenway trail integration. Cary is pursuing purchasing floodplain and riparian buffer corridor for the entire reach. Cary is also on the final list for approval for $1.1M grant for stream stabilization and stormwater management along the Walnut Creek corridor from Cary Towne Blvd to I-40.

- Raleigh: Raleigh is advancing various GSI initiatives, including Raleigh's GSI visual monitoring program and GSI projects along roadways and in parks. For additional information, visit: Green Stormwater Infrastructure Initiatives.

- Raleigh: Raleigh's new Smokey Hollow Park Project will feature daylighting and restoration of Pigeon House Branch as well as a constructed wetland.

Funding

- Stormwater Utility fees fund projects in Raleigh, Holly Springs, Apex, Morrisville
- Debt financing
- Raleigh plans to issue revenue bonds for stormwater FY 25
- Budget allocation- Cary has recurring appropriation from Utility Fund balance that is roughly equivalent to 15 cents per 1000 gallons water consumed by Cary Customers that will be applied to Jordan Lake One Water
- Public-Private Partnerships
- Grants:
    - NCDEQ Financial Resources for Watersheds Water Quality, Cost-Share, Grants and Loans
    - USEPA: Green Infrastructure Funding and Technical Assistance Opportunities
    - Watershed Stewardship Network Funding Site: Sustainable Funding Resources
    - State and Tribal Assistance Grant (STAG) funding: Cary received $900,000 to support Swift Creek sensors and modeling.
    - Land and Water Flood Risk Reduction Grant
    - NCDEQ Water Resources Development Grant

Integrated Water Management

- Cross-communication between stormwater, planning, general services, parks and recreation departments helps facilitate coordinated stormwater management and support GSI projects that provide co-benefits.
- Cary: Coordinates across departments and is incorporating GSI into the 2040 Community Plan
- Raleigh: Works across the organization through staff in Stormwater Plan Review and Water Quality, including two "GSI Advocates", to implement GSI evaluation early in design and support above and beyond GSI with supplemental funding.
- Wake County: Coordinates with Housing Affordability and Community Revitalization Dept.to identify potential opportunities to integrate GSI into future affordable housing projects.
- Wake County: Facilitates flood coordination meeting to identify data sharing opportunities/needs, regulatory updates, pilot project opportunities with municipal partners and the following departments: Parks, Recreation and Open Space, Emergency Services, GIS, Planning, General Services Administration, Environmental Services, Soil and Water Conservation District.
- Wake County: Developing fifty-year One Water Plan that integrates all water

planning (water supply, wastewater treatment, stormwater and flood management, and groundwater protection) with County and municipal development and transportation planning.

Education

- Walnut Creek Community Partnership: Informed community helps promote GSI in rezoning, development efforts.
- Partners for Environmental Justice (PEJ): PEJ partners with City of Raleigh, Cary and other partners to develop the Walnut Creek Watershed Learning Network, a six-week community engagement and empowerment initiative.
- Cary: Grant funding supported partnership with NCSU Extension to produce Rain It In video series on GSI.
- Wake County Green Schools Partnership: Collaborative group of schoolteachers, administrators, environmental educators, parents, businesses, university and government partners that share a common goal to increase school sustainability and environmental literacy. GSI is one of the focus areas of this group.

Resources

- City of Raleigh Menu of GSI-based conditions for rezoning
- NCDEQ Stormwater Control Measure (SCM) Design Manual
- ACTION PLAN FOR NATURE-BASED STORMWATER STRATEGIES: Promoting Natural Designs that Reduce Flooding and Improve Water Quality In North Carolina

Stormwater Research

- NCDOT's Research & Development Office partners with NCDOT units, universities and business partners (including local governments) to fund research projects and solicits new research ideas on an annual basis. Applicants are encouraged to partner with a NCDOT unit on project proposals. Application information is available on NCDOT's Research & Development website. A comprehensive list of past research and ongoing research projects is available: on NCDOT Research Projects page.
- United States Department of Agriculture (USDA) Forest Service publications on the impacts of urbanization on forest hydrology in the piedmont of NC: Johnny Bogs Publications
- Dr. Bill Hunt, Dr. Sarah Waickowski and Bill Lord 2021 publication: Maintenance Costs of Stormwater Control Measures (SCMs) in North Carolina.

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