

# PLAN FOR CONTINUING TO ADVANCE THE USE OF GREEN STORMWATER INFRASTRUCTURE (GSI) IN RALEIGH

6/1/2021

*Prepared by the Stormwater Management Advisory Commission for Raleigh City Council*

***City Action #1: Lead by example by adopting and implementing a formal City policy that requires evaluation of GSI on the City’s development and improvement projects.***

Why This is Needed	Recommendations
<p><b><u>Desired Outcomes</u></b></p> <ul style="list-style-type: none"> <li>• The City of Raleigh will routinely, actively, and visibly demonstrate the cost-effective use of GSI on its own projects, leading by example in advancing the use of GSI.</li> <li>• Where existing impervious surfaces on City of Raleigh redevelopment projects are exempt from stormwater treatment requirements by State of NC law, the City will consider treating stormwater voluntarily, as a matter of adopted policy, as if treatment were required by the UDO. The City will use GSI practices for stormwater treatment to the extent practicable.</li> <li>• On all City of Raleigh land development and redevelopment projects that are subject to requirements in the UDO for stormwater treatment, the City will routinely evaluate using GSI practices to comply with the adopted policy.</li> <li>• City Stormwater Management staff will continue to reach out to City executive managers and project managers to better understand their perspectives about the benefits of and impediments of incorporating GSI into the City’s development projects and about internal procedural changes that could help them choose to use GSI.</li> <li>• City executive managers and project managers will reach out to City Stormwater Management staff for information and technical support about the use of GSI both in general and about specific City development projects. Project managers will become more familiar with and conversant in the use of GSI and have ready access to expert support and tools for evaluating GSI options and making GSI design decisions.</li> </ul> <p><b><u>Observed Challenges</u></b></p> <ul style="list-style-type: none"> <li>• Consideration of GSI on the City’s development projects largely is to the discretion of the City’s project managers and supervisors. City project managers need more systematic procedures and guidelines for when and how to consider GSI on their projects.</li> <li>• The City’s ability to require stormwater treatment on redevelopment projects is limited by NC State law that prohibits all municipalities from adopting ordinances that require treatment of stormwater runoff from existing impervious surfaces. Stormwater runoff from these impervious surfaces is thereby exempt from regulation by the City’s UDO. However, the City may choose to voluntarily treat stormwater runoff from exempt impervious surfaces on its own properties and development projects.</li> <li>• For some City development projects, the incremental cost of using GSI to treat stormwater may be higher than the cost of minimum requirements, and project budgets have not included funds for these unanticipated costs.</li> </ul>	<p><b><u>Actions</u></b></p> <ul style="list-style-type: none"> <li>• Create a new City staff role of “GSI Advocate” in Stormwater Management to represent GSI to City executive managers, project managers, and designers to support them with using GSI on City projects. Maintain the GSI Advocate’s knowledge and training on a high level. (also see Action #2)</li> <li>• Vet the draft City GSI Policy and Implementation Guide with City departments and executive management.</li> <li>• Adopt and implement the City GSI Policy and adjust and update the policy as needed.</li> <li>• Share successes and lessons learned among City staff.</li> <li>• Continue training and updating City staff about GSI.</li> </ul> <p><b><u>Needed Resources</u></b></p> <ul style="list-style-type: none"> <li>• City project managers will need knowledge, time, tools, mandate, and support for adhering to the City GSI Policy.</li> <li>• Budget for the GSI Advocate position and balance staff workloads to ensure the GSI Advocate is available to City project managers and their designers when needed.</li> <li>• Budget for GSI expert consultant support to augment support from the GSI Advocate and help launch and initially maintain the City’s GSI Cost Tool and enhance the GSI Policy Implementation Guide.</li> <li>• Budget for time of City project managers and their designers and for soil testing to support site-specific evaluation of the suitability of GSI in the project’s site design, per the City GSI Policy.</li> <li>• Budget for potential incremental costs of using GSI to treat stormwater when higher than the cost of minimum requirements, or provide a separate funding source for covering these incremental costs through supplemental funding from the Stormwater Utility via a rate increase and corresponding utility level of service approval by City Council.</li> </ul>

***City Action #2: Provide information, support, recognition, and incentives to private developers and their designers for incorporating GSI into their development projects.***

Why This is Needed	Recommendations
<p><b><u>Desired Outcomes</u></b></p> <ul style="list-style-type: none"> <li>Private developers and designers will become familiar and comfortable with evaluating the use of GSI in their development site designs and frequently choosing to incorporate GSI into their developments.</li> <li>City staff will reach out to private developers and designers to better understand their perspectives about the benefits of and impediments of incorporating GSI into development and redevelopment projects and about regulatory and procedural changes that could help them choose to use GSI.</li> <li>Private developers and designers will reach out to City staff for information and technical support about the use of GSI both in general and about specific development projects.</li> <li>City staff will be available to help orient private developers and designers to GSI concepts and to using the City's GSI Cost Tool.</li> <li>The City and private developers will explore opportunities for developers to contract with the City to implement GSI for the City within City street rights-of-way as extensions of their development projects (on a reimbursement basis via UDO 8.6.5.A).</li> <li>Where existing impervious surfaces on private redevelopment projects are exempt from stormwater treatment requirements by NC law, private developers will take advantage of City funding assistance through Raleigh Rainwater Rewards to assist with costs of implementing GSI practices.</li> </ul> <p><b><u>Observed Challenges</u></b></p> <ul style="list-style-type: none"> <li>Many private developers and designers are not familiar with or are skeptical about incorporating GSI practices into their development site designs, concerned that plan reviews and approvals will take more time, cost, and review cycles than designs using conventional, gray stormwater treatment practices.</li> <li>Some private developers and designers believe that GSI practices always cost more to construct and to maintain than conventional, gray stormwater treatment practices.</li> <li>NC municipalities are prohibited by NC law from adopting ordinances that require treatment of stormwater runoff from existing impervious surfaces within redevelopment project sites. Stormwater runoff from these impervious surfaces is thereby exempt from regulation by the City's UDO.</li> <li>Likely because of challenges cited above, City staff has seen little interest from developers and their designers in using the GSI text changes to the UDO that were adopted in 2017 in their site designs or in applying for use of the City's Green Raleigh Review process.</li> <li>The incentives being afforded via the 2017 UDO GSI revisions and via Green Raleigh Review might not be strategically targeted and and/or might not afford sufficient benefits to attract developers' interest in GSI.</li> <li>Advocacy for using GSI practices has not been part of the traditional role of the City's development plan review staff.</li> <li>The development community has not been well-represented in past stakeholder input processes about the use of GSI in site development and redevelopment. In recruiting representatives for a new GSI stakeholders focus group, City staff should be clear about goals and requests for stakeholders' time (also see Action #5).</li> </ul>	<p><b><u>Actions</u></b></p> <ul style="list-style-type: none"> <li>Create a new City staff role of "GSI Advocate" in Stormwater Management to represent GSI to developers and designers and to support them with using GSI on their projects including at pre-submittal meetings for early consideration. Maintain the GSI Advocate's knowledge and training on a high level. (also see Action #1)</li> <li>Convene a stakeholder focus group to identify reasons for apparent low developer interest in GSI and to explore ideas for changing existing incentives and/or adding new incentives for using GSI. As appropriate based on focus group input, encourage text changes to the UDO and changes to City policies and practices for advancing the use of GSI. Coordinate this work with related work by staff reviewing existing GSI-related aspect of the UDO (see Action #5).</li> <li>Complete and formally issue the City's updated Stormwater Design Manual with guidance for evaluating and implementing GSI practices.</li> <li>Continue to host workshops and participate in events that reach out to developers and private designers about applications for GSI practices.</li> <li>Maintain and enhance information about the use of GSI on the City's website.</li> <li>Lead by example with GSI on City development projects and share information and experiences with private developers and designers. (also see Action #1)</li> <li>Coordinate the work of a stakeholder focus group with staff's work in reviewing the UDO for barriers to and incentives for GSI (also see Action #5).</li> </ul> <p><b><u>Needed Resources</u></b></p> <ul style="list-style-type: none"> <li>Identify and recruit community representatives for participating in a stakeholder GSI focus group to provide external input and help to raise awareness.</li> <li>Budget for the GSI Advocate position and balance staff workloads to ensure the GSI advocate is available to development clients when needed.</li> <li>Budget for GSI expert consultant support to augment efforts of the GSI Advocate and help launch and initially maintain the City's GSI Cost Tool.</li> </ul>

***City Action #3: Increase awareness of potential benefits of using GSI in redevelopment and new development as conditions in the City's cases for property rezoning.***

Why This is Needed	Recommendations
<p><b><u>Desired Outcomes</u></b></p> <ul style="list-style-type: none"> <li>Increasing community stakeholders' awareness of the potential benefits of incorporating GSI practices into development designs will increase developers' interest in offering rezoning conditions that incorporate meaningful use of GSI in resulting development projects.</li> <li>Private developers will offer rezoning conditions that incorporate the use of GSI into designs of properties for which they are seeking rezoning and intend to develop.</li> <li>City staff will be made available, as requested, to serve as educators and facilitators to community stakeholders and developers in identifying and vetting potential opportunities for incorporating GSI practices into rezoning conditions and into site designs.</li> </ul> <p><b><u>Observed Challenges</u></b></p> <ul style="list-style-type: none"> <li>GSI-related rezoning conditions cannot be a City requirement of the property owner/developer to secure rezoning.</li> <li>This action requires buy-in from the development community, the Planning Commission, and City Council to be effective.</li> <li>In the City's evaluations of individual requests for rezoning with UDO requirements, specific to references to the 2030 Comprehensive Plan Update, potential impacts of rezoning are not consistently addressed for the "EP" policies and actions given in the Comp Plan's Environmental Protection chapter. Some of these policies and actions relate to the City encouraging the use of GSI in land development and redevelopment (e.g., EP 3.4 Low Impact Systems for Parking, EP 3.8 Low Impact Development, and EP 3.18 Green Infrastructure).</li> </ul>	<p><b><u>Actions</u></b></p> <ul style="list-style-type: none"> <li>Working with the City Attorney's Office, develop and vet a menu of example GSI-based conditions for rezoning applicants to consider when seeking rezoning of properties for development.</li> <li>Confer with other municipalities about their experiences in this regard (e.g., Town of Cary, NC).</li> <li>Increase involvement of Stormwater Management staff in reviewing and commenting on rezoning requests regarding stormwater impacts of the requests and opportunities for including GSI as solutions and/or conditions offered by applicants.</li> <li>Include GSI in topics of collaboration of the liaisons of/between the Planning Commission and the Stormwater Management Advisory Commission.</li> <li>In evaluating rezoning cases for consideration by the Planning Commission and City Council, routinely address policies and actions given in the Comprehensive Plan Update's Environmental Protection chapter that pertain to the City encouraging the use of GSI in land development and redevelopment.</li> </ul> <p><b><u>Needed Resources</u></b></p> <ul style="list-style-type: none"> <li>Budget for GSI expert consultant support to augment efforts of the GSI Advocate to research and learn from other communities using rezoning conditions successfully.</li> </ul>

***City Action #4: Address potential benefits of GSI in the City's templates of plans for roadway corridors, neighborhoods, and parks and routinely address GSI in these types of plans and reports.***

Why This is Needed	Recommendations
<p><b><u>Desired Outcomes</u></b></p> <ul style="list-style-type: none"> <li>GSI will become an accepted, routine part of the City's long-term planning process and receive early consideration by cross-department teams capable of integrating GSI into planning reports, presentations, and public-facing information.</li> <li>City staff will routinely collaborate across departments to make sure that GSI is addressed in plans and reports thoroughly, consistently, and in keeping with current best practices.</li> </ul> <p><b><u>Observed Challenges</u></b></p> <ul style="list-style-type: none"> <li>Will require consistent, clear communication of multi-disciplined coordination through the area planning process.</li> </ul>	<p><b><u>Actions</u></b></p> <ul style="list-style-type: none"> <li>Routinely include GSI in planning for future redevelopment and in scopes of work for planning consultants. Identify specific projects and cost estimates, where applicable, in study reports and plans.</li> <li>Routinely include Raleigh Stormwater staff on planning teams to provide input about GSI through the planning process.</li> </ul> <p><b><u>Needed Resources</u></b></p> <ul style="list-style-type: none"> <li>Form a City work group among relevant departments to develop a framework for integrating these planning processes.</li> <li>Budget for GSI expert consultant support to augment efforts of the GSI Advocate.</li> </ul>

***City Action #5: Assess the 20+ UDO GSI text changes adopted in 2017 for benefits realized and opportunities for improvements.***

Why This is Needed	Recommendations
<p><b><u>Desired Outcomes</u></b></p> <ul style="list-style-type: none"> <li>The City’s development ordinances will clearly communicate to developers and designers that the City welcomes the use of GSI practices in site development and desires to work with the development community to advance the use of GSI.</li> <li>The City will consider needs and priorities of the development community in preparing and evaluating potential text changes to the UDO intended to advance developers’ use of GSI. The City will consider both input to making new text changes to the UDO and feedback on previous text changes to the UDO.</li> <li>City staff will track and regularly report on the extent to which GSI provisions in the UDO are being used and their benefits to Raleigh.</li> </ul> <p><b><u>Observed Challenges</u></b></p> <ul style="list-style-type: none"> <li>Educating City staff and developers on GSI opportunities already provided in the UDO needs to be intentional and continuous.</li> <li>The development community has not been well-represented in past stakeholder input processes about the use of GSI in site development and redevelopment. In recruiting representatives for a new GSI stakeholders focus group, City staff should be clear about goals and requests for stakeholders’ time (also see Action #2).</li> </ul>	<p><b><u>Actions</u></b></p> <ul style="list-style-type: none"> <li>Proceed with the UDO text change process for outdoor amenity areas, which City Council authorized on 2/16/2021.</li> <li>Using the outdoor amenity area staff work group as a model, review other text changes made to the UDO in 2017 for advancing the use of GSI in Raleigh for the extent to which they are achieving their intended purposes.</li> <li>Coordinate this review with related work by a stakeholder focus group (also see Action #2).</li> </ul> <p><b><u>Needed Resources</u></b></p> <ul style="list-style-type: none"> <li>Budget for GSI expert consultant support to augment efforts of the GSI Advocate to facilitate the UDO update review by City staff and stakeholders, and document recommendations for the City Manager’s office and City Council.</li> </ul>

***City Action #6: Continue to implement and build the program for inspecting and maintaining City-owned stormwater control measures, which includes GSI practices\*.***

Why This is Needed	Recommendations
<p><b><u>Desired Outcomes</u></b></p> <ul style="list-style-type: none"> <li>The City will maintain its stormwater control measures (SCMs, both GSI and gray infrastructure*) for compliance with the UDO, State of NC Stormwater Discharge Permit requirements, and other regulations and for the benefits that the SCMs provide for water quality and health of streams and lakes.</li> <li>The City will maintain its SCMs in ways that also provide aesthetic amenities visible to the public, that demonstrate integration of GSI into site landscapes, and that lead by example in the use of GSI.</li> </ul> <p><b><u>Observed Challenges</u></b></p> <ul style="list-style-type: none"> <li>Responsibility for maintaining City-owned SCMs had been dispersed among City departments and SCM maintenance had been inconsistent.</li> <li>Stormwater Management initiated a program for bringing inspection and maintenance of City-owned SCMs under central responsibility of and funding by Stormwater Management. Engineering Services is in the process of entering into Service Level Agreements (SLAs) with other departments for Stormwater Management to take on this responsibility and workload, department by department. This process is taking longer and proving more difficult than expected.</li> <li>As the City constructs and brings online more SCMs, including smaller and more-dispersed GSI practices, costs for maintaining City-owned SCMs have risen beyond available annually budgeted funds and other City resources (staff, equipment).</li> </ul> <p><small>*GSI practices are a subset of stormwater control measures (i.e., SCMs include both GSI practices and gray infrastructure practices).</small></p>	<p><b><u>Actions</u></b></p> <ul style="list-style-type: none"> <li>Clearly communicate to managers of pertinent City operations the importance of maintaining City-owned SCMs (compliance, appearance, image, leading by example).</li> <li>Execute SLAs between Engineering Services and City departments that operate SCMs for the City.</li> <li>Clearly communicate staff roles and responsibilities for complying with the terms of SLAs between Engineering Services and other City departments.</li> <li>Provide and train Stormwater Management staff to structure, implement, and administer the SCM inspection and maintenance program.</li> <li>Provide and train staff in other City operations for maintaining City-owned SCMs under coordination, administration, and reimbursement by Stormwater Management.</li> <li>Contract for SCM maintenance work that cannot be provided by City operations.</li> </ul> <p><b><u>Needed Resources</u></b></p> <ul style="list-style-type: none"> <li>Budget for staff and equipment dedicated to implementing the SCM inspection and maintenance program.</li> <li>Budget for ongoing staff training in current best practices for inspecting and maintaining SCMs.</li> <li>Budget for ongoing operating funding for the SCM inspection and maintenance program.</li> <li>Budget for information management systems for tracking the growing inventory of SCMs, their inspection and maintenance, and costs incurred and transferred among operations.</li> </ul>



To	Raleigh City Council
Thru	Wayne Miles, Stormwater Program Manager
From	Stormwater Management Advisory Commission
Department	Engineering Services
Date	June 1, 2021
Subject	Plan for Continuing to Advance the Use of Green Stormwater Infrastructure (GSI) in Raleigh

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### **PURPOSE AND BACKGROUND**

This memo report provides the response of the Raleigh Stormwater Management Advisory Commission's (Commission) to a directive from the Raleigh City Council for the Commission to prepare and deliver a "Plan for Continuing to Advance the Use of Green Stormwater Infrastructure (GSI) Practices in Raleigh" (Plan).

Since receiving Raleigh City Council's approval in 2016 for City staff to proceed with the first work plan for advancing GSI, the City has been implementing new policies, procedures, and tools needed to advance the use of GSI voluntarily. Much has been accomplished by the City since that time to enhance the City's Unified Development Ordinance (UDO) and operational framework to better support implementation of GSI. At its May 7, 2019 meeting, City Council indicated that it would like to see more City and private projects taking advantage of that framework to use GSI more frequently than was being observed. City Council went on to pass a motion at that meeting directing the Commission to "develop a plan to convert Raleigh's GSI rules from voluntary to mandatory" and to provide the plan for the City Council's consideration in August 2019. The motion also requested that City staff "look at other cities with mandatory GSI to study their effectiveness."

At City Council's August 20, 2019 meeting, the Commission Chairperson addressed the Council to provide and summarize a [memo report](#) and a timeline for the proposed Implementation Plan and prepared a [presentation](#). The Council acknowledged and commended the Commission's efforts and, following discussion, passed a motion that further directed the Commission and City Stormwater Management staff to "work with other City departments to ensure that any draft plan is consistent with the City's existing legal authority, that the plan focus on developing strategies to enhance the use of GSI, and that appropriate stakeholders are engaged in its development, that [the Commission] and staff examine other NC municipalities with success in enhancing use of GSI and recommend strategies to build on that success in Raleigh." The motion included

an amendment that the Commission also look into “how low-impact GSI integrates with the City’s current system, and [whether] reduction in stormwater runoff and the plan’s implementation [is] cost-justified?” (Refer to [minutes of City Council’s August 20, 2019 meeting.](#))

### **COMMISSION-RECOMMENDED GSI PLAN ELEMENTS**

Based on the revised City Council directive, the Commission formed a GSI Committee to work closely with City staff to prepare this Plan for Continuing to Advance the Use of GSI Practices in Raleigh (Plan), with assistance from the City’s GSI consultant Tetra Tech. This Plan focuses on the following six key “City Actions,” each described in more detail in the accompanying table titled, “Plan for Continuing to Advance the Use of Green Stormwater Infrastructure (GSI) in Raleigh.”

- 1) ***GSI in City development projects.*** Lead by example by adopting and implementing a formal City policy that requires evaluation of GSI on the City’s development and improvement projects.
- 2) ***GSI in private development.*** Provide information, support, recognition, and incentives to private developers and their designers for incorporating GSI into their development projects.
- 3) ***GSI in rezoning decisions.*** Increase awareness of potential benefits of using GSI in redevelopment and new development when offered as conditions in the City’s cases for property rezoning.
- 4) ***GSI in City plans.*** Address potential benefits of GSI in templates for roadway corridor plans, neighborhood plans, and area plans and routinely address GSI in these types of study reports.
- 5) ***GSI in the UDO.*** Assess the 20+ UDO GSI text changes adopted in 2017 for benefits realized and opportunities for improvements.
- 6) ***GSI maintenance.*** Continue to implement and build the program for inspecting and maintaining City-owned stormwater control measures, which includes GSI practices.

Information on the background, history, and context of the City’s progress in advancing the use of GSI generally and connections to each of the six recommended City Actions are provided in the balance of this memo.

### **BACKGROUND AND CONTEXT FOR THIS PLAN**

The City’s earliest association with advancing the use of GSI (then called Low Impact Development, LID) was around 2005 with staff’s development of information for the general public about benefits of LID and City Council’s encouragement and support for LID, soon followed by construction of several demonstration LID projects by Stormwater Management, some partially grant-funded. Around 2010, the Stormwater Management Advisory Commission also increased its focus on LID and on building a case for the City to invest in using and promoting LID, including building the City’s capacity to shift from reliance solely on conventional “gray” approaches toward green infrastructure (GI). The City focused its efforts on the stormwater aspects of GI – GSI, an approach that preserves natural features that absorb stormwater, reduce pollution, and reduce runoff

volume and, where natural features are removed, replaces them with constructed features that mimic nature as much as possible. By using mainly natural materials, such as soil, plants, rock, and mulch, GSI features can be designed to be aesthetic amenities, reduce urban air temperatures, and make spaces more welcoming and inviting. By absorbing stormwater, GSI features also increase infiltration to groundwater, which slowly releases flows to streams between rainfalls and during droughts.

In 2013, following a recommendation by the Stormwater Management Advisory Commission to City Council, the Council again endorsed GSI as a City initiative and authorized City staff to procure professional services to provide staff with technical and facilitation support for advancing the use of GSI, and develop a GI/LID plan for the Council's consideration. Following a competitive selection process, in late 2013 the City contracted with Tetra Tech and began a multiyear program working with City staff setting priorities and developing processes for advancing the use of GSI in Raleigh, beginning with forming an interdepartmental GI/LID Task Force and leading to the presentation to City Council of the City's [GI/LID Work Plan](#) in February 2015. Early landmark points in the City's progress with advancing GSI were completion in May 2016 of reports from two work groups, each composed of around 20 City staff and non-City stakeholders – the [Implementation Work Group](#) and the [Code Review Work Group](#).

Having initially focused on planning and building capacity for using GSI, in 2016 the City shifted focus to implementation and providing tools and systems for advancing GSI. Based on understanding gained during the capacity-building and planning efforts, City staff and Tetra Tech came to appreciate that City operations and staff serve multiple roles in the City's initiative to advance the use of GSI, each with distinct purpose and mission:

- **Developer** of capital and other improvement projects (subject to regulation same as private developers);
- **Regulatory administrator and enforcer** of the City's codes and ordinances in the UDO;
- **Advocate** for broadly advancing GSI in Raleigh to benefit water quality and stream health; and
- **Regulated entity** under the City's NPDES Stormwater Discharge Permit with the State of North Carolina (and **internal administrator and enforcer** of those permit requirements within the City's operations).

In its role as developer, the City and private developers have much in common, and many of the tools and systems that the City is preparing for advancing GSI serve both. However, there also are important differences between public and private developers' purposes, missions, responsibilities to the public, and public perceptions, and the GSI tools and systems will serve each differently. For this reason, the following discussion is presented as GSI on City and private development projects, respectively.



Concurrent with the Commission's work in developing the recommendations in this Plan, a related effort was undertaken by the [North Carolina Coastal Federation](#) (NCCF) with support from [The Pew Charitable Trusts](#) (Pew), resulting in their March 2021 release of "[Action Plan for Nature-based Stormwater Strategies: Promoting Natural Designs that Reduce Flooding and Improve Water Quality In North Carolina.](#)" Numerous public- and private-sector stakeholders contributed to this plan, including representatives of the City of Raleigh and the City's consultant Tetra Tech. North Carolina Department of Environmental Quality's then-Secretary Michael S. Regan (now U.S. Environmental Protection Agency Administrator) commended this effort and the 60-member volunteer stakeholder work group for their recommendations to state leaders for policies and programs for improving North Carolina's water quality and making the state less vulnerable to floods, commenting that "We cannot do the same old things and expect a different result."

### **GSI ON CITY OF RALEIGH DEVELOPMENT PROJECTS**

Since 2013, the City has accomplished a great deal and progressed toward systematically incorporating GSI into the City's own development projects as "business as usual." The following sections summarize the City's progress and accomplishments in advancing the use of GSI with focus on City projects. The Commission's GSI Plan includes these recommended City Actions for building on this progress: #1, GSI in City development projects; #4, GSI in City plans; and #6, GSI maintenance. Refer to the accompanying table of City Actions for descriptions.

#### ***Past and current use of GSI practices on City development projects***

The City has been implementing GSI practices as stand-alone retrofit projects since about 2010 and has been incorporating GSI practices into development and improvement projects since about 2015. These GSI practices are both voluntary and for compliance with stormwater-treatment requirements in the City's UDO. To help City staff, design professionals, and developers incorporate GSI into site designs, the City has developed and provided a variety of materials, tools, training sessions, and on-line materials, including the following:

- The City has posted information about the use of [GSI on the City's website](#) since 2015.
- Since 2014, City staff frequently has made presentations about the use of GSI to professional and business organizations, to City boards and commissions, and at workshops and conferences.
- City staff and Tetra Tech prepared illustrative color "[GI/LID fact sheets](#)" that show multiple options for applying GSI to various development types (commercial, residential, mixed use) and with real examples of cost savings achieved in those development types. These fact sheets have been posted on the City's website since 2015. Printed versions have been distributed widely to

designers and developers, and other municipalities have sought permission to post them on their websites.

- City staff and Tetra Tech prepared seven [standard detail drawings for GSI practices](#) located in street rights-of-way and posted them on the City's website in 2016. Based on feedback from designers and construction managers and contractors, these drawings were updated in 2020 and additional drawings are in preparation. Connections to GSI also have been added to the [City's Street Design Manual](#).
- During 2018, City staff and Tetra Tech conducted workshops tailored for City staff and the City's contract designers about incorporating GSI into site development plans for City projects.

The following projects are representative of the City's use of GSI practices in designs in progress and on City projects already constructed, primarily on roadway and park improvement projects:

- GSI with street improvements and other right-of-way projects (funded mostly with Roadway Design and Construction CIP and bond funds):
  - [Bioretention cells](#) constructed with improvements for [Sandy Forks Road](#), [Milburnie Road](#), [Yonkers Road](#), [Fox Road](#), and Hillsborough Street; constructed as a stand-alone retrofit on Pullen Road near NCSU; under design with improvements for Blue Ridge Road, Old Wake Forest Road, [Atlantic Avenue](#), Marsh Creek Road/Trawick Road, [Barwell Road](#), [Six Forks Road](#), and New Bern Avenue BRT; and as planning concepts for three green streets project in the [Midtown-St. Albans Area Plan](#).
  - [Stormwater wetlands](#) constructed with improvements for [Pullen Road Extension](#) and with new Fire Stations #12 and #14.
- GSI in City parks and other facilities (funded mostly with Stormwater Management CIP funds and grant funds):
  - [Bioretention cells](#) constructed as retrofits in the [Raleigh Rose Garden](#); under construction as retrofits [adjacent to Walnut Creek Wetland Park](#), in [Glen Eden Pilot Park](#), and in an informal pocket park at [Glenwood Avenue and St. Mary's Street](#); in design as retrofits in Biltmore Hills Park (via grant to NCSU), part of improvements for Baileywick Park; and as planning concepts for proposed [Devereux Meadow Park](#) and [Dix Park Plaza and Play](#).
  - [Riparian wetlands](#) under construction as part of stream restoration at [Wooten Meadow Park](#).
  - [Subsurface gravel wetland](#) under construction at [Walnut Creek Wetland Park](#).

- Silva Cell stormwater/pavement/tree management system constructed as part of park improvements at Chavis Memorial Park [with [Raleigh Rainwater Rewards \(R3\)](#) assistance].
- Rainwater harvesting/cisterns constructed as retrofits at six RFD fire stations and at Walnut Creek Wetland Park (with R3 assistance).
- Green roof constructed as a retrofit at Buffalo Road Aquatic Center (with R3 assistance).

***Policies and practices for ongoing and future use of GSI on City development projects***

City staff has heard from private developers and designers that some either are not familiar with GSI or are skeptical about the cost-effectiveness of GSI practices for their development projects. Staff also has observed little interest from private developers in using those provisions included in the text changes made to the UDO in 2017 that encourage GSI use in private development or in participating in Green Raleigh Review, a special development plan review process for encouraging private developers to use GSI. Feedback from the private development community is that the City is in a special position of visibility and opportunity to demonstrate ways that thoughtful site design can advance the use of GSI on the City’s development projects. They would like to see more leadership by example from the City via GSI on City projects for parks, streets, offices, recreation facilities, entertainment facilities, and parking lots and garages.

The City’s Stormwater program staff agrees with the Commission that the City can and should lead by example by incorporating GSI into City CIP and other development projects to the extent practicable given site conditions and other project constraints. Ideally, the City should routinely, actively, and visibly demonstrate the cost-effective use of GSI on its own projects. While the City has incorporated GSI into many of its development projects, consideration of GSI largely is to the discretion of the City’s project managers and supervisors, and the City recognizes that its project managers need procedures and guidelines for when and how to consider GSI on their projects. To address this need, the Commission has worked with City staff and Tetra Tech to develop a City GSI Policy that, as drafted and presented to City Council via this GSI plan, will require City staff to thoroughly evaluate opportunities, costs, and benefits of incorporating GSI into all applicable City development projects, acknowledging that GSI may not always be the best or sole solution for managing stormwater on a given project.

In evaluating whether and the extent to which a GSI Policy for the City should mandate the use of GSI on City development projects, the Commission considered the following as important precepts:

- ***Lead by example.*** The City should routinely, actively, and visibly demonstrate the cost-effective use of GSI on its own projects, leading by example in advancing the use of GSI. (The [NCCF/Pew document](#) makes the following related recommendation: “State and local governments need to lead by example by

encouraging the use of nature-based stormwater strategies and implementing them widely..., consistently and systematically [encouraging their use] when undertaking new government construction projects [and] devising or amending...policies and procedures to facilitate increased use of these strategies.”)

- ***Treat stormwater even where treatment is not required.*** Where existing impervious surfaces on City projects are exempt from stormwater treatment requirements by State of North Carolina law, the City may choose to voluntarily treat this stormwater runoff and should evaluate doing so, as if treatment were required by the UDO, and should choose to use GSI practices voluntarily to the extent practicable.
- ***Use GSI practices for treating stormwater.*** On City development projects that are subject to requirements in the UDO for stormwater treatment, the City should routinely evaluate using GSI practices and choose GSI practices for compliance where practicable.
- ***Connect to City Council’s vision plans.*** The City’s GSI Policy should be consistent with and support implementation of the City’s 2030 Comprehensive Plan Update and the City’s FY21-FY25 Strategic Plan (excerpts specific to GSI provided in Attachment A).

On this basis, the Commission reviewed and deliberated over several draft versions of a City GSI Policy and a companion City GSI Policy Implementation Guide and recommended that City staff and Tetra Tech test the draft policy and guide on actual City development projects, taking on the role of the City’s project manager charged with evaluating the use of GSI per the policy and the guide. Staff recommended and the Commission agreed with selecting two large projects under design by City contract design firms and being managed by City staff: expansion of Chavis Memorial Park (Parks, Recreation and Cultural Resources) and development of the Downtown Civic Campus (Engineering Services). Testing of the draft policy and policy guide provided valuable feedback regarding the provisions and wording in both documents, which informed revising them as well as the prototype City GSI Cost Tool. Tetra Tech’s testing of the draft policy and policy guide are documented in a [report dated January 21, 2021](#).

The Commission reviewed and endorsed these revised documents during its May 6, 2021 meeting and voted to recommend that City Council formally adopt and implement the draft City GSI Policy dated June 1, 2021, provided in Attachment B. Similarly, the Commission recommends that the City administratively adopt, implement, maintain, and modify as needed the draft City GSI Policy Implementation Guide dated June 1, 2021, also provided in Attachment C.

## **GSI ON PRIVATE DEVELOPMENT PROJECTS**

Since 2013 the City has taken a variety of actions targeted toward encouraging the private development community to incorporate GSI into its projects. The following sections summarize some of these actions. The Commission's GSI Plan includes recommended actions for building on this progress, as follows, each described in the accompanying table of City Actions: #2, GSI in private development; #3, GSI in rezoning decisions; and #5, GSI in the UDO.

### ***Encouraging GSI through development ordinances and policies***

Early in the efforts of the City's GI/LID Task Force, and later with the stakeholder work groups (Code Review and Implementation), the City recognized that mandating the use of GSI for stormwater management through the UDO on land development projects would be legally and politically difficult. Further, the City's ability to require stormwater treatment on redevelopment projects is limited because stormwater runoff from existing impervious surfaces is exempt from regulation by the City's UDO by State of North Carolina law that prohibits all municipalities from adopting ordinances that require treatment of stormwater from existing impervious surfaces. Because of these limitations, the City has focused its efforts for advancing GSI on leading by example by constructing on-the-ground examples of GSI practices and by striving to reduce barriers and provide incentives that encourage the private development community to use GSI voluntarily. The following are examples of measures the City has taken to encourage GSI through changes to its ordinances, policies, and administrative practices:

- In 2017, with stakeholder input, the City Council [adopted more than 20 text changes to the UDO](#) for enabling and encouraging GSI in development projects.
- Based on stakeholder input, in 2017 the City launched Green Raleigh Review, an alternative process for the City's review of site development plans that incorporate GSI. Participating developers receive partial fee reductions, special City staff support through the plan review process, and faster plan reviews. (The [NCCF/Pew document](#) recommends actions with similar objectives, noting that state and municipal stormwater permit-issuing entities should "expedite permit applications that are designed to achieve runoff volume matching as specified in the state's stormwater design manual" and also should make available technical specialists who can "meet with project designers and developers in early stages of the design phase to evaluate, advise, and provide technical assistance on site suitability for nature-based stormwater strategies.")
- In 2018, the City hosted a GSI Implementation Workshop for over 30 private designers to review the GSI-related UDO text changes, tools for supporting GSI that the City developed, and the opportunities provided by the new GRR program. The private designers also shared their concerns about not wanting to try to get City approval for GSI until the City demonstrated it could use GSI on its own capital improvement projects. (The [NCCF/Pew document](#) makes the

following related recommendation: “State and local leadership, as well as associated professional and educational organizations, need to promote education and professional training on nature-based stormwater and watershed management strategies.”)

- Multiple private designers participated in a Project Advisory Committee (PAC) that guided development of the online GSI Cost Tool for Raleigh during the tool’s initial design and beta testing period from late 2018 through early 2020.
- In 2020, added a new subchapter to the City’s draft updated Stormwater Design Manual that, once the manual is adopted, will guide designers considering GSI about special considerations for GSI in the site plan review process, with emphasis on considering the use of GSI as early as possible.

### ***GSI in rezoning decisions***

Stormwater concerns often are raised during the City’s process for considering property owners’ requests for rezoning of properties, in part because “upzoning” often enables resulting development to increase the area of impervious surface on the property and run off of stormwater from the property. The City’s UDO currently addresses stormwater impacts from a perspective of controlling peak flows of stormwater runoff from development sites, however the UDO does not address control of stormwater volume. Therefore, in situations where stormwater concerns arise and the rezoning applicant wishes to address those concerns, there may be benefits to the applicant offering rezoning conditions that include the use of GSI practices for mitigating potential increases in stormwater volume from the rezoned property.

The wording of rezoning conditions is important because, once adopted, these conditions become enforceable similar to stormwater-related requirements in the UDO. Therefore, rezoning conditions must be written clearly and precisely as to objective standards that site development designs must meet, and it may be beneficial for the City to prepare and make available a menu of example GSI-related rezoning conditions for rezoning applicants to consider.

As an example case, the recent rezoning process for the Downtown South project included the applicant offering a condition pertaining to the use of GSI practices in the site development, among other stormwater-related conditions. As the public becomes more aware of stormwater issues and as concerns pertaining to stormwater impacts of rezoning cases are raised, applicable GSI-related rezoning conditions may benefit the applicant/developer, the surrounding community, and the environment.

### **Attachments**

- A. Excerpts from the City of Raleigh 2030 Plan and the FY21-FY25 Strategic Plan
- B. Draft City GSI Policy
- C. Draft City GSI Policy Implementation Guide

**ATTACHMENT A**  
**EXCERPTS FROM RALEIGH’S 2030 COMPREHENSIVE PLAN UPDATE**  
**AND FY21-FY25 STRATEGIC PLAN THAT PERTAIN TO THE**  
**USE OF GREEN STORMWATER INFRASTRUCTURE (GSI)**

6/1/2021

**2030 COMPREHENSIVE PLAN UPDATE**  
**SECTION 5 – ENVIRONMENTAL PROTECTION**

**5.2 DESIGN WITH NATURE**

Policy EP 2.1 Natural Resource Protection

Ensure protection of Raleigh’s unique and significant natural resources – its natural areas, landscapes, and ecological systems – through best practices management, stewardship, conservation, restoration, and land use regulations.

Policy EP 2.2 Environmentally Sensitive Development

Ensure Raleigh’s growth and land development practices are compatible with the city’s natural form, vegetation, topography, water bodies and stream, floodplains, wetlands, and other natural riparian assets. This will decrease erosion, reduce stormwater run-off and flooding, improve water quality, protect wildlife habitat, and provide buffers and transitions between land uses.

Policy EP 2.5 Protection of Natural Water Features

Protect, restore, and preserve rivers, streams, floodplains, and wetlands. These water bodies provide valuable stormwater and surface water management and ecological, visual, and recreational benefits.

**5.3 WATER QUALITY AND CONSERVATION**

The core goals to be fulfilled by these water quality and conservation policies include: keeping and treating rainfall on-site or as close to site as much as possible, thereby mimicking the flow of water in a natural setting and reducing non-point source pollution from stormwater run-off; increasing water conservation measures and reducing overall demand for water; minimizing soil erosion and sedimentation; reducing hazardous and damaging flooding; and reducing nutrient loads.

Policy EP 3.2 Protection of Local Streams and the Neuse River

Protect and preserve local streams and the Neuse River, primary channel, major tributaries, intermittent headwaters streams, floodplains, and topography to improve overall water quality for drinking, fish and wildlife habitat, and fishing, boating, and other recreational uses.

Policy EP 3.4 Low Impact Systems for Parking

Well maintained permeable pavement and other low impact systems for parking areas should be encouraged throughout the city, especially in environmentally sensitive areas and floodplains.

Policy EP 3.8 Low Impact Development

Promote the use of low impact development (LID) techniques to help mitigate the impact of stormwater runoff. This includes the use of green roofs, rain gardens, cisterns, rain barrels, and other measures in urban and suburban landscapes.

Policy EP 3.12 Mitigating Stormwater Impacts

Potential stormwater impacts from new development on adjoining properties should mimic pre-development conditions and control the peak rate of runoff and/or volume of runoff so as to avoid flooding of adjoining and downstream properties, erosion of stream banks, and to allow the recharging of groundwater. The intent is to avoid environmental and economic damage to the adjacent properties, city infrastructure, and receiving surface waters.

### Policy EP 3.18 Green Infrastructure

Continue to improve surface water quality and protect water resources through the design, construction, and installation of green infrastructure (GI) for city projects and facilities. Green infrastructure uses vegetation, soils, and on-natural materials to absorb and filter polluted water that would normally runoff impervious surfaces directly into a waterway. Low impact development (LID) incorporates many of the principles related to green infrastructure. Widespread use of green infrastructure will also better prepare Raleigh for the effect of climate change along with managing the quality and quantity of stormwater runoff.

### Action EP 3.1 Demonstration Projects

Work with other city departments, regional partners, and the local development community to promote demonstration projects with the City of Raleigh that use multiple water conservation measures on single sites. Incorporate Best Management Practices (BMPs), such as green roofs, bioretention cells, permeable pavers, large- and small-scale rainwater harvesting, and similar innovative projects. Offer incentives, such as grants, fee waivers, expedited review, tax breaks, and/or density bonuses or transfer provisions for participating in demonstration programs.

### Action EP 3.2 Incorporation of Green Infrastructure/Low Impact Development into City Code

Develop and adopt low impact development (LID) and green infrastructure (GI) code and provisions so that rainwater is retained and absorbed on-site as an alternative to traditional approaches that include piping, channelization, and regional detention. Create templates, fact sheets, and costing estimating tools to help administer the GI/LID ordinance at development sites and within the public right-of-way. Develop incentives for GI/LID, such as stormwater utility fee credits, stormwater quality cost share, public-private partnerships, permitting incentives, and others.

## **FY21-FY25 STRATEGIC PLAN**

### **MISSION**

To build a stable platform of evolving services for our community through which we champion positive and sustainable growth and realize visionary ideas for all.

### **VISION**

To pursue world-class quality of life by actively collaborating with our community towards a fulfilling and inspired future for all

### **GROWTH AND NATURAL RESOURCES**

Initiative 1.2: Build on the Green Stormwater Infrastructure policy and additional tools to encourage low-impact development in private and public projects.



## ATTACHMENT B

### CITY OF RALEIGH POLICY FOR THE USE OF GREEN STORMWATER INFRASTRUCTURE ON CITY PROJECTS

6/1/2021

In keeping with the City of Raleigh's desire to encourage the use of Green Stormwater Infrastructure (GSI) throughout Raleigh and to lead by example in this regard, the City adopts this administrative policy for managing stormwater runoff and for the use of GSI on City projects. The following background provides context for this policy:

- The Raleigh City Council, through its adoption of the City's 2030 Comprehensive Plan Update and the City's Strategic Plan, has endorsed protection of Raleigh's significant natural resources, including our surface waters, streams, groundwater, wetlands, and lakes that flow to the Neuse River.
- Over many decades, Raleigh's surface waters have become increasingly degraded, physically and biologically, due largely to removal of natural soils and vegetation, construction of impervious surfaces, and alteration of natural surface water and groundwater hydrology, resulting in substantially higher rates and amounts of stormwater runoff and pollutants flowing into surface waters and reduction of stream base flows between rainfall events.
- Much of Raleigh was developed before 2001, when City and State of North Carolina regulations began requiring installation and maintenance of stormwater management practices that reduce rates of post-development stormwater runoff and pollution discharge to drainage systems and surface waters, and current North Carolina law prohibits municipalities from adopting ordinances that would require management of runoff from existing developed areas and from previously developed areas when they are redeveloped (i.e., "exempted" impervious surfaces).
- Low impact development (LID) is an approach to managing stormwater using green stormwater infrastructure (GSI) practices which employ natural and constructed landscape features that capture, absorb, and store rainfall and stormwater runoff and that provide multiple benefits, including reduced stormwater volume and pollution, and, since mid-2015, the City has been building capacity within its operations for advancing the use of LID and GSI practices through: revisions to the City's Unified Development Ordinance (UDO) to remove barriers and explicitly support the use of GSI/LID; adoption of GSI standard design details and fact sheets; development of a GSI Cost Tool to help evaluate design options; creation of a Green Raleigh Review program to help incentivize use of GSI; and integration of GSI and LID concepts into the City's 2030 Comprehensive Plan Update and the City's Strategic Plan.
- The City wishes to further encourage the use of LID and GSI throughout Raleigh, believes this can best be accomplished by leading by example, and wishes for the City to integrate LID and GSI into its development and redevelopment projects, including improvements to buildings and site infrastructure, parks and recreation facilities, and street and roadway infrastructure, where practicable and to the City's benefit.

#### **Section 1. Purpose.**

The with Raleigh City Council desires to encourage the use of GSI throughout Raleigh and to lead by example in this regard. The City adopts this administrative policy for managing stormwater runoff and for the use of GSI on City projects.

## Section 2. Definitions.

- Current stormwater regulations – Current City ordinances and other applicable County, State, and Federal regulations pertaining to stormwater management for development and redevelopment sites.
- Exempted impervious surface – Impervious surface that was emplaced before May 1, 2001, when the City began regulating the placement of new impervious area, or was legally permitted after May 1, 2001.
- Green stormwater infrastructure (GSI) – Any of a number of practices that, used individually or collectively, contribute to managing, treating, and reducing stormwater runoff from a development or redevelopment site, as close as possible to the runoff's source, by preserving natural landscape features (such as vegetation, soils, hydrology, and natural processes) and/or by mimicking natural processes through installation and maintenance of structurally engineered devices (such as bioretention cells, bioswales, permeable paving/pavers, green roofs, stormwater street trees, and cisterns). In addition to contributing to stormwater management, GSI practices can enhance site aesthetics, improve air quality, reduce urban heat island impacts, provide shading, create wildlife habitat, reduce energy consumption, reduce infrastructure costs, and increase property values. (Raleigh UDO).
- Gray stormwater infrastructure – Engineered conventional stormwater drainage and detention systems (e.g., pipes, street gutters, ditches, and ponds) whose primary purpose is moving stormwater away from the built environment and to the nearest surface water body.
- GSI runoff volume – The 90<sup>th</sup> percentile stormwater management goal for GSI design requirements. (draft Raleigh Stormwater Design Manual) (See definitions for “90<sup>th</sup> percentile rainfall event” and “Runoff volume matching.”)
- GSI Cost Tool – An online, spreadsheet-based tool that assists designers, developers, and City project managers with estimating costs associated with Raleigh-area site development using GSI/LID approaches, gray infrastructure approaches, and combinations, and comparing costs of a range of scenarios. The tool references a local cost database generated by professionals who work in land development and design of these practices, along with costs that are being applied to real-world local projects. The tool also helps users identify where and how distributed GSI practices now are allowed by recent revisions to the City’s Unified Development Ordinance (UDO).
- Life-cycle cost – The overall cost of a project for its anticipated lifetime including planning and design, construction, operations and maintenance, and replacement costs.
- Low impact development (LID) – An approach to land development (or redevelopment) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions. (U.S. Environmental Protection Agency)
- Minimum Design Criteria (MDC) – The requirements for siting, site preparation, design and construction, and post-construction monitoring and evaluation necessary for NCDEQ to issue stormwater permits that comply with NC water quality standards. (15A NCAC 02H)

- 90<sup>th</sup> percentile rainfall event – The rainfall event corresponding to a precipitation amount accumulated over a 24-hour period that 90 percent of all rainfall events historically do not exceed. (based on EPA 841-B-09-001) In Wake County, the 90<sup>th</sup> percentile precipitation amount currently is about 1.4 inches.
- Runoff volume matching – A basis for evaluating change in the amount of stormwater runoff from a defined area, such as a development site, such that the amount after the change is no more than the amount before the change, based on a defined storm event such as the 90<sup>th</sup> percentile rainfall.
- Service level agreement (SLA) – A written and signed agreement between City departments or operations that defines the type and amount of service to be provided, roles and responsibilities associated with the service, cost accounting, and metrics by which the service is to be measured.
- Stormwater control measure (SCM) – A device or practice for collecting, conveying, storing, treating and controlling stormwater runoff and pollutants. (based on definition of Stormwater Control Devices in Raleigh’s UDO)
- Stormwater Nitrogen and Phosphorus (SNAP) v4.1 Tool – A project-scale tool for modeling nitrogen and phosphorus in stormwater runoff from development sites and nutrient reductions provided by stormwater treatment. As of October 2018, it is the NCDEQ-approved tool for regulatory compliance with stormwater requirements of the Falls and Jordan nutrient strategies and for alternative riparian buffer mitigation compliance in all watersheds with buffer regulations. Most of the SCMs that follow DEQ’s [MDCs](#), as well as custom SCMs, can be modeled with the SNAP tool. ([NCDEQ – Nutrient Practices and Crediting](#))
- Storm-EZ – A spreadsheet based on the Natural Resources Conservation Service (NRCS) Discrete Curve Number Method and current research on stormwater control measures. Designers enter data about the site plan and the stormwater control measures that will be used. Then, Storm-EZ reports how closely the project matches the pre-development runoff volumes. Storm-EZ can also be used to judge compliance with the "basic treatment" approach (85% total suspended solids removal) or a hybrid approach of some LID practices used in conjunction with basic treatment. (NCDEQ – Stormwater LID and Storm-EZ)

**Section 3. Applicability** – All City projects.

City projects that alter the landscape shall incorporate GSI to the extent practicable. At the beginning of their preliminary (conceptual) design stage, City projects shall be evaluated for their potential for managing stormwater using GSI practices. If it is determined that implementing GSI for a project by runoff volume matching is not feasible, City staff shall implement approaches that reduce stormwater runoff volume and protect surface water quality to the extent practicable, short of achieving runoff volume matching, by optimizing the use of GSI.

**Section 4. Applicability** – City projects with budgets above \$500,000.

City projects with budgets above \$500,000 that alter the landscape shall be evaluated, at the beginning of the project’s preliminary (conceptual) design, for their potential for managing stormwater as follows:

- Exempted impervious surfaces: City projects’ management of stormwater shall be evaluated for runoff volume matching as if the existing project site were 100% forested/wooded land in good condition. While this is a goal the City will strive to achieve on applicable projects it may not be feasible for all projects. Other benefits such as nutrient reduction and peak flow reduction potential should be evaluated to the extent practical. The GSI design expert reviewing stormwater management options should use best professional judgment in determining the optimal application of practices for a given site to provide multiple benefits at a reasonable cost.
- New/proposed impervious surfaces: The use of GSI practices shall be evaluated for runoff volume matching as if the proposed project site were 100% forested/wooded land in good condition. The

goal shall be to design the stormwater management to achieve runoff volume matching using GSI practices which, under state and local regulation, would deem the project in compliance with water quality regulations for nutrient reduction. This evaluation shall inform site and stormwater design decisions, recognizing that a design based on replicating hydrology of 100% forested/wooded land is a goal the City will strive to achieve but may not be feasible for all projects. The GSI design expert reviewing stormwater management options should use best professional judgment in determining the optimal application of practices for a given site ensuring that all stormwater requirements are met. Any other benefits achieved through GSI that extend beyond stormwater requirements should be noted to the extent practical.

**Section 5. Resources in support of required evaluations.**

City staff responsible for implementing applicable City projects shall consult with staff designated by the City's Stormwater Management Division (SMD) for assistance with evaluating the potential use of GSI. SMD staff will assist with the following:

- a. Determining GSI runoff volume: The design basis for evaluating the potential use of GSI shall be the runoff volume matching approach, such that the volume of stormwater runoff leaving the site after development is no more than the volume of runoff before development for the 90<sup>th</sup> percentile storm event, based on actual or assumed (e.g., forested/wooded) pre-development site conditions.
- b. Estimating and comparing costs: Cost evaluations should include estimates of initial/capital costs, ongoing future costs, and life-cycle costs for designing, constructing, and maintaining stormwater management aspects of the project. For estimating and comparing costs, the GSI Cost Tool developed and provided by SMD shall be employed in consultation with SMD staff. For life-cycle costs, a planning and design factor of 20% of construction cost, a study life of 40 years and a discount rate of 2.75% should be the default assumptions, subject to the judgement of the designer and cost estimator as to what would be representative of the selected practices and applicable for the project site.
- c. Cost of post-construction inspection and maintenance: For stormwater control measures (SCMs) that are owned by City operations that have an executed service level agreement (SLA) with SMD for managing the operation's SCMs, costs of routine SCM inspection and maintenance of will be borne by SMD.
- d. Analysis of nutrient load requirements: the level of detail for nutrient analysis will depend on whether water quality regulations must be met for the given site or if the information is generally of interest to summarize another benefit of incorporating GSI. The designer should reference the guidance provided in the City's Stormwater Management Design Manual. Where nutrient requirements are applicable and a GSI design cannot meet the volume matching threshold to be deemed compliant, the SNAP tool maintained by NCDEQ or other nutrient load accounting tools accepted by the City for determining compliance can be used to estimate post-construction nutrient loads. Where water quality requirements are not applicable but there is general interest in potential water quality benefit, simple approaches that approximate reduction based on the runoff volume reduction can be used.
- e. Analysis of peak runoff rates, new and proposed impervious surfaces: Many developments are required to manage peak runoff rate relative to pre-development conditions. The designer may consult article 9.2.E of the City's Unified Development Ordinance for additional information regarding stormwater runoff controls for the project site. The Storm-EZ tool can be used to provide rough estimates of peak flow rate for pre- and post-development conditions for the purpose of the

evaluation under this GSI Policy.

- f. Documentation of the evaluation steps and narrative discussions and conclusions of GSI evaluations: The City has prepared a GSI Policy Implementation Guide to help project managers and SMD staff in conducting and documenting evaluations.

**Section 6.** Management-level decision making regarding the use of GSI on a specific project.

Written documentation shall be maintained by the City project manager of the specific project jointly with the assigned SMD staff person supporting the evaluation. The basis for the decision should be included in the documentation where the City project manager concludes that GSI should be incorporated with the project. In cases where the City project manager does not recommend GSI, the project manager will document the rationale for this opinion. For such cases, the SMD staff person shall add documentation either confirming the decision or listing recommendations for GSI and the corresponding rationale. The project's department representative and the appropriate SMD representative will subsequently discuss both sets of recommendations with the City Manager or designee to arrive at a final decision.

In making a decision of whether to incorporate GSI into a specific project, the sponsoring Department and SMD should consider factors in addition to differences in life-cycle cost. Such factors may include but are not limited to:

- a. the relative cost of incorporating GSI compared with the overall cost of the project
- b. additional runoff volume reduction and/or pollutant reduction provided that goes beyond any City requirements
- c. site location such as whether the project is in a neighborhood or watershed that is already challenged by stormwater and/or water quality problems such that additional runoff volume reduction and/or pollutant reduction would be considered beneficial
- d. other co-benefits to the City offered by the GSI that are not provided by the project design if no GSI is included, for example:
  - i. supporting public health and wellness
  - ii. supporting rainwater harvesting and reuse to reduce potable water consumption
  - iii. contributing to reduction in urban heat island effect or other air quality improvement
  - iv. supporting energy conservation and/or carbon sequestration
  - v. improving safety (e.g., walkable, bikeable streets or greenways)
  - vi. providing a visual amenity particularly in dense urban areas of the City

# ATTACHMENT C

## GUIDELINES FOR EVALUATING USE OF GREEN STORMWATER INFRASTRUCTURE (GSI) AND STORMWATER CONTROLS ON CITY OF RALEIGH PROJECTS

DRAFT 6/1/2021

### 1. CONTEXT OF THE POLICY AND THESE GUIDELINES

On [date], the Raleigh City adopted a policy titled *Policy for the Use of Green Stormwater Infrastructure on City Projects* (Policy). In adopting the Policy, the City Council expressed its desire to encourage the use of Green Stormwater Infrastructure (GSI) principles and practices throughout Raleigh, its belief that this can best be accomplished by the City leading by example, and its intent that the City integrate GSI into its development and redevelopment projects, including site infrastructure, parks and recreation facilities, and street and roadway infrastructure, where practicable and to the City's benefit.

These guidelines are intended to help the City's management and project managers implement the Policy consistently and as intended and establish a framework through which the City's projects managers can readily receive assistance and guidance from the City's Stormwater Management Division (SMD) while evaluating the use of GSI and other stormwater controls on their development projects. SMD acknowledges that this evaluation requires multiple skill sets to conduct site evaluations, recommend and design GSI practices, and apply various tools during the process. However, it is the intent of SMD to help City project managers to meet the purpose of the GSI Policy and City Council's direction for the City to demonstrate leadership in advancing GSI within City projects, and as such ensure that adequate resources are allocated to the project GSI evaluations. Benefits from incorporating GSI extend beyond stormwater management and help justify this upfront effort. As the City and project designers become more accustomed to the process, greater efficiency can be expected. The following guide is provided to support the evaluation process by providing a flow of actions and insight to their execution. The case studies performed for the City's Civic Campus and Chavis Park projects are attached to the guide to provide preliminary examples that can help project managers and designers with evaluations for their City projects. As more experience is gained, the guide can be updated accordingly to further improve outcomes and efficiency.

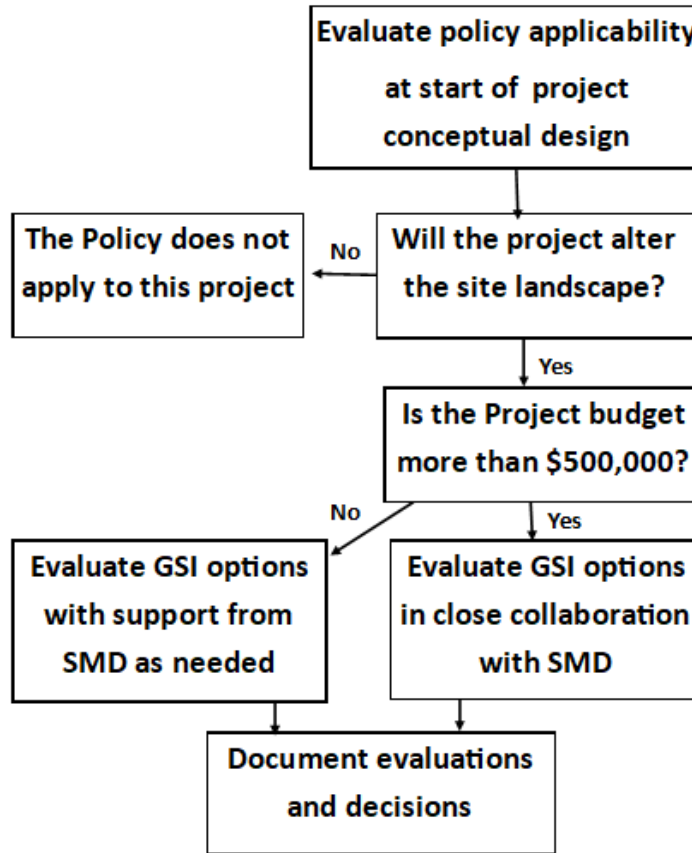
### 2. APPLICABILITY OF THE POLICY

At the beginning of the preliminary (conceptual) design stage for any City project, check:

- a. Will the project alter the site's landscape? If yes, proceed to item 2.b; if no, then no further action is needed regarding the Policy.
- b. Is the project budget more than \$500,000? If yes, proceed to item 3. If no, proceed to item 4.

### 3. PROCEDURES FOR PROJECT BUDGETS MORE THAN \$500,000

- a. The City's Project Manager (PM) should contact the designated SMD staff person as soon as the applicability of the Policy has been determined to arrange for GSI evaluation support. Provide SMD with the project name, type (e.g., street ROW, property development, or park development), location, and whether project is new development or re-development. SMD will enter the project into a database of project evaluations. The overall process is shown in the flow diagram below:



**Figure 1. Flow Diagram for Evaluating GSI in City Projects**

- b. Schedule a conference early with SMD staff to initiate the evaluation. Note that it may be more efficient to accomplish these tasks over two meetings rather than one; a kickoff meeting to go over the process and needed information, and a second meeting to discuss preliminary stormwater management ideas and the assignments for conducting the full evaluation. Recommended elements to cover in the meeting(s) include:
- i. Overview of policy objectives by SMD staff
  - ii. Project summary by City project manager incorporating a site map and any initial concepts for the project including anticipated impervious and pervious features
  - iii. Regulatory requirements that apply to the project design (i.e., for new or existing redevelopment) for stormwater management and City GSI Policy goal for retaining stormwater runoff volume onsite
  - iv. Any preliminary ideas for type of stormwater management that is being considered and where it may be located on the site
  - v. Potential stormwater management scenarios to be evaluated under the GSI policy (Note: these will be more general at this initial stage and subsequently refined as site conditions are further analyzed and specific GSI practices are selected)
  - vi. Introduction to the Raleigh GSI Cost Tool
  - vii. Evaluation components and extent to which SMD will be needed to support each:

- 1) Calculations of pre- and post-development runoff volumes
  - 2) Identification of GSI options to consider in concert with or in replacement of conventional stormwater management measures
  - 3) Life-cycle cost estimation for identified scenarios
  - 4) Construction and maintenance evaluation
- viii. Site design information needed to support the GSI scenario evaluations (including Storm-EZ and Cost Tool applications):
- 1) Master or conceptual plans showing proposed project layout, pervious and impervious areas, description and sizing of facilities and amenities, and any conceptualized stormwater management measures
  - 2) GIS data available for the site including where available topography, parcel boundaries, existing impervious cover, existing vegetation, utilities, soils, drainage conveyances, and streams
  - 3) Additional site data, where available, including site survey, soil investigations, and other investigations of site conditions or documentation of site constraints (wetlands, contaminated soil, historic or cultural resources)
- ix. Evaluation documentation requirements
- x. Assignments and schedule
- c. The City PM and SMD staff person will need to track evaluation steps and assignments documenting findings and conclusions. It is recommended that written documentation include the following (additional guidance for conducting the evaluation are incorporated throughout these items):
- i. An overall project and site description including the project's location, size, features, relative impervious and pervious areas (distinguishing new from existing impervious area totals), soil properties, existing vegetation, conveyance drainages and streams, utilities, etc. (include narrative and figures)
  - ii. A description of each design scenario evaluated (include narrative and figures)
    - 1) One scenario will need to represent the minimum project site stormwater management requirements, including no requirements if existing impervious surface is exempted by the City's policies and no new impervious area is proposed (i.e., under Policy item 4.a). New development or redevelopment with new proposed impervious surface will require determining minimum level of stormwater controls to meet City and state requirements (i.e., applying Policy item 4.b).
    - 2) One or more additional scenarios involving the incorporation of GSI should be documented. The design engineer should identify recommended GSI using best professional judgment for the types of practices that will work best for the project site. It is recommended that the design engineer consider soils, topography, and drainage area for the proposed practice location along with expected benefits provided for the life-cycle cost to be incurred. The design



engineer should also identify any key site constraints limiting the application of stormwater management practices to certain GSI practice types as well as maintenance considerations such as access or necessary equipment. This is where the design engineer will need to decide whether volume matching can be achieved, and if not what level of GSI is warranted or what combination of GSI and conventional stormwater management control is needed to meet requirements and advance the City's objective for GSI. Evaluating more than one scenario incorporating GSI may be desirable by the City PM to help choose between options that provide different levels of benefit for varying costs.

iii. A summary of stormwater-related analyses that were conducted for the site:

- 1) Volume Matching Analysis: Storm-EZ is recommended for use as the primary computation tool for the volume matching evaluation. The model can be set up to evaluate each of the GSI scenarios conceptualized during the preliminary meeting with the project manager (or as further refined as the evaluation proceeds). The project designer should first establish the pre-developed condition to serve as the benchmark for evaluating volume matching criteria. Depending on the nature of the proposed development (greenfield, redevelopment without increase of imperviousness, or redevelopment with an increase in imperviousness) the project designer may need to consider multiple pre-development conditions for purposes of both volume matching evaluation and for consideration of peak flow management requirements (covered further in the next sub-item). The project designer can then use the Storm-EZ tool to evaluate the potential post-development conditions and incorporate the selected GSI and conventional stormwater management practices for each scenario. It is important to note that the evaluation using Storm-EZ is somewhat iterative requiring a review of volume matching results and if necessary, and applicable, modification of the conceptualized stormwater management practices in each scenario.

The project designer should be aware that Storm-EZ relies on an NRCS Curve Number computation to estimate runoff volumes in the predevelopment condition. As a result, the hydrologic soil group (HSG) for a site plays a significant role in the quantity of pre-development runoff. Sites that are dominated by more permeable soils (HSG A or B) often exhibit very low or even no runoff during the 90<sup>th</sup> percentile event when modeled as woods in good condition. The designer may find it difficult in such cases to configure GSI practices that can meet the volume matching objective of the policy for a developed site on these soils. In contrast, on sites in which low permeability soils dominate (HSG C or D), the application of GSI practices that rely on infiltration is often limited by design guidance. The designer should be familiar with these competing factors and use professional judgment in selecting practices for a particular site that are both practical and achieve optimum function.

- 2) Peak Flow Comparison: Where peak flow management is required by the City (see UDO article 9.2.2.E for applicability and requirements), the Storm-EZ tool provides a very coarse approximation of peak flow for each evaluated scenario

(in both pre- and post-project conditions) which can be used to determine potential compliance. Storm-EZ tool can also be used iteratively to approximate the size of a conventional peak detention practice necessary to accomplish peak flow management requirements to use in comparison to performance and cost of the GSI-based scenarios.

- 3) Nutrient Reduction: Where nutrient reduction is required by City stormwater regulations the stormwater designer may utilize the SNAP tool or other applicable nutrient load computational tools to evaluate the post-development condition and compare nutrient load performance between individual scenarios. Where compliance with City nutrient requirements is not necessary, such as redevelopment projects which do not increase impervious area, the project designer may approximate nutrient reduction as equivalent to the runoff volume reduction or by other simplified assumptions. The latter can be important to providing co-benefit information to support the decision of whether to implement the recommended GSI.
  - 4) Other Analyses: The City project manager and SMD may conduct other analyses if thought to be relevant and useful to the evaluation. Such analyses should be documented in the scenario evaluation narrative summary.
- iv. GSI cost summary comparisons between scenarios (including capital, operating/maintenance, replacement, and life-cycle cost produced by the GSI Cost Tool):
- 1) The GSI Cost Tool is accessible online from the SMD web page.
  - 2) The designer should create a “new project” within the online GSI Cost Tool using relevant information on the project type, size, name, and if applicable, unit cost of land acquisition. This component applies for project properties that need to be purchased or for which land acquisition costs should be incorporated into the policy analysis.
  - 3) The project designer should develop a cost tool scenario for each stormwater management scenario identified during project evaluation. During scenario development the project designer should consider the following steps:
    - a. The project designer should validate life-cycle cost assumptions and pervious/impervious area information on the Project-Scenario Description tab. Note that completing additional information on this tab such as design elements and scenario areal features may be informative but is not necessary for the purpose of developing scenario life cycle costs.
    - b. Select non-conventional and conventional structures that are inherent to the scenario and provide area of volume associated with each structure on the “structures” tab. An important consideration in the selection and inclusion of structures is ensuring consistency between scenarios. For example, if one scenario uses permeable pavement as a GSI practice all other project scenarios should include the same area as a structure whether it’s permeable pavement, asphalt pavement, or other structural surface.

- c. While the Cost-Item Unit Cost tab is set to default values for all cost items the project designer should consider providing project specific unit costs if applicable.
  - d. The project designer should review the cost item assumptions for each structure type and where necessary provide refined cost item assumptions.
  - e. The designer should consult the results tab for a summary of life cycle costs broken down by construction, planning and design, Operation and Maintenance, and replacement costs. Note that more life cycle cost breakdowns for each structure type can be reviewed on this tab as well and used for consideration of various combinations of GSI and conventional stormwater management approaches.
- v. Narrative discussion of technical aspects of constructing and maintaining each scenario and comparing those aspects:

Throughout the development of stormwater management scenarios, the project designer should consider the feasibility of constructing and maintaining stormwater management facilities or infrastructure. It is recommended that the designer provide a narrative of key site constraints to scenario implementation and potential mitigation measures considered during each scenario's development. This narrative should consider site construction access, impacts to existing infrastructure and vegetation, and long-term maintenance needs. Where differences between scenarios impact construction and maintenance, the narrative should include a comparative discussion of key differences and if applicable the role these differences might serve to decision makers. Since GSI practices often rely on non-structural elements such as soil permeability and vegetation, consideration should be given to maintaining these features and the impact such maintenance would have on long-term site operations and relative costs looking for ways to potentially reduce such costs. SMD will be responsible for all SCM operation and maintenance and can therefore assist the City project manager in understanding these implications.

- vi. Narrative discussion of conclusions regarding the practicability of incorporating GSI into the site design, technical and cost bases for the conclusions, and a statement of the PM's decision regarding the extent to which GSI will be incorporated into the site design:

SMD will update the database of evaluations to incorporate the results.

Note that the GSI Policy indicates that significant departures from the Policy's provisions for documenting evaluations and decisions shall be discussed in advance with the Engineering Services Director or a designee. Additionally, it will be important that the narrative discuss considerations and the key factors outlined in Section 6 of the GSI Policy for making any recommendations or decisions regarding GSI.

**4. PROCEDURES FOR PROJECT BUDGETS \$500,000 OR LESS**

- a. The City's Project Manager (PM) should contact designated Stormwater Management Division (SMD) staff person as soon as the applicability of the Policy has been determined to arrange for GSI evaluation support services. Provide SMD with the project name, type (street ROW, property development, or park development), location, and whether project is new development or re-development.
- b. Early in the project's conceptual design, the City's PM and/or contracted consulting design project manager for the project should confer with staff of the City's Stormwater Management Division about resources available for supporting this evaluation, including tools for estimating and comparing stormwater management strategies, calculations of pre- and post-development runoff volumes (using NCDEQ's Storm-EZ or similar), and life-cycle costs of site design scenarios (using the City's GSI Cost Tool).
- c. The City's PM shall document their evaluation of GSI practices via a memo addressed to the City's Engineering Services Director describing the project's conceptual site design and stormwater management scenarios considered, comparison of life-cycle cost estimates for the scenarios, conclusions regarding the practicability of incorporating GSI into the site design, technical and cost bases for the conclusions, and a statement of the project manager's decision regarding the extent to which GSI will be incorporated into the site design.

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