



City of **Somerville**

Green Stormwater Infrastructure Candidate Location Siting Application

Michael Hanley, Lucica Hiller, David Bedoya

City of Somerville, Massachusetts

Agenda

- Introduction and Background Information
- Challenges of Green Stormwater Infrastructure (GSI) in Dense Urban Areas
- Criteria for GSI Siting
- Automating the Process of GSI Candidate Siting
- Innovations and Successes of our GSI Siting Tool
- Potential Future Improvements and Applications
- Summary, Conclusions, Q&A

Background Information

- City of Somerville, Massachusetts
 - Most densely populated City in New England
 - Conveyance Systems mostly built in late 1800s to early 1900s
 - Rapid Development = Rapid Increase in Imperviousness
 - Development of a Flood Mitigation and Water Quality Improvements Master Plan



Green Stormwater Infrastructure (GSI)

- Plants, soils, permeable materials, and other landscaping features to capture and filter stormwater and recharge groundwater.
- Known to bring community benefits that range from flood control, water quality improvements to a reduction in urban heat island effect.
- Performance is highly site-specific with soil, topographic and groundwater properties conditioning performance of these systems.



Challenges of GSI in Dense Urban Areas

- Distributed nature of GSI
- Site-specific challenges and variables
 - Must be located away from utilities
 - Required soil parameters
 - Required ground sloping
 - Required drainage volumes



Criteria for GSI Siting

PARAMETER	CRITERION	SOURCE
Somerville ROW	In park, sidewalk or road adjacent to curb	Somerville GIS
Slope	Less than 5%	NOAA LiDAR
Soil Type	Hydrologic soil type A or B, C acceptable	NRCS Web Soil Survey Tool
Water, Sewer, Drain	3.5 feet clearance	Somerville GIS
Buildings	7 feet clearance	Somerville GIS
Trees	10 feet clearance	Somerville GIS
Parking Meters	5 feet clearance	Somerville GIS
Sidewalk	At least 4 feet wide	Somerville GIS
Railroad	25 feet clearance	MassGIS
Driveway/curb cut	5-foot clearance	GIS not available, orthophoto imagery used where possible
Crosswalks/sidewalk ramps	5-foot clearance	GIS not available, orthophoto imagery used where possible
Underground utilities (other than sewer and drain)	3.5-foot clearance	GIS not available
Groundwater	At least 7 feet below ground	GIS not available

GSI TYPE	SITING PARAMETERS
Rain Garden	In a public space (park or existing green space) adjacent to impervious area
Planter Box	Sidewalk width: At least 9 feet
Curb Bumpout	<ul style="list-style-type: none"> • Parking Lane present (restrict width to the width of parking spot) • 2-way streets with at least 26 ft combined width • 16 feet of pavement clearance for Emergency Vehicles
Subsurface Trench	Available footprint and drainage, but not enough space for either bumpout or planter box



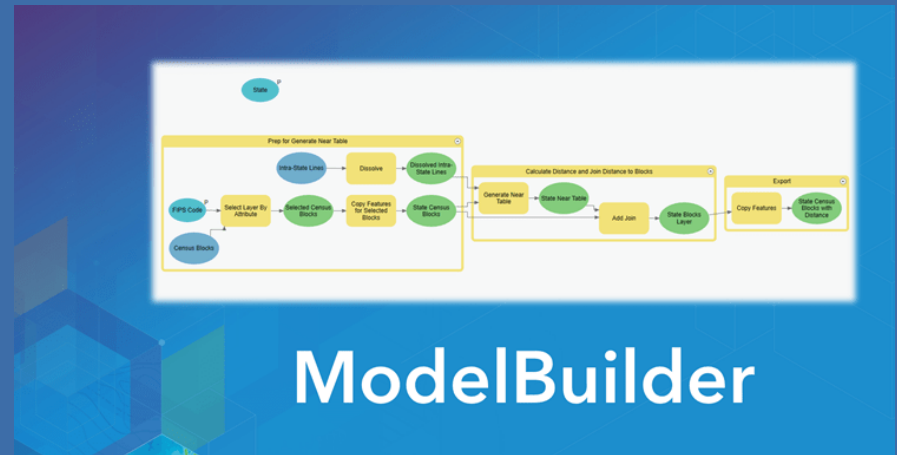
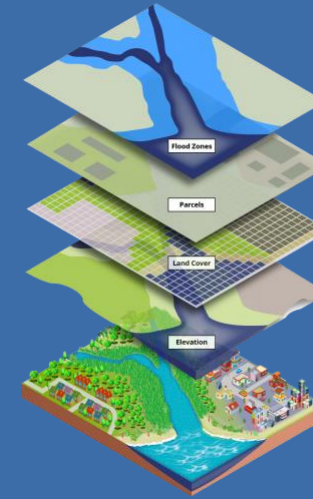
Steps for GSI Candidate Siting

- Identify Areas within Public Right-of-Way
- Identify sites within the areas, and select GSI type
- Compute Annual Phosphorus Loading Reductions at candidate GSI sites
- Normally requires multiple field inspections and detailed site-by-site analyses

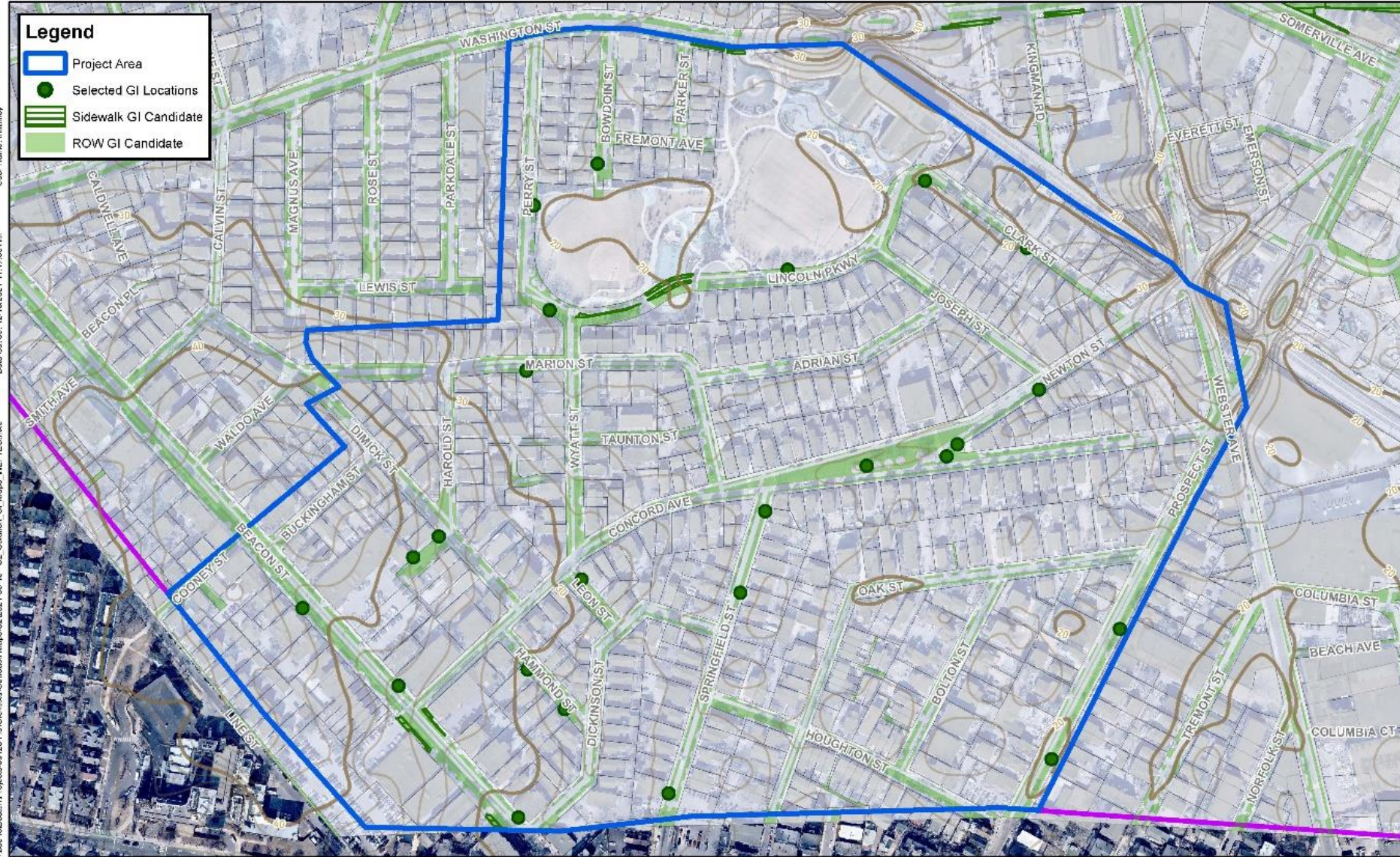
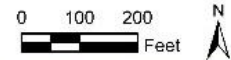


Automating the Process

- ArcGIS Model Builder and Python Scripting
- Utilizes:
 - Available GIS layers
 - Topographic data
 - Satellite imagery data
- Instantly generates candidate GSI sites across large areas

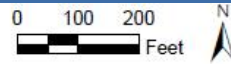


Concord Avenue and Lincoln Park Area Sewershed C2: Green Infrastructure Suitable Areas and Selected Sites

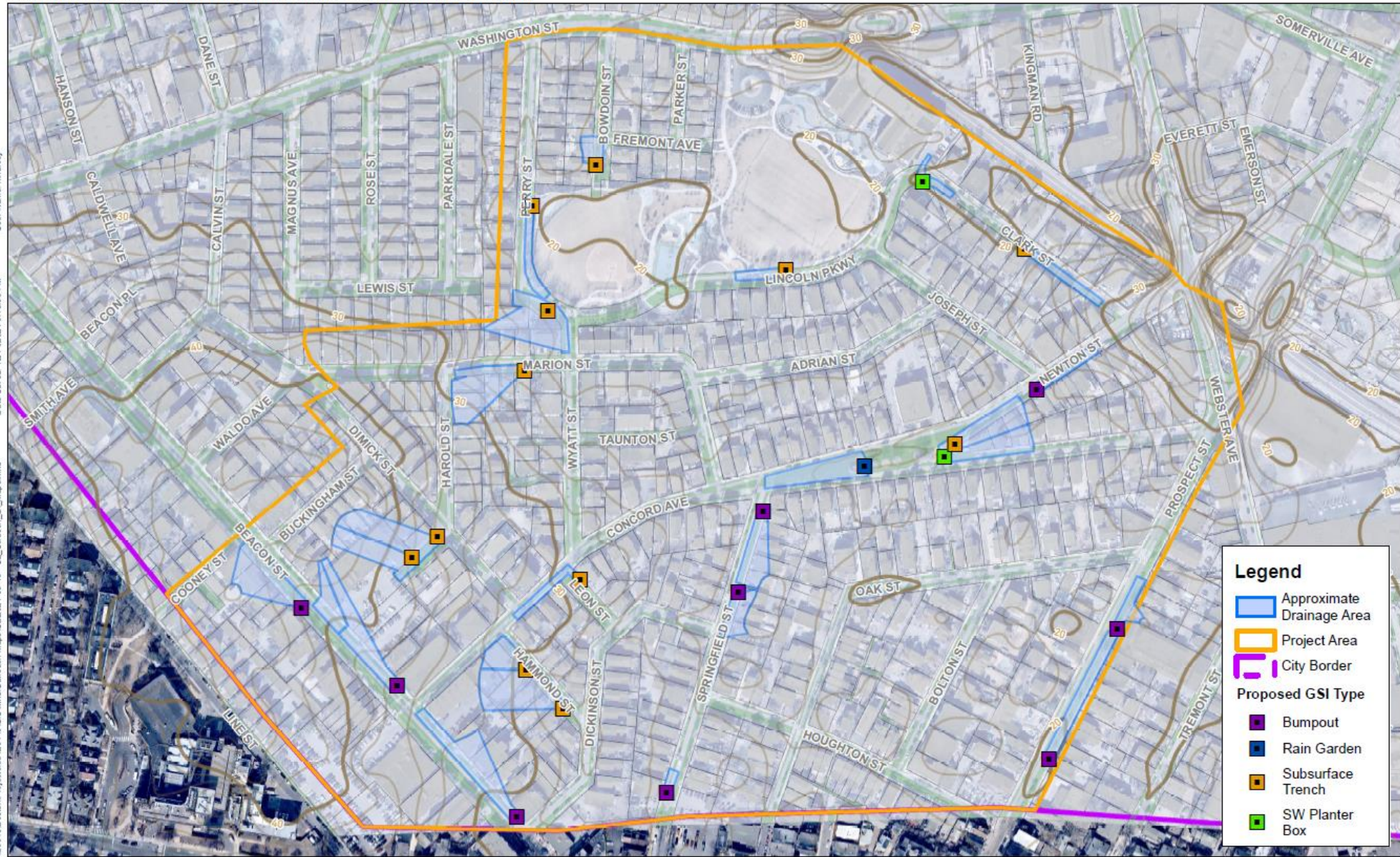


User Name: mshelley
Date Saved: 12/15/2021 11:47:00 AM
I:\gis\Bosdon\Projects\501234\501234\GIS\Map\C2\2021-05-15 - C2_Solution_GI_Map_DEFTEC.mxd

Concord Avenue and Lincoln Park Area
Sewershed C2: Green Infrastructure Candidate Locations



User Name: mhanrey
 Date Saved: 1/21/2022 15:18:03 PM
 \b004f98ce08f6\Projects\50123449\GIS\Map\Output\Map\1202021-08-19 - C2_Solution_GI_Map.mxd



Legend

- Approximate Drainage Area
- Project Area
- City Border

Proposed GSI Type

- Bumpout
- Rain Garden
- Subsurface Trench
- SW Planter Box

Innovations of our GSI Candidate Siting Tool

- Can quickly perform the bulk of the analysis on a sewershed-by-sewershed basis, or City-wide
- Easily customizable based on siting criteria and available spatial data
- Greatly simplifies computation of annual phosphorus loading reductions at candidate GSI sites
- Creation of public outreach maps showing GSI candidate siting locations



Public Outreach



Tool: Green Infrastructure

Description: Built systems that mimic natural systems and helps improve stormwater runoff and may help reduce flooding

<p>Flood Mitigation</p> <ul style="list-style-type: none"> • Somewhat Effective <p>Water Quality</p> <ul style="list-style-type: none"> • Highly effective for areas tributary to GI 	<p>Advantages</p> <ul style="list-style-type: none"> • Mimics natural processes • Provides green space and cooling • Added aesthetics • Adds value to the neighborhood • Provides water quality benefits 	<p>Limitations</p> <ul style="list-style-type: none"> • Limited suitable locations in dense urban environments • Modest flood reduction • High maintenance • Possible existing utility conflict • Loss of parking spaces and sidewalk space
--	--	---

Color Code:

- Flood Mitigation
- Water Quality
- Combined Sewage Management

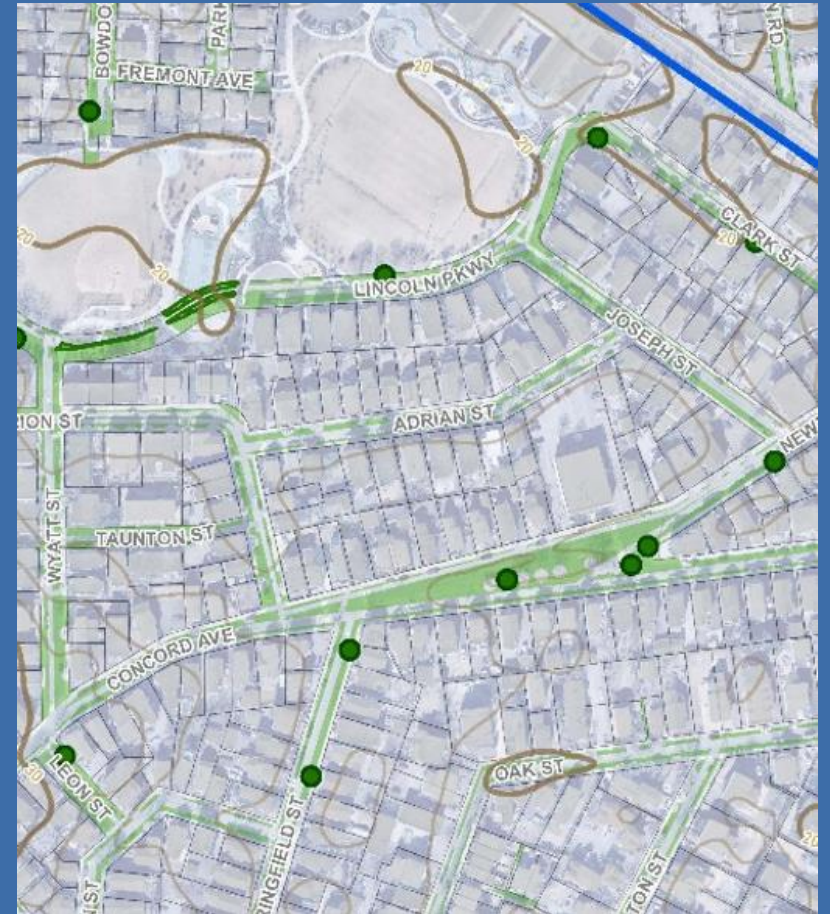
Examples of Available Tools:

- | | |
|--|--|
|  <p>Increase Pipe Size</p> |  <p>Green Infrastructure</p> |
|  <p>Sewer Separation</p> |  <p>Stormwater Storage Tank</p> |
|  <p>New Catch Basins</p> |  <p>Combined Sewage Storage Tank</p> |



Success of the Application

- Reduces the time and effort required to perform a preliminary GSI Siting Analysis
- Takes available and relevant spatial data as input, simplifying the analysis and reducing the required field work
- Can be customized for different GSI Siting criteria
- Could be adapted and scale to use for other siting analyses



Potential Improvements

- Ability for the tool to select BMPs, and handle missing GIS data layers (image recognition for driveways, etc.)
- Automate Drainage Area Delineation
- Calculate Phosphorus Loading

Looking Forward

- Applications of this toolbox for other infrastructure types and municipal assets
- Improving the tool for even more detailed and cost-effective GSI siting
- How would you use this? Any other applications?

Summary

- GSI known to bring many community benefits and water quality improvements
- Traditional siting approach is challenging, time-consuming, and costly
- Development of a toolbox to automate the process and perform preliminary desktop analysis
- Potentially adaptable/scalable for other use cases and infrastructure types

Let's Connect!



Michael Hanley
Dewberry
Staff Engineer



Lucica Hiller
City of Somerville, MA
Stormwater Program
Manager



David Bedoya, PhD, PE
Dewberry
Senior Associate and
Market Segment Leader



Peter Garvey, PE
Dewberry
Vice President and
Business Unit Manager



City of **Somerville**

Green Stormwater Infrastructure Candidate Location Siting Application

City of Somerville, Massachusetts

Michael Hanley, Lucica Hiller, David Bedoya