

Green School Outline

Prepared For:
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Intro A Green Schoolyard Manual

Green City, Clean Waters is Philadelphia's 25-year plan to protect and enhance our watersheds by managing stormwater with innovative green infrastructure. The Philadelphia Water Department developed Green City, Clean Waters to provide a clear pathway to a sustainable future while strengthening the utility, broadening its mission, and complying with environmental laws and regulations.

The implementation of this mission focuses on different urban land use conditions to develop green stormwater infrastructure (GSI) to capture stormwater at its source and minimize the amount of pollutants that reach the Delaware River, the Schuylkill River, and the many tributary streams within the city. Each land use condition presents its own unique conditions that must be addressed if GSI solutions are to be successful.

It is the goal of PWD to provide technical assistance unique to each land use scenario that can ensure long term sustainability of GSI features. PWD Green Streets program is an excellent example providing technical assistance to developers, private entities, non-City agencies, and non-profits, and their designers and contractors undertaking improvement projects within the right-of-way in order to encourage the inclusion of green stormwater infrastructure elements.

The Green Streets Manual is the result of the Philadelphia Water Department working closely with the Mayor's Office of Transportation and Utilities, the Streets Department, Philadelphia Parks and Recreation, and other public utilities, partners, and agencies to develop detailed design templates for green streets that are flexible enough to be applied in a variety of urban street conditions.

Similarly, a Green Schoolyard Manual would outline what types of GSI practices are appropriate for schoolyard elements and provide standardized details, and lay out the necessary design review and maintenance procedures to expedite green schoolyard development in Philadelphia. While PWD has developed a triple bottom line benefits approach for green stormwater infrastructure of economic, environmental and social, schoolyards have an added layer of educational and health related benefits. The matrix developed in partnership with PWD and the Philadelphia Green Schools Alliance illustrates these expanded benefits and the points of intersection between schools and GSI.

It is the intent of Philadelphia Water to develop the most effective green infrastructure to support schoolyard settings. This document is the first step in developing a Green Schoolyard Manual and is a literature review focused on identifying, appraising, selecting and synthesizing current national city and school district data relating to the integration of green stormwater infrastructure and schoolyard design standards.

This literature review is one of two supporting documents prepared for Philadelphia Water as the first steps in creating a green schoolyard manual. The review explored current state, city, municipality and school district literature regarding existing or potential integration of green stormwater infrastructure and the design of schoolyards.

Philadelphia Green Schools Alliance 6/25/15

economic

Typical Schoolyards Elements

500 muster Infrastructure Educational Opportunity Mature Play of Tree's **Integrated Benefits Outcomes** education Expand outdoor education Create places for hands-on learning Improve nutrition education with gardening Increase physical education options environmental Increase green infrastructure Apply green technology and materials Improve local environmental quality health Increase access to fresh produce Improve physical activity for youth and adults Create opportunities for active living social/cultural/historical Create places for positive community change Develop life skills for people of all ages Celebrate local heritage and culture

Invest in community

Improve property values

Create green Jobs

1

Executive Summary Observations and Findings

OVERVIEW

Of the 70 cities researched, 177 references were found relating to stormwater, green stormwater infrastructure, and schoolyards. The documents were either city or district documents, case studies, scholarly articles, and/or third party resources. These references fell into the folloing general categories:

104 GSI related material

50 Stormwater specific material

27 Schoolyard related material

1 Maintenance specific material

'Green stormwater infrastructure' (GSI) was found to be used synonymously with 'low impact development' (LID) and both were used in search queries throughout the process. Most municipalities target GSI and LID strategies for residential, commercial, municipal/institutional, and industrial facilities...seemingly all aspects of a landuse except schoolyards.

As Example: Denver Development Type Guidelines

Ultra-Urban

High Density Mixed Use

Higher Education Campus

Industrial

Low Density Mixed Use

Residential

Parks and Natural Areas Open Space

While a large percentage of cities have stormwater manuals in general, detail for specific design items such as rain gardens, green roofs, etc. is lacking. Standards regarding public interaction is minimal and, when referred to, the focus is passive addressing aesthetic appeal. Any other interaction was directed at maintenance personnel.

Only New York City, Portland and San Francisco appear to have integrated standards for GSI and schoolyard guidelines. The San Francisco Unified School District (SFUSD) and Portland Public Schools (PPS) are found to have the most relevant information online regarding GSI/LID development in schoolyards. Both cities have school district publications that outline the processes, expectations, guidelines, etc. for designing, creating, and maintaining green school yards. (See the SFUSD Green Schoolyard Manual and PPS Design Guidelines and Standards) These documents are very much a collaboration across municipal departments and support larger city and county stormwater management and low impact development master plans, guidelines, manuals, and/or handbooks.

San Francisco based non-profit Education Outside has spearheaded efforts for greening 22 elementary schoolyards to date in partnership with the SFUSD Sustainability Director, helping to create the school district's design process and guidelines. These guidelines include ensuring that interested groups be in communication with the SFUSD district architect. Education Outside,

as a third party, also helps community groups and schools tap into voter approved bond funding, plan, staff and maintain projects. They also offer educational resources on trees, rainwater, mulch & compost, curriculum and troubleshooting.

PPS has adopted GSI standards that meet the larger Washington County's Clean Water Services Low Impact Development Handbook...similarly, they refer to the City's Red Cinder Ecoroof Design Guidelines as the go to source for implementing and maintaining green roofs on school property.

School district facilities staff act as project managers to help community groups through the process of designing, planning, and implementing schoolyard projects to ensure that completion of projects which meet codes, district standards, and will have long-term maintenance and community support. This in turn also creates opportunities for consistency throughout the schoolyard greening process. It is important to note that the PPS web page is transparent and encouraging toward these efforts, but at the same time is conscious of protocol and the continuity of built projects in partnership with the city. For instance, on the Portland Public Schools Garden Projects web page, under item 5, Develop watering plan, it states "If the garden is a stormwater management installation, the city requires an operations and maintenance plan in order to get a permit."

For both school districts, funding and budgets are of concern especially in regards to the maintenance, care, and upkeep of schoolyard projects. School district facility/landscape staff are stretched thin, and there are subsequent requirements built into the stages of design and planning. In order for projects to be considered, detailed maintenance plans are required during the approval process. This includes outlining which community group is responsible for the scheduling of, for instance, community volunteer days, watering for plant establishment, monitoring of GSI elements (rain barrels/cisterns) and trash removal throughout the year. Education Outside offers specific maintenance curriculum and workshops as part of an agreement between the school and community. (Their agreement form can be seen here.)

The successes of green schoolyard initiatives in both Portland and San Francisco are a clear result of collaboration from both 'grassroots' and 'grasstops'. They have efficiently unified community and neighborhood groups, individual schools, water departments, and city and county governments. In the spirit of public schoolyards being the second largest category of public land within a city, the school districts demonstrate that the existing city, county, regional or state published resources regarding other public spaces are found to be valued and referred to. Furthermore, these resources are valued for their potential to create educational opportunities within schoolyards while supporting school missions. In partnership with schools and government staff, neighborhoods are encouraged to take ownership of their schoolyards and in-so-doing are empowered to steward education, community, water quality/conservation, and the overall beautification of their neighborhoods and cities.

Methods and Procedure Description

Overview

The process for this literature review included the recognition, retrieval and synthesis of relevant material relating to municipalities and/or school districts that recognize stormwater management opportunities and low impact development

strategies/approaches as they relate to schoolyards. During this stage relevant reports, articles, monographs, dissertations, etc. were identified, reviewed and ranked as follows:

- 5 GSI manual with green schoolyard manual
- 4 Green schoolyard guidelines but no GSI
- 3.5 or 4/3 Both GSI and Schoolyard guidelines but separate not integrated
- 3 Well developed guidelines for GSI but nothing related to schoolyards
- 2 GSI manual but not easily translated for a school environment
- 1 Nothing

The process of reviewing the literature and writing a literature review can be complicated and lengthy. When an orderly system can be designed, it is easier to keep track of the reference material. A system of organization and planning through matrices will allow for the retrieval of data in the future. For each city or state identified a master list of internet links to documents and a bibliography was compiled in matrix form.

City selection was based on three criteria:

- 1) Including the Top 50 most populated. (From New Orleans Pop. 343,829, to New York City Pop. 8,175,133) 50 Largest populations
- 2) PWD list of peer cities
- 3) Lesser populated cities that exhibited "GSI potential"

Additionally, the documents have been categorized by five content areas:

- GSI Green Stormwater Infrastructure material referencing green stormwater or low impact development techniques
- SW Stormwater material referencing typical grey stormwater infrastructure techniques
- M Maintenance maintenance standards, guidelines and/or practices
- SY Schoolyards material referencing schoolyards through either school district or third party publication
- CS Case Study material referencing GSI and/or green school projects as pertains to that city It was not the intent of

Study Limitations

This report evaluates the strengths and weaknesses of the literature collected and read based on the criteria described herein. Material was collected during a two month period and relied solely on internet access of documents and associated links. Using Google, Google Scholar, and the University of Colo. Library search engines to find literature related to green stormwater infrastructure as it applies to schoolyard application, implementation, education, ecology, and water quality improvement opportunities. The following search queries in each search engine were used:

City Ranking Evaluation of standards available at city or school district level

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RATING	STATE	CITY
5	New York	New York City
5	California	San Francisco
5	Oregon	Portland
4	Pennsylvania	Philadelphia
4	Massachusetts	Boston
4	New Zealand	Auckland
4	Ontario	Toronto
3.5	Arizona	Tucson
3.5	Colorado	Denver
3.5	Colorado	Ft. Collins
3.5	British Columbia	Vancouver
3.5	Georgia	Atlanta
3.5	Vermont	
3	California	Los Angeles
3	Illinois	Chicago
3	Texas	Houston
3	Texas	San Antonio
3	California	San Diego
3	Texas	Dallas
3	California	San Jose
3	Texas	Austin
3	Indiana	Indianapolis
3	Texas	El Paso
3	Washington	Seattle
3	District of Columbia	Washington
3	Oklahoma	Oklahoma City
3	California	Sacramento
3	Missouri	Kansas City
3	Arizona	Mesa
3	Nebraska	Omaha
3	Colorado	Colorado Springs
3	California	Oakland
3	Minnesota	Minneapolis
3	Oregon	Eugene
3	Nebraska	Lincoln
3	South Dakota	Sioux Falls
3	Alaska	Anchorage
3	Missouri	St. Louis
3	Maryland	Prince George's County

3 Arizona

2.5	Arizona	Phoenix
2.5	Oregon	Bend
2.5	Utah	Salt Lake City
2.5	Hawaii	Honolulu
2	Florida	Jacksonville
2	Ohio	Columbus
2	Texas	Fort Worth
2	North Carolina	Charlotte
2	Michigan	Detroit
2	Tennessee	Memphis
2	Tennessee	Nashville
2	Maryland	Baltimore
2	Nevada	Las vegas
2	Kentucky	Louisville
2	Wisconsin	Milwaukee
2	New Mexico	Albuquerque
2	California	Fresno
2	Virginia	Virginia Beach
2	North Carolina	Raleigh
2	Florida	Miami
2	Oklahoma	Tulsa
2	Ohio	Cleveland
2	Louisiana	New Orleans
2	Illinois	Springfield
2	Wisconsin	Madison
2	Alabama	Auburn
2	Connecticut	Bridgeport
2	Washington	Olympia
2	North Carolina	Wilmington
2	Arkansas	Little Rock
2	Québec	Montreal
2	Maryland	
1	New York	Buffalo

3

[&]quot;schools and alternative stormwater management" "schools and green stormwater infrastructure"

[&]quot;schools and stormwater retrofits" "green stormwater infrastructure in schoolyards" and "low impact development in schoolyards"

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- 2 Stormwater material lacking GSI approaches I 1 Nothing Relevant
- **GSI** Green Stormwater Infrastructure I **SW** Storm Water I **M** Maintenance I **SY** Schoolyards I **CS** Case Studies

RATING	STATE	СІТҮ	LINK CATEGORY	REFERENCE	REF. NO.	BIBLIOGRAPHY
5	New York	New York City	GSI	http://www.nyc.gov/html/dep/pdf/green_infrastructure/s tormwater_guidelines_2012_final.pdf	1	Department of Environmental Protection, New York City. (July 2012). Guidelines for the design and construction of stormwater management systems. Retrieved from http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf
5	New York	New York City	SW	http://www.dec.ny.gov/docs/water_pdf/swdm2010entire.pdf	2	Center for Watershed Protection. (August 2010). Storm water management design manual. Retrieved from http://www.dec.ny.gov/docs/water_pdf/swdm2010entire.pdf
5	New York	New York City	М	http://www.nyc.gov/html/dep/pdf/green infrastructure/bioswales-standard-designs.pdf	3	Dept. of Environmental Protection, Office of Green Infrastructure, NYC. (August 29, 2014). Standards for green infrastructure. Retrieved from http://www.nyc.gov/html/dep/pdf/green infrastructure/bioswales-standard-designs.pdf
5	New York	New York City		http://www.nyc.gov/html/ia/gprb/downloads/pdf/NYC_Parks&Rec_Schoolyards.pdf	4	Global Partners' Innovation Exchange, NYC. (JULY 8, 2013). Best practice: Converting schoolyards to community playgrounds. Retrieved fromhttp://www.nyc.gov/html/ia/gprb/downloads/pdf/NYC_Parks&Rec_Schoolyards.pdf
5	New York	New York City	CS	http://water.columbia.edu/files/2014/04/Green Infrastructure FINAL.pdf	5	Economides, C. (Spring, 2014). Green infrastructure: Sustainable solutions in 11 cities across the united states. Retrieved from http://water.columbia.edu/files/2014/04/Green_Infrastructure_FINAL.pdf
5	New York	New York City	CS	http://www.treehugger.com/clean-technology/nyc-build-green-playgrounds-stormwater-capture.html	6	Markham, D. (March 14, 2012). NYC to build green playgrounds for stormwater capture. Retrieved from http://www.treehugger.com/clean-technology/nyc-build-green-playgrounds-stormwater-capture.html
5	California	San Francisco	GSI - SY	https://www.educationoutside.org/sites/default/files/docs/ /SFGSA-Resource-Directory-2009.pdf	7	Danks, S., & Cooper, T. (2008). Green schoolyard resource directory: For the san francisco bay area. https://www.educationoutside.org/sites/default/files/docs/SFGSA-Resource-Directory-2009.pdf: San Francisco Green Schoolyard Alliance.
5	California	San Francisco	GSI	http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2778	8	Beaupre, D., et. al. (November 2009). San Francisco Stormwater Design Guidelines, appendix A: BMP factsheets. http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2778: City of San Francisco, San Francisco Public Utilities Commission, Port of San Francisco.
5	California	San Francisco	GSI	http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2779	9	Beaupre, D., et. al. (November 2009). San Francisco Stormwater Design Guidelines. http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2779: City of San Francisco, San Francisco Public Utilities Commission, Port of San Francisco.
5	California	San Francisco	GSI	http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2775	10	Beaupre, D., et. al. (November 2009). San Francisco stormwater design guidelines, appendix D: Vegetation palette. http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2775: City of San Francisco, San Francisco Public Utilities Commission, Port of San Francisco.
5	California	San Francisco	GSI - SY	https://www.educationoutside.org/sites/default/files/docs//SFUSD%20GSY%20Guidelines 2013.pdf	11	Sustainable San Francisco Unified School District. (October 16, 2013). Green school guidelines. https://www.educationoutside.org/sites/default/files/docs/SFUSD%20GSY%20Guidelines_2013.pdf: San Francisco Unified School District.
5	California	San Francisco	GSI	http://www.sfwater.org/index.aspx?page=446	12	San Francisco Public Utilities Commission:. (2015). Stormwater design guidelines links. Retrieved from http://www.sfwater.org/index.aspx?page=446
5	California	San Francisco	GSI	https://www.casqa.org/sites/default/files/BMPHandbooks/BMP NewDevRedev Complete.pdf	13	Camp Dresser & McKee Inc. (CDM) and Larry Walker Associates (LWA). (January 2003). Stormwater best management practice handbook: New development and redevelopment. www.cabmphandbooks.com: California Stormwater Quality Association. doi:https://www.casqa.org/sites/default/files/BMPHandbooks/BMP_NewDevRedev_Complete.pdf

LEGEND

5 - GSI material incorporated with green schoolyard materials I 4 - Well developed GSI guidelines but no Green schoolyards guidelines I 3 - GSI guidelines but not in detail with design elementsI

2 - Stormwater material lacking GSI approaches I 1 - Nothing Relevant

RATING	STATE	СІТҮ	LINK CATEGORY	REFERENCE	REF. NO.	BIBLIOGRAPHY
5	Oregon	Portland	CS	http://www.gnof.org/wp-content/uploads/2013/06/FINAL- Green-Stormwater-Infrastructure-Programs.pdf	14	Greater New Orleans Foundation. (2013). Green stormwater infrastructure programs, policies, & projects from exemplar cities. Retrieved from http://www.gnof.org/wp-content/uploads/2013/06/FINAL-Green-Stormwater-Infrastructure-Programs.pdf
5	Oregon	Portland	GSI	https://www.cleanwaterservices.org/Content/Documents/ Permit/LIDA%20Handbook.pdf	15	Public Education and Outreach Committee, Tualatin Basin Natural Resources Coordinating Committee. (July 2009). Low impact development approaches handbook. https://www.cleanwaterservices.org/Content/Documents/Permit/LIDA%20Handbook.pdf: Clean Water Services.
5	Oregon	Portland	GSI in SY	https://drive.google.com/file/d/0B2vrIMdSVqNEc0FYMnhr NWxxcFE/view	16	Portland Public Schools. (July 1, 2014). Portland public schools: Design guidelines & standards. https://drive.google.com/file/d/0B2vrIMdSVqNEc0FYMnhrNWxxcFE/view: Portland Public Schools.
5	Oregon	Portland	SY	http://www.pps.k12.or.us/files/facilities/LRFP - PDF(1).pdf	17	Portland Public Schools. (May 2012). Long range facility plan. http://www.pps.k12.or.us/files/facilities/LRFPPDF(1).pdf: Portland Public Schools.
5	Oregon	Portland	SY	https://www.portlandoregon.gov/bes/article/464519	18	Environmental Services. (September 2013). Red cinder ecoroof design guidelines: Working for clean rivers. https://www.portlandoregon.gov/bes/article/464519: City of Portland.
5	Oregon	Portland	GSI	http://www.portlandoregon.gov/bes/34598	19	Environmental Services, City of Portland. (2015). Sustainable stormwater management. Retrieved from http://www.portlandoregon.gov/bes/34598
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5	Oregon	Portland	GSI - SY	http://depave.org/	178	Depave. (2015). Home page. Retrieved from http://depave.org/
5	NA	NA	GSI - SY	http://drum.lib.umd.edu/handle/1903/12845	Lit - 2	Jensen, A. P. (2012). Green and blue schools: The use of environmentally sensitive rainwater design at Georgetown Visitation Preparatory School in Georgetown, Washington DC (Plant Science and Landscape Architecture (PLSA)). doi:http://hdl.handle.net/1903/12845
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- 2 Stormwater material lacking GSI approaches I 1 Nothing Relevant

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4	Massachusetts	Boston	GSI	http://www.bwsc.org/ABOUT_BWSC/systems/stormwater _mgt/Stormwater%20BMP%20Guidance_2013.pdf	26	Boston Water & Sewer Commission, & Geosyntec. (January, 2013). Stormwater best management practices: Guidance document. Retrieved fromhttp://www.bwsc.org/ABOUT_BWSC/systems/stormwater_mgt/Stormwater%20BMP%20Guidance_2013.pdf
4	Massachusetts	Boston	SY	http://schoolyards.org/pdf/SYDesignGuide.pdf	27	Boston Schoolyard Initiative. (2013). Schoolyard design guide. Retrieved from http://schoolyards.org/pdf/SYDesignGuide.pdf
4	Massachusetts	Boston	SY	http://schoolyards.org/pdf/OCDesignGuide.pdf	28	Boston Schoolyard Initiative. (2013). Outdoor classroom design guide. Retrieved from http://schoolyards.org/pdf/OCDesignGuide.pdf
4	Massachusetts	Boston	SY	http://citysprouts.org/programs/edible-education/	29	Citysprouts, B.Edible education. Retrieved from http://citysprouts.org/programs/edible-education/
4	Massachusetts	Boston	SY	http://greenschoolyardnetwork.org/	30	Green Schoolyard Network. (September 25, 2011). Top ten reasons to have an outdoor classroom in every schoolyard. Retrieved from http://greenschoolyardnetwork.org/
4	New Zealand	Auckland	GSI	https://cdn.auckland.ac.nz/assets/creative/schools- programmes- centres/transforming%20cities/Greening Cities Report.pd f	31	Boyle, C., Dr. Gamage, G. B., Dr. Burns, B., Dr. Fassman-Beck, E., Dr. Knight-Lenihan, S., Dr. Schwendenmann, L. & Thresher, W. Greening cities, A review of green infrastructure. Retrieved fromhttps://cdn.auckland.ac.nz/assets/creative/schools-programmes-centres/transforming%20cities/Greening_Cities_Report.pdf
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RATING	STATE	СІТУ	LINK CATEGORY	REFERENCE	REF. NO.	BIBLIOGRAPHY
4	Ontario	Toronto	GSI	http://sustainabletechnologies.ca/wp/wp- content/uploads/2013/01/LID-SWM-Guide- v1.0 2010 1 no-appendices.pdf	36	Credit Valley Conservation; Toronto and Region Conservation. (2010). Low Impact Development Stormwater Management Planning and Design Guide. Retrieved from http://sustainabletechnologies.ca/wp/wp-content/uploads/2013/01/LID-SWM-Guide-v1.0 2010 1 no-appendices.pdf
4	NA	NA	SY	https://getd.libs.uga.edu/pdfs/long joy d 200405 mla.pd f	Lit - 4	Long, J. D. (2004). Ecological schoolyards: Connecting to our native landscape (Master of Landscape Architecture).
3 & 4	Arizona	Tucson	GSI	http://watershedmg.org/sites/default/files/greenstreets/G S_manual_FinalforWeb.pdf?sid=1266	37	MacAdam, J. (October 2012). Green infrastructure for southwestern neighborhoods. (Version 1.2). http://watershedmg.org/sites/default/files/greenstreets/GS_manual_FinalforWeb.pdf?sid=1266: Watershed Management Group.
3 & 4	Arizona	Tucson	GSI	http://watershedmg.org/green-streets/resources	38	Watershed Management Group. (2015). Green infrastructure resources. Retrieved from http://watershedmg.org/green-streets/resources
3 & 4	Arizona	Tucson	SY	http://www.azgfd.gov/i e/ee/resources/books/schoolyard habitat.pdf	39	Johnson, L. M., Mielcarek, L., Tompkins, R., Parizek, J., Mayoral-Pena, G., Jablonski, R. & Pinto, R. (2008). Schoolyard habitat design. http://www.azgfd.gov/i_e/ee/resources/books/schoolyard_habitat.pdf: School of Landscape Architecture; College of Architecture, Planning and Landscape Architecture; The University of Arizona.
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2 - Stormwater material lacking GSI approaches I 1 - Nothing Relevant

GSI - Green Stormwater Infrastructure | **SW** - Storm Water | **M** - Maintenance | **SY** - Schoolyards | **CS** - Case Studies

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5 - GSI material incorporated with green schoolyard materials I 4 - Well developed GSI guidelines but no Green schoolyards guidelines I 3 - GSI guidelines but not in detail with design elements I

2 - Stormwater material lacking GSI approaches I 1 - Nothing Relevant

GSI - Green Stormwater Infrastructure | SW - Storm Water | M - Maintenance | SY - Schoolyards | CS - Case Studies

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GSI - Green Stormwater Infrastructure I **SW** - Storm Water I **M** - Maintenance I **SY** - Schoolyards I **CS** - Case Studies

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