

# **Work Plan for Advancing Green Infrastructure and Low Impact Development in Raleigh**

**City of Raleigh  
Public Works Department  
Stormwater Management Division**

**February 2015**

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# Work Plan Summary

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This Work Plan for Advancing Green Infrastructure and Low Impact Development in Raleigh (GI/LID Work Plan) was developed from late 2013 through 2014 using a deliberative and collaborative process involving City of Raleigh staff from numerous operations (City staff GI/LID Task Force), consulting firm and facilitator Tetra Tech, Inc., and stakeholders from City of Raleigh citizen boards and councils, development organizations, environmental and conservation organizations, and citizen advocacy organizations.

At the outset of the process, the City staff GI/LID Task Force established the following guiding principles for incorporating GI/LID into new development, redevelopment, and existing development that:

- Demonstrate the City's leadership and set an example
- Accommodate essential City operations
- Are scalable and affordable
- Consider long-term cost-effectiveness and can be sustained over a long period of time
- Consider strategic timing/phasing of actions
- Add amenities
- Balance multiple City objectives
- Help educate City staff and provide clear vision
- Make sense to citizens and City staff responsible for implementation
- Consider the social component/complexity of Raleigh (i.e., makes sense for Raleigh)

A companion document, Advancing Green Infrastructure and Low Impact Development in Raleigh: Overview of the Process and Work Plan for Next Steps (February 2015), defines GI and LID for the purpose of this Work Plan, describes the process the City employed, and provides context for the City's selection of the seven work items summarized in Table 1 and described in this GI/LID Work Plan.

This Work Plan will be presented to Raleigh City Council for comments and direction to staff regarding the Work Plan's content, timetable, consultant cost estimates, and priorities for implementation. Staff's efforts for implementing the work items are subject to direction from City Council and availability of funds for consultant support.

**Table 1. Summary of GI/LID Work Plan Items**

Work Plan Item	Purposes, Key Outputs, and Benefits	Estimated Duration	Estimated Consultant Cost
1. Review Ordinances and Policies as They Pertain to Using GI/LID	<ul style="list-style-type: none"> <li>•Memo that identifies and evaluates barriers, differentiating between residential development and commercial/institutional development</li> <li>•Memo that describes potential code revisions</li> <li>•Fewer barriers to using GI/LID</li> <li>•Clear expectations for developers and designers wanting to use GI/LID</li> <li>•Get cross-department input and buy in</li> </ul>	8 months	\$54,000
2. Develop GI/LID Templates for Streets	<ul style="list-style-type: none"> <li>•Street typology templates that include GI/LID practices and that address staff concerns about GI/LID's effects on municipal operations</li> <li>•Clear GI/LID options for streets for use by developers and designers</li> <li>•Fewer barriers to developers' use of LID with streets</li> </ul>	6 months	\$33,000
3. Develop a Tool for Evaluating GI/LID's Cost-Effectiveness	<ul style="list-style-type: none"> <li>•Raise awareness among staff, developers, and designers about costs of using GI/LID</li> <li>•Build capacity among same for evaluating GI/LID for specific projects</li> <li>•Memo that compares and evaluates available cost-effectiveness tools and recommends tool selection</li> <li>•White paper on triple bottom line benefits of GI/LID</li> </ul>	4 months	\$34,000
4. Prepare Fact Sheets and Construction Checklists for GI/LID Practices	<ul style="list-style-type: none"> <li>•Communicate that Raleigh welcomes GI/LID</li> <li>•Raise staff awareness of benefits and limitations of GI/LID and advance staff's buy-in</li> <li>•Promote staff inter-department coordination and consistent policies and practices about GI/LID</li> <li>•Promote early communication among staff, developers, and designers about GI/LID</li> <li>•Fact sheets and construction checklists for GI/LID practices</li> <li>•Get cross-department and development community input and buy in</li> </ul>	6 months	\$44,000
5. Prepare a Guidance Framework for Maintaining GI/LID Practices	<ul style="list-style-type: none"> <li>•Systems for tracking inspection and maintenance of dispersed GI/LID devices and for producing management, compliance, and cost reports</li> <li>•Feedback about maintenance and costs for City use in rate setting and code evaluation and for developers'/designers' decision making</li> </ul>	9 months	\$54,000
6. Identify Opportunities for GI/LID Retrofits on Developed Properties	<ul style="list-style-type: none"> <li>•Accelerate and improve the City stormwater retrofit program</li> <li>•Locate retrofit practices in street ROWs</li> <li>•Design practices to reduce stormwater volume as well as rate and pollutants</li> <li>•Include GI/LID practices in designs for new City facilities and modifications to existing facilities</li> <li>•Get cross-department input and buy in</li> </ul>	6 months	\$54,000
7. Evaluate Using Incentives to Encourage GI/LID	<ul style="list-style-type: none"> <li>•Establish GI/LID as "business as usual"</li> <li>•Reduce developers' actual of perceived risk of using innovative approaches such as GI/LID</li> <li>•Establish new development and redevelopment as prime opportunities for using GI/LID</li> <li>•Get development community input and buy in</li> </ul>	6 months	\$73,000
All Work Plan Items		Timeline, Table 2	\$346,000

Table 2. Timeline for GI/LID Work Plan Items

Work Plan Item	months from consultant authorization											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Review Ordinances												
2. Design Template for Streets												
3. LID Cost Effectiveness Tool												
4. Site Planning Factsheets and Checklists												
5. Operations and Maintenance Guidance												
6. Priority Opportunities on Existing Development												
7. Incentives Review												

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# Item 1: Review Ordinances and Policies as They Pertain to Using GI/LID

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## PURPOSE AND BENEFITS

Ordinances that bear on potential use of GI/LID typically are woven through the body of code, and barriers to using GI/LID often are embedded in those ordinances, sometimes in subtle ways. Barriers can take many forms. For example, ordinances sometimes treat vegetated GI/LID practices as being in addition to, rather than integrated with, requirements for open space, landscaping, setbacks, screening, trees, and other vegetation, which can make GI/LID an extra project cost unnecessarily. Other barriers can cause delays and add costs associated with variances, plan approvals, permits, and inspections.

As part of conveying its message that Raleigh welcomes GI and LID as part of new development and redevelopment, the City wants to ensure that its ordinances and policies support and encourage use of GI/LID. Given the breadth of GI/LID practices, this means going beyond examining City stormwater policies and standards to evaluating key provisions in the Unified Development Ordinance that affect the feasibility, effectiveness, and cost of implementing GI/LID and preparing code language that can address GI/LID barriers. To be successful, this must consider goals for development and redevelopment in Raleigh and the range of roles and functions of City operations. In addition, documents that guide and inform high-level broad planning and strategy, such as the 2030 Comprehensive Plan, that provide broad guidance to staff for creating and modifying ordinances and policies will be reviewed.

The purpose of this work item is to propose clear and effective policies and standards that City Council, City staff, and the development community can support and use in implementing GI/LID and can be considered in future UDO updates.

## DESCRIPTION

This work item includes the following activities for identifying and reviewing City ordinances:

- Identify existing key code provisions that either support or present barriers to GI/LID,
- Recommend potential ordinance revisions that can address barriers and strengthen opportunities for GI/LID implementation, and
- Work with community stakeholders to identify potential ordinance revisions that will meet multiple objectives and can be considered in future updates of the UDO and related ordinances.

This work will be collaborative among City staff, the City's consultant, and community stakeholders.

## APPROACH

**Work group input.** With consultant support, City staff will form a work group composed of representatives of City departments that develop and implement City ordinances that are likely to bear on the City's implementation of GI/LID. The work group is expected to include representatives from the following City operations: Planning Department (Planning and Zoning, Development Services, Transportation Planning, Urban Design Center), Public Works Department (Stormwater Management, Design and Construction, Transportation Field Services), Solid Waste Services, Fire Department; Parks, Recreation and Cultural Resources (Urban Forestry, Design Development), Public Utilities, and City Manager's Office of Sustainability.

**Ordinances to be reviewed.** It is anticipated that this review of ordinances and policies will be strategic, with the following sections preliminarily targeted as the most pertinent and important for focusing this review:

Division II – Code of General Ordinances

- Part 7 Solid Waste Services
  - Chapter 2, Section 7-2005 Precollection Practices, Removal of Rubbish, Weeds, and other Refuse
- Part 10A Unified Development Ordinance
  - Chapter 2 Residential Districts
    - 2.3 Compact Development
    - 2.4 Conservation Development
    - 2.5 Common Open Space Requirements
  - Chapter 7 General Development Standards
    - 7.1 Parking
    - 7.2 Landscaping and Screening
  - Chapter 8 Subdivision and Site Plan Standards
    - All sections
  - Chapter 9 Natural Resource Protection
    - 9.1 Tree Conservation
    - 9.2 Stormwater Management
    - 9.3 Floodplain Area Regulation
    - 9.4 Erosion and Sediment Control

The work group will review this preliminary list of ordinances, associated guides, manuals, and policies, and the 2030 Comprehensive Plan and consider revising the list. The work group also will identify and provide pertinent memoranda from staff and advisory boards that previously have identified ordinance barriers to GI/LID (e.g., SMAC/EAB's joint report about curb and gutter, and staff's response).

Existing checklist tools that have been developed and applied by other municipalities for evaluating barriers to use of GI/LID will be used to review pertinent sections of City ordinances and policies. A version of a checklist tool developed by the City's consultant will be reviewed by the work group and will be tailored for Raleigh's circumstances and goals for this work item.

**Review of ordinances.** The review of targeted ordinances will identify and evaluate provisions that:

- Already encourage or support use of GI/LID,
- Clearly limit or prevent the use of GI/LID,
- By ambiguity, tend to discourage or prevent use of GI/LID, and/or
- Now are absent, but if added, could better enable or encourage use of GI/LID.

The checklist tool will be used to note where each identified barrier is located in City ordinances, each barrier's relative importance (high, medium, or low) for implementing GI/LID, and opportunities for changing the ordinance to address the barrier.

Identification and evaluation of ordinances will include meetings and interviews with key City staff and will be documented in a draft memorandum for the work group to review and provide comments. This memorandum will note whether each identified barrier pertains to residential development, non-residential development, or both. Work group members will comment individually on the draft memorandum, and City staff and the consultant will compile comments and facilitate a work group meeting to discuss the draft findings and comments. Follow-up interviews may be required with individual work group members or other City staff. Based on the work group's comments, a revised draft memorandum will be prepared.

**Stakeholder input.** City staff will invite community stakeholders representing development, design, environmental, and neighborhood interests to review and comment on the findings in the draft memorandum, provide input regarding the relative importance of the barriers identified, and help identify any additional barriers that were not identified and should be addressed. As warranted from this stakeholder input, City staff and the consultant will conduct additional evaluation and revise the memorandum.

**Potential changes to ordinances.** Based on the final memorandum about barriers to implementing GI/LID, staff and the consultant will draft potential changes to specific City ordinances using the checklist tool as a framework. Alternative ordinance language will be drafted for each identified barrier, and a memorandum will be prepared that gives current and draft revised language, purpose for the revision, and evaluation of the revision's effects on City processes having to do with development design, approval, construction, and ongoing maintenance. The memorandum will summarize key findings and recommendations and will distinguish between ordinance changes that pertain to residential development and non-residential development. As previously, work group members will comment on the draft memorandum, City staff and the consultant will compile comments and facilitate a work group meeting, and follow up interviews may be required. Based on the work group's comments, a revised draft memorandum will be prepared that presents and describes potential revisions to City ordinances for addressing barriers to implementing GI/LID.

City staff will invite community stakeholders to review and comment on this memorandum, provide input regarding the relative importance of the potential ordinance revisions, and identify any additional revisions that should be considered. As warranted from this stakeholder input, City staff and the consultant will revise the memorandum and summarize stakeholder comments and level of support for the ordinance revisions. The final memorandum will identify potential ordinance revisions that are highest priority for near-term actions and revisions that are for longer-term actions.

## WORK PRODUCTS

- Raleigh-tailored GI/LID-use checklist tool (a draft tool for the staff work group, and a final tool)
- List of targeted Raleigh ordinances and associated guides, manuals, and policies (a draft list for the staff work group, and a final list)
- Memorandum that identifies and evaluates barriers to use of GI/LID in Raleigh (a draft memorandum for the staff work group, a revised draft for stakeholders, and a final)
- Memorandum that presents and describes potential revisions to ordinances for supporting use of GI/LID in Raleigh (a draft memorandum for the staff work group, a revised draft for stakeholders, and a final)
- Summaries/minutes of meetings

## ESTIMATED DURATION AND CONSULTANT COST

- Duration: 8 months
- Consultant cost: \$54,000



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## Item 2: Develop GI/LID Design Templates for Streets

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### PURPOSE AND BENEFITS

Raleigh contains over 1,800 miles of streets that contribute large quantities of stormwater runoff and pollutants to streams and lakes. GI practices applied in street rights-of-way (ROWs), sometimes called “green streets,” manage stormwater within the ROW to reduce pollutants and downstream flooding. Green streets bring together practices of stormwater management, street engineering, and landscape design for better function, appearance, and cost-effectiveness of the collective infrastructure in street ROWs. Green streets also increase the safety, walkability, and appearance of streets, improve air quality, and reduce the urban heat island effect by reducing pavement and adding greenery.

The City staff GI/LID Task Force considered potential benefits and drawbacks of allowing and encouraging green streets in Raleigh. In particular, Task Force discussions identified aspects of five street cross-sections in the Unified Development Ordinance (UDO) about which City fire, street maintenance, and solid waste staff expressed concern; specifically, how narrowed street pavements and some other LID practices in street ROWs might impact their operations.

The purpose of this work item is to prepare street cross-section templates with incorporated GI practices that the City can consider adding to the street typologies in the UDO and the City Streets Design Manual. Among the issues to evaluate will be staff’s operational concerns already identified through the Task Force.

### DESCRIPTION

If accepted for use and incorporated into the UDO and Streets Design Manual, new or revised street templates will address multiple action items and issues raised by the Task Force, including:

- Swales, bioretention, and other GI/LID devices in street ROWs (costs for wider ROWs and maintenance; logistics of collection/pickup of loose leaves and refuse/recyclables containers),
- Edge-of-pavement treatments for streets without curb and gutter (costs for installation and maintenance),
- Street pavement widths for fire safety and solid waste collection (passage and turning around), and
- Protection of underground utilities in ROWs (logistics of installation and maintenance; infiltration of water along stone fill of utility trenches).

Intended users of these templates are City staff and the development community. Some templates could replace problematic cross-sections now in the UDO. They also could be used both for new streets and for retrofits on existing streets to be widened or otherwise reconstructed.

This work will be collaborative among City staff, the City’s consultant, and community stakeholders.

### APPROACH

**Work group input.** City staff will convene a work group with representatives from parties that the staff GI/LID Task Force identified as important for reviewing street templates. This work group is expected to include representatives from the following City operations: Public Works Department (Stormwater Management, Design and Construction, Transportation Field Services), Planning Department (Planning

and Zoning, Development Services, Transportation Planning, Urban Design Center), Public Works Department, Solid Waste Services, Fire Department; Parks, Recreation and Cultural Resources Department (Urban Forestry, Design Development), Public Utilities, and City Manager’s Office of Sustainability. Representatives from North Carolina Department of Transportation (which has its own LID program and an interest in advancing GI/LID) and private utilities may also be consulted as needed. Private land developers, engineers, and landscape architects and environmental group representatives may also be invited to participate in the work group.

**Cross-sections to be reviewed.** Fire Department and Solid Waste Services staff identified five cross-sections in the UDO

(<http://www.raleighnc.gov/content/extra/Books/PlanDev/UnifiedDevelopmentOrdinance/>) as being problematic for their operations:

Street Type	Concerns Expressed
Parkway divided highway with median ditch section and swales on both sides	Designs will need to accommodate runoff water entering the median and preventing parking on the median; design for maintenance of swales, including equipment needed; sedimentation and erosion control
Avenue with 125’ ROW	LID practices possibly conflicting with utility meters and sidewalks; GI practices possibly requiring wider ROW
Collector Avenue with 101’ ROW, one lane in each direction plus median and swales	Street parking, solid waste pick up, fire access, edge treatment, cost and difficulty of erosion control
Minor Residential Street/Avenue without Median, 80’ ROW (30’ pavement width, 11’ lane widths, and 4’ paved shoulder widths)	Solid waste and fire access due to narrow lanes, particularly if there is on-street parking
Residential Street with 70’ ROW (10’ lane widths and 2’ paved shoulder widths), sidewalk on one side of the street, and swales for drainage	Maintainability of swales, impacts on solid waste collection (trash containers falling into swales); width of street impacts solid waste and fire truck access; and conflicts with utilities and mailboxes

Through discussions with the work group, additional cross-sections may be identified and added to this list for review.

**Review of cross-sections.** Fire Department, Solid Waste Services, and Public Works staff will be interviewed to confirm that the above street cross-sections are of concern and the key issues of concern and to discuss whether revised templates should be developed.

The draft list of cross-sections and concerns will be reviewed at an initial meeting of the work group. The City’s consultant will share solutions from other communities to address these operational conflicts. The meeting will end with a small group conceptual design exercise for each roadway type to brainstorm what design options might work best for the Raleigh.

Based on the work group’s discussions and the design exercise, the consultant will develop preliminary draft street design templates. At a second meeting of the work group, the consultant will facilitate discussion and revision of the preliminary draft templates.

**Potential changes to cross-sections.** Based on the group’s discussions and the design exercise, the design templates will be revised as needed for each cross-section in a way that best meets the City objectives. A third full workgroup meeting will be held to review and discuss the revised templates. Follow-up interviews may be conducted with individual staff to clarify and address any remaining concerns. Final templates will be presented at a fourth work group meeting, and recommendations will be developed regarding moving forward with formally adopting and including them in the UDO.

## **WORK PRODUCTS**

- Summary of focus group discussions and recommendations
- Workgroup meetings (including agenda, presentation materials, small group design conceptual design materials for roadway types)
- Roadways templates for selected roadways (preliminary and Revised drafts, final streets design templates)
- Summaries/minutes of meetings

## **ESTIMATED DURATION AND CONSULTANT COST**

- Duration: 6 months
- Consultant cost: \$33,000

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## Item 3: Develop a Tool for Evaluating LID's Cost-Effectiveness

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### PURPOSE AND BENEFITS

City staff are aware of considerable and growing interest among developers and others in doing more to advance use of GI and LID practices for new development and redevelopment, as well as for City capital improvement projects. One reason is that GI/LID designs often offer long-term cost benefits over conventional designs. However, existing published studies generally do not apply well to local conditions, and much published cost data is so general that it is difficult to translate it into predictive models.

In general, more protective development standards add to development's cost. However, discussions of the City staff GI/LID Task Force and staff's informal discussions with developers and designers suggest the following regarding cost-effectiveness of GI/LID:

- On a site level, GI/LID practices sometimes can both reduce impacts to stormwater and improve a site's overall cost-effectiveness by making more efficient and productive use of available land.
- Developers and designers often are not aware that using GI/LID might serve their financial interests, or they lack access to information for evaluating GI/LID practices.
- Decision makers and stakeholders need more information on costs and benefits of GI/LID to help make better-informed choices.

The City would like to better understand how site-level use of GI/LID practices is likely to affect developers financially and readily be able to compare costs and benefits of using GI/LID practices with using conventional stormwater practices. The City staff GI/LID Task Force identified as a high-priority development of a GI/LID cost-effectiveness tool and application of the tool to a range of development types to (1) raise awareness among City staff, policy makers, the development community, and citizens about differences in cost and benefits between conventional stormwater management design and GI/LID design, and (2) build capacity among staff and developers as they evaluate the cost-effectiveness of GI/LID used in future development projects. The Task Force also wanted to put GI/LID in the context of larger community benefits through documentation of triple bottom line (TBL) metrics being used by other cities.

### DESCRIPTION

This work item will provide a framework for the City's selection of an LID cost-effectiveness tool and for evaluating use of GI/LID in the context of larger community benefits using triple bottom line metrics.

Activities will include the following:

- Prepare a white paper on GI/LID triple bottom line benefits (i.e., economic, quality of life, and environmental),
- Evaluate existing LID cost-effectiveness tools and select a tool for the City to use in its cost-effectiveness analyses,
- Tailor the selected tool to goals and needs specific to Raleigh, and
- Apply the tool to several real-world development scenarios as examples to aid staff and others with understanding the use and benefits of the tool.

## APPROACH

The City's consultant will concurrently evaluate LID cost-effectiveness tools and prepare the triple bottom line white paper.

**Evaluation of existing tools.** For cost-effectiveness tools, City staff and the consultant will review existing cost-effectiveness tools that can quantify costs and benefits of development designs, including both conventional stormwater designs and GI/LID designs. To help frame the range of this review, City staff will identify types of GI/LID practices that the tool should be capable of evaluating.

Tools for purposes related to use of GI/LID have been developed for use in the Triangle region by the State of North Carolina and by consultants (e.g., Jordan/Falls Lake Nutrient Loading Accounting Tool and the Upper Neuse Site Evaluation Tool). Tools specific to use of GI/LID also have been developed for nationwide application (e.g., Center for Neighborhood Technology Green Values® Calculator: Costs, Ecological, and the NRDC Calculator). Also, the State of North Carolina has developed Storm-EZ, a spreadsheet stormwater permitting tool developed for evaluating use of LID on land development projects. Each tool has its own purposes and evaluates different metrics. For example, some tools evaluate stormwater pollutant reduction and others evaluate hydrology or ecosystem services.

Types of costs that the tool must evaluate quantitatively include but are not limited to design, engineering, construction, land acquisition, and long-term maintenance. Benefits to be considered include water quality and quantity, hydrology, and other ecological functions. Tools that estimate economic and social benefits also will be reviewed. Tools that provide estimates of costs, possibly including initial costs, ongoing maintenance costs, and life-cycle cost analysis, also will be reviewed. Because some tools do not provide cost estimates, and because use of local and current cost data is desirable, available recent and local cost data will be reviewed in addition to existing tools.

Existing tools to be reviewed include the following:

- Storm-EZ: pre-development and post-development runoff volumes
- Jordan/Falls Lake Nutrient Loading Accounting Tool: nutrients and hydrology
- Upper Neuse Site Evaluation Tool (SET): nutrients, hydrology, and costs
- WERF BMP Cost Tools: costs
- Center for Neighborhood Technology Green Values® Calculator: costs, ecological and other benefits
- NRDC Calculator: costs, ecological and other benefits
- USDA i-Tree Software Suite: costs and hydrology benefits of trees

**Triple bottom line white paper.** Concurrently, the consultant will prepare a white paper that reviews most recent literature on how triple bottom line benefits (includes ecological, social, and economic) can be achieved using GI/LID. A draft white paper will be provided for City staff's review.

The consultant and City staff then will meet to receive and discuss the consultant's findings, as follows:

- Discuss the draft white paper on triple bottom line benefits of GI/LID,
- Present the findings of the cost-effectiveness tools review and the consultant's recommendations, and
- Discuss potential uses for the tools, individually or in combination, and about possible information gaps for which the City might want to consider additional tool development.

**Selection of cost-effectiveness tool.** Based on staff's comments on the draft white paper, the consultant will prepare a final white paper and, based on City staff's comments and input about cost-effectiveness tools, the consultant will prepare a memorandum that recommends methods for either tailoring an existing tool for the City's use or developing a new tool.

## **WORK PRODUCTS**

- White paper on triple bottom line benefits of GI/LID (draft and final)
- Presentation on cost effectiveness tools evaluation
- Memorandum that describes, compares and evaluates cost-effectiveness tools and recommends an approach for selecting and/or developing a tool for Raleigh (final only)
- Summaries/minutes of meetings

## **ESTIMATED DURATION AND CONSULTANT COST**

- Duration: 4 months: (through cost-effectiveness tool memorandum)
- Consultant cost: \$34,000

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## Item 4: Prepare Fact Sheets and Construction Checklists about GI/LID Practices

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### PURPOSE AND BENEFITS

With growing interest among developers and others in doing more to advance use of GI and LID practices for new development and redevelopment, as well as for City capital improvement projects, discussions with developers and their designers suggest that decision makers and stakeholders (e.g., citizens, developers, the City) need more information on costs and benefits of GI/LID to help them make better-informed choices. Unfortunately, developers and their designers often are not aware that using GI/LID might serve their interests, or they lack ready access to information for evaluating GI/LID practices.

The City staff GI/LID Task Force, recognizing the need to raise awareness among City staff and the development community about benefits and applicability of GI/LID, felt that having Raleigh-specific fact sheets and checklists about individual GI/LID practices would help advance use of GI/LID by:

- Clearly communicating that Raleigh welcomes use of GI/LID practices on new development and redevelopment sites,
- Raising staff's awareness and buy-in about the general desirability of using GI/LID and about benefits and limitation of individual GI/LID practices,
- Promoting City inter-departmental coordination and consistent policies and practices about GI/LID,
- Helping staff, developers, and designers communicate early about innovative ways to configure sites and better manage stormwater, and
- Informing staff's review of site development plans.

The Task Force felt these fact sheets, tailored to Raleigh's physical setting, particularly soils and climate, and to requirement of the City's UDO, should be used for outreach and pre-site plan meetings with developers and their designers. Fact sheets could help communicate early in the design process about innovative ways to configure sites, preserve existing natural features, incorporate GI/LID practices, and still realize a site's development potential. They would provide snapshot summaries of individual GI/LID practices, describing how they perform and providing information and links about applicability, siting, design, construction, and maintenance.

Importantly, fact sheets also can help users relate aspects of site design that traditionally have not been well-coordinated, such as drainage, stormwater management, landscaping, parking, and long-term grounds maintenance. Better coordination of these design elements can produce site plans serving multiple functions within the same footprint (e.g., integrated stormwater devices and landscaping, or stormwater devices and parking) and more efficient and cost-effective use of land.

Once completed, the fact sheets and checklists will be available to support City operations and help inform the public generally and the development community about using GI/LID through these and other sources:

- City's Stormwater Best Management Practices Manual
- Internal City operating procedures
- City's Stormwater and Planning webpages
- Office of Development Services' Customer Service Center

## DESCRIPTION

GI/LID practices fact sheets and checklists will cover the practices that staff and the City's consultant choose as appropriate to use in Raleigh and in common use elsewhere, ranging from low-cost residential to high-end development including subdivisions, commercial development, and mixed use. Existing fact sheets prepared by other municipalities and other organizations with more mature LID programs will be used to stimulate ideas and awareness of what has, and has not, worked well for others.

## APPROACH

**Work group input.** City staff will convene a work group with representatives from City departments and boards that the staff GI/LID Task Force identified as important for this work item: Development Management Team (Internal); Development Services Advisory Council (external), Planning Department (Development Communications), Public Works Department (Stormwater Management), and City Manager's Office of Sustainability. This work group will provide input and review draft versions of fact sheets and checklists.

**Selection of practices for fact sheets and checklists.** City staff and the consultant will develop a preliminary list of GI/LID practices for which fact sheets could be developed and identify kinds of information for each fact sheet. The number of fact sheets to be prepared will depend on the number of practices selected. A fact sheet will be developed for each selected practice, such as bioretention, green roofs, permeable pavement, bioswales, and rainwater harvesting. Additional fact sheets may be tailored for specific types of development, such as residential subdivisions, commercial, or mixed use, in which cases the fact sheets will cover combinations of practices in the context of the development.

Information sources for fact sheets will include the NC LID Guidebook, Raleigh Stormwater Design Manual, the NC Stormwater BMP Manual, EPA manuals, and fact sheets, stormwater BMP manuals, and guidance documents developed by other municipalities and organizations with more mature GI/LID programs.

For each GI/LID practice selected for a factsheet, a construction checklist also will be prepared. The checklists will note key construction activities and milestones, prompts about evaluating proper construction, and potential punchlist items for follow-up and acceptance by the City.

At their initial meeting, the work group will review the preliminary list of GI/LID practices, kinds of information to be included on fact sheets, preliminary formats for fact sheets and checklists, and examples of fact sheets and checklists used by other municipalities. Based on the work group's input, staff and the consultant will prepare a working list of GI/LID practices, types of development sites, and a fact sheet layout.

**Preparation of fact sheets and checklists.** The consultant then will draft one initial fact sheet and one checklist to serve as models before preparing the remaining fact sheets and checklists. The work group then will meet to discuss and comment on the models, and staff and the consultant will prepare drafts of the remaining fact sheets and checklists, and provide them to the work group for review. As with the models, the work group will meet again to comment on the drafts, and staff and the consultant will prepare the final fact sheets and checklists.



## **WORK PRODUCTS**

- Model GI/LID practice factsheet and checklist (draft and final)
- GI/LID practices fact sheets and checklists (drafts and finals)
- Fact sheets about GI/LID by type of development (drafts and finals)
- Summaries/minutes of meetings

## **ESTIMATED DURATION AND CONSULTANT COST**

- Duration: 6 months
- Consultant cost: \$44,000

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## Item 5: Prepare a Guidance Framework for Maintaining GI/LID Devices

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### PURPOSE AND BENEFITS

Proper design and construction of engineered stormwater devices are essential to their ability to meet intended water quality and flow control functions. Proper operation and maintenance also are important in order for stormwater devices to protect water quality as intended and not cause problems with aesthetics or public acceptance.

Inspections and maintenance are essential for preserving public and private investments in stormwater infrastructure. A systematic inspections and maintenance program for stormwater devices is needed to ensure desired benefits are achieved. Up-to-date and accurate tracking information helps ensure each device is properly maintained and helps coordinate maintenance efficiently. Databases that log the type, location, and condition of devices are used to schedule, plan, and track routine inspections and maintenance. Inventory data also can help locate stormwater system gaps and help identify priority areas for capital improvement program funding. Evaluation of cost-effective options for maintenance and clear responsibility for maintenance of devices are integral to developing an effective operations and maintenance program. Other benefits could include making activity and cost information available to the private sector to help with decisions about using GI/LID and to environmental regulatory agencies for evaluating the City's compliance with stormwater NPDES requirements.

This work will be collaborative among City staff, the City's consultant, and community stakeholders.

### DESCRIPTION

This work item will evaluate costs and responsibilities for maintaining GI/LID practices on City properties (such as parks, maintenance facilities, parking lots and decks, offices, and events venues), in City rights-of-way, and on private properties and prepare a guidance document for maintaining GI/LID practices that could be adopted by the City.

### APPROACH

**Work group input.** City staff will convene a work group to participate in discussions, review technical findings, and oversee development of GI/LID maintenance guidance. The City staff GI/LID Task Force identified representation from the following City operations as important for this work item: Public Works Department (Stormwater Management and Transportation Field Services), City Attorney's Office, and Parks, Recreation and Cultural Resources Department. The City's consultant will review the City's current maintenance guidelines, procedures, and enforcement policies; interview staff about those policies and procedures; interview private maintenance vendors; and develop recommendations for potential enhancement of these programs. Interviews with City staff and vendors will include as-built, inspections, and maintenance policies and procedures.

**Framework for maintenance review.** As a review framework, the consultant will use the Center for Watershed Protection's (CWP's) "Developing a Maintenance Program" from its guidance, "Managing Stormwater in Your Community". The CWP guidance highlights essential components of a maintenance program for evaluation:

- **Magnitude of maintenance needs.** How many stormwater devices are there currently, and how many devices are anticipated to be added in the foreseeable future? Of existing devices, how many have maintenance agreements and easements? What elements of the drainage infrastructure should be included in and synchronized with the maintenance program?
- **Responsibility for maintenance.** What are responsibilities for inspecting and maintaining stormwater devices on City property? On private property?
- **Level of service.** What is maintenance intended to achieve (i.e. level of functioning, aesthetics, etc.)? Are these levels of service clear? Based on the desired level of service, what is the scope of maintenance and schedule of maintenance needed by type of stormwater device?
- **Internal City resources, vs. contracting.** What is the City's preference for maintaining public systems?

**Maintenance guidance framework document.** The City's consultant will prepare memorandums that will summarize standard practices and associated costs for long-term operation and maintenance of GI/LID stormwater devices, the scope of the City's maintenance tasks (including estimated numbers of current privately-owned and current and future publicly-owned devices); outline an approach for maintaining stormwater devices, for both public and private devices (with special attention to LID devices in street ROWs); and make recommendations for enhanced procedures for maintenance. At strategic points, the work group will meet to discuss draft findings and needed revisions to the memos.

A draft GI/LID maintenance guidance framework document will be developed that draws from the memos. The work group will review and comment on the draft guidance. Based on comments received, a final will be prepared.

## WORK PRODUCTS

- Interview questions
- Summaries of interviews
- Memorandum on maintenance program review and recommendations (draft and final)
- Memorandum on GI/LID maintenance guidance (draft and final)
- Summaries/minutes of meetings

## ESTIMATED DURATION AND CONSULTANT COST

- Duration: 9 months
- Consultant cost: \$54,000

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## Item 6: Identify Opportunities for GI/LID Retrofits on Developed Properties

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### PURPOSE AND BENEFITS

Devices installed to reduce pollutants in stormwater runoff and/or reduce volumes or peak rates of stormwater runoff commonly are called stormwater best management practices (BMPs). Where stormwater BMPs are placed on already-developed land, they are called stormwater BMP retrofits. Retrofits usually are constructed voluntarily, not required by land-development ordinances.

For over 10 years the City's Stormwater Management Division has constructed and maintained stormwater retrofits on City-owned properties and, more recently, within City street rights-of-way, to help improve stormwater quality and the health of Raleigh's streams and lakes.

The City GI/LID Task Force discussed the importance of the City further demonstrating leadership in advancing GI/LID by using these practices where the City can exercise the most control – on City-owned properties – as part of showing that Raleigh welcomes GI/LID and providing examples of successful use of GI/LID that private developers can emulate. The Task Force also discussed the benefits of accruing lessons learned with City retrofit BMPs and applying them to initiatives for siting retrofit BMPs on private properties through incentives programs, such as the City's Stormwater Quality Cost Share Program.

While the City Stormwater Management Division, as part of its stormwater capital improvement program, routinely evaluates candidate sites and constructs stormwater retrofit BMPs, the City wants to accelerate and improve its program for retrofitting stormwater BMPs in the following ways:

- Develop a more systematic procedure for identifying and evaluating retrofit BMP sites;
- Increase the number of retrofit BMPs installed each year;
- Where practical, design retrofit BMPs to reduce pollutants, reduce runoff peak rates, and reduce runoff volumes (versus only one or two of these), in keeping with a GI/LID approach;
- Locate retrofit BMPs and GI/LID practices within City and State street rights-of-way (ROWs), particularly where they can be incorporated into designs for new streets, new curb and gutter, street widening, streetscapes, traffic calming, bike lanes, and other improvements in street ROWs;
- Incorporate BMPs and GI/LID practices into designs for new City facilities (such as parks, parking lots and decks, office buildings, and maintenance facilities) and modifications to existing facilities; and
- Promote City inter-departmental coordination and buy-in for using GI/LID practices.

### DESCRIPTION

This work item will identify best opportunities for GI/LID implementation on City properties (e.g., street projects, parking lots and decks, and parks), hereafter called GI/LID retrofits, and explore whether a larger scale strategic plan for GI/LID implementation on developed private properties would be desirable.

## APPROACH

**Work group input.** City staff will convene a work group with representatives from City departments that the staff GI/LID Task Force identified as important for this work item: Public Works Department (Stormwater Management, Design and Construction, and Field Transportation Services), Planning Department (Transportation Planning, Urban Design Center), Real Estate Office, and City Manager's Office of Sustainability. This work group will provide input and review draft memoranda and reports.

**Characteristics and opportunities for retrofits.** City staff and the City's consultant will meet with the work group to identify priority retrofit characteristics and screening criteria. As a goal for the meeting, 20 sites with opportunities for GI/LID on City property will be identified. To the extent possible, the sites will be selected to represent a variety of land uses, such as streets, parks, and parking lots, that offer opportunities for relatively low-cost and logistically simple options ("low hanging fruit"). When reviewing potential sites, staff and the consultant will consider City sites that already have GI/LID components so that a broader portfolio can be achieved and new types of sites added where optimal. Characteristics including specific watershed(s), neighborhoods, zoning districts or socio-economic areas of City interest could also be considered for closer examination of desirable opportunities.

**Collection of data.** The City and other public agencies have planned or implemented a number of GI/LID improvements and stormwater retrofit projects in Raleigh. These existing or planned projects represent a potential foundation for developing a larger scale strategic retrofit plan if the City were to decide to move forward with a more intensive effort in the future. Available information will be compiled and reviewed to identify locations and types of GI/LID projects on City properties. The sites will be cataloged to present the City's current GI/LID portfolio as a reference when examining potential new GI/LID sites.

Available GIS layers for the parcels of interest owned by the City will be collected (including major street projects with parkway area, public parking areas, maintenance facilities, administrative facilities, parks, etc.) and GIS data layers for soils, slopes, contaminated sites, utilities, and land cover/imperviousness will be assembled. Data on water quality impairments and flooding "hot spots" also will be collected.

**Potential locations for retrofits.** Using the data collected, staff and the consultant will conduct a desktop screening analysis to identify high-quality retrofit opportunities on City properties. This analysis will incorporate known opportunities and existing stormwater BMPs identified by the work group as well as opportunities identified through the screening process. Site feasibility will be evaluated, eliminating sites that have significant constraints due to landscape features such as soils and slopes; contamination; utility placement, etc. For the remaining sites, reconnaissance-level aerial imagery will be reviewed to help evaluate infiltration capacity, impervious area, space needs/requirements, water quality issues and flooding/drainage issues. The consultant will review the results with the work group at a second work group meeting and identify the most desirable sites for which to conduct field evaluations.

**Field evaluation and concept plans.** The most desirable candidate retrofit sites will be further evaluated through field reconnaissance to evaluate the accuracy of GIS data and feasibility for design, construction, and maintenance. A project-specific field data sheet will be used to evaluate the feasibility, document site conditions, and provide a space for a rough sketch of the potential retrofit opportunity. For sites determined to be feasible during field evaluation, simple tools will be used to estimate pollutant-load and volume-reduction benefits and costs of implementing GI/LID at each site. A draft concept plan will be developed for use in conveying retrofit concepts to stakeholders and enable implementation. The concept plan will consist of a brief narrative of site conditions and improvements, a plan view layout of specific improvements and overlaid aerial imagery, and details as appropriate.

**Implementation plan, schedule, and strategy.** Results of the field evaluations and retrofit concept plans will be reviewed at a third work group meeting. A final prioritization ranking will be developed based on work group comments. This prioritization will consider each GI/LID opportunity discretely. The consultant will develop an implementation plan and schedule for phasing in the design and construction of each priority retrofit opportunity, based work group input and on projected allocations for retrofit projects in the City's stormwater capital budget. The work group also will discuss whether a larger scale strategy for GI/LID on private properties should be developed based on lessons learned identifying, screening, evaluating, and prioritizing GI/LID retrofit opportunities on city properties. Results and recommendations from work group discussions will be incorporated into the implementation plan and schedule.

## **WORK PRODUCTS**

- Memorandum about site screening criteria, results, and summary of opportunities (draft and final)
- Memorandum about field evaluations, performance calculations, and concept plans (draft and final)
- Report about GI/LID priority retrofit implementation plan and schedule (draft and final)
- Summaries/minutes of meetings

## **ESTIMATED DURATION AND CONSULTANT COST**

- Duration: 6 months
- Consultant cost: \$54,000

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# Item 7: Evaluate Using Incentives to Encourage GI/LID

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## PURPOSE AND BENEFITS

Incentives usually provide a benefit to an owner, developer, or tenant that otherwise would not be realized. Most incentives are directly monetary (rebates, credits, subsidies, grants), some are indirectly monetary (accelerated permitting, reduced parking requirements, lower water bill), and some may be intangible and subjective (environmental consciousness, “green” recognition). Some incentives are geared toward new development or redevelopment, and others toward retrofits on already-developed land.

For existing development, many municipalities, including Raleigh, have rebate programs, cost sharing programs, and/or subsidized activities to encourage installation of stormwater BMP retrofits (reduce runoff pollutants, peak rate, and/or volume) or reduce use of potable water. Typically the desire is to stimulate use of small practices which, taken cumulatively on many sites over time or scaled up to treat runoff from a neighborhood, can provide-water quality benefits over a large area, such as a watershed.

For new development and redevelopment, many municipalities have experimented with ways to encourage developers to adopt LID practices. To help municipalities evaluate potential incentives for GI/LID, the USEPA Water Quality Scorecard offers 230 policy options for protecting and improving water quality across different scales of land use (site, neighborhood, and watershed) and across multiple municipal departments. The Scorecard includes options for strengthening local plans, incentive programs, and local codes. In 2012 City staff conducted a self-assessment using the Water Quality Scorecard and, in the process, identified which incentive programs are and are not currently being implemented by the City. The City staff GI/LID Task Force and the City’s consultant reviewed and discussed the 2012 Scorecard findings, which identified additional gaps as well. Based on the City’s Scorecard evaluation and Task Force discussion, the consultant has identified potential new incentives the City could use in implementing GI and LID in new development and redevelopment.

For Raleigh, incentives likely will be needed if private developers and land owners are to implement GI/LID practices on a meaningful scale, at least until GI/LID becomes better-established and no longer is viewed as an exception. In commenting on a draft of this Work Plan, developer stakeholders indicated that, even if the cost of GI/LID were comparable to the cost of traditional stormwater methods, they probably would use traditional methods because they are time-tested and developers know what to expect (costs and time for design, permitting, construction, and maintenance). These stakeholders believe that using GI/LID practices would introduce unknowns and added risk, for which they would want some form of return.

The overall goal of this work item is identifying high-priority incentives that should be investigated in more detail for possible use on a program level or for preparing potential revisions to City ordinances.

## DESCRIPTION

This work item will research practices and policies that have been used by other communities, discuss among staff and focus groups what approaches may be most appropriate for Raleigh, and recommend a suite of incentives for the City’s consideration.

Because types of incentives and mechanisms vary between those for existing development and those for new development, the approach for evaluating incentives options is presented separately for each.

## INCENTIVES FOR EXISTING DEVELOPMENT

### APPROACH

**Current City incentive programs.** City staff and the City's consultant will begin with a review of current City incentive programs that pertain to LID (e.g., Stormwater Quality Cost Share Program) to gain an understanding of current practices and potential enhancements. The consultant will interview City staff involved with these programs regarding their perspectives on program administration and effectiveness.

**Potential new incentives options.** For evaluating possible new LID incentives programs, including their potential complexity and feasibility, the consultant will develop an inventory and menu of types of potential LID incentive options, including outreach and financial incentives, used by other municipalities. This will include interviews with local incentives program administrators about annual budgets for financial incentives, level of participation, how incentives are targeted (e.g., by problem areas/watersheds, or city-wide), staff time for management and administration, and performance and effectiveness monitoring. Information also will be sought about incentives specific to various types of LID practices, such as cisterns, rain gardens and bioretention areas, downspout disconnection/redirection, retrofit of existing stormwater BMPs, and green roofs, which variously reduce peak stormwater flows and potable water demands, filter pollutants, and/or increase groundwater recharge.

The consultant will prepare a memorandum that summarizes identified incentives options; likely cost effectiveness (based on literature or case studies if available); type and expected pollutant-removal potential; potential administrative issues/complexity; and budget/cost implications.

**Stakeholder group input.** City staff will convene a stakeholder group with representatives from City staff, residential, commercial, and environmental interests that will review a draft of the memorandum and meet to convey their level of interest in various types of incentives, what realistically would need to occur for property owners to participate, and to rank the options based on criteria to be selected (e.g., ease of administration, extent of adoption, cost effectiveness, enhance public outreach, leveraging/consistency with other City objectives, and addressing water quality or drainage problems in different City neighborhoods). The goal of the work session would be to identify roughly five incentives program options that could be developed and investigated further. The consultant will develop a final memorandum documenting the discussion and recommendations of the focus group.

### WORK PRODUCTS

- Memorandum about potential GI/LID incentives for existing development (draft and final)
- Summaries/minutes of meetings

### ESTIMATED DURATION AND CONSULTANT COST

- Duration: 6 months
- Consultant cost: \$44,000



## INCENTIVES FOR NEW DEVELOPMENT AND REDEVELOPMENT

### APPROACH

**Current City incentive programs.** In conjunction with reviewing current City incentive programs as they apply to existing development, City staff and the City's consultant will review aspects that pertain to LID (e.g., Stormwater Quality Cost Share Program) as they might pertain to new development and redevelopment.

**Potential new incentives options.** Based on the City's Scorecard evaluation and Task Force discussion, the consultant has identified the following areas as potential new incentives for implementing GI and LID in new development:

- Natural areas/tree canopy:
  - Street tree protection and planning
  - Open space requirements and policies
  - Open space impact fees/policies (do not include stormwater goals)
  - Application of the Tree Conservation Ordinance ( is currently based on aesthetics and not linked to water quality)
- Infill policies/incentives:
  - Policies/incentives for directing development into previously developed areas with existing infrastructure
  - Alternative/reduced landscaping, parking, setback and other requirements for targeted infill areas
  - Payment in-lieu or off-site mitigation option whereby the City and development Community jointly plan and develop stormwater BMPs in infill/redevelopment areas (this relates to the "nuts and bolts" issue of cost effective stormwater management in dense development)
- Green streets:
  - Incentives for shared driveways, alleys, rear garages to reduce impervious area
  - Policies/plans/requirements for major street projects to integrate green infrastructure practices
- Green parking:
  - Incentives for use of pervious paving materials
  - Alternative parking designs and reduced parking requirements
  - Transportation demand management for new development to reduce parking
- Green on-site stormwater management:
  - Pre-site plan meeting with developer to discuss green infrastructure
  - Include landscape architect in review of stormwater management designs
  - Reduce impact fees when LID is used

The consultant will conduct a targeted literature review and use its experience working in other communities to add to this list of GI/LID incentives for new development. A memorandum will be prepared that provides a short description and/or example of each incentive.

**Stakeholder input.** Once the draft memorandum has been developed, a stakeholder work session will be held that includes City staff, a range of development representatives, and environmental group representatives. Before the meeting, participants will receive the draft memorandum for review. During the work session, participants will be asked their level of interest in/support of each incentive, what realistically would need to occur for developers to participate, and to rank the incentive options based on selected criteria (e.g. ease of administration, extent of adoption, cost effectiveness, leveraging/consistency with other City objectives, and addressing water quality or drainage problems in different City neighborhoods). The goal of the work session will be to identify incentive program options that could be

developed and investigated further. The consultant will prepare a final memorandum documenting the discussion and recommendations of the stakeholder group work session.

**WORK PRODUCTS**

- Updated menu of GI/LID incentives for new development
- Memorandum about potential GI/LID incentives for new development (draft and final)

**ESTIMATED DURATION AND CONSULTANT COST**

- Duration: 3 months
- Consultant cost: \$29,000