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Introduction

Purpose

The New York State Department of Environmental Conservation (DEC) issued a Municipal Separate Storm Sewer System (MS4) permit to the City of New York on August 1, 2015, pursuant to the federal Clean Water Act. The purpose of the MS4 permit is to manage urban sources of stormwater runoff to protect the overall water quality and improve water quality in impaired waters.

As required by Part III.C of the permit, the City must develop an enforcement response plan (ERP), which sets out the potential responses to violations, as needed to achieve compliance with the following programs (Permit Parts IV.D, IV.E, IV.F and IV.H, respectively):

(1) Illicit Discharge Detection and Elimination (IDDE);

(2) Construction Site Stormwater Runoff Control;

(3) Post-Construction Stormwater Management; and

(4) Industrial and Commercial Stormwater Sources.

This document describes the City's enforcement response protocol for investigating, documenting and enforcing against illicit discharges and potential illicit discharges into the MS4 as well as violations of MS4-related rules and regulations, in order to ensure compliance with the City's MS4 permit. As the NYC Department of Environmental Protection (DEP) will administer the above-referenced programs on behalf of the City, it will implement this plan in cooperation with other city agencies, including the Environmental Control Board (ECB), and the Departments of Buildings (DOB), Small Business Services (SBS) and City Planning (DCP).

Approach

DEP has based its approach on progressive enforcement, as required by the permit Part III.C.1, addressing "persistent non-compliance, repeat or escalating violations, or incidents of major environmental harm" through "progressively stricter responses," taking into consideration the violator's responsiveness and history of violations as well as the severity and type of violation. Enforcement responses include verbal warnings, written notices of non-compliance (NON), written notices of violation (NOVs or summonses), citations with civil and administrative penalties, criminal penalties, stop work orders, cease and desist orders, and withholding of plan approvals or permits.

Definitions

Authorized Inspection Agent. The term "authorized inspection agent" means an individual authorized pursuant to a contract entered into by DEP to conduct inspections on behalf of DEP.

Chronic Violator. The term "chronic violator" means a person or facility that has continuing or repeated violations of the applicable stormwater requirements.

Commissioner's Order. The term "Commissioner's Order" means any order issued by the Commissioner of Environmental Protection that may be necessary for the enforcement of the rules for use of and discharges to the MS4.

Covered development project. The term "covered development project" means development activity that involves or results in an amount of soil disturbance within the MS4 area greater than or equal to one acre. Such term includes development activity that is part of a larger common plan of development or sale involving or resulting in soil disturbance within the MS4 area greater than or equal to one acre or as established pursuant to these rules. Such term shall include all development activity within the MS4 area that requires a SWPPP pursuant to the New York State Department of Environmental Conservation (NYSDEC) construction general permit.

Department (DEP). The term "Department" or "DEP" means the New York City Department of Environmental Protection.

Industrial stormwater source. The term "industrial stormwater source" means any premises or facility that is subject to the MSGP.

Multi Sector General Permit (MSGP). The term "MSGP" means the NYSDEC State Pollutant Discharge Elimination System (SPDES) Industrial Stormwater Multi-Sector General Permit (MSGP), GP-0-17-004 or its successor, which covers discharges of stormwater to surface waters of the state from industrial activities.

Notice of Non-Compliance (NON). The term "NON" means a warning that a condition exists or an activity is being conducted that violates or may violate the rules for use of and discharges to the MS4.

Notice of Intent (NOI). The term "Notice of Intent" or "NOI" means the document submitted to NYSDEC to obtain coverage under the NYSDEC construction general permit or the MSGP.

Notice of Termination (NOT). The term "Notice of Termination" or "NOT" means the document submitted to NYSDEC to terminate coverage under the NYSDEC construction general permit or the MSGP.

Notice of Violation (NOV). The term "Notice of Violation" or "NOV" means a civil summons returnable before the ECB.

NYSDEC Construction General Permit (CGP). The term "Construction General Permit" or "CGP" means the NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity, GP-0-15-002 or its successor. The owner or developer of a construction project that will involve soil disturbance of one or more acres of soil must obtain coverage under the CGP before commencing any construction activity.

Stormwater Construction Permit. The term "Stormwater Construction Permit" means a permit issued by the Department authorizing development activity on land on which there is a covered development project in accordance with an approved stormwater pollution prevention plan (SWPPP).

Stormwater Maintenance Permit. The term "Stormwater Maintenance Permit" means a permit issued by DEP where maintenance of post-construction stormwater management facilities by owners of real property is required.

Stormwater Pollution Prevention Plan or SWPPP. The term "stormwater pollution prevention plan" or "SWPPP" means (i) when used in connection with a covered development project, a plan for controlling stormwater runoff and pollutants during construction and, where required by DEP's rules, after construction is completed, or (ii) when used in connection with an industrial stormwater source, a plan, which is required by the MSGP, for controlling stormwater runoff and pollutants.

Identifying/Investigating Noncompliance

The City may become aware of stormwater non-compliance or violations in a number of ways. Permit-required inspections or monitoring may reveal non-compliance: the City's programs include periodic or complaint-based compliance inspections of facilities subject to Construction/Post-Construction and Industrial/Commercial programs and routine monitoring and inspections to support the IDDE program (as authorized by Ad Code §24-524(k) and Ad Code §24-589), as required by the MS4 permit and DEP's WWTP SPDES permits. Staff of other city agencies may also identify illicit connections or illicit discharges during the course of performing their regular job functions. Finally, there may be complaints from the public. This section discusses the City's plans for inspections in each of the three regulatory programs required by the MS4 permit: IDDE, Construction/Post-Construction, and Industrial/Commercial.

IDDE

DEP may receive a complaint concerning an illicit connection or discharge through the City's 311 system or DEP may observe an illicit discharge during the course of operation. When one of these mechanisms triggers an IDDE investigation, DEP conducts appropriate in-sewer and/or aboveground inspection(s) to identify the source of dry weather discharge/POCs entering the MS4, consistent with applicable law, and takes necessary enforcement action to require abatement of the discharge. When another City agency identifies an illicit connection or discharge on their property, the agency is responsible for tracking, eliminating, and reporting it.

Construction/Post-Construction

The MS4 permit Parts IV.E.1(h) and (i) and IV.F.1(g) require DEP to address stormwater runoff to the MS4 from new construction activities and new development and redevelopment projects that result in soil disturbance of 1 acre or more. DEP inspects sites that have received SWPPP approval and permits under the DEP MS4 construction/post-construction permitting, inspection and enforcement program.

With respect to projects covered by the CGP with an active NOI at the time of SWMP approval and under active construction, DEP performs inspections triggered by complaints to DEC or the City, and refers violations to DEC for enforcement action. Other inspections in response to complaints may identify projects that are not covered by the CGP but may require coverage; these projects will also be referred to DEC for follow-up action.

With respect to Covered Development Projects, DEP uses announced and unannounced inspections, in accordance with applicable law, to determine whether projects have obtained appropriate permits under DEP's program and are complying with their SWPPPs. DEP prioritizes inspection sites that are most likely to have an adverse impact on water quality, based on the amount of exposed soil, the location of the site relative to a water body and the past performance of the responsible parties.

With respect to developed sites, DEP performs inspections based on complaints of discharges entering City sewers. Following the completion of construction, DEP performs, on a complaint basis and periodically, compliance verification inspections of sites with NYC stormwater maintenance permits to determine whether the owners are complying with their Stormwater Maintenance Permits and maintaining their stormwater facilities.

Industrial Stormwater Sources

The MS4 permit Part IV.H.3 requires the City to inspect facilities subject to the MSGP for stormwater discharges from industrial activities. Those facilities are prioritized for inspection according to the following criteria that characterize their potential for POC discharges or other water quality impacts to impaired waters: POC discharges to impaired waters; nature of on-site pollutant sources; proximity to a waterbody; violation history of the facility; and inspection reports and sampling results. DEP inspects "high" priority facilities annually; "medium" priority, at least once every three (3) years; and "low" priority at least once every five (5) years. DEP re-inspects within one year, facilities that receive a written violation.

Facility inspection will include review of the facility's compliance with its SWPPP. Non-compliance with the provisions of the SWPPP may result in enforcement action.

Enforcement Responses

The City has the legal authority to utilize any combination of the following enforcement measures, and to escalate enforcement responses when necessary:

1. Verbal Warnings are "consultative" in nature and specify the non-compliance and required corrective action.
2. Written Notices explain the nature of the violation and a deadline for taking corrective action.
   - » Commissioner's Orders (Ad Code §24-524(a) and Ad Code §24-581)
   - » NONs with Commissioner's Order
   - » NOVs that can incur civil penalties ((Ad Code §24-524(f) and Ad Code §24-585)) and may be accompanied by Commissioner's Orders that require cleanup and/or abatement of discharges,
3. DEP may issue stop work orders for construction/post-construction (Ad Code §24-558(a)), when DEP finds that development activity is in violation of chapter 5-a of the Administrative Code, DEP's implementing rules, the permit and/or the SWPPP and that the specified work being performed has or could have an effect on the discharge of pollutants, stormwater runoff volume or stormwater runoff velocity. In such a case, the specific work must cease (except work authorized or required by the Commissioner to ensure public safety or to stabilize the construction site, such as activities directed at cleaning up, abating discharge, and installing appropriate control measures).
4. Cease and Desist Orders – DEP (Ad Code §24-524(b) and Ad Code §24-582(a)) and ECB (Ad Code §24-524(d) and Ad Code §24-583(a))
5. Halting or preventing a discharge (e.g., by terminating water supply to a facility) (Ad Code §24-582(c) and Ad Code §24-583(b))
6. Withholding plan approvals or revoking a permit (construction/post-construction) (Ad Code §24-557)
7. Assessing recovery and remediation costs (Ad Code §24-524(h) and Ad Code §24-587)
8. Criminal penalties (DEP may refer to DA or federal prosecutors for prosecution) (Ad Code §24-524(g) and Ad Code §24-586).

Responsibilities of Enforcement Personnel

Employees of DEP and Authorized Inspection Agents have the following responsibilities:

- Reviewing, investigating, and tracking instances of noncompliance;
- Identifying suspected violations during facility inspections and sampling activities;
- Determining appropriate enforcement responses and ensuring timely action;
- Issuing verbal warnings, Orders, NOVs (with recommended penalties), and compliance schedules.

Overview of Enforcement Responses

Enforcement personnel consider a number of factors when determining the proper enforcement response:

- Severity of the violation, including duration, type of pollutant and quantity of pollutants,
- Effect of the violation on receiving water or public health and safety,
- Effect of the violation on City infrastructure, and
- Violator's history of violations and enforcement actions.

All enforcement responses will specify the nature of the violation and the required corrective action as well as a deadline

for completing that action. In some instances, DEP may initially issue a verbal warning or an NON, which may be accompanied by a Commissioner's Order. When there is continued non-compliance or the violator fails to timely take corrective action, DEP will respond with more severe enforcement responses such as civil summonses with fines and Commissioner's Orders.

When a condition exists in violation of the relevant provisions of the Administrative Code or DEP's implementing rules or orders, and such condition creates or may create an imminent danger to the sewer system or to the public health or to the life or safety of persons, the Commissioner may issue a cease and desist order. If there is continued or knowing violation of the relevant provisions of the Administrative Code or ECB's implementing rules or orders, or if ECB finds that the violation presents or may present a danger to the environment or threatens to interfere with the operation of the sewer system, ECB, after notice and the opportunity for a hearing, may issue a cease and desist order. If an entity does not comply with an order issued by DEP or ECB within the time specified, DEP may act to halt or prevent such discharge by:

1. sealing, blocking or otherwise inactivating any equipment, facility, or device;
2. terminating the water supply to the premises;
3. sealing, blocking or otherwise inactivating any private sewer or drain emptying directly or indirectly into the sewer system; or
4. any other means or method that is reasonable under the circumstances.

In addition, failure to comply with a Cease and Desist Order may result in the NYC Corporation Counsel's maintaining an action to compel compliance with or restrain by injunction the violation of the Order (Ad Code §24-524(e) and Ad Code §24-584).

Any violation of the Administrative Code, Rules or an Order may result in a summons with civil penalties not to exceed $10,000 for each violation (each day of a continuing violation constitutes a separate offense). The City may issue follow-up summonses with escalating fines. Continued and knowing violation of the Administrative Code, Rules or an Order may result in referral for criminal investigation. In addition, for any violation of the Administrative Code, Rules or an Order, an entity may be liable to the City for any expense (e.g., costs for response, remediation and emergency services) or any other loss or damage suffered by the City by reason of such violation.

Illicit Discharge Detection and Elimination (IDDE)

The MS4 permit Part IV.D requires NYC to develop, implement and enforce a program to detect and eliminate illicit discharges and illicit connections to the MS4. Working within the parameters of the MS4 permit, section 24-520.1 of the Administrative Code prohibits any direct or indirect discharge into the MS4 that is not composed entirely of stormwater, except "allowable non-runoff," as defined in DEP's rules. DEP's rules define "allowable runoff" as non-stormwater discharges associated with firefighting activities or as otherwise authorized by the Commissioner and provide a process by which a discharger may obtain approval for a non-stormwater discharge, consistent with the permit's requirements.

Enforcement against an entity responsible for an unauthorized non-stormwater discharge that the DEP Commissioner has not approved will be subject to enforcement as delineated in Section IV.B above and penalties as delineated in 48 RCNY section 3-123.

Construction Site Stormwater Runoff Control and Post-Construction Stormwater Management

MS4 permit Parts IV.E and F require NYC to develop, implement and enforce a program, which addresses stormwater runoff from construction activities on new development and redevelopment projects that result in a land disturbance of greater than or equal to one acre.

DEP requires a Stormwater Construction Permit for any development activity on a covered development project located

in the MS4 area, and a Stormwater Maintenance Permit for a covered development project that requires a SWPPP that includes post-construction stormwater management facilities.

Generally, enforcement proceeds as detailed above in Section IV.B. However, an additional measure available to DEP under the Construction/Post-Construction program is the Stop Work Order.

Industrial and Commercial Stormwater Sources

The MS4 Permit requires NYC to address stormwater discharges from industrial sources in the separately-sewered portions of the City. The permit also requires NYC to inspect other facilities, including commercial entities, to determine whether they generate significant contributions of pollutants to stormwater discharges.

DEP will maintain and update every 5 years an inventory of all industrial and commercial facilities that could discharge pollutants of concern in stormwater to the MS4. DEP will inspect the MSGP-permitted facilities to determine whether they are complying with the MSGP and their SWPPPs.[1] The MS4 permit requires the City to conduct enforcement activities as necessary to require compliance with the MSGP.

Generally, enforcement proceeds as detailed above in Section IV.B. However, an additional measure available to DEP under the Construction/Post-Construction Program is the Stop Work Order.

Enforcement Tracking

As required by Part III.C.2 of the MS4 permit, DEP tracks instances of noncompliance through an online database. The database documents the following:

- Name of owner/operator of facility or site of violation
- Location and type of stormwater source (i.e., construction project, industrial facility)
- NOV number or case identification number
- Description of violation
- Required schedule for returning to compliance
- Description of enforcement response used, including escalated responses if repeat violations occur or violations are not resolved in a timely manner
- Accompanying documentation of enforcement response (e.g., notices of non-compliance, notices of violation)
- Any referrals to different Departments or agencies
- Date violation was resolved

Recidivism Reduction

DEP will identify chronic violators of applicable stormwater requirements in order to reduce the rate of non-compliance recidivism. The MS4 permit defines a “chronic violator” as a “person or facility that has continuing or repeated violations of the applicable stormwater requirements.”

1 DEP will also inspect unpermitted industrial and commercial facilities in the inventory to provide NYSDEC the data necessary to determine whether such facilities require MSGP permitting or an individual SPDES permit.

DEP documents inspection results for these chronic violators and implements an increased inspection frequency or other disincentives. Examples of these measures include summonses with fines (up to $10,000 per day per violation), cease and desist orders, referral for civil action, and/or referral for criminal investigation.

Abbreviations

DEC: New York State Department of Environmental Conservation

DEP: New York City Department of Environmental Protection

ECB: Environmental Control Board

ERP: Enforcement Response Plan

IDDE: Illicit Discharge Detection and Elimination

MS4: Municipal Separate Stormwater Sewer System

MSGP: Multi-Sector General Permit

NON: Notice of Non-Compliance

NOV: Notice of Violation

OATH: Office of Administrative Trials and Hearings

SPDES: State Pollutant Discharge Elimination System

SWPPP: Stormwater Pollution Prevention Plan

Deliverables in the NYC MS4 Permit and Schedule			
Deliverable	**Permit Schedule**	**Status**	**Implemented**
II.B Impaired Waters			
Development of draft of land use coefficients and pollutant removal efficiencies for practices required for developers as part of pollutant load analysis (Part II.B.1.d)	February 1, 2018	Complete	✓
II.B Legal Authority			
Description of existing legal authority to control discharges to the MS4 (Part III.B.1.a)	February 1, 2016	Complete	✓
Description of the City's Legal Authority to Control Discharges to the MS4 (Part III.B.1.b)*	August 1, 2017	Complete	✓
III.C.E Stormwater Program Administration			
Notification to entities regulated under MS4 permit (Part III.E)	November 1, 2018	After SWMP Submittal	
IV. Stormwater Management Program Plan			
Progress Reports on the development of the SWMP Plan, including public involvement/participation components (Part IV. Introduction)	August 1, 2016	Complete	✓
	August 1, 2017	Complete	✓
Submission of the complete draft SWMP Plan, including all components identified in Parts II.B, III.A through D, and IV. Introduction and IV.A through J (Part IV. Introduction)	August 1, 2018	Complete	✓
IV. C Mapping			
Preliminary map with information completed to date (Part IV.C.2)	August 1, 2018	Complete	✓
Final map with information outlined in Part IV.C.1 (Part IV.C.2)	August 1, 2020	After SWMP Submittal	
Updated MS4 Drainage Map (Part IV.C.3)	Every 5 years after EDP	After SWMP Submittal	
IV.D Illicit Discharge Detection and Elimination			
Updated outfall list (Part IV. D.2)	Every year after EDP	Ongoing	✓
Illicit discharge trackdown (Phase I) schedule (Part IV.D.4)	Within 30 days of discovery or discharge	Ongoing	✓
Illicit discharge abatement program (Phase II) schedule (Part IV.D.4)	On or before end date of Phase I schedule	Ongoing	✓
Report of the location and ownership of illicit discharges to the MS4 where the MS4 discharges to waterbodies that are shown to have over 200 colonies/100 ml of fecal coliform and a schedule to eliminate those discharges (Part IV.D.5)	August 1, 2018 and every year thereafter	Complete	✓
Report on the unauthorized non-stormwater discharges to NYC's MS4 or CSO outfalls downstream of the regular (Part IV.D.5)	August 1, 2018 and every year thereafter	Complete	✓
IV.F Post-Construction Stormwater Management			
Establish an annually update an inventory of post-construction stormwater management practices within the MS4 storm seweshed area (Part IV.F.1.e)	August 1, 2018 and every year thereafter	Complete	✓

* The City will certify that it has adequate legal authority pursuant to Part III.B. upon DEP's adoption of final rules to implement the regulatory programs authorized under Chapter 5-A of the Administrative Code.

IV.G Pollution Prevention/Good Housekeeping for Municipal Operations and Facilities			
Perform an initial self-assessment of highest priority municipal operations and facilities (Part IV.G.1.d.i)	August 1, 2018	Complete	✓
IV. H Industrial and Commercial Stormwater Sources			
Update inventory of industrial/commercial facilities that are possible sources (Part IV.H.1.a.i)	Every 5 years after preparation of initial inventory	After SWMP Submittal	
Develop interim reports on the development of the SPDES MSGP inspection program (Part IV.H.3.a.i)	August 1, 2016	Complete	✓
	August 1, 2017	Complete	✓
Submit certification that training to inspectors to conduct industrial stormwater facility inspections has been completed (Part IV.H.4)	Every 2 years after SPDES MSGP inspection program approval	After SWMP Submittal	
IV.I Control of Floatable and Settleable Trash and Debris			
Submit certification that an interim floatable and settleable trash and debris reduction media campaign has been developed with implementation schedule (Part IV.I.3)	November 1, 2015	Complete	✓
Submit draft work plan for determining the amount of flotable and settleable trash and debris discharged, including land-based sources, from the MS4 to waterbodies listed as impaired for floatables for NYSDEC review and approval (Part IV.I.3)	August 1, 2017	Complete	✓
Submit a schedule for loading rate study for floatable and settleable trash and debris from the MS4 to waterbodies impaired for floatables in the MS4 areas (Part IV.I.3)	3 months after final work plan approval	After Work Plan Approval	
Commence study to determine loading rate of floatable and settleable trash and debris from the MS4 to waterbodies impaired for floatables in the MS4 areas (Part IV.I.3)	2 years after final work plan approval	After Work Plan Approval	
IV.J Monitoring and Assessment of Control			
Submit certification that Program has been implemented (Part IV.J.3)	August 1, 2020	After SWMP Submittal	
IV. M, IV.N, & IV.O Annual Reporting			
Public Presentation of draft annual report (Part IV.B.4.a)	Ever July 1st after every annual reporting year	After SWMP Submittal	
Annual Report Submission (Part IV.M) and MCC form (Part IV.N)	Every September 30th after every annual reporting year	After SWMP Submittal	
Annual effectiveness assessment (included in Annual Reporting Part IV.M.4.j.i) and associated review of activities or control measures (Part IV.M.4.j.iii)	4 years after EDP and annually thereafter	After SWMP Submittal	
Apply for Permit Renewal (Part IV.O)	180 days prior to permit expiration	After SWMP Submittal	

		Authority and Administration						
Responsible Agencies	Key Personnel Include:	Program Administra-tion	Legal Authority	Enforce-ment Respsonse Plan	Fiscal Analysis	Reliance on Third Parties	Public Education and Outreach	Public Involvement and Partici-pation
City Law	Deputy Chief - Environmental Law Division	Yes	Lead	Yes	Yes	Lead	Yes	Yes
DCAS	Deputy Chief of Staff	No	No	No	Yes	Yes	No	Yes
DCP	City Planner	No	No	No	No	Yes	No	Yes
DDC	Project Executive - Sustainable Infrastructure	No	No	No	Yes	Yes	Yes	Yes
DEP	Stormwater Management Program Coordinator	Lead	Yes	Lead	Lead	Yes	Lead	Lead
DOB	Administrative Architect	No	No	No	No	Yes	No	Yes
DOC	Director of Compliance - Environmental Health Unit	No	No	No	Yes	Yes	No	Yes
DOE	Water Treatment Manager	No	No	No	Yes	Yes	Yes	Yes
DOHMH	Chief of Environmental & Water Sciences	No	No	No	Yes	Yes	No	Yes
DOT	Senior Executive Director	No	No	No	Yes	Yes	Yes	Yes
DPR	MS4 Project Coordinator	No	No	No	Yes	Yes	Yes	Yes
DSNY	Director, Regulatory Compliance and Career Development	No	No	No	Yes	Yes	Yes	Yes
FDNY	Facilities Compliance Coordinator	No	No	No	Yes	Yes	No	Yes
NYPD	Environmental Coordinator	No	No	No	Yes	Yes	No	Yes
SBS	Executive Director	No	No	No	Yes	Yes	No	Yes

MS4 Permit

Stormwater Management Program

Mapping	IDDE	Construction and Post Construction Controls	PP/GH	Industrial/ Commercial Sources	Control of Floatable and Settle-able Trash and Debris	Monitoring and Assessment	Special Conditions for Imparied Waters	Record-keeping and Reporting
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	No	Yes	No	No	No	No	Yes
Yes	No	Yes	No	No	No	No	No	Yes
No	Yes	No	Yes	No	No	No	No	Yes
Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead
No	Yes	Yes	No	No	No	No	No	Yes
Yes	Yes	No	Yes	No	No	No	No	Yes
Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
No	Yes	No	Yes	No	No	Yes	No	Yes
Yes	Yes	No	Yes	No	Yes	No	No	Yes
Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Yes	Yes	No	Yes	No	No	No	No	Yes
Yes	Yes	No	Yes	No	Yes	No	No	Yes
Yes	Yes	Yes	Yes	No	No	No	No	Yes

The MS4 Permit requires the City to prepare an analysis of the expenditures necessary to meet the permit requirements during the five-year permit term. This appendix provides this information. Specifically, part III.D.2 of the MS4 permit requires:

> [By August of 2018] the Permittee must conduct an analysis of the capital and operation and maintenance expenditures necessary to meet the requirements of this permit during the permit term, including any development, implementation, and enforcement activities required. The analysis must include a description of the source of funds that are proposed to meet the necessary expenditures, including legal restrictions on the use of such funds.

I. Overview

A. Program Estimates

In accordance with Part III.D.2 of the MS4 permit, New York City (City) has conducted an analysis of the expenditures necessary to meet the MS4 permit requirements during this permit term (2015-2020). Overall, the City expects to have incurred approximately $87,393,111 in expenses from the Expense Budget and $9,905,860 from the Capital Budget between August 2015 and August 2020 for development, implementation, and enforcement of programs to ensure compliance with the permit. For the spending that has been incurred to date, the City's budget for each year has included sufficient funds to cover expense for the corresponding year.

This estimate focuses on costs incurred primarily for the purposes of compliance with the MS4 permit. It does not include certain ongoing City functions and programs that are related to MS4 programs but exist independently of the Permit's mandate. For example, this estimate does not include DCAS's inventory of City facilities, which may support mapping or other programs included in the SWMP but predates the Permit and is independently required under the City Charter. Street sweeping is another example of a program that the City funds that supports the MS4 program, but which is implemented for independent purposes and not included in the total estimated costs. Similarly, it does not consistently include routine maintenance activities and equipment costs that may also qualify as Pollution Prevention and Good Housekeeping (PP/GH). Additionally, the estimate does not include the cost of certain professional and administrative services that facilitate MS4 compliance or the salaries of agency staff whose work incidentally supports MS4 compliance but is performed primarily for purposes unrelated to the MS4 program. For instance, it does not include citywide services and resources provided by the Office of Management and Budget, the New York City Law Department, or the Office of Administrative Trials and Hearings, which have provided and will continue to provide assistance in MS4 program development, implementation, and enforcement. Moreover, this estimate does not include all staff and overhead costs where agencies are expanding the responsibilities of existing staff to include work related to the SWMP. Finally, additional expenses may arise as the City implements the program, beyond those included here, which are currently unknown.

Estimated total expenses over the five year permit term (2015-2020):

Capital Funds	Expense Funds
9,905,860	87,393,111

B. Sources of Funds

To support the MS4 program, the City relies on both capital and expense funds. Each of these sources has restrictions on the types of projects for which the funds can be used.

1. Expense Budget

The Expense Budget funds City government operating costs, including the operation of the City's water and sewer systems. These funds are used for two different types of expenses: Personnel Services, which include salaries and fringe benefits for government employees, and Other Than Personnel Services, which include goods, supplies, certain consultant and contractor fees, and equipment. The Expense Budget is funded by tax revenue collected by the City, which may be used for any municipal purposes, and by utility rates for water and wastewater services, which is to be used solely for the City's water and sewage system.

A large portion of the funds used to develop, implement, and enforce the MS4 program will be drawn from the Expense Budget.

2. Capital Budget

The Capital Budget provides funding for the construction and rehabilitation of the City's infrastructure. Capital expenses relate to the design, construction, or improvement of long-lived assets including schools, roads, and parks. Capital projects can be implemented using in-house or consultant resources, and these expenses, including certain consultant fees (e.g., construction management), would be funded by the Capital Budget. Funds from the Capital Budget can be used only for projects that have a value of at least $35,000 and a period of usefulness of at least five years. The Capital Budget is funded by proceeds from, the New York City Municipal Water Finance Authority (Water Authority), the New York City Transitional Finance Authority, and City general obligation bonds. As with expense funds, the proceeds of Water Authority bonds may be used only in connection with the water and sewer systems, while other bonds may be used for other municipal purposes. The Capital Budget is also funded by grants from federal, State and private sources. These federal grants include funds granted to the City for reconstruction by the Federal Emergency Management Agency (FEMA).

C. Budget Process

In order to secure the resources needed to fund the MS4 program, City agencies must undergo a formal budget process for each fiscal year, which includes the following steps:

» **Step 1: Preliminary Budget**

Each January, the Mayor presents a preliminary budget—an outline of his priorities and goals for the City. The City Council then follows a process to ensure that the budget reflects the priorities of New Yorkers in all 51 Council Districts.

» **Step 2: Council Analysis & Hearings**

From March to April, the Council analyzes the Mayor's preliminary budget and holds a series of public hearings to identify specific concerns through conversations with residents, advocates, and City agencies.

» **Step 3: Formal Response**

The Council formally responds to the Mayor's preliminary budget. This includes a summary of concerns expressed during the hearings and recommendations to address those concerns.

» **Step 4: Executive Budget & Hearings**

In April, the Mayor releases the Executive Budget, an updated proposed budget based on the Council's response. Again, the Council analyzes this budget and conducts a second round of hearings targeted at outstanding issues.

» **Step 5: Adopted Budget**

Through May and June, the Council and the Mayor negotiate adjustments to the Executive Budget, resulting in an agreement known as the Adopted Budget. This agreement must be reached before July 1, the beginning of the next fiscal year. No budget may be adopted without agreement reached between the Council and the Mayor.

The Mayor's Office of Management and Budget (OMB) is the City government's chief financial agency. OMB administers both the Expense Budget and Capital Budget for the City. This process has already taken place for the expenses that have been procured, and will take place for future expenses.

II. Funding Development, Implementation, and Enforcement Activities

Below are examples of ways in which the City is using the resources described above to develop, implement, and enforce the MS4 Program.

A. Development of the SWMP

The City's SWMP development efforts included coordination among City agencies as well as with stakeholders throughout the process. As described in Chapter 1 of the SWMP, the New York City Department of Environmental Protection (DEP) has been charged with coordinating efforts among City agencies to ensure the City's compliance with the MS4 Permit. In so doing, over the last four years, DEP has hired a new team to work specifically on the MS4 program. In addition, DEP has retained a consultant to support the planning and development of the program.

As agency commitments are clarified in conjunction with the development of the SWMP programs, a number of other City agencies are hiring staff to coordinate their compliance activities. The costs of those dedicated staff are included in the overall cost estimates provided above. However, as noted, salaries of agency staff whose work supports MS4 compliance but is performed primarily for purposes unrelated to the MS4 program are not generally included here.

B. Implementation of major SWMP programs

1. Public Education and Outreach

Costs associated with public education on the impact of stormwater on waterbodies will be paid for, in large part, with existing resources from a number of City agencies. In addition, DEP retained consultants for support with media campaigns, including "Don't Trash Our Waters," which focused on behavior change, and education/outreach pilots such as the MS4 outfall signage effort in Coney Island Creek.

A number of other agencies will work with DEP on education and outreach. For example, the New York City Parks Department (DPR) has assigned an MS4 Education and Outreach Coordinator to conduct internal and external trainings. In addition, DPR is developing and implementing educational activities with the support of other City agencies.

For more information on the Public Education and Outreach program see Chapter 2 of the SWMP.

2. Mapping

The development of the MS4 map pursuant to the permit will require additional City resources across a number of different agencies. For example, the New York City Police Department (NYPD) has procured necessary

software for the mapping requirement, DPR is developing a contract to determine storm sewer flow paths on DPR property, and the New York City Department of Citywide Administrative Services (DCAS) plans to hire a planner to help the agency fulfill its obligations under the permit. Some of the other agencies with mapping obligations under the permit will use existing in-house resources to map the necessary infrastructure and drainage areas. In addition, the New York City Department of Transportation (DOT) and DEP are engaging consultants to support the City's effort to map MS4 infrastructure of City-owned arterial highways.

For more information on the Mapping program see Chapter 4 of the SWMP.

3. Construction Site Stormwater Runoff Control and Post-Construction Stormwater Management

To administer the new regulatory program required under the MS4 Permit for construction and post-construction controls, DEP is hiring staff to create a new stormwater permitting group within DEP. This group will review and approve SWPPPs; issue permits for construction projects and for maintenance of post-construction stormwater management practices; and perform inspections of construction and post-construction sites. DEP is also developing a design manual to address City-specific requirements and preferred practices for covered development projects.

City agencies, like regulated private entities, will be responsible for developing SWPPPs, obtaining permits, installing and maintaining both erosion controls during the construction process and post-construction stormwater management practices.

For more information on the Construction and Post-Construction program see Chapter 6 of the SWMP.

4. Pollution Prevention and Good Housekeeping

DEP engaged a contractor to develop assessment and prioritization procedures for facility/operations along with one-page stormwater control measure (SCM) guides that cover a wide range of work activities conducted by City staff. In addition, DEP has retained a consultant to conduct initial facility stormwater engineering assessments to confirm the priority assignment for each City facility based on pollution potential; develop assessment reports including identification of structural and non-structural best management practices, procedures and policies that will be implemented to reduce or prevent the discharge of pollutants of concern; and provide initial pollution prevention training to agency facility personnel.

A number of agencies already incorporate stormwater control measures at their facilities as well as green infrastructure (e.g., vegetated swales), and some will be enhancing their stormwater control measures as part of the MS4 program. For example, DPR is developing an Environmental Service Contract and a separate budget through its Facilities Management Division, to fund initial upgrades of its operations and maintenance procedures. In addition, DPR is hiring 5 cleaning crews to undertake periodic system-wide catch basin maintenance on DPR property. DSNY will be hiring a compliance team to develop appropriate operation and maintenance procedures for each facility, to ensure all staff are appropriately trained and to do required reporting. In addition, DSNY will hire auditors to assist facilities with compliance efforts and to provide continued support.

For more information on the Pollution Prevention and Good Housekeeping program see Chapter 7 of the SWMP.

5. Industrial and Commercial Stormwater Sources

The MS4 Permit requires the City to prepare and maintain an inventory of all industrial and commercial sites/sources within the MS4 area. DEP's costs to administer this new inspection and enforcement program include hiring two project managers and a five-year contract with consultants who will inspect publicly and privately-owned facilities covered by the Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activities (MSGP) and assess unpermitted facilities in the inventory that may need to apply for coverage under a SPDES permit. The consultant is also supporting DEP in developing the program's standard operating procedures and checklists that are going to be used during inspections.

Most other agencies that own or operate industrial facilities that are covered by the MSGP will retain MSGP coverage, so they will not incur additional costs.

For more information on the Industrial and Commercial Stormwater Sources program see Chapter 8 of the SWMP.

6. Control of Floatables and Settleable Trash and Debris

DEP engaged a consultant to support DEP in determining the floatable loading rate from the MS4. The loading rate will quantify the amount of trash and debris discharged from the MS4 over a period of time and will be used to inform future programs.

For more information on the Control of Floatables and Settleable Trash and Debris program see Chapter 9 of the SWMP.

7. Monitoring and Assessment of Controls

DEP hired a consultant to assist in the development and implementation of phase one of the monitoring program. The consultant will help DEP with, among other things, data collection that will be used to determine whether there is any correlation between land use type and pollutant loadings. Analysis of the phase one data will be used to develop phase two of the monitoring program, and may aid in targeting pollutant reduction measures and practices to help meet water quality goals for a particular land use type.

For more information on the Monitoring and Assessment of Controls program see Chapter 10 of the SWMP.

8. Special Conditions for Impaired Waters

DEP has retained a consultant to support the development of technical tools that will be used to ensure that the City is in compliance with its permit obligations related to impaired waters without Total Maximum Daily Loads (TMDLs).

Other agencies will utilize construction contracts to implement additional requirements for Priority MS4 Waterbodies. Funding requirements will be developed at the commencement of specific identified upgrades.

For more information on the Special Conditions for Impaired Waters program see Chapter 11 of the SWMP.

C. Enforcement for the Three Regulatory Programs

1. Illicit Discharge Detection and Elimination

The Illicit Discharge Detection and Elimination (IDDE) program is a robust citywide program that DEP has administered for a number of years. The program covers all City sewers, both combined and separate. The City does not expect to incur any additional enforcement costs as a result of the requirements imposed by the MS4 permit. However, as the MS4 program develops, including the monitoring and public outreach portions of the program, reporting of illicit discharges may increase the number of investigations needed, which would require an increase in the funds expended by the City on this program.

For more information on the IDDE program see Chapter 5 of the SWMP.

2. Construction Site Stormwater Runoff Control and Post-Construction Stormwater Management

As described above, the Construction and Post-Construction program will require DEP to hire an entirely new enforcement team. DEP hired a director for the new enforcement team and will incur the costs of hiring new inspectors and support staff, purchasing equipment for inspectors including safety equipment and vehicles, and securing office space.

For more information on the Construction and Post-Construction program see Chapter 6 of the SWMP.

3. Industrial and Commercial Stormwater Sources

As noted above, pursuant to the MS4 permit, DEP will be responsible for inspections and enforcement at publicly and privately-owned MSGP-covered facilities in the MS4 area. Through the program, DEP will also assess unpermitted facilities to determine their potential need for SPDES permit coverage. In order to comply with these permit requirements, DEP has procured a 5-year contract with a consultant to conduct the initial round of inspections at both permitted and unpermitted sites, and DEP is in process of hiring two project managers to oversee the consultants.

For more information on the Industrial and Commercial Stormwater Sources program see Chapter 8 of the SWMP.

III. Conclusion

The City has secured and expects to continue to secure adequate resources to meet our obligations under the permit, consistent with the budget process. The estimate in this appendix includes all funding of development and projected implementation costs of which City agencies are currently aware. Additional expenses that may arise during the implementation and enforcement of this program may require additional funds from the City.

Appendix 2.1

311 Complaints related to MS4/ Stormwater Management Issues

311 is New York City's main source of government information and non-emergency services. It provides the public with quick, easy access to all New York City government services and information. The public may connect with 311 24 hours a day, 7 days a week, 365 days a year by:

- Visiting 311 online at nyc.gov/311;
- Calling 311 or (212) NEW-YORK, (212) 639-9675, from outside New York City;
- Texting 311-692;
- Downloading the NYC 311 mobile app for Apple or Android devices; or
- Tweeting to @nyc311

311 is accessible to non-English speakers, available online in over 50 languages and by phone in over 170 languages.

311 facilitates transparency and accountability. Service requests and agency responses are available to general public as open data online.

Currently, the public is able to use 311 to access information on many topics relevant to stormwater pollution and water quality. The public is also encouraged to use 311 to report information relevant to stormwater pollution. Through 311 the public can report:

- Fire Hydrant Complaint -Report a hydrant that is damaged, missing, or being used inappropriately.
- Fire Hydrant Leaking or Running -Report a fire hydrant that is leaking, running, or running at full blast.
- Flooding Street or Highway -Report street or highway flooding or a manhole overflow.
- Water Leak Complaint - Report water leaking into a public area or basement.
- Water Main Break - Report a possible water main break
- Water Wasting Complaint -Report the use of too much water.
- Waterway Complaint -Report floatables, trash, oil, gasoline, sewage, or an unusual color in a waterway.
- Dry Weather Sewage Discharge Complaint - Report of water flowing through a sewer outfall pipe during dry weather.
- Dumping in Catch Basin or Sewer - Report grease, gasoline, natural gas, cement, oil, sewage, chemicals or other liquids going into a sewer or catch basin.
- Sewer Backup - Report a sewer backup or get information about cleaning up after a flood.
- Sewer Line Complaint - Report of a damaged sewer line.
- Sewer Odor - Report a smell coming from a catch basin or sewer.
- Oil Spill - Report an oil spill.
- Chemical Complaint- Report chemical odor or chemicals that are abandoned, not stored safely, or spilled on a roadway or sidewalk

- Pesticide Use Without Notification Complaint - Report a person or business that uses pesticide without giving advance notice.
- Pigeon Droppings or Odor Complaint - Report pigeon waste or odor for sidewalks and private property.
- Dead Fish in Harbor or Bay - Group of dead fish in a harbor or bay (DEC).
- Dog or Animal Waste Complaint - Report property that is unclean due to animal waste.
- Bag of Garbage or Loose Debris in Street Complaint - Report a stray bag of garbage or loose debris in a driving or biking lane of a street.
- Dirty Yard or Alley Complaint - Report of an unclean or untidy yard, alley, or court that is visible from the street.
- Dumpster Complaint - Report a dumpster overflowing with garbage or construction debris.
- Garbage Truck Spill Complaint - Report of waste leaking or spilling from a garbage truck or garbage that spilled onto the ground while being loaded into a truck.
- Garbage, Recycling, or Organics Storage Complaint - Make a complaint about garbage or recycling stored or put out incorrectly.
- Illegal Dumping Complaint - Report the dumping of large amounts of trash.
- Litter Basket Request or Complaint - Request a public litter basket, report an overflowing or misused basket, donate litter baskets, or adopt a basket.
- Littering Complaint - Report chronic littering of small amounts of trash and debris.
- Loose Trash Complaint - Report garbage placed for pickup that has not been properly secured.
- Private Carter Sanitation Complaint - Make a complaint about a commercial waste disposal company.
- Chemical Complaint - Report a chemical safety problem including odors, abandoned or unsafely stored chemicals, and chemical spills.
- Waste Transfer Station Complaint - Make a complaint about the condition of a private waste transfer station.
- Dirty Sidewalk or Gutter Complaint - Report that a sidewalk or gutter, including 18 inches into the street, is unclean.
- Sidewalk Washing Complaint - Report sidewalk washing when it is not allowed.
- Catch Basin Complaint - Report a storm drain that is missing its cover, clogged, sunken, raised, damaged, or defective.
- Clogged or Blocked Culvert Complaint - Report a drain underneath a road that requires cleaning or is blocked.
- Street Not Swept Complaint - Report a poor or missed street cleaning.

- Building Construction Complaint - Report a building construction violation.
- Flyer or Poster Complaint - Report unwanted posters, advertisements, handbills, signs, menus, or stickers on public property, private property, or vehicles
- Public Plaza Complaint - Report a public plaza that is poorly maintained or not open to the public during posted hours. Public plazas are also known as privately owned public spaces.
- Park Maintenance Complaint - Report a park or park facility in need of cleaning or repair.
- Beach, Pool, or Sauna Complaint - Report an unsanitary condition, missing or broken safety equipment, or improper maintenance at a beach, pool, or sauna.
- Home Oil or Chemical Spill Complaint—Get information and assistance with a leaking or damaged home heating oil tank, or help with a chemical spill in your home or yard.
- Private Septic or Cesspool Complaint—If an individual, private, on-site sewage disposal system, (septic tank or cesspool), is failing or not operating properly, the public may report the condition. Call 311 to report a problem with a private septic or cesspool system.
- State and Federal Parks—Get information about parks within New York City and the greater Long Island area that are run by New York State and federal governments.

Appendix 3.1

Stakeholder Meeting Log with Summary of Public Comments and City Responses

Appendix 3.1
Table of Contents

Introduction

As described in Chapter 3: Public Involvement and Participation, the City has led a robust program to involve the public in the development of this Plan. The appendix summarizes public comments received through the following means:

- Stakeholder Meetings and Events
- Written Responses Received During Formal Comment Periods
- Emails Received

1.0 Stakeholder Meeting Log

DATE	MEETING NAME	BOROUGH
6/19/2018	REBNY's Management Division Board of Directors	Manhattan
6/18/2018	General Contractor's Association	Manhattan
6/15/2018	NYC Stormwater Design Manual Workshop	Manhattan
6/11/2018	Queens CB7	Queens
6/6/2018	Bronx CB 2	Bronx
6/1/2018	NYC Stormwater Design Manual Workshop	Manhattan
5/25/2018	Manhattan Borough Service Cabinet	Manhattan
5/21/2018	Trash Free Waters Challenge Kickoff	Brooklyn
5/9/2018	MS4 Briefing with SWIM Coalition	Manhattan
5/8/2018	2018 Waterfront Conference	Manhattan
5/2/2018	NYC Stormwater Design Manual	Manhattan
5/2/2018	NYC Stormwater Management Program - Public Meeting on the Draft Plan	Staten Island
4/30/2018	Industrial/Commercial Public Meeting	Brooklyn
4/26/2018	Bronx Borough Service Cabinet Meeting with Bronx Borough Board	Bronx
4/24/2018	NYC Stormwater Management Program - Public Meeting on the Draft Plan	Manhattan
4/24/2018	Brooklyn Borough Service Cabinet Meeting	Brooklyn
4/17/2018	Queens Borough Service Cabinet Meeting	Queens
3/6/2018	MS4 Briefing with SWIM Coalition	Manhattan
2/3/2018	Coney Island - MS4 Community Workshop	Brooklyn
12/7/2017	Industrial/Commercial Public Meeting	Brooklyn
11/29/2017	Industrial/Commercial Public Meeting	Bronx
11/28/2017	Industrial/Commercial Public Meeting	Staten Island
11/16/2017	Industrial/Commercial Public Meeting	Queens
11/9/2017	Industrial/Commercial Public Meeting	Queens
11/8/2017	Industrial/Commercial Public Meeting	Brooklyn
10/4/2017	Stormwater Advisory Group Meeting	Brooklyn
6/15/2017	Stormwater Advisory Group Meeting	Staten Island
5/16/2017	Public Meeting on the MS4 Progress Report (2017)	Queens
4/19/2017	Stormwater Advisory Group Meeting	Manhattan

4/14/2017	Quarterly Updates with SWIM Coalition	Queens
3/17/2017	Session 2: Construction/Post-Construction Lot-Size Threshold Study	Manhattan
2/17/2017	Stormwater Advisory Group Meeting	Brooklyn
2/4/2017	Quarterly Meeting with SWIM Coalition: SWMP Updates	Queens
2/3/2017	Coney Island Creek Community Meeting	Brooklyn
1/30/2017	Coney Island Creek - Community Board 13	Brooklyn
1/6/2017	Session 1: Construction/Post-Construction Lot-Size Threshold Study	Manhattan
12/13/2016	Stormwater Advisory Group Meeting	Bronx
12/8/2016	Quarterly Meeting with SWIM Coalition: SWMP Updates	Queens
12/2/2016	DEP MS4 Meeting: Construction/Post-Construction Lot Size Threshold Study	Manhattan
11/30/2016	Stakeholder Briefing: Webinar	N/A
11/29/2016	Stakeholder Briefing: Webinar	N/A
10/20/2016	Harlem River Community Meeting	Bronx
9/27/2016	Stormwater Advisory Group Meeting	Brooklyn
9/27/2016	Trash Free NYC Waters Working Group	Brooklyn
9/13/2016	SWMP Updates with SWIM Coalition	Queens
8/5/2016	MS4/CSO Briefing with Hudson Estuary Program	Manhattan
6/22/2016	Queens & Bronx Association - MS4 Update	Queens
6/22/2016	Public Meeting on the MS4 Progress Report (2016)	Manhattan
5/18/2016	The Bronx Community Board 8 - Environmental and Sanitation Committee Meeting	Bronx
5/4/2016	Quarterly Meeting with SWIM Coalition: SWMP Updates	Manhattan
4/4/2016	Lot-Size Soil Disturbance Threshold Study/Scope Review - Conference Call with SWIM Coalition	Queens
3/30/2016	Lot-Size Soil Disturbance Threshold Study with Stakeholders	Manhattan
2/18/2016	MS4 Permit Briefing at DOB Office with Queens AIA	Queens
2/17/2016	Quarterly Meeting with SWIM Coalition: SWMP Updates	Manhattan
2/17/2016	MS4 Presentation - General Overview (Brooklyn AIA)	Brooklyn
2/10/2016	NYWEA's 88th Annual Meeting - MS4 Presentation	Manhattan
1/12/2016	MS4 Briefing with Queens Community Boards	Queens
12/8/2015	MS4 Briefing Request (Wildlife Conservation Society)	Bronx
11/20/2015	MS4 Briefing Request (REBNY/GCA)	Manhattan
11/19/2015	Bronx River Ecology Team Meeting	Bronx
11/13/2015	MS4 Briefing Request (Cafeteria Culture)	Queens
11/2/2015	MS4 Briefing Request (Riverkeeper)	Manhattan
10/23/2015	MS4 Briefing Request (BX CB8, Friends of Van Cortlandt Park)	Bronx
10/22/2015	MS4 Briefing Request (SWIM Coalition)	Manhattan
9/29/2015	NYBG Tour of Selected Sites	Bronx
9/17/2015	Water Infrastructure Steering Meeting	Manhattan

2.0 SWMP Development Comments and Responses

2.1 Stakeholder Meetings between 2016 and 2017

Below are comments received at stakeholder meetings between 2016 and 2017. The City recorded approximately 165 comments over the course of this period and has summarized and categorized responses by each SWMP provision. The City provided verbal responses during these meetings with the best available understanding of the program at the time, and has updated its written responses in this appendix to reflect the final SWMP.

Public Education and Outreach

The questions and comments the City received on the Public Education and Outreach program reflected four general themes: 1) suggestions on how to improve education and outreach during SWMP development, 2) suggestions on how to educate the public throughout SWMP implementation, 3) questions for the Department of Parks and Recreation (DPR) and 4) questions for the Department of Education (DOE).

1 **SWMP Development:** The public suggested that the City create a more "catchy" name for stakeholder meetings and utilize social media to promote those meetings. The public also suggested that the City create more graphics and use them in public meetings to enable participants to understand MS4 Program requirements.

Response: *In response to public comments regarding our social interactions throughout the development of the SWMP, DEP increased its outreach. As a result, the City formed a Stormwater Advisory Group (SAG) and convened regular meetings that were open to the general public. The SAG meetings have seen better attendance than the first MS4 Annual Public meeting because of our social media outreach and notices to our stakeholders. We also began working with a graphics sub-consultant so that we can have readily available literature and material on the SWMP that is easy to digest and navigate.*

2 **SWMP Implementation:** The public suggested that the City create a list of stakeholder contact information by area of interest that could serve as a resource for volunteer events. The public also suggested that the City consider how it promotes shoreline cleanups and ensure that when training volunteers, the staff informs the public that they may come in contact with hazardous materials.

Response: *We will consider developing the stakeholder contact list. While some non-profit and private organizations may approve of our sharing their contact information in relation to the SWMP implementation/program, we will need to implement a procedure through our Bureau of Public Affairs and Communications to ensure that all participants consent to sharing information. Any protocols or procedures for shoreline cleanups will include safety guidance.*

3 **Questions for the Department of Parks & Recreation:**

3a. Is DPR interested in building stormwater lagoons?

Response: *Not at this time. Stormwater lagoons may lead to stagnant water, which can lead to negative outcomes such as mosquito larvae and maintenance concerns. Currently, DPR is focusing on green infrastructure such as rain gardens, permeable pavement, and subsurface infiltration.*

3b. What is DPR's policy for feeding birds and other wildlife?

Response: *DPR has a wildlife unit that educates New Yorkers about local wildlife such a birds, reptiles, and mammals. In 2017, the unit launched a media campaign telling the public not to feed New York City's wildlife. While it may seem helpful it can lead to pest control problems and can be harmful to the wildlife.*

4 **Questions for the Department of Education:**

4a. Do students learn how to repurpose waste?

Response: *DOE encourages reuse and repurposing of materials and has developed several partnerships and resources to support these initiatives. For example, GrowNYC created educational videos and lesson plans to equip teachers to discuss these issues. DOE has Zero Waste outreach staff to support both operational and educational aspects of waste reduction, diversion, and reuse. DOE has a significant amount of information and resources as well as a large group of volunteers willing to help schools.*

4b. What is the status of the Harbor Literacy curriculum?

Response: *The Harbor Literacy Curriculum is currently in need of more support and funding. In the interim, the Waterfront Alliance has been piloting an introductory waterfront field lab called Estuary Explorers, which includes field trips and a waterfront workshop program to introduce teachers and students to simple yet impactful hand-on lab work. More information can be found in the latest newsletter.*

4c. Does DOE partner with community gardens?

Response: *DOE has more than 700 registered school gardens, made possible by City funding and in partnership with GrowNYC's Grow to Learn program, Green Thumb, the Trust for Public Land, and other community-based organizations (CBOs). Many schools work together with community gardens, and this network continues to grow. The DOE's Sustainability office supports efforts that enable access to school green space, including providing outdoor learning, teaching about nutrition, growing food, etc. DOE has been in discussions with the Tisch Center for Food, Education and Policy at Teachers College at Columbia University to strategize ways to continue to grow citywide support for school gardens. There was a Sustainability Showcase held at Brooklyn College on 5/18/18 where there was a panel discussion on food and sustainability and a discussion with the audience of educators on nutrition education through school gardens. Visit www.schools.nyc.gov/sustainability for information on similar future events and email sustainability@schools.nyc.gov to be added to the newsletter/email blast distribution list.*

Public Involvement

The City received many comments on the public involvement and participation process. Comments and questions received fell into two categories: City services and public involvement.

1 **City Services:** What is the status of the Adopt-a-Catch Basin Program? Are all MS4 outfalls labeled? The public also suggested that the 311 application should have outfall coordinates for accurate reporting potential illicit discharges.

Response: *The Adopt-a-Catch Basin pilot program was an initiative in which DEP and the Office of the Brooklyn Borough President collaborated with block associations, business improvement districts (BIDs) and other CBOs to remove the debris that blocks storm drains. DEP provided training, as well as gloves and garbage bags, to participating organizations that agreed to maintain storm drains in their neighborhoods. DEP also enrolled participants in an early alert system to inform them of upcoming weather events that may cause flooding. DEP is currently working to expand the program to other areas of the City. See Chapter 11 for a description of the City's pilot program to encourage New Yorkers to contact 311 if they see a dry weather discharge from an MS4 Outfall. The City is currently evaluating system improvements to 311 as it relates stormwater and water quality complaints.*

2 **Public Involvement:** How can the City and environmental organizations work together to engage broader community groups in these topics? How can stakeholders continue to participate in SWMP development while the City drafts the Plan?

Response: *The City has identified key stakeholders and target audiences for education, outreach, and involvement efforts. Throughout the SWMP development, these stakeholders played a pivotal role in shaping the draft SWMP. For more information, see SWMP Chapter 3: Public Involvement and Participation. Throughout the SWMP document, you can also look for the sunshine yellow call-out boxes that describe public involvement in the development of those programs.*

Mapping

The questions and comments the City received on the Mapping program reflected three general themes: agency coordination, map content, and map accessibility.

1 **Agency coordination:**

1a. Will DEP finish mapping the DEP-owned MS4 outfalls and associated drainage areas by August 2018?

Response: *As of August 1, 2018, DEP has mapped 459 DEP-owned MS4 outfalls and delineated 272 drainage areas. Additionally, DEP has delineated one MS4 area draining to a CSO outfall downstream of the regulator and 28 drainage areas discharging into Bluebelts.. As indicated in the Permit, this is a preliminary map. DEP will continue to delineate the MS4 area draining to DEP-owned MS4 outfalls and to DEP-owned combined sewer outfalls downstream of a regulator, reporting on the progress made each year.*

1b. How many outfalls are owned by other City agencies?

Response: *The City does not yet know how many outfalls each agency owns. Agencies are working to identify agency-owned MS4 outfalls and will report on the progress made each year.*

1c. Are agencies adequately staffed to ensure compliance with the mapping requirements?

Response: *Yes, agencies either have the necessary resources or are working on getting the necessary resources to ensure compliance with the mapping requirements. Some agencies are using existing resources, some have hired new staff, and some are seeking assistance from consultants. To assist agencies with MS4 mapping, DEP has prepared a guidance manual and has convened a sub-team to highlight mapping requirements and methods for meeting these requirements. For more information, refer to the Fiscal Analysis.*

1d. How will the map be used for program enforcement?

Response: *The MS4 Map will show the area where the City will implement certain elements of the SWMP. Notably, the Pollution Prevention and Good Housekeeping, Construction/Post-Construction, Industrial/Commercial programs of the SWMP apply only to sites in the MS4 area. However, the DEP will not use the MS4 Map for enforcement purpose, rather it will use site-specific records as the basis of any enforcement actions.*

2 **Map Content:**

2a. Will the City include non-MS4 outfalls on the MS4 Map? Can DEP characterize street-ends as discharge points to include on the MS4 Map?

Response: *The MS4 Map will only include City MS4 outfalls. Street ends are not MS4 outfalls and will not be included on the MS4 Map. However, properties owned or operated by City agencies that drain via overland flow rather than through a piped outfall will be included on the MS4 Map.*

2b. Will High Level Storm Sewer Separation projects be included on the MS4 Map?

Response: *Areas draining to High Level Storm Sewers are part of the MS4 area and will be included in the MS4 Map, though there may be a lag between project completion and addition of the new drainage area to the MS4 Map.*

2c. Will the non-City entities like NYCHA and MTA be included?

Response: *Outfalls owned by non-City entities like NYCHA and MTA are not covered by the City's MS4 Permit and will not be included on the MS4 Map. If stormwater from property owned or operated by a non-City entity drains to the City's MS4 and is not subject to that entity's MS4 permit, the property will be considered part of the MS4 area, as would property owned by a private entity with a connection to the City's MS4.*

3 Map Accessibility:

3a. When and where will the preliminary map of the City's MS4 area be visible to the general public? Is there an online location with all City GIS maps that would include all point sources to waterways? The public also suggested that the City share the MS4 layer with other mapping programs such as Oasis.

Response: *The preliminary MS4 Map is available online to the public as of August 1, 2018 at nyc.gov/dep/ms4map. The MS4 Map includes the MS4 drainage area, MS4 outfalls, data from MapPLUTO, locations of facilities for municipal solid waste, public parks and other open lands, and SPDES permits draining to the MS4. Data from the MS4 Map is available for download through NYC Open Data at opendata.cityofnewyork.us. This will enable a variety of users, such as Oasis, to access and utilize the data. Additionally, locations of all outfalls known to DEP are currently available to the public through NYC Open Data.*

Illicit Discharge Detection and Elimination (IDDE)

The questions and comments the City received on the IDDE program reflected five general themes: IDDE program questions, IDDE program suggestions, water quality data, 311 reporting, and enforcement.

1 IDDE Program Questions:

1a. What are non-stormwater discharges?

Response: *The MS4 is designed to carry stormwater to receiving waterbodies. Therefore, any discharge to the City's separate storm sewer that is not stormwater, except firefighting discharges and those approved by the DEP Commissioner,[1] is not permitted. Examples of non-stormwater discharges include sanitary waste, waste oil, and wash water.*

1b. When was the DEP-IDDE program created, and has it been modified to account for demographic changes in NYC?

Response: *The DEP IDDE Program has managed citywide IDDE issues for over 25 years. The Program has evolved and has been modified based on changing regulatory requirements, data collection and analysis, and stakeholder input.*

1c. How will the City know if there are increases in allowable discharges?

Response: *The City tracks discharges authorized by the DEP Commissioner.*

1d. What is the City doing to investigate illegal connections in Newtown Creek?

Response: *In Newtown Creek, the City has prioritized resources for IDDE field investigations and currently has 3 active cases (as of August 1, 2018). Between 1989 and 2018 the City investigated 37 cases in Newtown Creek and abated over 1 million gallons per day of flow.*

2 IDDE Program Suggestions:

2a. The City should research programs in other cities and new technologies (e.g. drones).

Response: *The City collaborated with the Water Research Foundation and 34 communities in the U.S. and other countries to publish a review of innovative and integrated stormwater management initiatives, which includes information on IDDE programs in other cities and the technologies being used (link: http://www.waterrf.org/resources/Pages/NYC-Stormwater-Report.aspx).*

2b. The City should educate the public on illicit discharge prevention, identification, and reporting; signage near MS4 outfalls would be helpful for reporting purposes.

Response: *The City educates the public on illicit discharge prevention, identification, and reporting through public meetings and the DEP website. In February 2018, the City installed signs at the DEP MS4 outfalls in Coney Island Creek as a pilot project, in response to public requests to be able to easily report dry weather discharges. The first annual report will include an update on this pilot.*

1 15 R.C.N.Y. Section 19-02(j)

2c. The public should be notified of DEP-IDDE investigation results.

Response: *DEP IDDE investigation updates are available to the public through the NYSDEC NY-Alert system.*

3 Water Quality Data:

3a. IDDE-related water quality data should be made available like the Harbor Survey Monitoring data. How can the public exchange data with DEP? There should be an annual or biannual meeting between citizen scientists and DEP to do so.

Response: *As requested by the public, DEP publishes data from the Sentinel Monitoring Program on the DEP website (link: https://www1.nyc.gov/site/dep/water/harbor-water-quality.page). DEP agrees that citizen water quality monitoring programs are important components of citizen involvement and could supplement the monitoring programs that DEP has established for regulatory compliance purposes. Email ms4@dep.nyc.gov to share monitoring data with DEP.*

4 311 Reporting:

4a. Can the public use the 311 app to report IDDE issues?

Response: *The purpose of the 311 mobile application is to reduce call volume for common complaints. Since IDDE-related complaints are uncommon (relative to citywide complaint volumes), the public cannot use the app to report IDDE issues at this time. As such, it is best to go through the 311 website (http://www1.nyc.gov/311/index.page) or to call 311 to file a report.*

4b. Which 311 complaints are applicable to IDDE, pollution in streets, and stormwater pollution?

Response: *Refer to Appendix 2.1: 311 Complaints related to MS4/Stormwater Management issues for more information about stormwater complaints.*

4c. Is there a summary of 311 IDDE investigations?

Response: *NYC Open Data includes 311 service requests from 2010 to present (https://nycopendata.socrata.com/Social-Services/311-Service-Requests-from-2010-to-Present/erm2-nwe9); information is updated daily and includes complaint type and resolution description..*

5 Enforcement:

5a. How does DEP enforce the 'no dumping' rule for catch basins? Are violators fined? Will there be a re-evaluation of fines for environmental violations to be more effective?

Response: *DEP enforces the no dumping rule for catch basins by conducting field investigations and responding to 311 complaints. Refer to Appendix 1:1 Enforcement Response Plan for enforcement details. Periodically, the City re-evaluates penalties and updates them when necessary.*

Construction and Post Construction

The questions and comments the City received on the C/PC program reflected five general themes: Lot Size Threshold Study, threshold sizes, analyses and monitoring, requirements for property owners, and policy.

1 Lot Size Threshold Study:

1a. In the Lot Size Threshold Study, did the water quality analysis consider pollutants coming off of sites into waterbodies impaired for the pollutant for which it is impaired? Is it more stringent or less?

Response: *Pollutants of concern, commonly associated with urban stormwater runoff discharges, were considered in this study for all waterbodies, regardless of whether or not a waterbody is listed as impaired due to any of these pollutants. These pollutants included total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP), fecal coliforms (FC), and enterococci (ENT). The water quality evaluations considered pre- and post-development (redevelopment) pollutant loadings for each pollutant, and were based on specific technologies used for stormwater control (retention/treatment), which resulted in a more comprehensive source-load based analysis as compared to just considering impaired waterbodies.*

1b. Will the data and municipal survey results be available to the public?

Response: *Detailed information on municipal survey results is provided in Appendix A of the Lot Size Threshold Study*

1c. Were college students and professors asked to participate?

Response: *Multiple stakeholder workshops with industry professionals and technical experts were held in collaboration with the Real Estate Board of New York (REBNY) and Urban Green Council (UGC) throughout this project. We do not have specific information on whether college students and professors were among participating stakeholders.*

1d. For Task 3 of the Lot Size Threshold Study, who determines costs and expenses and where is it applied?

Response: *Regarding capital and operation and management cost estimates for various post-construction stormwater control technologies presented in Section 7 of the Lot Size Study report, the costs were developed by a specialty cost-estimating firm using historic cost data for stormwater control technologies in NYC and other large urban areas. The costs were also reviewed with the stakeholders and their comments addressed as part of the stakeholder participation process.*

1e. Are co-benefits accounted for?

Response: *The co-benefits of Green Infrastructure were accounted for in development of Preliminary Post-Construction Stormwater Control Measures (SCMs) Hierarchy Matrix presented in Figure 6.1, where the highest priority was given to On-Site Vegetated Infiltration practices. The primary focus was on pollutant load reduction in this study; however, DEP has been quantifying co-benefits associated with green infrastructure implementation in other parallel studies.*

2 Threshold Sizes:

2a. Can there be different thresholds for different types of properties (for example industrial & commercial sites, or differing watersheds and boroughs)?

Response: *As of now, the City will not implement thresholds based on land use type, receiving waterbodies, or boroughs. A uniform threshold across NYC was determined to be the most practical methodology for implementation by the construction community.*

2b. Why isn't the City looking at thresholds below 5,000 sf in the study?

Response: *Implementing SCMs on lots smaller than 5,000 sf is impractical due to severe space limitations. This lot size would include significant numbers of small residential properties with practically no room for SCMs. Experiences by other utilities showed that the administrative and technical costs far outweighed the achieved benefits when they decreased the lot size threshold to this extent; water quality improvement from regulating smaller lots was minimal.*

2c. Can the City include intermediate thresholds such as 7,500 sf or 12,500 sf?

Response: *The City added thresholds of 7,500 and 12,500 sf to the analysis in response to stakeholder feedback; the report includes these thresholds in all cumulative analyses.*

3 Analyses/Monitoring:

3a. Why does the City use 2008 as its rainfall year and historical data for design criteria for post-construction requirements?

Response: *The City selected and NYSDEC approved the 2008 rainfall from JFK Airport as a typical year of precipitation for the CSO LTCP evaluations. To maintain consistency with CSO methodology, the City used the 2008 rainfall for water quality evaluations in the Lot Size study.*

3b. How is the City using land use data to determine the relationship to pathogens?

Response: *In the Threshold Study, the City applied to all land uses the Event Mean Concentrations sourced from the Nationwide Urban Runoff Program (NURP), National Stormwater Quality Database (NSQD), and NYC's LTCP reports. Volume of runoff was determined based on land use. This approach is consistent with water quality evaluations performed in CSO LTCPs in NYC and other large cities.*

3c. Will infiltration practices influence a no-net-increase of pathogens and nitrogen?

Response: *The City has prioritized infiltration practices for its post-construction requirements. The City will evaluate the practice selected by the applicant and determine how well the applicant is meeting the no net increase requirement.*

3d. What is the timeline/process for how monitoring data will be considered in the MS4 Program?

Response: *See Chapter 10 for details on the MS4 Monitoring Program.*

3e. Has the City considered that volume approaches could be inaccurate?

Response: *Consistent with the NYSDEC Stormwater Design Manual, the Water Quality Volume is the primary calculation DEP uses to evaluate sizing of stormwater management practices. Before finalizing a design, especially in systems that require control of flow as well as water quality requirements, the final sizing should be based on modeling the SMP within the overall drainage system for the site.*

3f. The public also suggested that the City should use future/predictive climate change data in design consideration and stop using the term "extreme" in presentations to show the public that these events are occurring more frequently.

Response: *Separate from the MS4 Program, the City launched a Citywide Stormwater Resiliency Study. Rainfall poses many challenges and the City is committed to addressing urban flooding, protecting ecosystems, and protecting its vital infrastructure. The purpose of the study is to develop a citywide model to test multiple rainfall scenarios, and investigate the impact of changing climate conditions on flood conditions and existing stormwater management practices, based on climate projections from the New York City Panel on Climate Change (NPCC). These impacts include changes in sea level, groundwater, and the intensity, duration, and frequency of precipitation events. The study will also look at flooding from coincident surge and precipitation, and investigate geographically-specific stormwater conditions where flooding may be influenced by sea level rise, tidal inundation, and/or elevated groundwater. Results from these analyses will include flood maps, high level analysis of stormwater management options and costs, and prioritized list of proposed interventions. The study will run from May to November of 2018.*

4 Requirements for property owners:

4a. Will property owners be subject to post-construction enforcement?

Response: *Yes, property owners with post-construction practices under the program will be required to get an enforceable Stormwater Maintenance Permit that requires the owner to maintain stormwater management practices in keeping with their intended purposes.*

4b. Will the City create a program to certify professionals such as landscape architects and plumbers to ensure that BMPs are constructed and maintained correctly?

Response: *No, the City will rely on existing certification programs.*

4c. Will the MS4 Program require stormwater management retrofits for existing buildings?

Response: *No, retrofits are not required by this program. Only construction that meets the definition of a covered development project will be required to meet the new rules.*

4d. Why isn't the Green Infrastructure Grant Program mandatory for property owners?

Response: *The Green Infrastructure Grant Program is a voluntary program for private property owners in the CSO and MS4 areas of the city. DEP will fund up to 100% of the design and construction of green infrastructure. For more information visit https://www1.nyc.gov/site/dep/water/green-infrastructure-grant-program.page.*

4e. Will property owners or developers be required to model their own stormwater runoff, test for sample pathogens or monitor their own projects?

Response: *Property owners/developers will be required to model stormwater to demonstrate that practices implemented during and after construction will capture and treat stormwater runoff, as required.*

5 Policy:

5a. What is the City doing to address fertilizer runoff?

New York State's Nutrient Runoff Law has many requirements for fertilizer use. For more information visit: https://www.dec.ny.gov/chemical/67239.html#requirements

5b. How are Total Maximum Daily Loads (TMDLs) set?

Response: *TMDLs are developed and implemented by NYSDEC. For more information visit https://www.dec.ny.gov/chemical/31290.html*

5c. What happens if the City is unable to meet the no-net-increase requirements of the MS4 Permit?

Response: *The City must meet the no net increase requirements listed in Part II.B of the City's MS4 permit. Part II.B.1.c requires the City to develop procedures to ensure that SWPPPs for non-negligible changes in land use in the MS4 area and draining to impaired water bodies contain adequate controls to meet the no net increase requirements. DEP will incorporate these requirements into the review and approval processes for SWPPPs.*

Pollution Prevention and Good Housekeeping

The questions and comments the City received on the PP/GH program reflected four general themes: green infrastructure, facility assessments, agency specifics, and training.

1 Green Infrastructure:

1a. Will City agencies install any green infrastructure as required by PPGH prior to 2018?

Response: *No, City agencies did not install any green infrastructure as it pertains to the MS4 Permit prior to 2018. See Chapter 7 for more details on green infrastructure as it relates to the PPGH program.*

1b. How will the City assess whether or not green infrastructure technologies are a potential source of pollutants of concern and ensure that GI technologies are not impacted by other pollutants such as PAHs, toxics etc.?

Response: *The City has a robust Research and Development Program for green infrastructure practices. For more information visit www.nyc.gov/dep/greeninfrastructure*

2 Facility Assessments:

2a. The City should ensure that catch basins are prioritized based on potential impact to the MS4 and catch basins inspection schedules should consider seasonal impacts.

Response: *The City currently assesses and prioritizes catch basin maintenance in the public right of way. This maintenance includes criteria for seasonal impacts and rain events. The PPGH program also includes a prioritization tool for operations, which may influence stormwater control measures and maintenance.*

2b. The City should add flooding and storm surge risks to the list of metrics addressed at facilities. Facility Assessment reports should summarize which metrics applied to each facility to prioritize facilities as high, medium, and low priority.

Response: *The prioritization tool takes into account flooding zones, and the assessment reports have a detailed description of the metrics used for the facility prioritization.*

3 Agency Specifics:

3a. Does DOE have any bus maintenance yards within the MS4? Will DOE notify their third party bus companies of the permit requirements?

Response: *The current DOE inventory does not include any bus maintenance yards. Any city agency using contractors to perform municipal operations will require contractors in their contracts to comply with the terms of the MS4 permit.*

3b. Does DSNY categorize trash receptacles in the public right-of-way and their risks for polluting the MS4?

Response: *DSNY services several types of street litter baskets and manages pickups within scheduled routes based on efficiency and practicability, as determined over time. DSNY does not characterize street litter baskets by pollution risk.*

4 **Training:** The City should host workshops to train staff on stormwater control measures. The City should include MS4 content on Civil Service exams to ensure that new staff are prepared for the PPGH requirements.

Response: *The City is creating and will be implementing a PPGH training program, which will include instruction on the SCMs. Any employee responsible for an operation covered under PPGH will have to take and document this training.*

Industrial and Commercial (I/C)

The questions and comments the City received on the I/C program reflected three general themes: MS4 Permit obligations, I/C engagement, and rule-making.

1 **MS4 Permit Obligations:**

1a. Do direct drainage areas have obligations under this permit?

Response: *NYSDEC will continue to issue the SPDES MSGP permit to facilities, both in direct drainage and separately sewered areas. Facilities in direct drainage areas that are privately owned will remain wholly under NYSDEC's jurisdiction. DEP will assume responsibility for inspecting facilities located in the MS4 Area.*

1b. Who on-site (the property owner or business owner that operates the property) has obligations under this permit?

Response: *Under the MSGP, the owner or operator submits the NOI and is responsible for permit compliance until filing an NOT. As defined in the MSGP:*

Owner or Operator - means the owner or operator of any facility or activity subject to regulation under 6 NYCRR Part 750. In accordance with 6 NYCRR Part 750-1.6(a), when a facility or activity is owned by one person but is operated by another person, it is the operator's duty to obtain a permit.

2 **I/C Engagement:**

2a. Will inspections be announced?

Response: *MSGP facilities will receive one notice letting them know that DEP will now be the agency conducting inspections. Individual inspections will not be announced. See Chapter 8 for more details.*

2b. Will the City have a loan or grant program for facilities that find themselves in violation?

Response: *Not under the I/C program. However, property owners may be eligible for other grant programs or initiatives.*

2c. How will the City update the facility inventory to capture new facilities in the MS4?

Response: *The City uses the services of various databases to update the inventory of potential sites. However, if during the course of the field assessments, the inspectors identify new facilities, they will add those facilities to the inventory for future inspections.*

2d. How will new facilities know they are in the MS4 area?

Response: *The Preliminary MS4 Map is available online for general use at nyc.gov/dep/ms4map. For specific information about a particular property, facilities can make a request to their local DEP borough office.*

3 Rulemaking:

3a. How can facility owners and operators engage with the City during the rulemaking process?

Response: *See Chapter 3 for a description of how the City engaged the public during the rulemaking process. The City published the draft rules for public review pursuant to the City Administrative Procedures Act (CAPA), and evaluated comments received from the public before finalizing the rules.*

3b. Are the penalties set for violations? Will they be public?

Response: *The final rules will include specifics about penalties and violations; the penalty schedule will be adopted pursuant to CAPA by the time DEP begins to implement the program.*

Floatables

The questions and comments the City received on the Floatables program reflected three general themes: Public Engagement/Media Campaign, DEP Programs, and Other Agency Programs. Please note that additional comments on the Floatables Work Plan are included in Appendix 9.1.

Public Engagement/Media Campaign:

1a. The City should educate residents about their proximity to local waterbodies and how their consumption impacts the waste stream and engage a variety of audiences such as college students and neighborhood associations.

Response: *The City has a variety of efforts to educate New Yorkers on water quality issues and waste management issues. These include DEP's Environmental Education program, DSNY's Zero Waste Program, and DPR's Natural Classroom program, among others. For a list of the ways the City engages a variety of audiences, please refer to Chapter 2 of the SWMP.*

1b. Why did the City partner with the Aquarium on the media campaign?

Response: *The City collaborated with the New York Aquarium for the Don't Trash Our Waters Campaign to enhance the campaign by providing New Yorkers with the opportunity to learn more about the New York seascape and the impact of plastics in the ocean.*

1c. The media campaign should:

- Include facts about local wildlife;
- Include three cans to show the option to recycle;
- Replace the sea otter character with an oyster;
- Include migratory birds and fish;
- Feature artwork on sanitation trucks;
- Give a human element to the campaign so people care;
- Make the animals more realistic so children understand the harmful impacts of trash on wildlife;
- Include information on the economic costs in the campaign message so people understand how much it costs to deal with trash.

Response: *The City considered all public feedback received on the Don't Trash Our Waters Campaign, and ultimately incorporated some suggestions, such as including an oyster in the campaign, including recycling cans, and humanizing the characters to help people connect with the issue. In addition to the Don't Trash Our Waters Campaign, the City also ran other campaigns as detailed in Chapter 9 of the SWMP.*

4 DEP Programs:

2a. DEP should expand the adopt-a-catch basin program, as well as continue the catch basin inspection cycle program (1-year inspection cycle instead of 3-year).

Response: *The City is exploring the expansion of the adopt-a-catch basin program. DEP has increased catch basin inspections from once every three years to once every year, from July 1, 2016 through June 30, 2019, pursuant to Local Law 48 of 2015. At this time, DEP has not made a decision regarding the continuation of annual inspections past June 30, 2019, but will reevaluate the program to optimize benefits (the DEP WWTP's SPDES permits require a three-year cycle).*

2b. How often does the skimmer boat collect floatables from the booms?

Response: *Skimmer vessels are dispatched to retrieve collected floatables from booms and nets based on inspections conducted with small vessels within 24 to 48 hours of significant rain events. The inspection vessels are also equipped with hand netting tools in order to retrieve small amounts of floatables, so that the skimmer vessel use is more focused on containment sites with large amounts of floatables. In dry weather, boom and net inspections occur at least weekly and may occur more often for certain sites where specific tide and wind conditions may cause debris to accumulate outside of rain events.*

2c. Who do you call if the boom is full?

Response: *Any questions, reports, or complaints about a DEP boom should be made to 311. DEP is currently working to improve the process by which the public can make these types of complaints.*

2d. Are booms connected to moorings that move with the tide?

Response: *Most of DEP's booms include tide risers mounted in piles, which enable the containment facility to move up or down with tide conditions. The temporary CSO boom located in Gowanus Canal, however, does not have tide risers.*

2e. Can the City provide a fact sheet on booms and skimmers?

Response: *DEP makes information on booms and skimmers available on the DEP website and in the Annual CSO BMP report.*

2f. Can the City place nets around outfalls to collect trash?

Response: *While some select City combined sewer outfalls do have nets, the City is not proposing to put nets at MS4 outfalls at this time. Nets can be costly to install and maintain.*

2g. The public asked for more information on DEP's past assessment that 99% of marine debris discharged from the sewers comes from street litter, and criteria used to select waterbodies for the floatables loading rate assessment, and the status of new technologies available for capturing floatables as a tool for the City (i.e. vortex separation, trash wheel, and waste shark).

Response: *Previous assessments conducted in the 1990s characterized and quantified the trash and debris washing ashore, discharging from the sewer system, originating from the solid waste handling system, and other anthropogenic sources. This analysis found that at that time, the majority of floatables came from the sewer system. Additionally, approximately 99% of the items discharged from the sewer were consistent with street litter while sanitary items accounted for a little more than 1% of the items discharged. Further, DEP conducts an ongoing floatables monitoring program which includes a characterization of floatables found in problematic areas. These characterizations confirm that street litter continues to be a major source of floatables.*

Loading rates of floatables from the MS4 will be assessed for each waterbody listed as impaired for floatables in Appendix 2 of the MS4 Permit. These loading rates will be assessed using the methodology described in Appendix 9.1 of the SWMP. The City is reviewing and exploring technologies available for floatables controls including less traditional controls such as the trash wheel and waste shark.

5 Other Agency Programs:

3a. The public raised concerns about trash accumulation and floatables sources for the following: large public events like parades and marathons, marine transfer stations, docks and esplanades, and waterfront properties and walkways.

Response: *As stated in the NYC Administrative Code and Chapter 14 of the Rules of the City of New York, sponsors and participating vendors of block parties, street fairs, and other similar events are required to arrange garbage collection and ensure appropriate separation of recyclable materials. The PP/GH provisions of the SWMP address trash and debris management at City facilities and operations in the MS4 area such as marine transfer stations and waterfront properties.*

3b. The public suggested that DSNY expand its recycling program to include bottle caps and asked about education and legislative actions to address plastics.

Response: *Currently, DSNY accepts and recycles all rigid plastics, including rigid plastic caps and lids. A complete list of items that can be recycled in NYC is available at http://www.nyc.gov/recycle.*

The City has undertaken several initiatives to reduce all types of waste, including plastics, with the goal of sending zero waste to landfills by 2030. These include initiatives such as the B.Y.O. Campaign which encourages New Yorkers to use reusable items over single-use items, which are often plastic. The City also passed a Carryout Bag Law which imposed a fee of at least five cents on all carryout merchandise bags; however, in February 2017, the New York State legislature suspended the law and established a one-year moratorium on establishing new carryout bag fees in NYC. Despite the fact that the legislation was overturned, DSNY is committed to educating NYC residents about the importance of carryout bags and has given away over 315,000 free 0x30 bags from February 2017-April 2018.

3c. The public asked if DSNY would be willing to invest in sturdier trash cans and asked if alternate side parking and street sweeping can be re-evaluated if a neighborhood agrees to clean its own streets. The City should host a competition to encourage the public to design artwork for their local trash bins.

Response: *DSNY currently services 23,500 litter baskets throughout NYC. Businesses and organizations interested in purchasing deluxe, heavier-duty litter baskets are able to participate in the Sponsor-a-Basket Program. Through this program, DSNY replaces the City's standard litter basket with a pre-approved deluxe basket. These deluxe baskets can include a sponsor's logo or name to highlight their commitment to maintaining the community's quality of life. DSNY also encourages volunteers to enroll in our Adopt-a-Basket Program. This program allows volunteers to partner with DSNY by adopting a City's litter basket and help assist in maintaining it. Volunteers enrolled in this program can help protect health and quality of life by keeping public litter baskets from overflowing.*

Changes in alternate side parking and street sweeping are governed by existing City laws, which layout what criteria must be met in order to reduce alternate side parking regulations. If that criteria is achieved, then DSNY and the Mayor's Office will evaluate if a reduction in alternate side parking is efficient within that community board.

Monitoring

The questions and comments the City received on the Monitoring program reflected three general themes: general program questions, specific program questions, and citizen science engagement.

1 General MS4 Monitoring Program:

1a. Are waterbodies being monitored or outfalls?

Response: *The City is monitoring both waterbodies and outfalls. During Phase 1, the City will monitor only MS4 outfalls during wet weather to assess the influence of land use on stormwater discharge and pollutant concentrations. During Phase 2, the City will monitor both outfalls and associated waterbodies concurrently. In addition, existing monitoring programs such as the Harbor Survey and Sentinel Monitoring Programs will continue to monitor receiving water bodies during both Phases 1 and 2.*

1b. How are monitoring sites selected; is there a list?

Response: *DEP selected monitoring sites for wet weather sampling through desktop survey and field verification using the following criteria: (1) farthest downstream manhole or outfall pipe not influenced by tides; (2) no dry weather flows; and (3) safely accessible by sampling field crews. Chapter 10 (Table 10.2) of this Plan provides a list of the selected outfalls.*

1c. When will the monitoring program start?

Response: *The monitoring program will start by August 2020. However, as noted above, existing programs such as the Harbor Survey and Sentinel Monitoring are ongoing.*

1d. What precipitation average is DEP using to sample 3 times a year?

Response: *DEP will sample outfalls quarterly (four times per year) for 2 years during Phase 1, and will use an average precipitation of 0.4 inches. (See Appendix 10.1 for details)*

1e. How soon after rainfall will DEP collect samples?

Response: *DEP will start collecting grab water quality samples as soon as flow appears at the sampling location and after every 20 minutes until the flow in the sewer ceases. Flow will however be continuously monitored by an automated system that will be installed in the sewer.*

1f. Will DEP use automated solutions with micro-controls?

Response: *In the City's understanding of the question, DEP will collect samples for testing water quality parameters by grab and composite sample methods. In addition to collecting grab samples, DEP will also monitor flow by using an automated system that will be installed in the sewer prior to grab samples collection. DEP will use the flow and grab water quality concentration to estimate pollutant load discharging from each land use type.*

1g. How transparent will DEP be about monitoring/reporting in the next 3-4 years?

Response: *DEP will analyze monitoring data collected and report the data and analyses in each annual report for public review.*

1h. Could this monitoring program have caught the issues in Coney Island Creek?

Response: *The existing Sentinel and Harbor Survey programs identified the conditions in Coney Island Creek.*

2 Specific MS4 Monitoring Program

2a. Why do Phase 1 and Phase 2 sampling have different parameters?

Response: *The approach to selecting Phase 1 and Phase 2 parameters has changed since DEP first proposed parameters to the public. The revised approach is to complete Phase 1 monitoring, analyze the 2-years of collected data, and use the analysis results to better refine which of the Phase 1 sampling parameters to continue in Phase 2. Phase 1 parameters with concentrations below NYS water quality standards will be discontinued in Phase 2.*

2b. Will Phase 1 results influence Phase 2 parameters?

Response: *Yes. See response above.*

2c. Is Phase 1 land use-based monitoring within each borough or NYC as a whole?

Response: *Phase 1 monitoring will be conducted in four (Bronx, Brooklyn, Queens and Staten Island) of the five boroughs. We propose doing no monitoring in Manhattan. It is, however, important to note that Manhattan is a predominantly CSO and not part of the MS4 Area or subject to the MS4 permit.*

2d. Can DEP use past data to verify land use coefficients?

Response: *The City will estimate land use coefficients based on Phase 1 data.*

2e. Land use could be significant if urban structures contribute pollutants (e.g., rain gardens contributing to nutrient issues). The City should select outfalls to monitor that range in size.

Response: *The City will monitor from a range of land uses including open space and outdoor recreation; multi-family residential, commercial and office buildings; public facilities and institutions; industrial and manufacturing; one and two family buildings; and highway.*

3 **Citizen Science Engagement:** The City should widen the scope of the monitoring program to include citizen science data. The City should develop outreach on what the public can do to assist with the monitoring program.

Response: *As stated in Chapter 10: Monitoring and Assessment of Controls, the City considers established community-led monitoring data when evaluating long-term trends and comparisons of water quality. For example, during the development of several CSO LTCPs, organizations such as Riverkeeper, Bronx River Alliance, and the New York City Water Trail Association's Citizens Water Quality Testing Program conducted sampling and submitted data and analyses to the City. The City reviewed this information in relation to its own analyses, noted comparisons and differences, and in some cases used it for modeling calibration processes. DEP compared stakeholder data with City data and provided a summary of the comparison during public meetings, on the DEP website, and in the final CSO LTCP that DEP submitted to NYSDEC. Organizations in addition to those listed above that collect long-term water quality data are encouraged to notify and provide information on their monitoring programs to DEP's MS4 team by emailing MS4@dep.nyc.gov.*

2.1 Program Specific Engagement

The City conducted outreach for specific programs. Below is a summary of comments the City received during targeted stakeholder engagement for I/C and C/PC programs and the Coney Island Creek community by the City. Responses to Comments on the Floatables Work Plan are in Appendix 9.1. Verbal responses were provided during the meetings. The written responses included in this appendix reflect the final SWMP.

Industrial and Commercial

Summary of Industrial and Commercial Outreach during SWMP Development

As described in Chapter 8: Industrial and Commercial Stormwater Sources, DEP prepared and will maintain a facility inventory of all publicly and privately owned industrial and commercial sites that could discharge pollutants of concern (POCs) in stormwater to the MS4. As of August 1, 2018, the inventory includes approximately 1,300 unpermitted facilities that DEP will assess to determine whether the facilities generate significant contributions of POCs to impaired waters. DEP began conducting outreach to these facilities in the summer of 2017 and contacted all 1,300 facility owners to invite them to a series of informational meetings in Staten Island, Brooklyn, Queens, and the Bronx to describe the Industrial Commercial Program. The City used the following methods to contact owners:

- Letters and mailings
- Door-to-door outreach
- Phone calls
- Social media posts
- Notification letters to NYC City Council Members and local Community Boards to enlist their support in notifying facilities

The meetings were held:

- Staten Island—June 15, 2017
- Brooklyn—November 8, 2017
- Queens—November 9, 2017
- Queens—November 16, 2017
- Bronx—November 29, 2017
- Staten Island—December 5, 2017
- Brooklyn—December 7, 2017

Industrial/Commercial Stakeholder Feedback Summary:

- Roles and Responsibilities
  - » The City and NYSDEC should clarify their individual roles and responsibilities so that facility owners and operators know which agency to report to.
  - » Stakeholders expressed concerns about conflicts between regulatory agencies and want to ensure that there is no redundancy given the numerous inspections as the local, state, and federal levels.
  - » The City should give guidance on whether the owner or the operator is responsible for compliance. The City should clarify the difference in the types of stormwater permits (e.g., SPDES, MSGP, MS4)
  - » The City should be clear on whether or not there are costs associated with the being assessed and whether facilities will need to invest in new infrastructure to comply with the requirements.
  - » The City should take responsibility for the right of way and pollution off of City owned properties
  - » Facility owners requested City assistance in:

  - Identifying grants or other funding mechanisms to offset costs
  - Creating maps, lists or other tools so properties can easily identify if they're in the inventory
  - Identifying the types of operations that could generate POCs in stormwater
- Assessments/inspections:
  - » The City should be clear on the timing and scope of assessments and inspections.
  - » If facilities are found not to be in compliance, they should not be given automatic violations but should have an opportunity to address the issue.
  - » Facility owners requested that there be direct communication lines between DEP and those on the inventory throughout the assessment/inspection process.
  - » Facility owners asked for clarification on what types of issues could be seen on a site that would require referral to NYSDEC.
  - » Facility owners asked whether this program applies to sites that have no outdoor activities

Construction and Post-Construction

Stakeholder engagement conducted with industry professionals for the Lot Size Threshold Study

For the Construction and Post-Construction provisions of the SWMP, the City conducted specific engagement with the engineering, design, construction management, and real estate development communities. This engagement began on March 30, 2016 with targeted outreach on the Lot Size Soil Disturbance Threshold Study where industry professionals were invited to a meeting to learn about the scope of work for the study. Professionals then had the opportunity to provide comments on the scope and give early input based on their industry knowledge and design experience. In the fall of 2016, the City kicked off a partnership with the Urban Green Council (UGC) and the Real Estate Board of New York (REBNY) to bring together an even broader audience of professionals who will be impacted by the Construction and Post-Construction provisions. UGC and REBNY lead multiple feedback sessions with the development community and technical experts.

MARCH 30, 2016
DISCUSSION SUMMARY:

What is the contact info for submitting comments and site visit candidates?

- One set of comments per organization should be emailed to MS4@dep.nyc.gov by April 29 **2016.**
- If scheduling a site visit please include:
  - » Contact information
  - » Site Address
  - » Development type (residential, commercial, etc.)
  - » Anticipated soil disturbance size
  - » Potential constraints to stormwater management implementation
  - » For more information on the MS4 program visit www.nyc.gov/dep/ms4

Is DEP considering impacts of roadways within the study?

- Similar to the NYC Green Infrastructure Program for combined sewer areas, the SWMP will develop BMPs to address stormwater impacts from both private lots and the public right-of-way. The stormwater rule developed as a result of this study will apply to both public and private projects, and the MS4 permit includes additional requirements for municipal upgrades (these are required to consider and if feasible and cost-effective runoff reduction techniques and green infrastructure during municipal upgrades, including municipal rights of way).

Will the new water quality requirements apply to both new development/redevelopment and existing developments?

- The new requirements will only apply to new development/redevelopment projects, not retrofits of existing property. The city will provide the stormwater management requirements and design guidance along with the SWMP.

Based on discussion with other cities, what footprint size is required for the stormwater management practices?

- This depends on the water quality volume requirements, local site conditions, and types of allowable stormwater management practices.

How will NYC determine what constitutes a construction activity (e.g., two adjacent lots developed together)?

- Projects that are part of a common plan of development or sale will be considered together to count toward the disturbance threshold.

How will the contractor know what their responsibilities are under the new requirements? It is not always clear between owner/developer/operator who is responsible for SWPPP development, BMP implementation, etc.

- The procedures and rules will be specified as part of the SWMP. DEP intends to involve the development community in determining the appropriate requirements.

What will post-construction requirements be for inspection and maintenance? What will be passed along to the end user/small owner?

- The long-term operation and maintenance requirements will be specified as part of the SWMP, and the resulting costs to property owners under different zoning and size categories will also be one of the factors considered in the cost-benefit analysis for this study.

NYSDEC allows owners/operators to commence stormwater discharges from construction activities five days after submitting an electronic version of the NOI (ten days for a paper version), will NYC consider a similar timeframe?

- The current NYSDEC requirements will be considered under the development of the SWPPP review process.

Will DEP consider additional water quantity requirements beyond the current BWSO site connection process?

- DEP doesn't anticipate including additional water quantity requirements under this study, the focus is on stormwater management practices for water quality.

Will the SWPPP submissions be performed in conjunction with the BWSO site connection process for water quantity?

- DEP will coordinate internally to align processes, simplify procedures, and reduce duplication of effort to the extent feasible.

Who will be reviewing permit applications and SWPPPs?

- DEP will be the lead agency for SWPPP reviews, other permit processes are not anticipated to change.

What will NYC be doing for retrofits of existing properties?

- DEP is currently investigating multiple opportunities to encourage stormwater management on existing properties. One study underway will build on an existing grant program and make recommendations on how the City can further incentivize private property owners to "green" their properties. For questions on this study please contact MS4@dep.nyc.gov.

MS4 Industry Stakeholder Engagement
Summary Memo
prepared by
Cecil Scheib, PE, LEED AP
Urban Green Council
for the NYC Department of Environmental Protection

As part of the MS4 permit requirements, the NYC Department of Environmental Protection (DEP) must develop new programs and regulations for permitting runoff in separately sewered (MS4) areas. In order to gain industry feedback so that regulations can be the least harmful to economically productive development in New York City, DEP requested Urban Green and REBNY to lead a stakeholder engagement process.

In addition to the mailing lists and connections of DEP, Urban Green, and REBNY, Urban Green analyzed 12 months of DOB permit data in MS4 areas to determine which owners and contractors most commonly submitted permit requests for site disturbances.

Five onsite sessions were held, reaching over 50 industry stakeholders in total:

Introductory sessions
December 2, 2016 (REBNY): Engineers, consultants, and technical experts
December 15, 2016 (GCA): Contractors
January 6, 2017 (REBNY): Owners and developers

Interim review session
March 23, 2017 (REBNY): Joint session

Final review session
June 2, 2017 (REBNY): Joint session

In addition, Urban Green developed detailed online surveys for the costing process in which feedback was given on each stormwater control measure (SCM), for both capital and operational costs. About a dozen stakeholders responded to the survey, some in great detail.

At these events, hosted by REBNY, Urban Green moderated DEP presentations on state MS4 requirements with which they must comply, the Arcadis analysis of SCM capital and operational costs, permitting issues, and the environmental benefits and industry-wide costs of different lot size thresholds. Attendees gave feedback on how to make the regulations the least painful and inconvenient, suggestions as to the permitting process, and came to industry consensus on an appropriate lot size threshold.

Urban Green also prepared and revised through several versions and options an analysis of cost per residential unit, per borough, at different levels of residential exemption, based on cost data from Arcadis and internal statistical manipulation of PLUTO data.

A summary of key feedback from industry stakeholders is as follows:

1. Because of the multiple rounds of feedback on the costing exercise, including the detailed survey, there should be a high degree of industry consensus on the costing foundation for the threshold analysis.
2. Industry raised and supported the idea of exempting 1-2 family homes.
3. Industry was highly supportive of streamlining the NYSDEC/DEP permitting and inspection process and made multiple detailed comments regarding this. DEP has taken notes on these suggestions and they were discussed at multiple meetings.
   - The general consensus that NYC is the most bureaucratic city for permit requirements, and that this new process will slow everything down even more than they already are.
   - Technical/consultant firms have often felt stuck in the middle trying to resolve interagency issues.

4. There was the suggestion that NYC should consider a stormwater banking and credit system like DC.
5. There is a potential disconnect between definition of "redevelopment" in the NYC legislative proposal and the DEC definition for NOIs.
6. Industry suggested aids to compliance including:
   - A "standard objection" list like DOB uses
   - A list of activities that will make a successful SWPPP (like noise mitigation plan).
7. Industry supports a higher lot size threshold.

Coney Island Creek

Summary of the Coney Island Creek Community Workshops

The Coney Island Creek Community Workshops were held at the New York Aquarium for three consecutive years from 2016 to 2018 as a coordinated effort between the Coney Island Beautification Project, SWIM Coalition, Wildlife Conservation Society, Partnership for Parks, and DEP.

In 2016, DEP presented an overview of the MS4 Permit and described the coordination with the Coney Island Creek Long Term Control Plan. In 2017, DEP presented on Priority MS4 Waterbodies and the Illicit Discharge Detection and Elimination (IDDE) program with breakout sessions on IDDE notification, IDDE education and outreach, trash "hot spot" locations, and the best way to reach the community for education and outreach. In 2018, DEP presented to let the Coney Island Creek community know how their comments and suggestions were incorporated into the SWMP. Refer to Chapter 11: Special Conditions for more information on the City's engagement in Coney Island Creek during SWMP development and how the City responded to specific community requests.

Public Feedback Summary

- **IDDE Notifications**
  - Alert elected officials, community board, community organizations, schools, OEM, local newspapers
  - E-blast and/or text messages from community board or Notify NYC
  - Signage
    - Multiple languages
    - Located at libraries, precincts, firehouses, eateries, parks, boat access points, train stations, aquarium, CIC
    - Hang flyers in high rise buildings and senior centers
  - Radio announcements on language specific stations
  - Website
    - Post information on the illicit discharge
      - Create color coded system for discharge severity
      - Create grading system, like DOH's for restaurants, for waterbodies
    - Post specific address so there is a public notice and someone can't sell their home with the problem (for illicit connections)
    - Create a GPS app that allows phones to connect to the website, citywide program to get information on active investigations
  - Put a medallion on catch basin associated with an issue to let the public know a problem has been called in (for illegal dumping)

- **IDDE Education**
  - Storm stenciling
  - Attend community meetings and have workshops in the community
  - Programming with the aquarium and schools
  - Signs at parks, subway stations
  - Pamphlets at bodegas
  - Engage with developers and home/building owners
- **IDDE Community Requests**
  - Citizen science programs—need standard operating procedures and information for people to know how to document properly
  - Shoreline Survey and Sentinel monitoring data.
    - Schedule of when DEP goes out so community members can join
  - Make an example of violator companies
  - Reporting system with reward system
    - Anonymous notifications
    - Have the reward go back to the community, not to individuals
  - Label outfalls with ID and sign with information on reporting
    - Sign in multiple languages
- **Trash "hot spot" Locations**
  - Mermaid Ave.
  - NYCHA
  - Cropsey Bridge, Coney Island Creek Bridge, and under Belt Pkwy
  - Subway stations, bus stops, playgrounds
  - Specific intersections mentioned, listed in detailed notes document
- **Floatables Requests from Community**
  - Coordination with NYCHA and Sanitation
    - Want NYCHA to have and use dumpsters
  - Wind proof trash cans
  - CSO and MS4 outfalls
    - End-of-pipe netting
    - Booms
    - Skimmers
  - Conduct studies for the trash at the outfalls and illegal dumping of medical waste in CIC
  - Have Parks issue summons for people littering

2.2 2016 and 2017 Progress Report Comments and Responses

The City posted responses to each written comment on the 2016 and 2017 Progress Report to its website, and provided responses to the commenters, in November 2016 and August 2017.

2016 Progress Report

Background:

On August 1, 2015, the Department of Environmental Conversation (DEC) issued a new comprehensive permit to the City. The permit includes robust requirements that significantly expand the City's obligations to reduce pollutants discharging to the Municipal Separate Storm Sewer System (MS4). There are 14 City agencies with substantial obligations under the new MS4 permit, and the Department of Environmental Protection (DEP) is responsible for coordinating the efforts of those agencies with respect to all matters relating to the permit's requirements. The City's MS4 permit requires the development by August 1, 2018 of a Stormwater Management Program (SWMP) Plan, the goal of which will be to reduce pollution that reaches waterbodies through the MS4.

As required by the MS4 permit, the 2016 Progress Report on the development of the SWMP was presented to the public on June 22, 2016. This meeting included various stakeholders and everyone was informed that the Progress Report would be posted on the City's MS4 webpage in July. The 2016 Progress Report was open for comments through August 26, 2016. The comments received on each Progress Report presented and published will be used to inform development of the SWMP Plan. The following comments were received and responses were provided by the City.

City Responses to Comments on the MS4 Progress Report submitted August 24, 2016 by Riverkeeper representing comments from multiple organizations

Comment 1: Is the DEP including in its review of agency authorities and obligations any of the work (completed or ongoing) by the Department of City Planning that pertains to pollution sources and vulnerabilities in MS4 areas, for example the reports on Industrial Resilience or Open Industrial Uses?

> **Response 1: Yes**

Comment 2: Does the DEP believe, at this stage, that any new legislation will be required to implement the MS4 permit? If so, can the DEP share these plans with the public? Can the DEP also share the review of existing legal authority to control discharges into and from the MS4 and its proposed schedule for the adoption of comprehensive legal authority which was submitted to the DEC?

> **Response 2: The MS4 legislation was transmitted by the Mayor to the City Council on November 16, 2016 and is available on the Council's website.** http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=2884636&GUID=C605C2B3-29BA-4D7A-83D8-392CD45C7093&Options=ID|Text|&Search=ms4

Comment 3: Can the DEP share the interagency MOUs with the public (by distributing to the MS4 public mailing list and by posting online)?

> **Response 3: MOUs between agencies are currently being drafted and progress will be shared publicly as they are finalized.**

Comment 4: What interaction has the DEP had so far with New York City Council, and what will be the Council's role in overseeing DEP's actions under this permit?

> **Response 4: The Council's role is solely as the legislature, in adopting legislation. Preliminary outreach about proposed legislation has occurred. DEP will be hosting webinars on November 29th and November 30th from 3-5 pm to walk stakeholders and public through the proposed legislation.**

Comment 5: Does the DEP believe that new offices, programs, branches (or similar substructures) will need to be established in any of the MS4 Permit-covered agencies? If so, what programs, and for which agencies?

> **Response 5: All operating agencies will have resources to implement and track their efforts in Mapping, Illicit Discharge Detection and Elimination (IDDE), and Pollution Prevention and Good Housekeeping (PP/GH). Those with existing related Public Education/Outreach programs will incorporate MS4 messaging where appropriate.**

Some of the programs will be implemented or coordinated by DEP. DEP is in the process of establishing several new programs such as the Construction and Post-Construction program, which includes Stormwater Pollution Prevention Plan reviews, inspections and enforcement; and the Industrial/Commercial program, which includes inspections and enforcement. In addition, DEP is coordinating the PP/GH program among the city agencies. Other existing DEP programs will be enhanced to comply with MS4 requirements including IDDE and Monitoring.

Comment 6: Will the DEP release the "inventory" of existing programs referenced in the Progress Report? Similarly, will the DEP release its target list of citywide events where the agency plans to deploy public education and outreach assets in the coming 6-12 months?

Response 6: Information on existing Public Education and Outreach programs is currently available to the public on NYC agency websites. Additional information is available in DEP's Annual Report on Best Management Practices required by SPDES Permits for the City's 14 Wastewater Treatment Plants. A list of current programs will be provided in the Stormwater Management Program (SWMP). Examples of existing programs include and are not limited to:

- **DEP Art and Poetry Contest**
- **DEP Resources and Training for Educators**
- **DEP Adopt-a-Bluebelt**
- **DPR Natural Classroom and Urban Park Ranger Programs**
- **DOT Adopt-a-Highway/Greenway**
- **DSNY Adopt-a-Basket**
- **DSNY SAFE Disposal Program**

Sponsorship of and participation at citywide events is dependent on the availability of staff and resources and is subject to change. Example events include but are not limited to SAFE Disposal Events, the DEC Annual Hudson River Fact Finding Day, and Summer Streets.

Comment 7: While we appreciate the DEP's presence at conferences and festivals, table-side materials are not the only way—nor indeed the best way—to reach the average New Yorker. What is the DEP's plan for reaching families, businesses, industries, and tourists throughout the MS4 area?

Response 7: The City intends to use a variety of tools and strategies to reach New Yorkers. While full details on public outreach will be presented in the Stormwater Management Program (SWMP) Plan, example outreach activities may include meetings and workshops on specific permit provisions with the affected stakeholders, mailings to businesses, outreach to schools and educators, and paid advertisements.

Comment 8: At the public meeting for this annual permit update, it was suggested by a member of the public that the DEP should hold meetings individually tailored to each permit program area. As an example, even a discussion on something as discrete as the DEP's plans for fulfilling its mapping requirement can take well over an hour. Will the DEP consider this level of transparency?

Response 8: In response to the Public Meeting held June 22, 2016, DEP established a Stormwater Advisory Group (SAG) for the City and members of the public to convene quarterly throughout Stormwater Management Program (SWMP) development. The intent of the SAG meetings is for the City to share more detailed information on each permit provision and receive feedback and questions from the public.

The first SAG meeting held on September 27, 2016 covered portions of the Pollution Prevention/Good Housekeeping Program (PP/GH) for Municipal Operations and Facilities. The next SAG meeting on December 13, 2016 will focus on the Construction and Post-Construction Program development and initial results of the Lot Size Threshold Study. The public is notified of SAG meetings in advance via email. If you are interested in attending future SAG meetings, please email the MS4 Team at ms4@dep.nyc.gov.

Additional outreach with relevant stakeholders will occur for some subjects. For example, webinars on November 29th and 30th from 3-5 pm will inform two separate stakeholder groups about proposed legislation.

Comment 9: On the issue of technology, a proposal was made at the same public meeting that the DEP should explore ways to have citizens, businesses, and communities help the DEP with enforcement through technology. Does the DEP plan on generating any 21st Century solutions to the problem of enforcing a permit that covers thousands of facilities, even more outfalls, and incalculable direct-discharge spots across New York City?

Response 9: The City's 311 system is the most streamlined and effective method for the public to report Illicit Discharge Detection and Elimination (IDDE) issues, as it is centrally collected and tracked to meet multiple reporting needs. Currently, residents are encouraged to report all issues affecting City waterways by calling 311 or by visiting www1.nyc.gov/311. The request for technology that facilitates public reporting of stormwater issues has been noted and will be considered as program development progresses.

Comment 10: The DEP has previously mentioned that it plans to expand "311" support for MS4-type issues. Does this plan include expansion of the 311 phone app? If so, how? Does the DEP have information it can share on the reports already coming in to the 311 system about MS4-related issues, and examples of how the DEP generates solutions now?

Response 10: The 311 system already accommodates complaints that are relevant to the MS4 permit. This includes complaints of general water quality issues in City waterways, illegal dumping into catch basins, illicit discharges of sewage or industrial waste, dry weather discharges, leaking fire hydrants, and other sources of pollution leaking onto streets or sidewalks. All 311 service requests since 2010 are available to the public through NYC Open Data.

Comment 11: At what point, and in what form, will the DEP release the Permit-required map? For example, will the drainage map only become available with the final SWMP, will the DEP release GIS files of the map, and/or will the agency include in the map detailed information of all City-agency owned and controlled outfalls or simply pinpoint the location of unidentified outfalls?

Response 11: The map will be released in accordance with the content and schedule required by the permit. Currently, DEP is coordinating with other agencies to determine the appropriate format and level of detail to share publicly for the preliminary and final maps, the feasibility of various formats and public accessibility/interactivity, and whether any portions can be shared in advance of the Stormwater Management Program (SMWP) Plan submission.

Comment 12: We are significantly concerned with private connections into the MS4 system. We understand the DEP as having concluded it is not responsible for mapping these connections unless there is evidence of a dry weather discharge that can be tracked to a specific location. Is this the case? If this is not precisely accurate, how would, in your own words, the DEP describe action it will be taking with respect to mapping and monitoring past, present, and future private connections to MS4 systems?

Response 12: Dry weather discharges are the best indication of an illicit connection to the MS4. Once they are identified they will be abated, and the number detected and eliminated will be included in each annual report, so there is no need to maintain a map of these sites. Individual private connections are not mapped, but are reviewed and inspected through the existing sewer connection permit process.

Comment 13: Are all New York City owned and operated MS4 outfalls being pinpointed by the DEP under this permit, or just the outfalls from the specific "covered" agencies?

Response 13: As required by the MS4 permit, only outfalls owned and operated by agencies with obligations under the permit will be mapped.

Comment 14: Are street-ends and other known/discrete direct drainage, discharge, or conveyance points (i.e., not piped outfalls) that are owned or operated by City agencies being mapped as well? For example, waterfront stretches of City parks, DOT-controlled street-ends, or DEP wastewater treatment facility docks?

Response 14: Properties owned or operated by City agencies that drain via overland flow rather than through a piped outfall are being mapped as overland flow areas.

Comment 15: Most importantly, how does the DEP plan to discover and stop illicit discharges that are not occurring during dry weather? Certainly, sites with illicit or illegal connections, during storms, will have polluted runoff entering the City's MS4 system that may be entirely untreated and uncontrolled. We call for a plan to address these illicit and illegal connections in all weather conditions.

Response 15: The permit defines an illicit discharge as set forth in 40 CFR 122.26(b)(2): any discharge to a municipal separate storm sewer that is not composed entirely of storm water except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from firefighting activities per. As such, normal stormwater discharge is not considered an illicit discharge. It is important to note that dry weather provides the appropriate conditions to detect illicit discharges that can be diluted and difficult to track down during wet weather. Accordingly, DEP has been implementing a comprehensive Sentinel Monitoring Program to identify illicit discharges in conjunction with the Shoreline Survey Program. Wet weather monitoring as required by the MS4 permit will complement the dry weather sampling performed in the Illicit Discharge Detection and Elimination (IDDE) program. In addition, the City continues to rely on public reporting of illicit discharges at all times, to enhance the regular monitoring programs.

Comment 16: Does the DEP have any plans to expand the role of the public in IDDE enforcement work? As with the comment above relating to technology's role in public involvement, use here for enforcement would seem to be a logical place to start. Beyond 311-type interactions with the public for IDDE purposes, does the DEP have a plan to streamline how it receives tips (about issues like dry weather discharges) from the public, and, perhaps most importantly, responds to those tips?

Response 16: Please refer to the responses to comments 9 and 10 regarding 311 and the efforts toward enhanced reporting.

Additionally, the DEP Emergency Response Unit responds to reports of illicit discharges that enter the sewer system. Plans to engage the public will be detailed in the Stormwater Management Program (SWMP) Plan.

DSNY responds to 311 complaints and citizen tips regarding illegal dumping on public and private property. DSNY also issues violations for illegal dumping through its own investigations.

Comment 17: Does the DEP plan on sharing the records and procedures of the IDDE program with the public during the SWMP development (e.g., outcomes of recent enforcement actions, information on internal processes for handling reports of dry weather discharges, etc.)? This would allow much more informed comments when the 2017 progress report is issued, and would go far toward educating the public as to how the DEP's IDDE program works, and how it could be improved.

Response 17: The current Illicit Discharge Detection and Elimination (IDDE) program manages citywide issues of illicit discharge. The program is based on the SPDES permits for the fourteen NYC wastewater treatment plants which include, among other requirements, records requirements and dry weather discharge procedures, which DEP is implementing.

Comment 18: Regarding inspection and enforcement, what new staff does the DEP, specifically, require over the coming years (either filled since the permit issuance or planned to be filled)?

Response 18: DEP is currently developing the review, inspection, and enforcement aspects of new programs, which includes assessing personnel needs and developing a staffing plan.

Comment 19: Does the DEP plan to work with other City agencies to help alleviate the inspection and enforcement burden? If so, which agencies, and has the DEP secured such collaboration for the duration of the permit's lifespan? What is the proposed annual workload (sites visited, for example) for each proposed enforcement agent?

Response 19: The review, inspection and enforcement will not be a shared responsibility with other Agencies. DEP is undertaking the responsibility to manage two new programs: review, inspection and enforcement aspects of Construction/Post-Construction, and inspection and enforcement aspects of Industrial/Commercial stormwater management. As noted in the response to comment 18, DEP is currently developing these new programs, which includes assessing personnel needs, developing a staffing plan, and coordinating with other agencies on the process.

Comment 20: Does the DEP foresee any budget or legislative work with the City Council to help it fulfill this aspect of the MS4 permit?

> **Response 20: As noted in the February 1, 2016 submission, DEP is currently working with the New York City Law Department to pursue legislation in connection with certain elements of the permit. Reference the response to comment 4 regarding City Council's involvement.**

Comment 21: Is the DEP's lot size study examining only MS4 areas, or does it include CSO areas? Also, is DEP's lot size study examining what stormwater performance standard should be applied to properties smaller than one acre (which are not subject to DEC's Construction General Permit)?

> **Response 21: DEP's threshold study quantitative water quality modeling is focusing on MS4 areas consistent with the permit. However, DEP also included citywide DOB permit data in the initial lot analysis to assess the approximate number of sites that could be affected citywide. The threshold study is assessing the criteria and requirements for stormwater management practices to be applied to sites that create less than one acre of soil disturbance, such as the water quality volume to be managed and the specific types of practices allowed.**

Comment 22: Does the DEP plan to make its final list of municipal facilities and operations in MS4 areas publicly available in the final SWMP? If not, why not?

> **Response 22: The list of MS4 municipal facilities and operations will be provided, except for those omitted for security concerns.**

Comment 23: The DEP mentions that it plans to prioritize facilities into "High, Medium, and Low" grades based on their potential to impact water quality; can you be more specific? Does the DEP plan to look at potential impact to only those water quality characteristics for which a receiving waterbody (from each individual facility or operation) is impaired, or will the DEP take into consideration any potential impact—present and future—into consideration?

> **Response 23: Presentations describing the prioritization process were provided both at the Stormwater Infrastructure Matters (SWIM) Coalition Meeting on September 13th and September 27th Stormwater Advisory Group (SAG) meeting. The presentation is available at DEP's MS4 website: http://www.nyc.gov/html/dep/pdf/water_sewer/stormwater-advisory-group-092716.pdf**
>
> **All potential discharges of Pollutants of Concern (POCs) will be taken into account for the prioritization/ranking. Sites with POCs for which the receiving water body is impaired will carry a higher-weighted risk (i.e., may rank higher) than sites for which the surface water impairments are different from the on-site POCs. The potential risk to water quality is assessed using several criteria such as discharges of POCs to impaired waters, pollutant sources on site, proximity to a waterbody and history of problems that would impact water quality of the facility.**

Comment 24: Will toxics, wastes, oils, sediments, and hazardous substances be included in the DEP's setting of facility and operation classifications? What about plastics, pharmaceuticals, and personal care products?

Response 24: Facilities and operations will be prioritized in accordance with the prioritization protocol (see response to comment 23). The permit defines Pollutants of Concern (POCs) as a pollutant that might reasonably be expected to be present in stormwater in quantities that may cause or contribute to a water quality violation in waters of the State. All potential discharges of POCs will be taken into account for the prioritization/ranking.

Comment 25: The DEP's progress report notes that protocols and procedures have been established for this listing process, as well as training systems; can you share that information with the public? It should be made available for public comment.

Response 25: These protocols, procedures, and associated training are currently under development. DEP intends to provide a presentation summarizing these documents at the Stormwater Advisory Group (SAG) meetings to gather early feedback during Stormwater Management Program (SWMP) development. Final documents will be included in the SWMP Plan, for additional public review and comment.

Comment 26: The DEP states that it will be requiring these facilities and operations to "reduce or prevent" discharge of pollutants. How does the DEP plan on determining which facilities will only be required to reduce (not prevent) discharges? Why does the DEP not intend to set a goal of pollution prevention for these citywide facilities and operations?

Response 26: Stormwater Control Measures (SCMs) will be developed and implemented for operations conducted at facilities and off-site locations. These are pollution prevention measures that are intended to control impacts to stormwater runoff to the maximum extent practicable. The overall aim is to prevent, but in certain cases reduction may be the only achievable goal. The self-assessment program will help determine the effectiveness of the SCMs, and may result in revisions or development of new SCMs.

Comment 27: Facilities and operations, under the DEP's plan, will be conducting periodic self reporting; less often for "low" priority facilities and operations, more frequent for the "high" priority facilities and operations. What are these timetables, and does the DEP reserve the right to require more frequent self-assessments in the event of any external (e.g., water quality standard changes) or internal (e.g., facility leadership changes or repeated violations) factors?

Response 27: The facility self-assessments are a permit requirement applicable to all agencies affected by the permit, and each agency is responsible for its own compliance. The schedule and prioritization will be established in the Citywide Stormwater Management Program (SWMP). High ranking facilities will be assessed more frequently than lower ranking facilities. However, each time a scheduled self-assessment is conducted, the facility/operation ranking will be re-evaluated to account for any changed conditions at the site (e.g., if the site now has different uses or operations, or has implemented Stormwater Control Measures (SCMs) to prevent or reduce Pollutants of Concern (POC) discharges). The prioritization criteria and protocol will be consistent among all sites and instances of evaluation.

Comment 28: For facility and operation self-assessments, what level of oversight does the DEP plan on establishing? Will the DEP demand approval authority over self-assessment procedures for each agency, facility, or operation? Will the DEP be investigating, auditing, or inspecting these facilities on a random basis, and, if so, what percentage of these facilities and operations does the City plan to audit or inspect each calendar year?

Response 28: The facility self-assessments are a permit requirement applicable to all agencies affected by the permit, and each agency is responsible for its own compliance. In accordance with permit requirements (Permit Part IV.G.1.d), the Pollution Prevention and Good Housekeeping (PP/GH) program shall provide recommendations and time frames for modification when PP/GH practices are determined to be inadequate, and include provisions for follow-up to ensure recommendations are implemented within the specified time frames.

Comment 29: Will the DEP be allowing other "covered" agencies to conduct these self-assessments on a citywide basis, or require such assessments be tailored and conducted at each individual facility or operation? We recommend the latter.

Response 29: Each agency provided a self-prioritized list of operations and facilities, which served to estimate the quantity and types of facilities requiring assessment. To ensure consistency across all involved municipal facilities and operations, a third-party contractor is developing prioritization and self-assessment protocols, and performing the preliminary prioritization. A separate third-party contractor will perform on-site assessments to confirm, revise and add to the information used in the preliminary prioritization for the initial self-assessment. This contractor will also provide training to the municipal staff responsible for conducting self-assessments thereafter. Each agency will then be responsible for conducting and reporting on future self-assessments.

Comment 30: What records will be made available to the public of these self-assessments? Will there be recordkeeping requirements, and, if so, for how long will the DEP require city agencies maintain records of these internal assessments?

Will these assessments be sent to the State for review on an annual basis?

Response 30: Summary of the self-assessments for high priority facilities will be included as part of the Stormwater Management Program (SWMP) Plan. Each agency is required to maintain the records and documentation that are necessary to the aspects of permit implementation and compliance for which they are responsible. In accordance with the permit requirements, records must be kept for at least 5 years after they are generated.

Comment 31: This initial inventory of facilities and operations, as we understand it, has been reported to DEP by the "covered" agencies. What measures has the DEP taken to determine if this is a full and complete list?

Response 31: Existing data and information from multiple sources was used to identify City-owned properties and compared with agency-provided lists. Ongoing coordination among agencies will increase comprehensiveness and accuracy. Additionally, DEP is in the process of executing MOUs with each affected agency to memorialize mutually understood divisions of responsibility. Obligations of other agencies include providing DEP with all support and information necessary to develop the Stormwater Management Program (SWMP). Agencies are responsible for ensuring the data submitted is complete and accurate for permit compliance.

Comment 32: The permit also includes a requirement to "Consider and if feasible and cost-effective incorporate, runoff reduction techniques and green infrastructure during planned municipal upgrades including municipal rights of way." The annual report should explain the City's actions to date to implement this requirement across all city agencies, as well as next steps to further advance implementation

Response 32: DEP is currently working with the other affected agencies to gather information about the types of projects best suited for this type of work, and the associated funding sources. The Stormwater Management Program (SWMP) will include the procedures/criteria regarding the types of upgrades or work that qualify, and how feasibility and cost-effectiveness will be evaluated.

Comment 33: First, once the DEP has created its inventory of industrial and commercial sites, will it make that inventory publicly accessible? If not, why not?

Response 33: NY State DEC maintains the inventory of permitted industrial and commercial sites. Multi-Sector General Permits (MSGPs) are available to the public by a link at DEC's website (bottom of web page): http://www.dec.ny.gov/chemical/41392.html

Other aspects of creating and maintaining an inventory are still in development, and will be coordinated with DEC.

Comment 34: In developing this inventory of sites, the DEP notes that "facilities which are possible sources of pollution to the MS4" will be included for City oversight. What are the specifics of the DEP's system of review for determining whether a facility is a possible source of pollution to an MS4? Are these investigations tabletop exercises, or is the DEP investigating sites in person?

Response 34: The initial inventory of facilities was compiled from multiple data sources that include the particular Standard Industrial Classification (SIC) code a site is registered under. However, these SIC code registrations alone do not indicate whether the site is subject to SPDES Multi-Sector General Permit (MSGP). DEP is conducting a web-based screening of the inventory to eliminate those that don't pose a risk to stormwater. For example, a limousine service owner using their home as their office headquarters may be registered under a 'transportation' SIC code, yet the owner might simply be parking a vehicle in their driveway. This is not an industrial site/activity that poses a risk to stormwater, and as such this business would be removed from the inventory or classified as "no further analysis". Businesses requiring further analysis will remain on the list to be inspected physically for permit applicability.

Comment 35: For sites on the inventory, the DEP states that it has developed an inspection plan to determine if a site needs a SPDES permit. What is this plan, and when will the public be provided an opportunity to comment on the plan?

Response 35: The progress report states that the City will develop an inspection plan as part of this program. The inspection protocol for unpermitted facilities is still in development. The protocol will determine if the site requires

coverage under the MSGP, needs to apply for no-stormwater exposure certification, or is not subject to SPDES. DEP intends to provide a comprehensive overview of the Industrial and Commercial Stormwater Sources section of the Stormwater Management Program (SWMP) at a Stormwater Advisory Group (SAG) meeting to gather feedback from public. The final plan will be made available as part of the SWMP Plan for additional public review and input.

Comment 36: According to our understanding of the State SPDES databases, there are many sites in the City's MS4 area which had permits in the past, but no longer have coverage. We suggest that the DEP take a hard look at these facilities in the first year after it has been transferred enforcement jurisdiction.

Response 36: Comment noted.

Comment 37: The DEP progress report states that it plans to conduct inspections and enforcement at MSGP facilities ("to ensure they're complying with their SWPPPs"). Does this mean the DEP will not be inspecting sites that need a SPDES permit but do not have one? If so, why? We suggest clarifying this language to state that any sites in violation of the stormwater sections of the Clean Water Act and applicable State law will be subject to DEP jurisdiction for enforcement purposes.

Response 37: As required by the permit, unpermitted facilities will be inspected and assessed to determine if they generate significant contributions of Pollutants of Concern (POCs) to impaired waters, and if so, will be referred to DEC for permitting.

Comment 38: We notice reference in the DEP progress report to "no further action" sites. Can you please give more detail about such sites; for example, whether this is an enforcement-related designation, whether findings that sites require "no further action" will be posted as final agency actions and available to the public, and what these sites will be exempted from?

Response 38: Please see response to comment 34 regarding inventory analyses.

Comment 39: You stated that surveys were conducted with peer cities. Can you please share the results and responses to those surveys?

Response 39: Once the surveys are complete and we compile the information, we will make it available.

Comment 40: According to the 2016 progress report, the DEP is "evaluating the effectiveness of current control practices." With as much detail and specificity as possible, can the DEP provide the public with a list of those current practices?

Response 40: Detailed information on current control practices and their effectiveness was presented to the public at the Trash Free NYC Waters meeting on September 27, 2016. This presentation is available on the DEP website. Additional information is available to the public in the Annual Report on Best Management Practices required by SPDES Permits for the City's 14 Wastewater Treatment Plants. The Stormwater Management Program (SWMP) Plan will include a description of these programs, and will be provided to the public for review in advance of submission to the State.

Comment 41: The DEP is planning to develop a list of best available control technologies and systems. How will the DEP be defining "best available" for the SWMP? We are concerned that the high variability of NYC stormwater issues requires more than the best one-size-fits-all approach, city-wide, to debris and trash collection. Moreover, there can be many best approaches, depending on program aspects (e.g., there are best available ways to target educational facilities, different approaches for events and large event venues, and different best ideas for sidewalk garbage bins and street cleaning; no one approach is better than the others).

Response 41: The MS4 Permit stipulates that the program to control floatable and settleable trash and debris included in the Stormwater Management Program (SWMP) Plan be designed to identify technological advancements and best available technologies employed in other municipalities and assess their applicability to New York City. The City plans to accomplish this through a study. Referred to as the 'work plan' in the MS4 Permit, this study will determine the loading rate of floatable and settleable trash and debris from the MS4 to waterbodies listed as impaired for floatables. The results of this study will inform decisions about best controls for different areas within the MS4.

Comment 42: Where do street-ends (and the management of debris and garbage that accumulates there) factor into this permit provision and progress report?

> **Response 42: The City is currently developing a methodology to determine the loading rate of floatable and settleable trash and debris from the MS4, including land-based sources, as required by the Permit. If the public has information on street ends where garbage and debris accumulation is noted, the City can consider that information as it continues to develop a Floatables Control Program for the MS4.**

Comment 43: What work does DEP anticipate conducting with the Departments of Transportation and Sanitation? Specifically, how will the management of garbage on streets and at the curb be changed in NYC? Will any solutions generated here (e.g., better trash bin designs, street-end cleanups, etc.) be applied citywide? If not, why not?

> **Response 43: The MS4 Permit is issued to the City and requires implementation by affected agencies including the Departments of Transportation and Sanitation. Coordination with these agencies is already underway. As the work plan and studies are not yet complete, the City cannot at this time identify what controls will be implemented where, though both structural and nonstructural controls will be considered.**

Comment 44: Will any of the programs developed here as "best available" plans for debris, trash, and floatable pollution prevention be applied by any other agencies or authorities that are not covered by this permit? Has the DEP asked the Mayor's Office whether it can negotiate with any such agencies (e.g., NYC Housing Authority, Port Authority, state and federal highways, etc.) to try and improve floatables control on parcels they control?

> **Response 44: The City welcomes agencies and authorities without obligations to this permit to adopt best management practices to reduce their contribution to floatable and settleable trash and debris, including those that will be developed under the MS4 permit. To date there have been no formal discussions on this topic, and the MS4 Permit does not require these agencies/authorities to implement the Stormwater Management Program (SWMP). These entities are subject to their own MS4 obligations, separate from the City's MS4 Permit.**

Comment 45: We notice reference of initiating a pilot "Adopt-a-Catch-Basin" program. Can DEP share the extent and results or status of this pilot program? Does DEP plan to implement a broader Adopt-a-Catch-Basin program? Why or why not?

> **Response 45: The Adopt-a-Catch Basin program launched in April 2016. A joint effort between DEP and Brooklyn Borough President, this pilot program formed partnerships with block associations, business improvement districts, and other community-based organizations to remove debris that blocks storm drains. The effort is intended to curb localized flooding after heavy rainstorms and help prevent floatables such as bottles and other debris from entering into waterways. DEP provides training, gloves and garbage bags to participating organizations that agree to maintain storm drains in their neighborhoods. DEP also enrolls participants in an early alert system to inform them of upcoming weather events that may cause flooding. The pilot phase included sections of Brooklyn, and DEP would consider expanding the program to include other boroughs.**

Comment 46: We ask that the DEP include a monitoring plan and protocol for discharges from street ends, and include a system for public reporting of both discharges and clean-up need. With this MS4 permit, accumulated trash at a street end represents just as real of a potential water pollution risk as a waste oil leak or a combined sewer outfall. Discharges from street-ends should be monitored, reported annually, and, individually, assessed on an annual basis.

> **Response 46: Refer to the response to comment 42 regarding trash at street ends. 311 is currently the appropriate means for public reporting of discharges and clean-up needs.**

Comment 47: The DEP notes the presence of a series of "initial MS4 outfalls" for monitoring. For these, does the agency plan to monitor the outfalls and their drainage areas (to assess more specifically where the sources of pollution are coming from, rather than just the presence or absence of pollution), or just the outfalls? If just the outfalls, why?

> **Response 47: DEP is still developing a multi-purpose monitoring and assessment program and intends to share the details in a Stormwater Advisory Group (SAG) meeting to receive feedback.**

Comment 48: We fully support DEP's efforts to include worker safety in MS4 permit protocols and procedures. That said, "safety of sampling crew" is listed as a measure for determining sample sites—what did the DEP look at for this metric? How does DEP think this decision (to exclude otherwise appropriate sampling sites because of worker safety) will affect monitoring and assessment program effectiveness? Were any solutions developed or discussed for this concern (e.g., sampling at the MS4 outfall instead of within the manhole for any identified site) that might minimize worker safety concerns in order to develop a more appropriate set of monitoring sites? Will the DEP share information on the sites that would have been selected but for the safety concerns? If not, why not?

> **Response 48: The selected set of MS4 sampling locations will achieve all MS4 monitoring program objectives required by Permit Part IV.J.2. The Monitoring and Assessment Plan will describe why the location is selected, frequency of sampling, parameters to be sampled and description of sampling equipment. The City's Environmental Health and Safety (EHS) rules will be taken into account for an additional consideration to not pose a threat to worker safety.**

Comment 49: The DEP cites "sister-city" data on monitoring and assessment plans. Can the DEP share that information with the public? If not, why not?

> **Response 49: DEP is collecting information on other peer municipalities' MS4 Programs including Monitoring and Assessment. We will do an analysis of information learned and publish a report on the findings.**

Comment 50: Please ensure that the "Deliverables Schedule and Status" list includes all obligations under the permit. For example, the requirement to complete a lot size study is not listed under the post-construction section.

> **Response 50: The deliverables schedule and status list matches Table 2 in the MS4 permit. The Lot Size Soil Disturbance Threshold Study is not a deliverable, but will inform the Stormwater Management Program (SWMP). In accordance with permit requirements, the study recommendations on the appropriate threshold will be submitted as part of the SWMP.**

Comment 51: Does the DEP plan to make the initial MS4 sampling stations permanent? If not, what will be the level of permanence of any future-designated sampling stations? Surely, as work progresses on green and grey solutions to stormwater pollution, the representative monitoring sites may need to be amended. What is DEP's process for any such necessary amendments? Has the DEP considered building infrastructure into MS4 drainage areas for ease of regular testing (like, for example, drinking water testing sites or leachate wells)?

> **Response 51: DEP is still developing a multi-purpose monitoring and assessment program and intends to share the details in a Stormwater Advisory Group (SAG) meeting to receive feedback.**

Comment 52: Clearly we're commenting on an annual report already submitted to the State. We expect responses to these comments will be included (to the extent our suggestions or concerns shape the next year's report) in 2017's annual report. We are concerned that this will mean that our comments on the next (2nd) annual report will be reviewed after that report's submission, again, and be too late to shape the final SWMP to be submitted in 2**018.** Will the DEP provide the public with an opportunity before final submission to the State in 2017?

> **Response 52: DEP's Stormwater Management Program (SWMP) development schedule includes a lengthy, multi-stakeholder review process to allow sufficient time to receive, respond to, and incorporate comments on the SWMP Plan prior to submitting to the State by August 1, 2018. Public meetings such as the quarterly Stormwater Advisory Group (SAG) and other targeted stakeholder meetings will provide more detailed information on each SWMP component throughout program development, to receive comments in advance of issuing the full SWMP Plan for public review.**

Comment 53: Does the DEP have in its possession the state's 2016 list of impaired waterways, such that it can site to those waterways in responses to comments? If so, please make that available to the public. If not, when does the DEP expect to see a final 2016 impaired waterways list?

> **Response 53: DEC will publish the final list when it is ready.**

Comment 54: According to this progress report, the DEP is required to consider further cost-effective and feasible stormwater control measures, including green infrastructure (GI), structural retrofits, and non-structural controls in the drainage areas for these Priority MS4 Waterbodies. How will the City involve the public in determining where, and to what extent, such control measures are required?

> **Response 54: The Stormwater Management Program (SWMP) will include procedures/criteria for determining feasibility and cost-effectiveness for consistency in evaluation. DEP will continue to present updates and seek feedback on program development through public meetings.**

Comment 55: Prioritization of waterbodies, as described by the DEP, happens only when a waterbody has a DEP-completed Long Term Control Plan (LTCP) for Combined Sewer System pollution control and the MS4 pollution in such an LTCP is a "significant contributor of impairment." Will the DEP consider working to identify priority waterbodies for this MS4 program outside of and independent of the LTCP program? If not, why not?

> **Response 55: Not all impaired waterways can be designated as a Priority MS4 Waterbody, which is a permit-defined term. Please refer to the response to comment 56 (definition provided in Permit Part VI.B). The MS4 Stormwater Management Program (SWMP) will comprehensively apply to all MS4 areas, and additional measures will be taken in MS4 areas draining to Priority MS4 Waterbodies.**

Comment 56: In the case of future LTCPs, the DEP here states that new priority waterbodies will be developed "as LTCPs are approved by [the state]." Why is the DEP waiting for state approval of LTCPs before listing new prioritized MS4 areas? Neither currently considered priority areas (Coney Island Creek and Bronx River) has an LTCP which has been approved by the state, yet they apparently qualify as prioritization-acceptable. Why is the DEP raising the bar for future MS4 problem areas?

> **Response 56: The permit defines Priority MS4 Waterbodies as those water bodies for which an approved Combined Sewer Overflows Long-Term Control Plan (CSO LTCP) does not predict compliance with applicable water quality standards and where stormwater contributions from the MS4 are expected to be a significant contributor of the impairment identified in the CSO LTCP. The designation of Coney Island Creek and Bronx River is preliminary, taking into account the information in the submitted LTCPs.**

Comment 57: How will nitrogen and nutrient pollution concerns in the East River and Long Island Sound affect the impaired-waters work this MS4 permit will require?

> **Response 57: As required by the permit:**
>
> **For impaired waters without Total Maximum Daily Loads (TMDLs), in addition to the minimum control measures described in Parts IV.A through IV.J, the Stormwater Management Program (SWMP) will include procedures/control measures for no net increase in the Pollutants of Concern (POC) causing an impairment.**
>
> **For Priority MS4 Waterbodies, the City will identify additional or customized non-structural BMPs for each control measure described in Parts IV.A through IV.I to address the POCs causing the Combined Sewer Overflows Long-Term Control Plan (CSO LTCP)-identified impairment.**
>
> **We are currently developing our approach to these requirements.**

Comment 58: How would the required actions in this MS4 permit change were the waters of NYC subject to water quality standards based on the 2012 EPA Recreational Water Quality Criteria?

> **Response 58: The Stormwater Management Program (SWMP) is being developed in accordance with the requirements of the MS4 permit. If water quality standards or permit requirements change in the future, the SWMP would be revised to address those changes.**

Comment 59: Why have Flushing Creek and Westchester Creek not been considered as priority waterbodies under this permit?

> **Response 59: Please refer to the responses to comments 55 and 56.**

Comment 60: Most of Staten Island is an MS4 watershed, and the waterways around it are impaired for a variety of criteria. Yet, because Staten Island will not have its own LTCP, it appears as if it will be procedurally barred from consideration for Priority Waterbody status. Is this the case? If not, why not? Will the DEP consider listing the Kills around Staten Island as priorities?

Response 60: Please refer to the responses to comments 55 and 56.

Comment 61: Does the answer [to the question, "Will the City address industrial sites that send polluted stormwater into waterways by overland flow?"], where the DEP states the City is "only responsible for industrial and commercial sites that have the potential to discharge polluted stormwater to the MS4," mean that no existing (as opposed to potential) connections to the MS4 will be under the City's authority?

Response 61: Multi-Sector General Permit (MSGP)-permitted sites that have existing connections to the MS4 will be subject to the inspection and enforcement program developed under the Stormwater Management Program (SWMP). Additional industrial/commercial sites as described in Permit Part IV.H.1 that have existing connections to the MS4 will be subject to the unpermitted facility inspection program described under Permit Part IV.H.2.

Comment 62: For industrial and commercial sites that are connected to the MS4 system, if there is a violation that is the result of a discharge "directly to waterways … by overland flow," will the DEP have enforcement authority, or the State??

Response 62: Enforcement authority would likely rest with the state, but DEP may report the violation if discovered during the course of their inspection or the Illicit Discharge Detection and Elimination (IDDE) program.

Comment 63: The DEP focused its response [to the question, "Will there be a comprehensive plan to implement Green Infrastructure citywide?"] on the GI programs in place in CSO areas. There were only vague references to GI plans for priority waterbodies and other MS4 areas. Can the DEP be more specific about its plans for GI in the city-wide MS4 areas? What, if anything, does the agency plan for GI in non-priority MS4 waterbodies?

Response 63: There are two GI requirements in the MS4 Permit. One is in the Pollution Prevention and Good Housekeeping (PP/GH) section (Permit Part IV.G.2), applicable to planned municipal upgrades in MS4 areas. The other is in the special conditions for impaired waters (Permit Part II.B.2.a.iv), applicable to MS4 areas draining to Priority MS4 Waterbodies. We are currently developing our approach to these requirements and will continue to present updates and seek feedback on program development through public/stakeholder meetings.

Comment 64: Request that DEP work to make DSNY & DOT available for a floatables public meeting where the agencies can provide updates and take feedback on trash and debris control strategies.

Response 64: Coordination with DSNY and DOT on the issue of floatable and settleable trash and debris is already underway. Both agencies were present at the MS4 Annual Progress Meeting and participated in the breakout session regarding the control of floatable and settleable trash and debris. Agencies with obligations under the permit are encouraged to attend relevant public meetings, including Stormwater Advisory Group (SAG) and Trash Free NYC Waters meetings, in addition to the annual progress meetings.

City Responses to Comments on the MS4 Progress Report submitted August 26, 2016 by Bronx Council for Environmental Quality (BCEQ)

Comment 65: The Mapping Task described in the Progress Report missed the point of the Clean Water Act in that there should be no direct discharge into the Waters of the United States. Not only does this include much of the coastal areas of the city, but it also includes areas that are not draining to a CSO or a Publicly Owned Treatment Works (POTW)—which includes most, large parks. Neither of these areas are among the first steps; why?

> **Response 65: The MS4 permit authorizes discharge of stormwater from the MS4 system. As part of its requirements, the City must develop a GIS-based map of its MS4 drainage areas and MS4 outfalls. The GIS map will include all detected MS4 drainage areas and outfalls owned by the City. The City's MS4, which includes some City-owned park lands, does not drain to a CSO or a Publicly Owned Treatment Works (POTW), and will be subject to the control measures defined in the MS4 Stormwater Management Program (SWMP). Privately owned sites that drain stormwater runoff directly to open waters are not subject to the MS4 because they are not connected to City-owned storm sewers, but may require their own discharge permits.**
>
> **The first steps in the MS4 mapping effort focus on mapping MS4 areas for which data is readily available, such as tributary areas to the DEP storm sewer system. Drainage system data for other City-owned or operated sites first needs to be identified, collected, compiled, digitized, and/or created, and will be refined for greater accuracy throughout SWMP development and implementation.**

Comment 66: What exactly were the Mapping Requirements presented to the Stormwater Controls Working Group? Which three waterbodies are being delineated to test the tool and QA accuracy? If these were part of the previous SPDES permit, why do you need to test the QA accuracy?"

> **Response 66: The MS4 map requirements were additionally presented by DEP at the Interagency Mapping Sub-Team meeting, held in May 2016. This presentation described agencies' responsibility to map agency owned/operated MS4 outfalls, agency owned direct drainage areas, agency operated facilities/operations in direct drainage areas (termed "overland flow" areas), and agency owned infrastructure that connects to DEP's storm sewer system.**
>
> **The Quality Assurance (QA) protocol applies to DEP's process for mapping its own MS4 outfalls and drainage areas. Different QA protocols were employed for previous SPDES mapping of combined sewer outfall tributary areas. The first three MS4 areas DEP mapped were the Coney Island, Bowery Bay, and Hunts Point wastewater treatment plant drainage areas. The QA protocol was first applied to the mapping of these three areas and the accuracy of the protocol was assessed.**

Comment 67: The 2016 Progress Report explains that the MS4 program does not include mapping the City or Private Direct Drainage Areas. The chart states that these areas will continue direct drainage to waterways, despite the City's own admission in 2014 that "flowing directly into surrounding waterways through the City's MS4." This is confusing and clearly does not meet the requirements of the CWA. Can you explain this flaw?

> **Response 67: The 2016 NYC MS4 Progress Report explains that the MS4 program includes mapping of City-owned drainage areas, including City direct drainage areas (see page 7). The Progress Report also states that the MS4 program does not include mapping of private direct drainage areas, since these areas are not regulated by NYC's MS4 permit.**

Comment 68: Riverside (west of HHP) private sewer areas and Fieldston (east of HHP) private sewer area are mostly single family homes that have severe flooding and could be used as GI sites.

> **Response 68: Other than City-owned direct drainage areas along the waterfront, these areas are in DEP's combined sewer area, and are not subject to the MS4 permit, but could apply for Green Infrastructure (GI) grants under DEP's Combined Sewer Overflow (CSO) program.**
>
> **To augment its current efforts in stormwater management on private property, DEP is developing a new private property GI retrofit initiative. DEP released a Request for Information in October 2016 to receive feedback from public and interested stakeholders in formulation of the new GI Private Incentive program that is scalable.**

Comment 69: Is the area along the edge of the Hudson River from Edsall Ave to W 263rd Street and along the edge of the Harlem River from Bailey to Edsall Ave in the CSO area?

> **Response 69: The shoreline areas directly along the Hudson or Harlem Rivers are not included in our current map of the combined sewer area, and will be included in the MS4 mapping effort if they are city owned or operated. However, most areas further inland from the shoreline or not directly adjacent to the Hudson or Harlem Rivers are shown as part of the combined sewer area in our current map.**

Comment 70: The abandoned CSX and proposed parkland south of Van Cortlandt Park and all of VCP except by the weir are not in the combined system, and just like the Bronx River, it should have been on the MS4 map.

> **Response 70: Mapping of City-owned or operated sites (such as Parks) will be refined to increase accuracy as part of the MS4 mapping effort.**

Comment 71: Private properties that are part of the City's MS4 will be subject to the Construction/Post-Construction and Industrial/Commercial requirements of the MS4 permit. Will you require a Stormwater Management Program (SWMP) to meet the MS4 requirements for private properties?

> **Response 71: The MS4 Permit requires the City to submit a Stormwater Management Program (SWMP) Plan to DEC for approval. Private properties in the MS4 area that are subject to the Construction and Post-Construction portions of the SWMP will be required to prepare, implement, and maintain a Stormwater Pollution Prevention Plan (SWPPP) on site as described in the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity, and submit the SWPPP for DEP review and acceptance prior to commencing construction. Industrial properties in the MS4 area covered by the NYSDEC SPDES Multi-Sector General Permit (MSGP) and inspected under the Industrial/Commercial portion of the SWMP will be required to create, implement, and maintain a SWPPP on site as described in the MSGP.**

2017 Progress Report

Background:

On August 1, 2015, the Department of Environmental Conversation (DEC) issued a comprehensive stormwater permit to the City. The permit includes robust requirements that significantly expand the City's obligations to reduce pollutants discharging to and from the Municipal Separate Storm Sewer System (MS4). There are 14 City agencies with substantial obligations under the new MS4 permit, and the Department of Environmental Protection (DEP) is responsible for coordinating the efforts of those agencies with respect to all matters relating to the permit's requirements. The City's MS4 permit requires the development by August 1, 2018 of a Stormwater Management Program (SWMP) Plan, the goal of which will be to reduce pollution that reaches waterbodies through the MS4.

As required by the MS4 permit, the City made available to the public on May 8, 2017, the 2017 Progress Report on the development of the SWMP. On May 16, the City hosted a public meeting to present the Progress Report to all interested stakeholders. The 2017 Progress Report was open for comments through June 5, 2017. The City received comments orally at the public meeting and in writing, and has prepared the following responses.

City Responses to Comments on the MS4 Progress Report

Questions and Comments Received at the May 16 Public Meeting

Comment: Will the DEP portion of the MS4 map be completed by 2018?

Response: DEP has completed drainage area delineations for a little more than half of the known DEP-owned MS4 outfalls. DEP is continuing to delineate drainage areas for DEP-owned MS4 outfalls and anticipates completing this work by the submission of the preliminary map in August 2018.

Comment: 311 is inadequate for reporting discharges from outfalls to waterways. Additionally, the 311 mobile application should allow the public to make reports using GPS coordinates.

Response: Noted. The City is exploring ways to improve the process for reporting through 311 discharges from outfalls; this includes a pilot project to install signs at MS4 outfalls. By providing identifying numbers for MS4 outfalls, the City will make it easier for the public to report the location of the outfall to 311. There are no plans at this time to modify the 311 mobile application. Despite the challenges in reporting discharges from outfalls, 311 is still the best way to connect with the City on many MS4-related issues.

Comment: DEP should develop outreach about what citizens can do and how they can supplement monitoring/enforcement. Regarding the Citizen Water Quality Testing Program, how are data compared with what we collect? How can we engage the community groups to become more involved?

Response: DEP agrees that citizen water quality monitoring programs are important aspects of citizen involvement and could supplement the monitoring programs established for regulatory compliance purposes. Accordingly, DEP obtained the citizen water quality monitoring data for several waterbodies where LTCPs are developed, conducted comparisons and shared the results with multiple stakeholders including the SWIM Coalition. However, monitoring data from outside groups may or may not follow DEP and EPA-approved sampling procedures/guidelines. DEP will continue to evaluate whether and how it might be able to engage/utilize community groups. Some considerations include the feasibility of those groups' adopting standard protocols to match our current programs to ensure the data obtained are comparable and can be scientifically evaluated.

Comment: Newtown Creek sampling showed off the chart levels of, fecal coliform. What is DEP doing to investigate for illegal connections?

Response: DEP has active Illicit Discharge Detection and Elimination (IDDE) investigations in different receiving waterbodies, including Newtown Creek. In Newtown Creek, DEP is currently conducting source tracking via dye testing to confirm potential illicit connections. DEP will follow up with appropriate enforcement and coordinate with DEC as necessary.

Comment: What is the City doing to institute laws and regulations to reduce plastic waste at the source, such as plastic bag bans? How has the City highlighted the pollution of bags, plastic, bottles, etc.? When will we see some of the laws reflecting this and more public outreach?

Response: The City is pursuing several policies and programs that seek to reduce waste at the source. These include both legislative and regulatory approaches as well as public education and outreach approaches.

The City is in the process of banning expanded polystyrene foam. Following a May 12, 2017 determination by DSNY that expanded polystyrene foam could not be recycled in a manner that is economically feasible or environmentally effective for New York City, the City plans to institute a ban starting November 13, 2017.

The City has also attempted to reduce plastic bag waste by imposing a fee on all carryout merchandise bags. Local Law 63, passed by the City in 2016, would have imposed a fee of at least five cents on all carryout merchandise bags. In February 2017, however, New York State suspended the NYC Carryout Bag Law and established a one-year moratorium on establishing new carryout bag fees in New York City. NY State is establishing a task force to develop a uniform State plan for addressing the plastic bag problem. The task force includes appointees from the State Senate and State Assembly, as well as local governments and other stakeholders. By the end of 2017, this Task Force will conclude with a report and proposed legislation.

The City also has several public education and outreach programs that seek to raise awareness and change behaviors. These include the B.Y.O. campaign, Zero Waste programs, Talk Trash NY campaign, and the Clean Streets = Clean Beaches campaign. Most recently, DEP initiated a "Don't Trash Our Waters campaign" in collaboration with the Department of Sanitation, which was kicked off at Coney Island Creek and will be expanded to Bronx River Watershed this summer.

Comment: Will there be a re-evaluation of fines for an environmental violation so that they are more effective?

Response: The City has not yet decided on whether the MS4 program will include a revision of fines for environmental violations, but will consider this issue during SWMP development.

Comment: How is DEP catching one time offenders dumping paint/oil into catch basins?

Response: The response from DEP depends on how the complaint is received. If the complaint is submitted anonymously, DEP will send staff to investigate, and if DEP staff are able to connect a suspect to the illicit discharge, a violation is issued. If someone willing to give his or her name submits the complaint, and DEP does not witness the individual or company dumping into a catch basin, then DEP would require the person who witnessed the act to testify at the Environmental Control Board (ECB) to hold the offender accountable.

Comment: Since the Green Infrastructure Grant Program will now be eligible in MS4 areas, why not require that all properties participate in the program? The City should pass legislation requiring that all existing properties take the City's funding in order to ensure that all private properties will be retrofitted with green infrastructure.

Response: Under the Green Infrastructure Grant Program, the City does not provide funds for legally mandated actions under local, state, or federal law, and/or associated with administrative permit conditions or terms of settlement agreements. In other words, if the City were to require that existing properties retrofit with green infrastructure, it could not provide funding for the design and construction of the GI. Such a mandate, with no financial support, would be significantly challenging for many property owners around New York City. As a result, the City will continue to develop private incentive programs and conduct extensive outreach to encourage New Yorkers to participate in the optional programs.

Comment: What is the status of the Adopt-a-Catch Basin Program?

Response: The of the Adopt-a-Catch Basin pilot program was launched in 2016 in the Brooklyn neighborhoods of Canarsie, Gowanus, Prospect-Lefferts Gardens, and Sunset Park where catch basins that are clogged with garbage and other debris prevent adequate storm water collection, flooding areas nearby and forming small ponds that impede cars, bicyclists, and pedestrians. The effort is intended to curb localized flooding after heavy rainstorms as well as to help prevent floatables, such as bottles and other debris from entering into waterways. DEP provides training, as well as gloves

and garbage bags, to participating organizations that agree to maintain storm drains in their neighborhoods, and also enrolls participants in an early alert system to inform them of upcoming weather events that may cause flooding.. The City is still exploring expanding the program to other neighborhoods.

Comment: There should be graphics in the public meeting presentations that enable viewers to understand the difference between what is required for private and public business/homeowners per provision of the MS4 Permit.

Response: Noted. The City will consider using more graphics to clarify responsibilities for private businesses/homeowners impacted by the MS4 Permit. The City will also use graphics will be used in presentations and in the final Stormwater Management Program (SWMP).

Comment: How transparent will we be about monitoring/reporting in the next 3-4 years?

Response: In accordance with the MS4 Permit, the City will release an annual report each year. The report will be available online and public meetings will be held each year to discuss the content of the annual report. People will be able to submit questions, comments and concerns on the report to MS4@dep.nyc.gov. If the question is specifically referring to stormwater monitoring, then in accordance with the MS4 Permit, DEP will provide results of the information collected and analyzed as part of the Monitoring and Assessment Program. The results will be included in future MS4 Annual Reports.

Comment: Will High Level Storm Sewers (HLSS) be part of MS4? Are there sewer separation projects in process?

Response: High Level Storm Sewers (HLSS) that ultimately discharge to waters of New York State through MS4 outfalls owned or operated by the City are considered part of the MS4 and are covered by the permit. HLSS are one strategy for alleviating pressure on the combined sewer system and limiting combined sewer overflows. Since HLSS require a separate pipe and outlet to a waterbody, this strategy is only cost-effective for developments near the water's edge. Some select areas are receiving new HLSS.

Submitted June 1, 2017 by Marni Majorelle from Alive Structures:

Comment: Please include the MS4 in the Green Infrastructure Grant Program as soon as possible.

Response: The current Green Infrastructure Grant Program is now available citywide, in both the MS4 and combined sewer areas of the city. Through the NYC Department of Environmental Protection, in coordination with the NYC Law Department and the NYC Office of Management and Budget, the City is also developing new private incentive programs for green infrastructure implementation. As these programs are still in development, please visit www.nyc.gov/greeninfrastructure to sign up for the green infrastructure listserv to receive updates as they become available.

Comment: Other cities are creating storm water policies, green infrastructure incentives, and mandates that are more effective than NYC's. [The comment included an attachment with examples.]

Response: The City has formed positive relationships with many of the cities on this list to share best practices for incentivizing green infrastructure on private property. For example, DEP staff has visited Philadelphia, spoken with grant staff and grant recipients, reviewed grant documents such as contracts and applications, and visited constructed projects. This sharing has gone both ways and Philadelphia has modeled portions of its grant program on the current New York City Green Infrastructure Grant. During the development of the new private incentive program referenced in the response above, the City has hosted roundtable discussions with property owners and green infrastructure contractors to gather critical feedback. Additionally, DEP has completed stormwater surveys with approximately 30 municipalities (including all of those listed, with the exceptions of France and Switzerland) to learn more about their stormwater programs, including how they implement and incentivize green infrastructure programs, and will be publishing the summary of these surveys by the end of this year. Furthermore, the program the City is developing in accordance with the MS4 Permit for Post-Construction Stormwater Management will require green infrastructure and related measures for certain new construction and reconstruction projects. DEP has held several workshops in collaboration with Urban Green Council and REBNY including the development community and their technical engineering companies to discuss what would be the

appropriate lot size threshold for NYC by taking into account water quality, cost, local size conditions, impervious surface coverage, total lot area managed, number of affected public/private properties and other relevant factors.

Submitted June 2, 2017 by Ira Gersenhorn:

Comment: This MS4 Progress Report is from NYC DEP. Should there be a separate MS4 Progress report from every city agency or does this report involve all city agencies?

Response: There are 14 City agencies with substantial obligations under the MS4 permit. Pursuant to Executive Order No. 429 of 2014 and Section 1403 of the New York City Charter, as recently revised by Local Law 97 of 2017, the Department of Environmental Protection (DEP) is responsible for coordinating the efforts of those agencies with respect to all matters relating to the permit's requirements. As a result, the 2017 Progress Report is produced by DEP and reports on the work of all of the city agencies with permit obligations.

3.0 SWMP Plan Comments and Responses

The City prepared responses to each written comment received on the draft SWMP Plan. The written comments have been organized by SWMP provision. The source of each comment is identified in brackets at the end of the comment.

Further, comments the City received at draft SWMP stakeholder meetings between April—June 2018 were recorded and then summarized and categorized by SWMP provision. Verbal responses were provided during the meetings. The City has included written responses to these comments in this appendix. These comments are identified as received at stakeholder meetings through in brackets at the end of the comment.

Public Comments Received:

1. SWIM Coalition, May 15, 2018. Public Comment on the Stormwater Management Program Plan for the NYC Municipal Separate Storm Sewer System.
2. Coney Island Beautification Project, May 15, 2018. Public Comment on the Stormwater Management Program Plan for the NYC Municipal Separate Storm Sewer System
3. Alley Pond Environmental Center, May 15, 2018. Municipal Stormwater Management Plan.
4. Kira Aiello, via email May 9, 2018. Alley Pond Watershed.
5. Tom McGlinchey, via email April 23, 2018. Comment on MS4 SWMP.
6. Dahlia Thompson, via email May 15, 2018. Comments on the draft NYC Stormwater Management Plan.
7. Linda Cohen, via email May 14, 2018. Comments regarding MS4—Staten Island.
8. James Scarcella, via email May 15, 2018. LTCP Comments.
9. Emily Chiu, via email May 9, 2018. Please Consider Alley Pond Environmental Center for MS4.
10. Robin Spiegelman, via email May 9, 2018. Storm Sewer System at Alley Park.
11. Queens College CUNY, School of Earth and Environmental Sciences, May 15, 2018. Public comment on the draft NYC Stormwater Management Program report.
12. NYCH2O, May 15, 2018. Public Comment on the Stormwater Management Program Plan for the NYC Municipal Separate Storm Sewer System.
13. Coney Island History Project, May 15, 2018. Comments: Draft NYC Storm water Management Plan.
14. Ida Sanoff via email, May 15, 2018. More LTPC Comments.
15. Comments received during SWMP Plan presentations, April 17 to June 11, 2018.

1. Legal Authority

1a. Fiscal analysis must allocate funds to implement SWMP programs. DEP states that "[t]he City is confident that it has adequate resources to comply with the Permit's terms, and will include a more detailed fiscal analysis in the Plan submittal in August 2018." It is crucial that DEP completes its fiscal analysis prior to issuance of its initial SWMP. While there is no doubt that the City has adequate resources, it is certain that DEP, at least, will need additional staff to cover its new enforcement duties under the SWMP without short-changing other water quality protection duties. Specifically, the review of stormwater pollution prevention plans (SWPPPs) will demand significant amounts of new staff time. Funds should be allocated to get this program and others off the ground. Moreover, without earmarking funds for Education and Outreach, the City likely will continue with business as usual, instead of taking important steps that will help New Yorkers understand and modify behaviors that lead to stormwater pollution. These expenses and others should be accounted for in the present SWMP. Regardless of when DEP completes the fiscal analysis, it must be subject to public review and comment, as it will become part of the SWMP. [1]

Response: *Refer to updated text in Chapter 1: Legal Authority and Program Administration.*

1b. DEP should account for the role of City agencies in the Enforcement Response Plan. DEP appropriately states that the Department of City Planning, Department of Buildings, Department of Transportation, and Small Business Services will cooperate in implementing the Enforcement Response Plan. Yet, in Figure 1.1, "Agency Roles and Responsibilities Matrix," none of these City agencies is shown not to have a role in the Enforcement Response Plan. Some of the regulations overseen by these agencies are crucial to stormwater pollution prevention. For example, the Buildings Department is in a position to enforce erosion and sediment control, post-construction stormwater controls, green stormwater infrastructure requirements and other important measures. We expect that these agencies will share a leadership role in enforcing measures to prevent stormwater runoff. Such role should be made explicit in Figure 1.1 and throughout the SWMP. [1]

Response: *DEP will be enforcing "erosion and sediment control and post-construction stormwater controls." DOB/other agencies will not. The reference in the ERP to DEP's implementation of the plan "in cooperation with other city agencies," indicates that DEP will coordinate with other agencies that may have some involvement with entities subject to DEP's permitting programs. For instance, DEP will coordinate with DOB to ensure that a developer does not receive a building permit or certificate of occupancy for a project subject to the DEP Construction/Post-Construction requirements without having a Stormwater Construction Permit or Stormwater Maintenance Permit, where such permits are required. ECB adjudicates certain violations. The actions of other agencies will contribute to our enforcement, but they will not be enforcing on DEP's IDDE, C/PC and I/C programs. They will continue enforce their own rules and codes, some of which may contribute to water quality protection, but those rules and codes are not the subject of the ERP. Other City agencies may identify, in the course of their operations, illicit discharges, which they may also refer to DEP for enforcement.*

1c. Fiscal analysis must allocate funds to implement SWMP programs. Specifically, without earmarking funds for Education and Outreach, the City likely will continue with business as usual instead of taking important steps that will help New Yorkers understand and modify behaviors that cause stormwater pollution. These expenses and others should be accounted for in the present SWMP. [12]

Response: *SWMP Chapter 1 addresses the Permit provision related to the fiscal analysis, which requires the City to indicate that it has adequate funds to meet the requirements of the MS4 Permit. The City has allocated and will continue to allocate funds to public education and outreach, as described in Chapter 2. The City has included these expenses in the costs of developing, implementing, and enforcing the SWMP as explained in the Fiscal Analysis. Other SWMP chapters describe additional public education and outreach initiatives.*

1d. This is an old city—does the City have the budget to rectify old sewers? [15]

Response: *Refer to the Fiscal Analysis in Chapter 1: Legal Authority and Program Administration. DEP maintains and repairs/replaces sewers as necessary as described in Section 1.1 of the Plan.*

1e. This is a very large program and it seems like there would be a significant cost associated with developing this program; are there sufficient financial resources for doing so? [15]

Response: *Refer to updated text in Section 1.5 of the SWMP, which details anticipated costs and sources of funds to meet the MS4 Permit requirements.*

1f. What is the status of the green text amendment that should be preventing homeowners and businesses from paving their front and back lawns? It seems problematic that the City has a whole new program for stormwater management but is not enforcing current regulations. Neighborhoods in Queens and Brooklyn have drainage issues because of property owners illegally paving.

Response: *In 2008 the New York City Council adopted the Department of City Planning's Yard Text Amendment. The intent of the rule is to preserve landscaped and planted areas in order to support stormwater management throughout the City. The Department of Buildings (DOB) currently enforces these rules on a complaint basis. Enforcement may be challenging due to several factors including a lack of historic documentation of the site and staffing levels. DOB is currently planning to expand its pool of inspectors to improve response times.*

2. Public Education and Outreach

2a. Department of Health and Mental Hygiene (DOHMH) should have a role in Public Education and Outreach. As detailed below, the proposed Public Education and Outreach Program could be greatly expanded and actively pursue behavioral modifications to prevent polluted runoff. DOHMH could assist DEP in surveying current behaviors and attitudes that lead to pollution and developing messaging, advertisements, and educational programs to help change such behaviors. Yet in Figure 1.1, "Agency Roles and Responsibilities Matrix," DOHMH is shown not to have a role in the Public Education and Outreach Program. The SWMP should incorporate DOHMH into these efforts. [1]

> **Response:** *There are several City agencies, including DOHMH, that do not conduct educational or outreach programming directly relevant to stormwater pollution, and therefore are not shown to have a role in Figure 1.1 or Chapter 2. If appropriate, however, DEP and other City agencies may work with non-listed agencies such as DOHMH to implement education and outreach programs. For example, at DEP's request, DOHMH assisted with a survey to assess littering attitudes and behaviors for the floatables media campaign.*

2b. The SWMP should propose and fund new education programs focused on stormwater management. The SWMP does not appear to recommend any new educational programs but rather relies entirely on existing programs. We support integrating SWMP messaging into existing programs as an efficient way to broaden outreach. This goal should be clearly stated in the plan so that the reader understands that DEP is aiming to enhance stormwater literacy and not just environmental literacy. Still other new programs will be necessary to educate our communities about stormwater pollution specifically. We suggest the following initiatives:

- Leading workshops for communities within Geographic Areas of Concern
- Creating high school environmental clubs throughout the City
- Partnering with local non-profits for "Nearby Nature" educational hikes and workshops
- Incorporating pet waste management information into City dog park and greenway maps
- Sending yearly mailers for industrial sites and developers potentially affected by the SWMP
- Sending comprehensive sustainability guidelines for homeowners covering handling of toxics, disposal of household cleaners, landscaping and lawn care, pest control, car care, water conservation, etc.
- Creating an online resource library for school and community groups and voluntary educators
- Posting signage along all waterways, especially those in Geographical Areas of Concern, and those in highly-trafficked riparian recreational areas to increase awareness of local water resources and potential stormwater impacts
- Developing educational materials tailored to minority and underrepresented communities
- Assembling media kits and submitting articles to local media outlets
- Providing storm drain stenciling tools and guidance for non-profit partners
- Convening a "Speakers Bureau" of stakeholders knowledgeable in stormwater matters that can address various audiences

It might also be useful to survey non-governmental organizations offering educational programs. There are many that conduct programs with stormwater components or other relevant content. For instance, the New York City Water Trail Association already collects data on surface water around the city and would be an excellent organization to reach a wide audience actively engaged in these topics. There is a concurrent effort at the NY/NJ Harbor Estuary Program to catalogue organizations working on water quality, green infrastructure, and stormwater programs. It would behoove the DEP to work with these existing entities, in addition to the SWIM Coalition and member organizations, to help coordinate city-wide efforts related to stormwater. DEP should at a minimum be aware of these programs and if possible collaborate with them to reach more people. City agencies could help promote events like Riverkeeper Sweep that raise awareness about stormwater pollution issues and invite public participation. We would be glad to work with DEP staff to help compile such information. [1]

Response: *Refer to updated text in Chapter 2: Public Education and Outreach.*

2c. DEP should establish an online searchable database for City-run and private programs relevant to stormwater. It is unclear how people would find out about these educational and outreach programs. A single repository would allow those interested to find out about events and get involved. [1]

Response: *The City currently has multiple mechanisms for publicizing events, including social media, listservs, mailers, and posters in libraries, supermarkets, and community venues. Events offered by the City as well as nonprofits are often included in the Citywide Event Calendar. Visit http://www1.nyc.gov/events/ to search events by category, location, and date. Further, nonprofits are able to publicize volunteer opportunities through NYC Service. Visit nyc.gov/service for more information. The City will explore various options to characterize stormwater-related programs.*

2d. DEP should establish baseline data on existing knowledge and attitudes and direct resources toward understanding behavioral change. In order to assess the effectiveness of the City's Public Education and Outreach Program, we urge DEP to work with DOHMH to conduct a stormwater public awareness survey at the beginning, during, and at the end of the permit term to gauge any change in behavior over time. Surveys directed at specific audiences, such as dog owners, automotive groups, homeowners, or neighborhoods in impaired waterbody watersheds, could be informative. [1]

Response: *Thank you for the suggestion.*

2e. "Target Audiences" (Section 2.3) should include all of the "Key Stakeholders" in Section 3.2. The individuals identified in the "Key Stakeholders" will be ambassadors for the stormwater management program. Moreover, the business community target audience should be broken down into various sectors (e.g., real estate development, automotive, construction, pest management, landscaping, waste management, etc.) so that outreach and education can be targeted at specific commercial activities. [1]

Response: *We thank the SWIM Coalition for their role as a Key Stakeholder and educating community groups about stormwater and water quality issues. We have edited Section 2.3 to reference the Key Stakeholders and their role in the development of the SWMP. The target audiences in the business community will be expanded to include example sectors.*

2f. DEP must allocate funds to educational materials, programs and advertisements focused on stormwater management. Without earmarked funds, the City is unlikely to undertake any specific campaigns that might help alter potential pollution behavior of roughly 8.5 million New Yorkers. For instance, many New Yorkers are unaware of which stormwater conditions would be reportable to 311. Subway ads could help inform communities about how to help City officials keep their neighborhoods and their waters clean. [1]

Response: *Refer to updated text in Chapter 2: Public Education and Outreach and Chapter 1: Legal Authority and Program Administration.*

2g. DEP and Department of Transportation (DOT) should partner with non-governmental organizations to create a storm drain stenciling program. There have been many requests for assistance on storm drain stenciling from community-based organizations (CBOs), going back almost two decades. With the implementation of the SWMP, now is the time to capitalize on this grassroots interest. Specifically, DEP and DOT should create instructions that will allow non-governmental organizations to easily organize stenciling events/ activities and pick up free stenciling tools and paint from DEP. They should also streamline a process to provide permission to CBOs. Currently, the New York City Soil and Water Conservation District must submit a request for a permit on behalf of CBOs with information on exactly where drains will be stenciled. A simple system by which a CBO can directly request a permit with a general area (rather than listing all the streets) would be desirable. We can also allow CBOs to adopt a portion of a watershed to stencil. DEP could then establish a numerical target (e.g., number of drains marked, percentage of catch basins in a sewershed) and measure progress yearly. Such a program would achieve the dual goals of public participation and community education. [1 and 12]

Response: *Refer to updated text in Chapter 2: Public Education and Outreach.*

2h. Please provide signs at all outfalls, both CS outfalls and MS4 outfalls, and also nearby to underwater outfall pipes, so that the public is aware of these locations. [7]

Response: *DEP has installed signs that can be read by the public on the water and land sides of all 422 CSO outfalls. These signs indicate that there is a wet weather discharge point and feature icons telling people not swim, boat, or fish during rain*

events. DEP launched an MS4 Outfall Sign Pilot in 2018 in Coney Island Creek to educate the public about how to notify the City if they see a dry-weather discharge. DEP will evaluate the effectiveness of adding this signage to determine whether to expand this program to other locations.

2i. Currently 311 operators cannot find Great Kills National Park on 311 maps. Please place the beach areas of Great Kills Beach, at least till the high water mark, on the 311 system. Please include these 311 complaints on status updates through NYC Open Data. [7]

Response: *Thank you for feedback and concern. Unfortunately, 311 does not handle complaints about State or Federal Parks/Beaches. You can find more information for Gateway National Park, which includes Fresh Kills Park and Beach, online here: https://www.nps.gov/gate/index.htm and report issues for by calling (718) 354-4606.*

311 also has a general referral service for State and Federal Parks to find contact information for other locations: http://www1.nyc.gov/nyc-resources/service/2517/state-and-federal-parks.

2j. Please amend the 311 reporting of sewage discharge to include federal property and NYC public Parks and beaches. Currently, the 311 Operators refuse to take info without a cross street, and no shoreline has a cross street. [8]

Response: *311 does accept complaints about City beaches and parks (http://www1.nyc.gov/nyc-resources/service/2171/park-maintenance-complaint). Unfortunately, federal property is outside of 311's jurisdiction.*

You also can report discharges of sewage, suspicious, or unusual color in any NYC waterway (http://www1.nyc.gov/nyc-resources/service/2745/waterway-complaint). The reporting system requires the reporter to provide either a street address or an intersection, which can be difficult with waterways. In these instances, we appreciate reporters using the closest address/intersection/block available, so that the complaint can be logged properly. Reporters also can always provide additional location information, including GPS coordinates, if you have them. All of this will help City responders get to the location.

2k. The SWMP should propose new education programs focused on stormwater management. The SWMP does not appear to recommend any new educational programs, but instead relies entirely on existing programs. We support integrating SWMP messaging into existing programs as an efficient way to broaden outreach. This goal should be clearly stated in the plan so that the reader understands that the DEP is aiming to enhance stormwater literacy and not just environmental literacy. Still other new programs will be necessary to educate our communities about stormwater pollution specifically. We suggest the following programs:

- Workshops for communities within Geographic Areas of Concern
- Creating high school environmental clubs throughout the City
- Partnering with non-profits like NYC H2O for "Nearby Nature" educational hikes and workshops
- Creating a resource library for school and community groups and voluntary educators
- Posting signage along all waterways, especially those in Geographical Areas of Concern and those in highly trafficked recreational areas, to increase awareness of local water resources and potential stormwater impacts
- Developing educational materials tailored to minority and underrepresented communities
- Providing storm drain stenciling tools and guidance for non-profit partners like NYC H2O
- Convening a "Speakers Bureau" of stakeholders knowledgeable in stormwater matters that can address various audiences

It might also be useful to survey non-governmental organizations offering educational programs. There are many organizations like NYC H2O that conduct programs with stormwater components and other relevant content. DEP should at a minimum be aware of these programs and if possible collaborate with them to reach more people. City agencies could help promote events like our beach clean-ups that raise awareness about stormwater pollution issues and invite public participation. It would behoove the DEP to work with existing entities like Riverkeeper and SWIM and NYC H2O, to help coordinate city-wide efforts related to stormwater. [12]

Response: *Thank you for the comment and list of suggested programs. We recognize the need to expand and enhance our Public Education and Outreach Programs, and plan to explore and fund new education programs in the coming years. Our first effort has been to identify and fully expand existing programs we have Citywide as a standard baseline. We will continue to develop new initiatives and incorporate SWMP messaging in our outreach efforts. We will clarify in the SWMP Plan that our goal is to enhance not only stormwater literacy, but also environmental literacy.*

We also look forward to continuing our coordination with you and other stakeholders during the implementation stages of the SWMP; and hope to work collaboratively with non-governmental organizations or educational programs going forward.

2l. Re: dog waste, nice to see that there will be an educational campaign to "pick it up". But I have yet to hear of a solution to people throwing the bags into what they think is "the sewer" - the storm drains. After every rain, the beach is loaded with empty and partially filled poop bags. In addition to being unsanitary, it certainly contributes to the nitrogen problem. [14]

Response: *Thank you for the comment. We anticipate creating a campaign specific to this effort to better educate the general public.*

2m. The measurable goals for public education and outreach do not include measures of effectiveness of the message. There is a lot of education mentioned, but how do you measure if it is working? [15]

Response: *As detailed in the Plan, we will measure the overall effectiveness of the SWMP and progress towards reducing stormwater pollution from the MS4 through the achievement of the measurable goals set forth in each chapter. For public education and outreach in particular, we will measure effectiveness through the reach and scope of the program. We may also gauge the effectiveness of the program through the positive results we observe in other programs. For example, a decrease in the number of illicit connections to the storm sewer may indicate that education and outreach efforts around illicit discharge detection and elimination have been effective. Similarly, for the Construction/Post-Construction Program, an increase in the number of sites in compliance with regulations may indicate that education and outreach about the program have been effective.*

2n. I tried to file a complaint with 311 for a location at Great Kills/Fort Wadsworth, but 311 couldn't find the location. [15]

Response: *311 does not handle complaints about State or Federal Parks/Beaches. You can find more information for Gateway National Park, which includes Fresh Kills Park and Beach, online here: https://www.nps.gov/gate/index.htm and report issues for by calling (718) 354-4606. 311 also has a general referral service for State and Federal Parks to find contact information for other locations: http://www1.nyc.gov/nyc-resources/service/2517/state-and-federal-parks.*

3. Public Involvement and Participation

3a. DEP staff have done a commendable job engaging members of the public and collaborating with them on SWMP development. The SWIM Coalition appreciates the regular update meetings during which SWIM members were not only given opportunities to understand the DEP's thinking better but also able to ask questions and make suggestions. [1]

Response: *DEP has enjoyed these regular check-ins with the SWIM coalition, and hopes to continue this collaborative partnership as we continue to refine the SWMP in the future.*

3b. Outreach strategies should be differentiated based on differences among stakeholders. Public education and participation are inherently related; meaningful public involvement and participation depend on an educated public. We recommend that DEP clarify and make explicit the connection and coordination between education and outreach (Chapter 2) and public involvement (Chapter 3). Moreover, different stakeholder groups require different educational strategies. Input from students and educators is likely different than from the design, construction, and development community. There should be an outreach strategy for each stakeholder group listed under section 3.2. Such strategy will not only include how to reach out to the stakeholder group but also how to provoke and focus their input. [1]

Response: *We have edited Chapter 2 to clarify that public involvement is a critical component of education and outreach. We agree that different stakeholder groups require different educational and outreach strategies. We intend to use the strategies most appropriate for each group and message.*

3c. A suggestion for outreach, we must not depend on social media as many residents do not have access. DEP should contact schools, religious institutions, libraries, area businesses, etc. [2]

> **Response:** *The City currently engages local organizations such as schools, libraries, and businesses in a variety of programs that are relevant to the SWMP. We will continue to identify and work with these organizations throughout SWMP implementation.*

3d. DEP staff have done a commendable job engaging members of the public and collaborating with them on SWMP development. We appreciate the regular update meetings during which NYC H2O members were not only given opportunities to understand the DEP's thinking better but also able to ask questions and make suggestions. [12]

> **Response:** *Thank you for this comment. We look forward to continuing this work with you throughout SWMP implementation.*

3e. Outreach strategies should be differentiated based on differences among stakeholders. Public education and participation are inherently related; meaningful public involvement and participation depend on an educated public. We recommend that DEP clarify and make explicit the connection and coordination between education and outreach (Chapter 2) and public involvement (Chapter 3). Moreover, different stakeholder groups require different educational strategies. There should be an outreach strategy for each stakeholder group, not only including how to reach out to the stakeholder group but also how to provoke and focus their input. As we at NYC H2O know from our extensive work in NYC public schools, outreach strategies for high school students, and Input and feedback from students and educators, is very different from that involving the research community. [12]

> **Response:** *Refer to updated text in Chapter 2: Public Education and Outreach.*

3f. 100 public comments does not seems like a lot for a City this large. What kind of outreach did you do to make sure people were aware of the program? [15]

> **Response:** *The City conducted extensive outreach and engagement throughout SWMP development. Please see Chapter 3: Public Involvement and Participation for more information.*

3g. How should people report to the City? [15]

> **Response:** *311 is New York City's main source of government information and non-emergency services. See Appendix 2.1 for a list of the types of complaints related to stormwater pollution and water quality that the public can report to the City.*

3h. Does the City have a survey that people can fill out with complaints and reports of things they see on a regular basis in the waterways and parks? [15]

> **Response:** *See response to comment 3g above.*

3i. Which Bronx community stakeholder and environmental organizations did the city work with in developing the SWMP? [15]

> **Response:** *The City met with the Bronx River Alliance and the SWIM Coalition regularly throughout SWMP development. The City also briefed the Bronx Service Cabinet throughout SWMP development.*

3j. The public comment period is already over; is there room for DEP to come out and talk more about this program for interested parties (e.g., Manhattan Community Board 4 has significant waterfront parkland and there are groups that would be interested in learning more)? [15]

> **Response:** *While almost all of Manhattan is serviced by the combined sewer system, DEP is happy to participate in follow up meetings about water quality in general and share information about the SWMP in particular with other interested groups.*

4. Mapping

4a. DEP's interactive MS4 map should integrate existing DEP datasets and provide easily downloadable files. The SWMP or response to comments should clarify whether DEP will incorporate datasets, such as the Combined Sewer Overflow (CSO) drainage areas and green stormwater infrastructure assets. It should also clarify whether data sets will be incorporated into easily downloadable shapefiles and KML files for outfalls and drainage areas. [1]

> **Response:** *DEP and other City agencies make a variety of GIS datasets publicly available for a variety of different purposes. The Preliminary MS4 Map provides preliminary information specifically about the City's MS4 drainage area and MS4 outfalls, along with the supplemental information required by the MS4 Permit. The Preliminary MS4 Map is available in an interactive format as of August 1, 2018 at nyc.gov/dep/ms4map. The public may download the data contained in the map in a variety of formats through NYC Open Data at opendata.cityofnewyork.us. Other data sets provided by DEP and other City agencies are also available for download at opendata.cityofnewyork.us.*
>
> *DEP may revisit the suggestion to provide a more comprehensive map that combines MS4 and CSO drainage areas in the future.*

4b. DEP should integrate mapping resources with existing citywide datasets. MapPLUTO is a go-to data source for many planning efforts. DEP should work with the Department of City Planning to make MS4 and CSOs an attribute in PLUTO. [1]

> **Response:** *As described in the Plan, the MS4 Map will incorporate data from some existing citywide datasets. The City will not incorporate Preliminary MS4 Map information into other citywide datasets such as MapPLUTO. Once the delineation of the MS4 drainage areas is complete, the City will determine whether to incorporate the information from the MS4 mapping program into other citywide datasets.*

4c. Please do all that you can to properly map the sewer systems and then to make these maps available as part of the local park signage at Oakland Lake, Alley Creek, Joe Michael's Mile along Little Neck Bay, Alley Pond Park at various points and where the proposed LTCP chlorination/dechlorination plant will be built. [5]

> **Response:** *As described in the Plan, DEP and other City agencies are currently delineating the MS4 drainage area and identifying MS4 outfalls. This includes reviewing available information about the existing sewer systems and in some instances conducting field investigation. The MS4 Map is available to the public at nyc.gov/dep/ms4map as of August 1, 2018. For security reasons, DEP will not place signs in parks near waterways showing the sewer system.*

4d. The outfall definition may want to clarify what is meant by "to another MS4"—I'm assuming this isn't intending that every pipe connected to a storm sewer is considered an outfall and another MS4 is implying another municipality or entity such as The Port Authority of New York and New Jersey. If it isn't clear, then the number of outfalls reported could become too cumbersome to track. [6]

> **Response:** *The MS4 Permit defines an outfall as "any point where a municipally owned or operated separate storm sewer system discharges to either surface waters of the State or to another MS4." The definition recognizes the possibility that a City-owned storm sewer may have an outfall to another separate storm sewer system owned or operated by another public entity. A private property connecting to a DEP separate storm sewer would not be considered an outfall under this definition. The language in the chapter has been modified to clarify this definition.*

5. Illicit Discharge Detection and Elimination

5a. The SWIM Coalition welcomes DEP's increased commitment to expand the shoreline survey to inspect 100% of stormwater outfalls every 10 years. Previously DEP had surveyed 50% of all outfalls every five years. While DEP ultimately will not have to perform more inspections, covering every stormwater outfall will ensure all major illicit discharges are identified within that decade-long span. [1]

> **Response:** *Comment noted.*

5b. High levels of Enterococci should trigger IDDE investigation. DEP proposes that when a Sentinel Monitoring Program sampling station exceeds 200 fecal coliform/100 mL, the adjacent shoreline is prioritized for a mini-shoreline investigation to determine source/cause of contamination. DEP notes in Appendix 5.1 that it is also sampling for Enterococcus to be

consistent with the Harbor Survey program. DEP could better protect public health if the mini-shoreline investigation was triggered when the station exceeds Enterococci standards. The protective standard provided in the U.S. Environmental Protection Agency's 2012 Recreational Water Quality Criteria (30 Culturable Enterococci at a geometric mean of 30 cfu/100 mL and an statistical threshold value of 110 cfu/100 ml). [1]

> **Response:** *DEP currently collects water samples for enterococci in order to have a better understanding of the condition of NYC waterbodies. However, DEP will continue to use fecal coliform as the trigger for the mini-shoreline survey, as required by the MS4 Permit Part IV.D.5. DEP is using fecal coliform to trigger mini-shoreline investigation because this is a permit requirement as stated in Section IV.D.5 of the MS4 permit.*

5c. Public notifications of illicit discharges should be improved. Will DEP text and/or email updates from the state Department of Environmental Conservation (DEC) daily on illicit discharges? How will DEP improve on the Sewage Pollution Right to Know Act 4-hour notice requirement, and actively alert the public on illicit discharges? Will DEP integrate illicit discharge notifications with Notify NYC? How can the public learn more about what is going on with these continual discharges, and whether they are still going on? According to DEC, the current Coney Island Creek alert, has been occurring for more than 30 weeks. This notice could include much more information to help the public understand the nature of the ongoing pollution dangers and what actions are being taken to eliminate the discharge. [1]

> **Response:** *NYSDEC sends notifications to the public through its NY Alert System within four hours of receiving notice from the City of a sewage related discharge. The requirement to use the NY Alert System is in the NYS Sewage Right to Know Law. The public can sign up to receive these notifications through https://alert.ny.gov/. During the development of the SWMP, the City explored the possibility of using Notify NYC as a means to notify the public of illicit discharges but determined that the NY Alert System is currently the best way for the public to receive updates. Further, DEP commissioned a study of options to update its current NYC waterbody advisory website for combined sewer overflows and added illicit discharge notification to the scope of work. The goal of this project is to assess current advisory systems in NYC, solicit agency and public feedback, and develop detailed recommendations for system improvements based on expert assessment of how existing systems might be reconciled, and by considering successful examples from other cities. The City convened a Waterbody Advisory Stakeholder Group to receive public input through the study and to inform the final recommendations.*

5d. The penalty schedule for illicit discharges should be made explicit in the SWMP to help put the regulated community on notice. In keeping with the need to educate New Yorkers on stormwater pollution issues, notice of potential penalties may help raise awareness of the issues and promote compliant behaviors. [1]

> **Response:** *The Sewer Control Rules Penalty Schedule can be found at 48 RCNY Section 3-123. The City updated the Enforcement Response Plan (Appendix 1.1) to include this reference.*

5e. DEP should record all complaints, agency responses, and outcomes. In addition to the monitoring provisions DEP suggests, it should also track the number of complaints received via 311 or other means, any corrections made in response to complaints, the number of outfalls screened, and the quantities of flow eliminated. [1]

> **Response:** *The public can access 311 reports via the 311 website at http://www1.nyc.gov/site/311reporting/311-reports/service-requests.page. Available reports include information on Calls and Inquiries, Service Requests and Service Request Maps. For information on IDDE investigations, the public can access the DEP website to view the Integrated Sentinel Monitoring Report.*

5f. DEP must improve on the Sewage Pollution Right to Know Act 4-hour notice requirement, as previously noted years past before the community was notified of the millions of gallons per week of raw sewage being dumped into CI Creek. Locally Coney Island Beautification Project has been conducting water monitoring, DEP should connect with locals to learn of citizens activities and publish results. [2]

> **Response:** *See response to comment 5c.*

5g. I would ask that you do all that you can in implementing the SWMP that you provide a good deal of focus on uncovering illicit discharge and illegal hookups to the stormwater system that affect Alley Creek and Little Neck Bay and surrounding points in its estuary. [5]

Response: *DEP will continue to implement its robust IDDE program, which includes uncovering illicit discharges and illegal connections to the stormwater system that affect Alley Creek and Little Neck Bay and surrounding points in its estuary. The public can also help with this effort by reporting illicit discharges through 311.*

311 provides a mechanism for the public to report illicit discharges to the City. Waterway complaints, illegal dumping, and oil spills are examples of reports the public can make through 311. The City responds to 311 reports based on the type of complaint. Chapter 2 in Section 2.5 of the SWMP provides additional information on public reporting of illicit discharges.

5h. Please bring about the connection of the home sewage on Douglas Manor to the sewer system, instead of letting these cesspools leech into the local waters. [5]

Response: *Thank you for the comment.*

5i. Please provide sufficient funding for the IDDE program for the east/south shore beaches which continue to suffer from sewage washing on shore. Key indicators of sewage including feminine hygiene products are often seen on the beaches, and they are also reported on DEP's Volunteer Floatable data sheets. There are indications that some of the sewage in our waters is originating from bypasses or SSOs from the Oakwood Treatment Plant. The DEP map on page 6 of the NYC Stormwater Management Program, entitled "Waterbodies Impaired for Pathogens", indicates that something is fouling up the waters downstream of the Oakwood Treatment Plant. This is the only area on Staten Island which is indicated as a "Pathogen Impaired Waterbody" Please post data which summarizes these IDDE field investigations on the Sentinel monitoring reports. [7]

Response: *Results for pathogen monitoring for this area will be included in the Integrated Sentinel Monitoring Report. Analysis of Sentinel stations for the period 2002-2016 in Raritan Bay show that fecal coliform levels are consistently lower than the NYSDEC 200 fcu/100 mL standard. Also, the public can make 311 waterway complaints to alert the City to issues they observe.*

5j. Please provide more funding for IDDE to detect septic tanks that have sewage leaks, and post data which summarizes these IDDE field investigations on the Sentinel monitoring reports. [7]

Response: *The City updated Chapter 5: Illicit Discharge Detection and Elimination of this Plan to include information on septic systems in NYC. Refer to the chapter for details on the City's septic system jurisdiction and response to failing systems.*

5k. We request DEP work with DOB and Dept. of Health to inspect and quantify the discharge from the 20,000 on site disposal systems on Staten Island. The pathogens ruin water quality and are a health hazard. [8]

Response: *See the response to comment 5j.*

5l. If there are illegal cross connections polluting our waters, the licensed plumber who certified the work should have license revoked. [8]

Response: *Most cases of illegal connections are associated with older buildings, in which the record of the plumber who completed the work may not be available, but the District Attorney's office has brought charges against plumbers for repeatedly connecting sanitary pipes to storm sewers. DEP will continue to provide education and outreach to plumbers to ensure they properly connect new buildings to the sewer system.*

5m. A more aggressive program to monitor illegal discharges is needed. As you know, Beach Haven Apartments - a multi building apartment complex, with about 900 units, was illegally dumping sewage into storm water lines for a long, long time. It was obvious there was a problem, because the stench near CSO OH 21 was overwhelming. Although "citizen testing" was being done, the results did not make much sense. I had to contact the Interstate Environmental Commission to come down and test the discharge from the outfall. They discovered that there was practically pure sewage pouring out of OH **21.** The IEC reportedly has skilled technicians and excellent laboratories, but not much in the way of funding. Why isn't more being done incorporate this excellent resource into the monitoring process? [14]

Response: *Coney Island Creek meets the definition of a Priority MS4 Waterbody. The City will not only implement the SWMP, but will also invest in further IDDE activities in the creek, as noted in Chapter 11. As described Chapter 5, DEP has*

an aggressive program to detect and eliminate illicit discharges. Implementation of this program in Coney Island Creek has led to the identification and abatement of multiple illicit discharges including the Beach Haven apartments described in the question. The City works with the NYSDEC and other local, state, and federal agencies as necessary. Email MS4@dep.nyc.gov with citizen science data, and report illicit discharges through 311. Refer to Chapter 2, Section 2.5 for details on reporting illicit discharges.

5n. Re: Illegal hookups of sanitary lines into storm water lines, once the property owner receives an order to remedy an illegal discharge, it seems to take forever before the work is done. Property owners should be required to fix the hookups within a specified time period. If they cannot afford to do so, it should be done by the city and there should be a mechanism to bill them or place a lien on the property. [14]

Response: *Many property owners are unaware if they have illegally connected pipes. When DEP issues a Commissioner's Order, the property owner typically hires a plumber in a reasonable timeframe or may need to apply for a loan. Very rarely are property owners unwilling to rectify the problem; however, if they are, the case is sent to the Office of Administrative Trails and Hearings (OATH) where penalties may be levied for non-compliance. NYSDEC also takes enforcement action against recalcitrant property owners.*

5o. Are illicit discharges being reported to an open data system? [15]

Response: *Yes, the NY Alert System alerts the public to sewage illicit discharges once confirmed. Data on illicit discharge 311 responses is available on NYC Open Data and is updated daily.*

5p. What happens to unconfirmed illicit discharges? [15]

Response: *Unconfirmed illicit discharges are discharges from an MS4 outfall during a dry weather period of 48 hours or more. In such cases, DEP would take a sample of the discharge to determine whether it is an illicit discharge or not (for example, it could be the tide flowing out of the outfall between high and low tide). If DEP confirms the discharge is an illicit discharge, DEP conducts a field investigation to identify the source of the discharge. Refer to Figure 5.2 in Chapter 5 for more information.*

5q. Who investigates illicit discharges? [15]

Response: *DEP investigates illicit discharges citywide, and other City agencies investigate illicit discharges if such discharges are identified on their properties. For discharges that the City identifies as reaching Waters of the State, the City coordinates with NYSDEC on such investigations by notifying the State and including a source trackdown schedule. If DEP discovers the source, DEP submits an abatement plan to NYSDEC.*

5r. What are the potential sources of pathogens? Does this plan address septic tanks? [15]

Response: *Potential sources of pathogens in waterbodies include sanitary pipes illegally connected to storm sewers, wildlife, pet waste, and failing septic systems. The City updated Chapter 5: Illicit Discharge Detection and Elimination of this Plan to include information on septic systems in NYC. Refer to the chapter for details on the City's septic system jurisdiction and response to failing systems.*

5s. If there is an emergency who responds? City or State? [15]

Response: *In an emergency, the City responds to IDDE issues. Units in FDNY and DEP respond if there is a major spill. Refer to Chapter 5: IDDE for details.*

5t. How are is the City tracking down sources of sewage that washes up onto beaches? (example: Great Kills Beach). [15]

Response: *If sewage washes up onto a beach, there could be many possible sources. DOHMH is responsible for beach surveillance and monitoring for permitted City beaches. DEP responds if an outfall is the source of the sewage discharge. NYSDEC and the Coast Guard have jurisdiction over state waters and the National Park Service has jurisdiction at Great Kills Beach, the example provided in the question.*

5u. How is the City handling illicit discharges related to faulty septic systems? [15]

Response: *See the response to comment 5j.*

5v. How are reporting and notifications handled for illegal hookups or discharges, red dye tracking, etc.? [15]

Response: *As detailed in Chapter 5: Illicit Discharge Detection and Elimination, section 5.4.3, the public is notified by NYSDEC through the NY Alert System of sewage related illicit discharges. The City notifies NYSDEC when an illicit discharge is identified and when the source is discovered. DEP uses several tools to detect and track illicit discharges including but not limited to dye testing, some of which require notifications to other entities.*

5w. Are septic systems regulated by MS4? There are about 20,000 unmonitored/unregulated septic systems impacting shell fishing in Raritan Bay. [15]

Response: *See response to comment 5j.*

6. Construction and Post-Construction

6a. The construction size threshold for stormwater pollution prevention plans (SWPPPs) should be set at 5,000 square feet. The entire threshold analysis (i.e., Appendix 6.1) is based on assumption layered upon assumption. It gives the impression of a rigorous, objective conclusion that 20,000 sf is the optimal threshold, but this method of analysis doesn't support any such conclusion. Even DEP's own consultants find that "[t]he approximate 'knee-of-the-curve' for acres vs. permits is around 15,000 SF." And DEP discounted the strongest evidence of what is the "maximum extent practicable" (i.e., the fact that almost all other large cities use a size threshold lower than 20,000 sf). While other cities have much lower thresholds, Philadelphia has set its threshold at 15,000 sf. Since the impact on one- and two-family homes seems to be what is giving DEP concerns about using a lower threshold, we believe DEP could use the 20,000 threshold for these light residential uses, but implement a lower threshold for other land use types. Or DEP could apply SWPPP requirements for small residential sites but apply less stringent/simpler substantive requirements for those sites, akin to Seattle's approach to post construction stormwater regulation. In any event, DEP should add to its threshold study an evaluation of thresholds with one- and two- family homes excluded, considering the stormwater benefit and burdens on the regulated community. [1]

Response: *The results of our analysis do not support a 5,000 sq. ft. threshold. The commenter also suggests 15,000 sq. ft. threshold. The Utility Survey (Appendix A of SWMP Appendix 6.1) shows that as programs mature, local needs shape the program requirements. The statistical data (Figure 4-3 in this Appendix) show the breakdown of number of lots and acres impacted. The program benefit is dependent on area regulated (see figures 8.1 and 8.2 in the study). At the 20,000 square feet and above threshold, close to half of the expected acres to be developed are in the program. Going down to 15,000 square feet increases the number of lots - which controls the number of applications, reviews, and inspections - by 20, but the number of acres by only 8, thereby limiting the water quality benefit of adding these properties. Decreasing the threshold gives moderate to low increases in area added to the program, but requires a high level of effort for staff to administer the program (i.e., processing applications and inspecting sites). Additionally, the ability of individual lot owners to install practices on their sites becomes more limited and more costly as the size of the lot goes down.*

6b. The SWMP must provide a schedule for implementing the threshold. The Draft SWMP does not set forth a timeline that will ensure a size threshold for SWPPP requirements will be implemented before the end of the current permit term. The SWMP presumes nothing will happen until after the next MS4 permit renewal (which we know, as a practical matter, will probably be a very long time from now). DEP states in the Draft SWMP, "[o]nce NYSDEC approves the proposed reduction, the City will work to implement the reduced soil disturbance threshold through future rulemaking to redefine covered development project, expected to be initiated in the City's second MS4 Permit cycle." The lack of a timetable violates the permit's requirement that the SWMP "shall also include a plan for developing adequate legal authority to implement any recommended revisions to the lot size soil disturbance threshold . . . and shall identify any feasible steps that could be implemented during the remainder of the permit term." The timetable is crucial not only to comply with the MS4 permit, but also to put the regulated community on notice that it can expect stricter standards in the future. Much of this outreach is already being done by DEP now. [1]

Response: *The City plans to implement the program at the 1-acre threshold for at least a full year before implementing the reduced threshold, in order to gain experience with the program. The City anticipates initiating rulemaking for the reduced threshold during the second cycle of the MS4 Permit, between 2020 and 2025.*

6c. DEP must clarify the nature of its permit application review in Section 6.1. The SWIM Coalition understands that DEP will review and approve permit applications based on the substantive adequacy of the proposed pollution control measures, not just whether an application has been completed. The nature of the review should be noted in the SWMP to put the regulated community on notice. [1]

Response: *Sections 6.1.1 and 6.1.2 detail what an applicant must include in the SWPPP to receive a Stormwater Construction Permit. Additional details are in the draft rule, which is available on the City Record.*

6d. The Design Manual should undergo public review and comment. The SWMP should make explicit that the construction design manual will undergo review and comment concurrent with the proposed rulemaking. Also, the SWMP should specify that if the design manual includes any substantive elements that differ from the DEC Design Manual, those should be subject to DEC review and approval. [1]

Response: *The NYC Design Manual will be available for public review prior to the effective date of DEP's regulatory program for stormwater from construction activities. NYSDEC will review the Manual as well.*

6e. DEP should explain the purpose of the "no net increase" requirement in Section 6.1.3. For projects that are exempt from the no net increase requirement (e.g., projects that do not result in any increased impervious area) can DEP please explain whether the applicable post-construction requirements allow for increased pollutant loadings as compared to pre-project conditions? If the post-construction requirements do allow that, then the standards must be strengthened to meet the "Maximum Extent Practicable" standard; if they don't allow that, then what is the purpose of the "no net increase" requirement? [1]

Response: *The No Net Increase requirements are included in the MS4 permit Part II.B.b. DEC identified several water bodies in Appendix 2 of the MS4 permit that are impaired for phosphorus, nitrogen, pathogens, and/or floatables. Chapter 6: Construction and Post-Construction of the SWMP explains how DEP will address the permit requirements in the administration of its Construction/Post-Construction regulatory program. The No Net Increase requirements exceed the requirements applicable in other drainage basins, which the City has determined meet the MEP standard.*

6f. The SWMP should be revised to clearly state that a Qualified Professional must certify the proper installation of post-construction controls. DEP states in Draft SWMP section 6.2 that a "qualified inspector" must certify that post-construction controls were installed properly. However, section 24-560 of the NYC Code states that a "qualified professional," which is a person with a more advanced qualification, must provide a certification in order to obtain a maintenance permit after construction is complete. This is an important distinction, because a "qualified inspector" is required to have expertise only in erosion and sediment control, not in post-construction stormwater management. The SWMP should be revised to clearly state that a Qualified Professional must certify the proper installation of post-construction controls.

Furthermore, to ensure that the system of reliance on Qualified Professionals is working as intended, the SWMP should include measurable goals for the percentage of sites that DEP staff will inspect before signing notices of termination on the construction permits and issuing maintenance permits. [1]

Response: *The language in the April Draft SWMP followed the NYS Notice of Termination (NOT) procedure that allows the Qualified Inspector to certify that post-construction practices have been installed in accordance with the SWPPP.*

The commenter is correct that section 24-560 of the NYC Code requires inspection reports submitted with applications for issuance and renewal of stormwater maintenance permits to be certified by a Qualified Professional. DEP agrees that it is more efficient to have a single inspection upon completion of construction for purposes of both the NOT and the maintenance permit. The SWMP has been updated accordingly.

6g. DEP should clarify which projects that subject to SWPPP requirements. First, projects to reduce coastal flooding can cover large areas of land and are typically situated along shorelines. Thus, they should not be wholesale exempt from SWPPP requirements. [1]

Response: *Projects constructed in the MS4 Area to reduce coastal flooding are not exempt from SWPPP requirements. As set forth in the MS4 Permit, SWPPPs for proposed flood management projects, as such projects are defined in footnote 6 on page 21 of the Permit, must, in addition to all other requirements for SWPPPs, "assess the impacts on water quality of receiving waters."*

6h. Second, DEP should impose SWPPP requirements for sites that discharge stormwater directly through privately-owned pipes. [1]

Response: *Consistent with the requirements of the MS4 Permit, DEP's authority to administer the Construction/Post-Construction Program is limited to "covered development projects" as defined in Admin Code §24-541, which are projects in the MS4 Area, also as defined in that section. DEP does not have authority to require stormwater permits for sites that discharge stormwater directly to waters of the State through privately owned pipes.*

6i. There is no justification for exempting City agencies from post-construction controls. DEP proposes to exempt public properties and public projects from maintenance easements. Such easements are meant to "ensure that future owners of the property are aware of the post- construction SMPs [stormwater management practices] and their ongoing obligation to operate and maintain them in accordance with the operation and maintenance manual in the approved SWPPP. The easement also puts the property owner on notice that DEP may inspect post- construction SMPs." The City should set the example for the development, design and real estate communities, not carve out an exemption for itself. It is not inherently burdensome to abide by post-construction stormwater management practices that the City itself has designed, so all property owned by City agencies should be subject to DEP inspections. Abiding by post- construction rules that all other property holders are obliged to would also avoid confusion at the time of sale or transfer to private parties, which could then be required to implement stormwater practices. [1]

Response: *City agency projects are not exempt from post-construction controls. They are generally exempt from the requirement of maintenance easements—not stormwater maintenance permits, consistent with Admin Code §24-***559.** *The purpose of a maintenance easement is to give DEP access to properties for inspections; this easement would not be needed for access to City-owned sites. Moreover, the City cannot grant an easement to the City on property it already owns. This section of the Administrative Code provides that the Corporation Counsel may require the execution and recording of an easement should the City subsequently convey the property to a non-City entity.*

6j. Training on construction and post-construction stormwater management should be extended to private parties and tracked. Staff training in stormwater control design review, inspection and enforcement will be crucial. DEP could improve results by extending training to the regulated community, especially after it has issued the Design Manual. DEP could then track attendance at local, state and federal training programs. Attendance could be encouraged by decreasing permitting fees for contractors who provide proof of attendance at relevant training sessions. [1]

Response: *Interesting idea, could warrant future consideration.*

6k. DEP can and should set a minimum number or ratio of inspections per project prior to issuance of notices of termination. A goal would allow DEP to set a target against which it could measure performance. Such a target would also drive DEP to calibrate its staffing levels to the number of inspections necessary. Additionally, such a target could be flexible and within control of the agency. For instance, DEP could set the target at 20% of applications or 20 applications, whichever is less. That way, DEP could ensure it has resources to attain the goal. [1]

Response: *Thank you for the thought, we will consider as we develop the program.*

6l. There is a proposed sale for a piece of property that now houses a Burger King that apparently is to have its entire footprint used for a multilevel structure. The shopping mall at Douglaston Plaza is a huge concrete platform with a huge amount of runoff from both multilevel parking lots and roofs. It is half vacant and there are proposed tenants that may further tax sewer needs. Please review these proposals as opportunities to greatly reduce runoff and sewage. [5]

Response: *Thank you for the comment. We will review as necessary.*

6m. The draft plan calls for the NYS Stormwater Management Design Manual to be used as the guidance document for stormwater BMPs when required based on the site disturbance until the City releases its own stormwater design manual. In general, the DEC manual is geared towards less urban conditions than found typically in New York City, and as a

result it may be difficult to follow the design guidelines in full, leading redevelopment projects to opt for practices like hydrodynamic separators. It is recommended that there be some guidance or outreach on what types of modifications may be acceptable to adapt green infrastructure practices for meeting MS4 requirements prior to a new stormwater manual tailored to the ultra-urban environment. [6]

> **Response:** *Thank you for the comment. The purpose of New York City Design Manual is to address urban conditions that the State Manual has not thoroughly addressed. It will include the SMP Hierarchy as part of the planning process required for SWPPPs. Designers will need to consider the options presented in Figure 6.2 in Chapter 6 of the SWMP.*

6n. In Chapter 6: Construction and Post-Construction, the focus is apparently limited to avoiding any increases in stormwater caused by new construction disturbances of areas above the 20,000 square foot threshold. However, excess stormwater in New York City is already a problem even if there is no new construction or land disturbances as described. Only very few weak, tentative statements are made regarding GI: "Incorporating Green Infrastructure into City Projects can *additionally help meet* the post construction SWPPP requirements...." (italics added). Figure 6.2 on page 109 provides a hierarchy to guide the selection of stormwater management plans for developers, and this chart describes some different types of green infrastructure, but it is confusing and unclear why certain types are prioritized over others. In MS4 areas where infiltration of stormwater may not be possible, there can still be a role for innovative green and grey technologies to retain and/or treat stormwater. On-site Vegetated Infiltration seems to be the highest priority, but would require some of the largest spaces compared to others (Sub-surface infiltration, green roofs). In a highly urban area, where space is at a premium, the relatively low priority accorded to green roods, which efficiently adapt and make use of existing underutilized space, is puzzling. The possibility that onsite stormwater from multiple sources could be directed to a common treatment area, such as a constructed wetland, is left unexamined. [11]

> **Response:** *The chapter focuses on the creation and implementation of a new regulatory program to meet the requirements of the MS4 Permit issued to the City by NYSDEC. The regulatory part of the program addresses private and public development projects on sites. Should a developer propose a common treatment area in the scope of a covered development project, DEP would review that plan as it would any other project. Identifying and developing common treatment areas throughout the city is outside the scope of the Construction/Post-Construction Program. The NYC Stormwater Design Manual will provide developers with the option to utilize a variety stormwater management practices beyond just infiltrative green infrastructure, when that preferred option is not feasible. Additionally, DEP recently expanded the Green Infrastructure Grant Program to all areas of the City to encourage further GI implementation. Finally, while there may be circumstances in which it would be practicable to direct stormwater from multiple sites to a common area for storage/treatment, generally administrative and legal issues, including the easements necessary to enable stormwater from one private site to be treated on another, preclude such arrangements, especially in an urban setting.*

6o. On the reduction of threshold for triggering post-construction requirements, the City prioritizes rain gardens, but what if you have a large area that can't be served by just one rain garden? What other controls can we use? [15]

> **Response:** *While DEP prioritizes on-site vegetated infiltration stormwater management practices, such as rain gardens, other practices are acceptable for sites with space or soil suitability constraints. Chapter 6 of the Plan provides the hierarchy of stormwater management practices. Additionally, DEP is currently developing a design manual that will clarify what types of practices are acceptable in different circumstances.*

6p. Is there anything that active construction projects need to keep in mind now to be in compliance with the future DEP program? [15]

> **Response:** *DEP will not administer the Construction/Post-construction program until after the effective date of the proposed rules. Going forward from the effective date, new projects will be subject to the City's program. Generally, most of the requirements will be the same as those under the State's Construction General Permit. Prior to submitting an NOI to DEC, you will have to come to DEP for review and acceptance of the SWPPP. A new rule making process will be undertaken in the future when DEP reduces the soil disturbance threshold that triggers coverage under the C/PC program.*

6q. Can the City shut down a construction site that is out of compliance? [15]

Response: *Currently the State is administering the C/PC program. Once the rules become effective, one of the enforcement tools available to the City are Stop Work Orders and Commissioner Orders which may be applied to a specific activity or a whole site. See the Enforcement Response Plan.*

6r. How will the City ensure private construction sites are getting the required stormwater permits? [15]

Response: *As required by the MS4 permit, by November 1, 2018, DEP will notify existing owners and operators of construction activities subject to the SPDES CGP, of the NYC program requirements including the DEP SWPPP review and acceptance process. Applicants will need to get an MS4 SWPPP Acceptance signed by DEP to get coverage under the NYS CGP. Additionally, under the Building Code, DOB will not issue building permits or certificates of occupancy without certification that the applicant has the requisite stormwater permits from DEP.*

6r. Does the City have the resources or adequate staffing for this new program? [15]

Response: *Information about the adequacy of the City's resources is included in Section 1.5 of the SWMP Plan.*

7. Pollution Prevention and Good Housekeeping

7a. The threshold for implementing runoff reduction techniques and green infrastructure in public projects should be based solely on the project cost, and not type of project. Please clarify that the reference to the Charter sec. 224.1(b)(1) cost threshold is a reference to only the dollar amount ($2M), and not a limitation to the types of projects (i.e., only buildings) covered by the Charter provision. The SWIM Coalition fully supports consideration of and requirements for green infrastructure on all City upgrade projects, including within affected or adjacent municipal rights-of-way and on all DOT projects. There is a great need and a huge opportunity to incorporate green infrastructure into projects in the public right-of-way, such as street and sidewalk rehabilitation, water and sewer utility projects, parks, playgrounds, greenways, and others. Similarly, improvements to public drainage infrastructure, since it often has the undesirable side-effect of directing more polluted runoff to nearby waterways, should be accompanied by green infrastructure projects that simultaneously help protect water quality and further improve flood control. Section IV.G.2 of the MS4 permit mandates that these various municipal upgrades incorporate green infrastructure where feasible and appropriate. [1]

Response: *The current PP/GH Program is intended to also cover municipal upgrade projects in the right of way (ROW) and other municipal properties such as parks, and is not limited to buildings. For the PP/GH Program, municipal upgrades are capital projects as defined by the NYC Charter and that meet the cost threshold of $2,000,000. The citation for section 224.1 was simply intended to reference the cost threshold. The SWMP was updated for clarity.*

7b. Green infrastructure should be defined broadly to include bioretention practices. Please clarify what definition of green infrastructure is being used for purposes of screening the feasibility purposes. Sites should not be screened out on sole basis that infiltration is not feasible. The SWMP should clearly state that the requirement to use green infrastructure, where feasible and cost-effective, includes using non-infiltrating bioretention practices where infiltration is not feasible. [1]

Response: *The term Green Infrastructure (GI) is included in the Definitions section of the SWMP Plan and lists several examples of bioretention practices. Each agency will determine which practices are most feasible for its municipal upgrade projects, based on the parameters in Permit Part IV. G.2. The City allows underdrains for GI retrofits constructed on private property and non-right-of-way public property. DEP does not allow connections to DEP sewers through underdrains for right-of-way GI projects due to operation and maintenance concerns.*

7c. The method for determining cost-effectiveness should be set forth in the SWMP or accompanying documents. DEP has not offered a definition of "cost-effective." The City should commit to a budget for green infrastructure as a proportion of capital projects. [1]

Response: *Considerations for cost-effectiveness include capital costs and O&M over the lifetime of the asset compared with stormwater reduction benefits, which are project-/site-specific and agency-specific. There is no single definition or criterion for cost-effectiveness that the City can apply; all financial aspects of each individual project must be considered in combination. The City will install GI to the MEP based on the criteria set forth in the permit. Setting a budget for GI could unnecessarily*

restrict or over-commit City resources if project feasibility does not match up to the dollar amount budgeted. The MS4 SWMP Annual Reports include metrics to track both the number of projects evaluated for GI opportunities and the number of projects where city agencies implemented GI.

7d. City agencies should incorporate green infrastructure when feasible and cost-effective. DEP states in the SWMP that "[a]gencies will incorporate GI if all of the following assessments indicate it may be appropriate and feasible." The word "appropriate" should be removed; that is not the standard set forth in the permit. The City has developed criteria for agencies to use during municipal upgrade planning as a consistent method for assessing feasibility of green infrastructure implementation. The criteria are then summarized in a few bullets, but these bullets do not include sufficient technical detail to provide an objective or consistent method for determining cost-effectiveness and feasibility. The SWMP must provide, subject to public review and comment and DEC approval, a technical methodology that will be used to determine feasibility and cost-effectiveness of green infrastructure in covered projects. The SWMP must also state that all agencies will be required to use that methodology—not simply state that one is available for agencies to use if they wish. [1]

Response: *DEP worked with other City agencies to develop criteria, mainly to add clarity to the permit language. Agencies are required to evaluate the criteria and to keep a record, for any municipal upgrade projects for which they found GI infeasible/non-cost-effective, of the justification for that determination. The City agrees removed the word "appropriate" from the text in the SWMP chapter.*

7e. The SWMP should include provisions for mandatory inventorying and asset management of all stormwater best management practices. Such practices include gray and green structural stormwater controls on all city properties, such as BMPs that are not subject to Maintenance Permit requirements, either because they pre-date the new Maintenance Permits or because they are installed in projects that were not subject to mandatory post-construction requirements. [1]

Response: *Each agency under the PP/GH Program, with the assistance of DEP, has identified and evaluated not only their structures, but also their practices under the PP/GH provisions of the program.*

7f. The SWMP should set a goal for waste removal and reduction of road salt and fertilizer use. The SWMP can be set up to reduce the amount of salt use by incorporating the use of alternatives for roadway deicing, such as liquid calcium magnesium acetate. Moreover, workshops could be developed for public employees responsible for road and grounds maintenance as well as landscaping at public facilities. DEP can measure attendance at these meetings and overall reduction in salt, fertilizer and water use after the program has been implemented. Additionally, the number of municipal waste baskets in MS4 areas and frequency of service/pick up should be measured as a goal. [1]

Response: *A third-party contractor will assess City operations including the roadway deicing and fertilizing operations. If warranted, the contractor will make recommendations for improving the controls associated with these operations. Timelines will be provided to agencies for periodic re-evaluation of their operations and for updating controls as needed. All city employees conducting municipal operations within the MS4 area must take PPGH training, and agencies must track the numbers and names of employees who take the training. The number of people trained will be submitted as part of the annual report. The PPGH training is adaptable in a way that agencies can customize the modules to fit the needs of the employees performing an operation covered under the permit.*

7g. Pollution Prevention/Good Housekeeping for Municipal Operations and Facilities: Fines for illegal dumping should be set to repair damages to the public good. Businesses should not just absorb fines as the cost of doing business. [2]

Response: *The PPGH Program will assess facilities and off-site operations to determine potential impacts to stormwater. This includes city owned properties that might be un-manned. The assessment will evaluate if illegal dumping is taking place and the appropriate controls. Chapter 5: IDDE addresses illicit discharges and illegal dumping. Appendix 1.1 (Enforcement Response Plan) includes some information on violations and enforcement responses.*

7h. As both faculty researchers and concerned citizens, we are disappointed in the overall limited scope of the documents, its lack of focus on timely action to reduce uncontrolled stormwater discharges and cursory mention of GI. Indeed, the MS4 permit requires describing opportunities for GI implementation and retrofits, which is currently lacking in the report. [11]

Response: *The MS4 Permit requires the City to implement measures to reduce pollution in stormwater runoff. The SWMP includes a robust set of programs to address pollution in stormwater discharges, as required by the MS4 Permit, often going beyond Permit requirements. Many of the programs included in the SWMP are designed to control, at their source, pollutants that stormwater may carry into the MS4 system and the waterways. As detailed in Chapter 7: Pollution Prevention/Good Housekeeping, the City is actively assessing planned municipal upgrades for GI opportunities. Furthermore, the City has identified additional GI in the Coney Island Creek MS4 area, as stated in Chapter 11: Special Conditions for Impaired Waters. Finally, DEP has an existing robust Green Infrastructure Program separate from the MS4 SWMP. Refer to the Introduction of the SWMP and the DEP website ((https://www1.nyc.gov/site/dep/water/green-infrastructure.page)) for more information on this program.*

7i. In Chapter 7, instead of being a central focus of the Stormwater Management Program, the sparse discussion of Green Infrastructure is relegated to a category of "housekeeping for municipal operations and facilities", despite the fact that volumes of stormwater generated from private properties, streets, parking lots, and rooftops greatly exceed the relatively small amounts from City facilities. Further de-emphasis of the potential of Green Infrastructure is found (pg. 121) in the statement: "Agencies will incorporate GI if all the following assessments indicated it *may* be appropriate and feasible" (italics added). In addition, we note that in Table 7.4, p. 122 describing the Pollution Prevention/Good Housekeeping Program, the goal "Consider runoff reduction and green infrastructure" is dead last in the list, following goals such as "Maintain an inventory of municipal operations and facilities", which has nothing to do with stormwater pollution. [11]

Response: *An integral component of a successful PPGH program for municipal facilities and operations is identifying potential sources that could pose a risk to stormwater runoff; accordingly, we must first inventory all municipal facilities and operations in order to prioritize facilities and operations for assessment and implementation of storm water controls. The PPGH program also addresses GI, for which the City agency will evaluate a facility when the facility undergoes a municipal upgrade.*

7j. How is the City assigning the priority ranking of municipal facilities and operations? [15]

Response: *Municipal facilities and operations are categorized as high, medium, or low priority using a standardized prioritization protocol based on their potential to contribute to stormwater pollution. This standardized prioritization protocol includes a list of questions that will be answered by facility assessors on site. Each answer results in a numeric score, which is used to calculate a final score for the site once all questions are completed. This score identifies the prioritization category.*

8. Industrial and Commercial

8a. The SWIM Coalition fully supports DEP's initiative to inspect the roughly 1,300 facilities it suspects may be operating without required Clean Water Act (CWA) Permits. It is unacceptable that these industrial facilities are operating without oversight. Any such industrial activity must be covered by a State Pollutant Discharge Elimination System (SPDES) permit that imposes best management practices to prevent contaminants from reaching waterways. DEP's proposal to inspect each of the roughly 1,300 facilities it suspects may require permit coverage will ensure each one's potential to discharge is minimized. [1]

Response: *DEP will begin going to these facilities when DEC approves the SWMP and DEP's rules for the Industrial/Commercial Program are final and effective. DEP will refer to DEC, in accordance with Permit Part IV.H.2.a., those facilities that may be significant contributors of pollutants to the MS4. If DEC confirms that a facility is subject to the MSGP, we will add the facility to the list of permitted facilities, which will be publicly available.*

Note: many of these facilities do not appear to have outdoor activities; DEP will need to inspect them to determine if they are conducting activities indoors that might be subject to SPDES. DEP will also welcome referrals from the public of facilities that are suspected to be contributing pollutants. DEP will inspect these facilities to determine if they are significant contributors of pollutants.

8b. The Industrial and Commercial Facility Inventory (I/C Facility Inventory) should be made publicly available. These sites are potential pollution hazards. It is well within the interest of the public to ensure these sites are operated safely so as to avoid pollution. In fact, DEP contemplates that it will receive public complaints related to these facilities. If the reports are

made available, the public can track DEP's progress in inspecting the facilities, review enforcement history, and monitor ongoing enforcement actions. This information is not confidential. SIC codes are already available in publicly accessible databases, and EPA and DEC each have databases where permit coverage and enforcement history are made publicly available. As those databases will not reflect City enforcement actions, there is still a need for a Citywide database. [1]

Response: *See answer above to comment 8a.*

8c. DEP should report all noncompliant facilities to DEC, not only significant contributors of pollutants. Though enforcement actions must be prioritized based on the target facilities' potentials to pollute, the trigger for SPDES permits is not the amount of pollution, but the type of operation and its location within a separate sewer or direct discharge area. In other words, the CWA requires permits for all polluted industrial stormwater, regardless of how significant. DEP proposes that following its on-site assessment, the agency will refer facilities to DEC only if they are potential significant contributors of pollutants. All facilities subject to CWA permitting requirements should be reported to DEC for the state to pursue enforcement at its discretion. At a minimum, the Facility Assessment Reports should explicitly assess whether the facility requires SPDES permit coverage. [1]

Response: *DEP will provide DEC with inspection reports approximately quarterly. As to currently permitted facilities, DEP will enforce against those it finds to be non-compliant with the applicable requirements or regulations. As to facilities that are unpermitted, DEP will refer to DEC for possible permitting those that may be significant contributors of pollutants to the MS4, in accordance with Permit Part IV.H.2.*

8d. Potential flood hazards should be assessed during facility inspections. While facilities might be deemed "no exposure" because nothing on the outside of the property poses danger, all facilities should nevertheless be assessed for impacts that flooding of the inside of their buildings might have on the nearby waterway. This would serve to inform facilities about flood risk and help emergency responders prepare for and respond to urgent situations following major storm events. [1]

Response: *Storm surge and flooding are outside the scope of the I/C Program, but the City is addressing other issues related to hazardous material storage in flood plains. DEP is promulgating rules that address spill prevention measures for portable containers of hazardous substances in order to prevent releases of hazardous materials in case of extreme weather events, and to require spill prevention measures for certain facilities.*

8e. Please control to the maximum extent possible the industrial and commercial strains placed on the system, including both human waste and water runoff from parking lots and roofs. [5]

Response: *Noted; thank you for the comment.*

8f. Chapter 8, with the title "Industrial and Commercial Stormwater Sources", entirely lacks any discussion of Green Infrastructure despite increasing evidence that industrial/commercial property rooftops and parking lots represent the single biggest opportunity for reducing urban stormwater flows (by 25-55%, Eaton 2018). There is not even any mention of the use of tax incentives to encourage private businesses to invest in such stormwater reduction strategies. [11]

Response: *Chapter 8 addresses the requirements under Section H of the MS4 permit, which focuses mainly on setting an inspection program for permitted and unpermitted facilities located within the MS4 area.*

8g. What are the facilities that will be impacted by the I/C program? There is a facility owned by EDC with a cracked pipe. [15]

Response: *The I/C Program will impact publicly and privately owned industrial and commercial sites in the MS4 area that may conduct activities within the industrial sectors covered by the Multi-Sector General Permit. DEP compiled an inventory of these I/C facilities using various databases. DEP will begin going to these facilities when NYSDEC approves the SWMP and DEP's rules are final. DEP will refer to NYSDEC, those facilities that may be significant contributors of pollutants to the MS4. As NYSDEC confirms that these facilities are subject to SPDES permitting, we will add them to the list of permitted facilities, which will be publicly available and subject to ongoing inspections. The public can report an illicit discharge to 311. Refer to Chapter 2: Public Education and Outreach for more details on what can be reported to 311. For additional information on DEP's program to identify and eliminate illicit discharges, refer to Chapter 5: IDDE.*

8h. Can the City share the list of MSGP facilities? [15]

Response: *NYSDEC issues the MSGP permit. The list of facilities covered under MSGP is currently available to the public through NYSDEC's online drop box.*

8i. Are there penalties for non-compliance? [15]

Response: *The stormwater law that took effect in May 2017 authorizes imposition of penalties for violations. DEP will promulgate a penalty schedule through the regular CAPA process, including a public comment period, before the regulatory program takes effect.*

8j. Regarding SPDES permits and MSGPs, is NYSDEC getting out of the SPDES permitting business? [15]

Response: *NYSDEC will still administer the MSGP program and issue SPDES permits. Under the City's I/C Program, the City will take on inspection and enforcement functions for NYSDEC's Multi-Sector General Permit for stormwater from industrial activities for covered facilities located in the MS4 area.*

8k. Will there be a list available of the non-compliant sites each year? [15]

Response: *Information about facilities with NYSDEC MSGP coverage is publicly available through NYSDEC's Dropbox. This includes past notices of violations (NOVs).*

8l. At car washes, where does the dirty wash water with soap and chemicals go? [15]

Response: *The Department of Consumer Affairs regulates car washes under the Car Wash Accountability Law. More information is available at https://www1.nyc.gov/site/dca/businesses/info-car-wash.page*

9. Floatables

9a. DEP should record its compliance with Local Law 48 until it is evaluated. The law calls for annual catch basin inspections through July 2019 and also calls for unclog and repairs to basins within nine days of a complaint being filed. DEP states that the law will be re-evaluated. Do you plan to continue the annual inspections? Has DEP been able to meet the nine-day response time frame? These complaints and repair times should be tracked and reported as SWMP measurable goals. [1]

Response: *As required by Local Law 48 of 2015, DEP currently inspects catch basins annually and submits semi-annual reports to the Mayor and Speaker of the City Council regarding the inspection, maintenance, and repair of catch basins within the jurisdiction of the DEP Commissioner. These reports, which include response time to complaints, are publicly available at http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=1688033&GUID=46C4E2FE-0532-4B83-8841-FBC4012A4433. Additionally, DEP reports on the catch basin complaints received and resolution time in the Mayor's Management Report (MMR), publicly available at http://www1.nyc.gov/site/operations/performance/mmr.page. As shown in the MMRs, DEP has been able to meet the nine-day resolution time.*

At this time, DEP has not made a decision regarding the continuation of annual inspections past June 30, 2019, but will reevaluate the program to optimize benefits (the DEP WWTP's SPDES permits require a three-year cycle). As stated in the SWMP, the City will report the number of catch basins inspected, cleaned, and retrofitted and the number of catch basin hoods repaired, installed or replaced in each annual report.

9b. Curb inlet screen covers and catch basin hoods should be installed in new and repaired catch basins in the separate sewer areas. Why do current catch basin design standards not include curb inlet screen covers anymore? The report states that older catch basins still have them. Relatedly, does DEP track installation and repair of catch basin hoods in separate storm sewers separately from its CSO reporting requirements? As part of its Loading Rate Analysis, DEP should determine if these or other technologies would have a significant reducing impact on floatables. [1]

Response: *Catch basins serve to collect rainwater and direct it to the sewer system. DEP periodically updates standards for sewer infrastructure, including catch basins, for a variety of reasons. Current DEP standards for catch basins are available at http://www.nyc.gov/html/dep/pdf/water_sewer/41.pdf, and require all new catch basins to have hoods. As detailed in the Plan, past DEP assessments indicate that hoods are an effective floatable control. DEP tracks installation and repair of catch*

basin hoods in DEP catch basins citywide, including the MS4 area. As delineation of the MS4 area is still in progress, DEP does not currently separate the installations and repairs done in the MS4 area from those done in the combined sewer area.

The Loading Rate Study is designed to calculate the load of trash and debris discharged from the MS4 to floatables impaired waterbodies and will not assess the effectiveness of the various control technologies. However, DEP will consider the effectiveness of curb piece designs, with the goal of screening out large pieces of debris, but also maintaining proper drainage, for which the basins were originally designed. Furthermore, DEP may test various controls as part of the overall program to control floatable trash and debris.

9c. DEP should adopt an interim reporting schedule for the Loading Rate Workplan: The Loading Rate Workplan report says the plan must begin within two years of NYSDEC approval and will take three years to complete. What is the interim reporting plan for the three-year implementation phase of the workplan? [1]

Response: *DEP will report on the status of the Loading Rate Study implementation in the MS4 Annual Reports throughout the duration of the study. This has been clarified in Chapter 9 of the Plan.*

9d. The Adopt a Catch Basin Program should be expanded beyond Brooklyn. Is this program still in place? Has it expanded beyond Brooklyn, or are there any plans to do so? What kind of support does DEP provide to those who adopt one? [1]

Response: *The Adopt-a-Catch Basin Pilot Program was an initiative in which DEP and the Office of the Brooklyn Borough President partnered with block associations, business improvement districts and other community-based organizations to remove the debris that blocks storm drains. DEP provided training, as well as gloves and garbage bags, to participating organizations that agreed to maintain storm drains in their neighborhoods. DEP is currently exploring this and other stewardship programs.*

9e. The B.Y.O. Campaign should be expanded and reinvigorated. Has this program been discontinued? Is there any plan for DEP to resume the program if the Mayor's Office cannot support it? [1]

Response: *The B.Y.O. Campaign is an important component of the plan to reach the City's Zero Waste goal laid out in OneNYC, and a key campaign of GreeNYC. GreeNYC is the City's public outreach and education program dedicated to engaging and mobilizing New Yorkers to make more sustainable choices.*

The B.Y.O. campaign is ongoing and there are no plans to discontinue the campaign. GreeNYC continues to place ads, participate in events, and give away reusable items to encourage New Yorkers to become part of the B.Y.O. movement. To take the B.Y.O. pledge, visit https://www1.nyc.gov/site/greenyc/take-action/byo-pledge-form.page.

9f. Please make public the Floatable Data Sheet annual composite reports (Volunteer Beach Floatable Program). [7]

Response: *The Floatables Monitoring Progress Report, which utilizes data collected by citizen scientists through the Volunteer Survey Program, is available on the DEP website at https://www1.nyc.gov/site/dep/water/how-nyc-is-keeping-our-waterways-trash-free.page*

9g. Chapter 9, on the Control of Floatable and Settleable Trash and Debris, touches on some of the important physical pollutants carried by stormwater, but omits any mention of chemical or biological pollution, such as metals, nutrients, or bacteria, and the well-known resultant hypoxia or even anoxic conditions from excess nutrients in receiving waters. [11]

Response: *Chapter 9, Control of Floatable and Settleable Trash and Debris details the City's program to comply with Part IV.I of the MS4 Permit, which focuses on floatable trash and debris. The Plan addresses other pollutants in other chapters. For example, Chapter 2, Public Education and Outreach identifies nutrients, pathogens, oil and grease and toxic or harmful substances as pollutants the educational programs will tackle. Chapter 5, Illicit Discharge Detection and Elimination focuses on the City's program to remove sources of pathogens and nutrients resulting from illicit discharges and to prevent other hazardous waste from entering the MS4.*

9h. Re: floatables, the public needs to be educated about balloon releases. It is not uncommon to turn on the TV and see a feature about a memorial to someone who has recently passed or some sort of celebration that involves the release of balloons. I can recall events in Coney Island to celebrate or support a person/event/cause that involved the release

of hundreds of balloons. The public has no idea that the strings and deflated torn plastic are a danger to wildlife and contribute to the microscopic plastic junk fouling our waterways. [14]

Response: *DPR does not allow the release of balloons during events permitted by DPR. The City will consider adding additional educational information to address this topic as part of the on-going effort to expand MS4-related education.*

9i. When will these media campaigns run? [15]

Response: *The City has run three separate campaigns to raise public awareness of the issues around trash and debris. The B.Y.O. Campaign launched in 2015 and is ongoing; the #TalkTrashNewYork Campaign launched in Spring 2017; and Don't Trash Our Waters ran during the Summer and Fall of 2017.*

9j. After it rains there is a lot of trash in the Bronx River—what is being done for that? [15]

Response: *The Bronx River has many existing floatable controls in place, including public litter baskets, street sweeping, catch basin hoods, underground inline netting systems, and a floating boom. In addition, the Don't Trash Our Waters campaign targeted neighborhoods around the Bronx River. In the coming years, the City will undertake a loading rate study to determine the amount of trash and debris entering waterways like the Bronx River through the MS4.*

9k. Are the floatables reports published? [15]

Response: *Yes, the reports are available online. The Floatables Monitoring Report is available at https://www1.nyc.gov/site/dep/water/how-nyc-is-keeping-our-waterways-trash-free.page. The Annual CSO BMP report, which includes information about catch basin maintenance and the boom and skim program is available at https://www1.nyc.gov/site/dep/water/harbor-water-quality.page. In the future, Annual Reports documenting SWMP implementation will also be available online.*

10. Monitoring

10a. DEP should expand the Phase I Monitoring Program to 12 sampling locations. DEP chose to sample eights sites for quarterly sampling. These eight sites cover six land use types, but DEP did not provide a rationale for doubling up on two land use types and not others. Can DEP sample two sites each land use type, for a total of 12 sampling locations? If not, please provide the rationale for obtaining multiple samples of some land use types and not others. [1]

Response: *DEP selected the two locations for low-density residential and industrial land uses to aid in the evaluation of similar land uses across boroughs or watersheds. The selected outfall for each land use type is representative of other outfalls draining a similar land use type. SWMP section 10.2.1 lists the criteria used to select the Phase 1 sampling outfalls. Many outfalls are tidally influenced and would produce inaccurate data. Additionally, it is challenging to find outfalls with a predominant land use type because NYC's densely urban environment includes a wide range of land uses draining to each outfall.*

10b. DEP should sample two outfalls serving primarily open space areas. What was the justification of the Bronx outfall HP-627 as the site to measure and assess open space land uses? There are high, known concentrations of fecal indicator bacteria upstream of this area. These may lead DEP to overestimate the pathogen runoff potential from these types of land uses. [1]

Response: *This outfall does not receive drainage from the Bronx Zoo area, if that is the upstream area with known high concentrations of pathogens referred. The area draining to this outfall is predominantly from Woodlawn Cemetery in Woodlawn Heights. SWMP section 10.2.1 lists the criteria used to select the Phase 1 sampling outfalls. DEP selected this outfall because it meets our selection criteria including accessibility, crew safety, single predominant land use type (86% of open space), lack of dry weather flows in sewers and no tidal influence. None of the other outfalls mapped at the time the SWMP went out for public review satisfied the criteria stated above. Phase 1 outfalls may change as data collection is initiated if DEP determines that data collection is limited by any unforeseen conditions or if more appropriate outfalls are identified. This ongoing ability to modify monitoring procedures is aligned with the adaptive management approach being employed by DEP to collect and evaluate the most meaningful data for the multi-phased MS4 Monitoring Program.*

10c. Please make the oversight and the assessment of controls as transparent as possible, informing the public about the kind of pathogens being measured, other causes of concern in the water, and how they are tracked, and also, how we can become informed of overflows. [5]

Response: *The City will inform the public about pathogen data collected and analyzed. The City will collect fecal coliform and enterococci (pathogen) data as stated in Section 10.3.3 and Appendix 10.1 of the SWMP. Results of the analyses will be included in the MS4 SWMP Annual Reports as public information. The public can receive notifications about combined sewer overflows and illicit connections through the NY-Alert System. Visit https://alert.ny.gov/ to sign up.*

10d. Where are the phase 1 monitoring locations? [15]

Response: *Refer to the Table 10.1 in Chapter 10: Monitoring and Assessment of Controls or Figure 1 included in Appendix 10.1: Monitoring Plan.*

11. Special Conditions

11a. DEP should identify all impaired waterbodies listed in Appendix 2 of the City's MS4 Permit as "Priority MS4 Waterbodies." It is questionable that only one waterbody, Coney Island Creek, was identified as a "Priority MS4 Waterbody." The permit definition is "water bodies for which an approved CSO LTCP does not predict compliance with applicable water quality standards and where stormwater contributions from the Permittee's MS4 are expected to be a significant contributor of the impairment identified in the CSO LTCP." Data from DEP indicates that not only are pathogens attributable to MS4 areas, trash pollution is a major cause of water quality impairment. Data from DEP indicates that of the floatable trash collected by the DEP from their containment structures and open water areas, greater than 90% is collected on the Bronx River. Many of the LTCPs show non-compliance with water quality standards (which is why they all have, nominally, use attainability analyses (UAAs)), and they typically point to MS4 and direct drainage as the other source preventing water quality standards compliance. For instance, the UAA for Westchester Creek states: "Non-attainment of primary contact water quality criteria are attributable to the following UAA factors: Human caused conditions (direct drainage and urban runoff) create high bacteria levels that prevent the attainment of the use and that cannot be fully remedied for large storms." Similar language is applicable to the Hutchinson River and other waters. For each of the waterbody segment listed in Appendix 2 of the MS4 Permit other than Coney Island Creek, what is the justification for not identifying those segments as Priority MS4 Waterbodies? For those waters that receive pollution from upstream areas, such as those areas in Westchester County, please define the proportion of pollutants of concern attributable to New York City MS4 and direct drainage areas in comparison to the proportion coming from separate sewers and direct discharges upstream of New York City. [1]

Response: *Coney Island Creek is the only waterbody that currently meets the criteria for a Priority MS4 Waterbody, as defined in the permit. Other waterbodies with approved CSO LTCPs are predicted to meet applicable water quality standards and/or it was found that stormwater is not a significant contributor to the impairment identified in the CSO LTCP.*

11b. DEP must set firm milestones and deadlines and identify public and private green infrastructure opportunities for the Coney Island Creek Priority Waterbody Plan to comply with permit requirements. Under the MS4 Permit, DEP must provide a "listing of the additional or customized non-structural BMPs and a schedule to commence implementation within the shortest reasonable time." The BMPs proposed, however, are not defined, and their start dates are malleable. For instance, DEP, along with partner agencies, "will begin coordinating catch basin marking opportunities in the Coney Island Creek MS4 drainage area in fall 2018" and DEP will "assess the feasibility of additional source tracking methods, and anticipates initiating the procurement process in 2018." These schedules don't say when implementation will begin. "Procurement" isn't implementation but rather a bureaucratic activity prerequisite to being able to implement the BMPs. Firm milestone deadlines must be set for each of these programs. DEP must also track and report its progress in implementing these milestones. Moreover, under the MS4 Permit DEP must provide "a description of opportunities for implementing green infrastructure pilot projects and other structural retrofits in Priority MS4 Waterbodies that are cost-effective and feasible." DEP states that it has identified "potential opportunities on City-owned property, but it doesn't actually describe the opportunities identified. It seems DEP has yet to actually determine whether any opportunities for "cost-effective and feasible" green infrastructure retrofits exist. Rather, it says, DEP is partnering with other agencies to evaluate those opportunities. These opportunities should be identified and evaluated in the SWMP as required by the Permit. Moreover, to address pollutants of concern, DEP must evaluate green infrastructure opportunities on private property in Priority MS4 Watersheds. [1]

Response: *Chapter 11 of the SWMP Plan includes a section for Enhanced or Additional Stormwater Control Measures for Coney Island Creek, which lists the proposed BMPs and information about implementation timelines for each. The next section in the chapter, titled Opportunities for Green Infrastructure Pilot Projects, provides the description of opportunities for implementing GI pilot projects, as required by the Permit.*

11c. All City agencies should be involved in implementing Priority MS4 Waterbody BMPs. Why are some City agencies excluded from implementing this requirement? Department of Design and Construction and Department of Citywide Administrative Services are excluded, but they control public property/projects that have a role in reducing pollutants of concern. [1]

Response: *All relevant City agencies will be involved in implementing the regular MS4 programs described in Chapters 2-10 of the SWMP Plan. Construction projects in Priority MS4 Waterbodies are additionally subject to requirements in Permit Part II.B.1.b. The City is also exploring the feasibility of additional or customized non-structural BMPs for City facilities in watersheds of Priority MS4 Waterbodies in accordance with Permit Part II.B.2.a.*

11d. DEP should map and identify "Geographic Areas of Concern." For all waters the DEP identifies as Priority MS4 Waters, DEP should provide an additional map of the drainage area for that waterbody. Not only would the map help educate the public, but it would help City agencies identify areas where additional pollutant reduction measures could be undertaken for pollutants of concern. [1]

Response: *The City will delineate the drainage areas that correspond with MS4 outfalls. The Preliminary MS4 Map shows the information completed to date. The City may revisit other mapping suggestions in the future.*

11e. DEP's impaired waters maps should be clarified and corrected. In the Executive Summary, Introduction, and Impaired Waters chapter, the impaired waterways maps are hard to make out. Can DEP make those full page, perhaps in an appendix, or zoom in/call out the tributaries that are impaired? Also, Flushing Creek and Newtown Creek are impaired for pathogens, and DEP's lists and maps should be corrected. [1]

Response: *The SWMP reflects Permit requirements, which include using the impaired waterways list at the time of permit issuance. Chapter 11 now includes larger format figures depicting the locations of waterways impaired by the four pollutants of concern. The figures in the SWMP are based on Appendices 1 and 2 of the Permit, which include the detailed information you are looking for.*

11f. Activities in Coney Island should be used as a template throughout the NYC waterways. Successes such as community meetings should be duplicated where DEP truly listened to residents and implemented stakeholder's ideas. [2]

Response: *The City will duplicate the Coney Island Creek coordination efforts as a model for any future designated Priority MS4 Waterbodies. Activities undertaken in any Priority MS4 Waterbody will target the impairment pollutants and related sources specific to that waterbody. The City may evaluate pilot programs to determine whether it is feasible to duplicate them in other MS4 areas.*

11g. Chapter 11 discusses Special Conditions for Impaired Waters. It states (pg. 86) that "Impaired waters with approved CSO LTCPs that do not predict compliance with applicable water quality standards, and where stormwater contributions from the MS4 area expected to be a significant contributor to the impairment, are Priority MS4 Waterbodies." This is an exact description of Flushing Creek/Bay which has been impaired for decades. In addition, as shown in the Historical MS4 map in the Executive Summary, this waterbody has numerous MS4 outfalls. Yet, only Coney Island Creek is described as having a Priority MS4 Waterbody plan. It is inexplicable why Flushing Bay and Creek, are one of the largest single CSO-induced impaired waterways, has not been designated a Priority MS4 waterbody. [11]

Response: *The MS4 SWMP addresses the separately sewered areas of NYC. It does not address combined sewer overflows or stormwater that enters the combined sewer system. Flushing Bay and Creek do not meet the criteria for a Priority MS4 Waterbody, as defined in the permit. Other than Coney Island Creek, waterbodies with approved CSO LTCPs are predicted to meet applicable water quality standards and/or it was found that stormwater is not a significant contributor to the impairment identified in the CSO LTCP.*

11h. The Coney Island History Project has been involved in environmental work on Coney Island Creek for several years. In the past we've designed and placed permanent informational signage along the creek in Calvert Vaux Park and Kaiser Park, and created corresponding booklets for creek walking tours. We also work with local schools in Coney Island, giving environmental presentations that trace the importance and history of the Coney Island Creek estuary. Other projects we're involved in are shoreline cleanup of floatables, water quality testing, and exhibits at our Coney Island Exhibit Center. In the past we've applied for a grant to create catch basin signage for source control and we regularly walk or kayak the creek to monitor storm drains for illegal discharges. [13]

> **Response:** *As described in Chapter 11, the City partnered with the Coney Island Beautification Project on community workshops throughout SWMP development. We look forward to working with Coney Island History Project and other community organizations as we move into SWMP implementation.*

11i. We are located in a zone that's responsible for a great deal of the floatable pollution that comes through the storm sewers. Our location in the heart of the amusement area gives us a unique opportunity to distribute materials and educate the public about source pollution, green infrastructure, and related issues in the community. Much of the outreach we'd like to do has been addressed in the management plan and we're interested in continuing and expanding our educational programs as part of MS4. The creek needs more monitoring and the drain signage program should really be expanded north of the creek to the neighborhoods that have no idea that they're connected to the creek watershed! [13]

> **Response:** *As described in Chapter 11, Coney Island Creek is a Priority MS4 Waterbody. We have already implemented several new programs and initiatives within the watershed including signage at MS4 outfalls, pet waste dispensers at local parks, and a behavior-change media campaign to reduce floatable trash and debris. We look forward to working with local stakeholders to further implement education and outreach efforts in the neighborhood.*

11j. There needs to be more coordination between DEP and other agencies (i.e. EDC) regarding stormwater management in the Coney Island Creek watershed. [14]

> **Response:** *Coney Island Creek is a Priority MS4 Waterbody, and the SWMP includes a Priority Waterbody Plan for the Creek (Chapter 11). City agencies are already coordinating stormwater management projects beyond the MS4 programs they are implementing Citywide.*

11k. Why is Bronx River not a Priority MS4 Waterbody? [15]

> **Response:** *Coney Island Creek is the only waterbody that currently meets the criteria for a Priority MS4 Waterbody, as defined in the Permit. Other waterbodies with approved CSO LTCPs are predicted to meet applicable water quality standards and/or it was found that stormwater is not a significant contributor to the impairment identified in the CSO LTCP.*
>
> *Despite not being a Priority MS4 Waterbody as defined by the Permit, DEP has explored opportunities for additional GI along the Bronx River and partnered with the Soil & Water Conservation District and Bronx River Alliance for a trash wheel feasibility study. Additionally, the "Don't Trash Our Waters Campaign" targeted communities near the Bronx River.*

12. Recordkeeping and Reporting

12a. Is the City only keeping records for 5 years? [15]

> **Response:** *As required by the MS4 Permit, the City will retain records related to the SWMP for a minimum of 5 years. The Consolidated Information Tracking System, which is the database that will store records related to the SWMP, is designed to keep these records in perpetuity.*

13. General SWMP

13a. We do request that the uniqueness of each site is taken into consideration. A one size fits all sites plan may not be best. Here at Alley Creek we have a huge tidal difference that sometimes leaves the tiniest trickle of water in the creek and at other times a very high tide occurs. We are concerned that some of the proposed actions might have more of an impact on the native flora and fauna as those very low tide periods and maybe less effective than thought during those very high tide periods. [3]

Response: *As required by the MS4 Permit, the programs described in the SWMP Plan are applicable in all MS4 areas of NYC. The Priority Waterbody Plan will address the designated waterbody's pollutants of concern through pilot projects and enhanced MS4 program measures specific to that waterbody, using an integrated approach to consider other programs and improvement plans for the waterbody and the areas draining to it.*

13b. Please consider the importance of the Alley Pond watershed when going forward with your Municipal Storm water management plan. Alley Pond Park and The Alley Pond Environmental Center in particular should be kept clear of pollutants and sewage overflow. As the population of Northeast Queens continues to grow, we need to protect our natural environments, so that everyone in our city has some breathing room. The Alley Pond Environmental Center has taught generations of Queens's students to value and protect our urban natural spaces. They deserve to be considered and protected in any plan put forward by the DEP. [4]

Response: *The City will implement the SWMP in all MS4 Areas, and we look forward to working with the Alley Pond Environmental Center and other community groups on implementation in the Alley Creek watershed.*

13c. Please consider alley pond Environmental center for MS4. [9]

Response: *Thank you for this comment. We will consider all MS4 areas in the City. If the Environmental Center has specific MS4 programs (e.g. Public Education and Outreach) that it would like to participate in implementing, we are happy to coordinate.*

13d. Since uncontrolled stormwater is the driving factor for combined sewer overflows, which is the single most important contributor to poor water quality, it is critical that urban stormwater be reduced in order to improve coastal water quality for millions of New Yorkers. Particularly in combined sewer areas, important progress has been made using both gray and green infrastructure (GI) approaches, however we believe that New York City should prioritize and invest more in many opportunities to use Green Infrastructure to reduce stormwater at its source, including in separated sewered areas. [11]

Response: *The MS4 SWMP addresses the separately sewered areas of NYC. The MS4 Permit includes two important requirements for green infrastructure. One is addressed in the PP/GH program (Chapter 7) and applies to planned municipal upgrade projects. The other is piloting green infrastructure or other stormwater runoff control techniques in Priority MS4 Waterbodies (Chapter* **11).** *Additionally, the Construction/Post-Construction program (Chapter 6) requires runoff reduction from development and redevelopment projects, and green infrastructure or other on-site infiltration practices are the preferred approach.*

13e. We understand the layout of the document and material covered in individual chapters is influenced by regulatory requirements, and many areas of focus in individual chapters are very important to the success of the MS4 program, such as Chapter 2 Public Education and Outreach, and Chapter 4 Mapping. However, we find it most disconcerting that there is no significant discussion or specific chapter heading on the topic of stormwater source reduction. As a transport agent, stormwater often carries a very high pollutant load (fecal bacteria, metals, oxygen-consuming wastes, etc.) to receiving waters, therefore it follows that reduction of the transport agent, i.e. stormwater, will be the most efficient way of reducing pollution. [11]

Response: *The City has numerous policies and programs to reduce the volume of stormwater, but the MS4 permit does not specifically govern those programs. The MS4 Permit requires the City to implement measures to reduce pollution in stormwater runoff. The purpose of the MS4 Permit is to control at their source pollutants that stormwater may carry into the MS4 system and waterways. If less pollution enters stormwater runoff, then, regardless of the volume of stormwater entering the waterbody, it is cleaner and poses less threat to aquatic life and human health. However, the Construction/Post-Construction program (Chapter 6) does require runoff reduction from development and redevelopment projects.*

13f. We believe that the lack of action or specific proposals to reduce uncontrolled stormwater through MS4 permitting will needlessly prolong the current situation of intermittently unacceptable water quality in City embayments and coastal waters. In particular, Green Infrastructure (GI), which is globally recognized as the single most effective approach to reducing stormwater, is only mentioned briefly in scattered locations in the report. This is in contrast to US EPA guidance in its Green Infrastructure Strategic Agenda which lists Green Infrastructure approaches among the top objectives to reduce stormwater runoff related to SSOs, CSOs, and MS4s (US EPA 2013). [11]

Response: *The MS4 Permit requires the City to implement measures to reduce pollution in stormwater runoff. The purpose of the MS4 Permit is to control at their source pollutants that may be carried by stormwater. The programs described in the SWMP will improve the water quality of stormwater discharges from the MS4, as required by the MS4 Permit. Green Infrastructure is not feasible in all locations, and in some areas poses other environmental concerns such as increasing levels of contaminants underground at industrial sites.*

DEP has an existing robust Green Infrastructure Program separate from the MS4 SWMP. Refer to the Introduction of the SWMP and the DEP website ((https://www1.nyc.gov/site/dep/water/green-infrastructure.page)) for more information on this program.

13g. Porous paving in parks, pedestrian plazas and other large spaces should be mandated. Green roofs or similar storm water reducing measures, should be mandated for any project that receives public funding, i.e. homeless shelters, schools, health centers, etc. [14]

Response: *Local Law 97 of 2017 requires City agencies to determine the feasibility of incorporating green infrastructure into capital projects, and applies to all areas of the City (not limited to the MS4).*

13h. To create the MS4 system, does the City have to rip up the streets? [15]

Response: *The vast majority of the municipal separate storm sewers covered by this program already exist. To maintain the sewer system, DEP conducts inspections and, as needed, repairs or replaces sewer structures. There are some areas where new storm sewers are being constructed, which are typically tied to high level storm sewer projects near the waterfront or part of planned storm sewer buildout, such as in Southeast Queens and East New York.*

13i. Most New Yorkers live in the combined areas of the city, why doesn't this plan do anything to address stormwater in those areas? [15]

Response: *DEP has a separate and robust program to address stormwater in areas of NYC with a combined sewer system. That program seeks to reduce combined sewer overflows through waterbody-specific Long Term Control Plans. To date, DEP has allocated 8 billion dollars to this effort. More information is available at http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/index.shtml.*

13j. How does the Bluebelt System fit into MS4 requirements? [15]

Response: *Bluebelts are part of the MS4 and are an important tool to mitigate stormwater pollution and flooding. A Bluebelt is a collection of streams, ponds and wetlands that naturally convey, store, and filter stormwater runoff. The Bluebelt program preserves natural drainage corridors such as streams and ponds, and optimizes natural drainage through the design and construction of stormwater controls to filter stormwater before it empties into the New York Harbor.*

13k. Will the draft SWMP presentation be available online? [15]

Response: *MS4 presentations and other educational material on the Stormwater Management Program can be viewed at nyc.gov/ dep/ms4.*

13l. Will the plan expedite plans to upgrade old infrastructure responsible for CSOs? [15]

Response: *Combined Sewer Overflows are addressed through a separate program. The SWMP complements the combined sewer overflow reduction program, but addresses a different problem.*

13m. Is the State the regulator? [15]

Response: *NYSDEC is the State regulatory agency that issued the MS4 Permit and oversees the City's compliance. The Permit requires the City to administer several regulatory programs, including two related to existing State regulatory programs. As explained in detail in the SWMP, the City will administer a new regulatory program for stormwater runoff from new construction and redevelopment projects (see Chapter 6) and will take on inspection and enforcement functions for NYSDEC's Multisector General Permit for stormwater from industrial activities (see Chapter 8).*

13n. What is the May 15th deadline? [15]

Response: *May 15th was the deadline for all public comments on the SWMP Plan.*

13o. Will the City acquire vacant or other properties for installing GI? [15]

Response: *The City does not have any current plans to acquire vacant or other properties for green infrastructure as part of the MS4 program. DEP does offer a grant program citywide to private property owners who wish to retrofit their property with Green Infrastructure.*

13p. Are there any DEP efforts to identify properties and fund Bluebelts before properties get developed (e.g. North Shore)? [15]

Response: *DEP will expand the Mid-Island Bluebelt in Staten Island to provide local residents with high quality drainage infrastructure and explore opportunities to install Bluebelts in other advantageous locations citywide. A planned Bluebelt must go through the environmental review process, which includes opportunities for public review and comment.*

13q. Do NYC wastewater treatment plants have the capacity to treat all this stormwater? [15]

Response: *Generally, NYC's 14 wastewater treatment plants can treat 2x the dry weather flow. For the MS4 area and for the purposes of the SWMP, stormwater that drains to the MS4 is discharged directly to local waterbodies and does not go to wastewater treatment plants.*

13r. What effect will this program have on private homeowners? [15]

Response: *There will be no effect on private homeowners unless they have an illicit sewer connection in their home, are illegally dumping into the MS4, or plan to construct or re-develop their property and will disturb an acre or more of land making them subject to the Construction/Post-Construction program requirements.*

14. Other

14a. I am concerned about the amount of stormwater that is entering Alley Creek or Little Neck Bay at various points, either because of stormwater outflow, or the way that it mixes with sewage in the CSO, or, how it runs down the streets and enters the Creek and Bay without entering any part of the enclosed system. It appears from my understanding of what you have presented in the LTCP for Alley Creek that the creek itself will not attain swimmable goals for a long time, because of illegal connections and other sources of pathogens. A walk to the southern end of the estuary along Alley Creek, along its western side, just short of the Long Island Expressway suggests just how much work is needed. The visible amount of garbage that is retained in the "lion's cage" would suggest a great deal more of unwanted microbes of all levels of danger. This is when the amount of recreational use along the trails surrounding Alley Creek is continuing. Stormwater entering the system which then just mixes with the combined sewage to spill out into the Creek and Bay during rain events is simply confounding. [5]

Response: *This comment is unrelated to the MS4 SWMP, but the Alley Creek LTCP provides extensive related information. Alley Creek is designated as a Class I waterbody by New York State Department of Environmental Conservation, suitable for secondary contact recreation and aquatic life propagation and survival, not for primary recreation (i.e. swimming). As noted in the LTCP, no evidence of primary recreation could be identified in Alley Creek. However, the LTCP did evaluate the ability of Alley Creek to achieve the "swimming" or primary contact bacterial standards during the recreational season for the recommended plan. The LTCP projected 98% attainment with the fecal coliform primary contact standard (see Table 8-18 in Alley Creek LTCP Supplemental Documentation), a very high level of attainment. With regard to the illicit sources of pathogens to Alley creek, DEP has made efforts to track down illicit discharges to the Creek and reports on these efforts to NYSDEC on a regular basis. DEP periodically cleans the "Lion's Cage." This structure captures street litter and trash that washes through the sewer system during rain events, which would otherwise be a source of floatables to Alley Creek. The stormwater that mixes with CSO is directed to and captured at the Alley Creek CSO Facility, which reduces the quantity of stormwater that would have discharged to the Creek. In calendar year 2016, the Alley Creek CSO Facility captured over 300 MG of CSO and stormwater, which was subsequently treated at the Tallman Island wastewater treatment plant.*

14b. We need the Bluebelt expanded to meet the demand of billions of gallons of CSO. We are requesting the LTCP include funds for acquisition of parcels for Bluebelt expansion. [8]

> **Response:** *The MS4 Permit and the SWMP Plan address separately sewered areas of the City, rather than CSO areas. DEP plans to expand the Mid-Island Bluebelt in Staten Island to provide local residents with high quality drainage infrastructure and explore opportunities to install Bluebelts in other advantageous locations citywide.*

14c. We oppose the use of post discharge chlorine, the effects on the marine ecology are not fully known, and how can DEP state chlorination is acceptable? [8]

> **Response:** *The MS4 SWMP does not include any chlorination projects. For information on the Long Term Control Plans that include chlorination projects visit www.nyc.gov/dep/ltcp.*

14d. We are fed-up with so called "forced main" and or private WTCP, your LTCP must have a provision to amend Local Law to make private WTCP unlawful. Previous private WTCP of development become unmanageable and unmaintained, then DEP and taxpayers are required to bail out development that should not have been permitted. [8]

> **Response:** *The MS4 Permit and SWMP Plan address the storm sewer system. If there are any specific questions or concerns about a privately-owned pumping station or privately-owned wastewater treatment plant, you can contact the State (NYSDEC) and/or the DOHMH.*

14e. NYC DEP to pay particular attention to the unique aspects of the Alley Pond watershed, and, in particular, all that flows into Alley Creek. The larger issues of effluent from stormwater entering the combined sewage system and creating an overflow is of course related. The less stormwater entering the system or carrying garbage and pollutants into the Creek and Bay, the better. [10]

> **Response:** *The MS4 SWMP addresses the separately sewered areas of NYC. It does not address combined sewer overflows or stormwater that enters the combined sewer system. The City will implement MS4 programs as described in the SWMP for all MS4 areas draining to Alley Pond.*

14f. The tight connection between uncontrolled stormwater and the occurrence of combined sewer overflows in wet weather is aptly illustrated by the figure on page 5, showing how stormwater is a direct cause of CSO entering coastal waterways. Hence, in CSO areas, stormwater reductions that limit CSO volume are a far better treatment than CSO chlorination, which is the approach promoted in many of the approved Long Term Control Plans (LTCP). Furthermore, Stormwater by itself is a direct discharge pollutant to local waterways, and some approved LTCPs (e.g. Flushing Creek) suggest that even with total CSO capture (not planned), these waterways would still not meet fecal pathogen water quality standards. Therefore, stormwater source reduction, capture and treatment are important to ensure water quality improvement in addition to the approved CSO LTCPs. [11]

> **Response:** *While stormwater runoff and CSOs are linked in areas of the City with combined sewers, this issue is addressed through the City's CSO Mitigation Program, and the Long Term Control Plans. Additionally, reducing stormwater runoff is one of main drivers of New York City's Green Infrastructure (GI) Program. DEP and agency partners design, construct and maintain a variety of sustainable green infrastructure practices such as green roofs and rain gardens on City owned property such as streets, sidewalks, schools, and public housing. Green infrastructure promotes the natural movement of water by collecting and managing stormwater runoff from streets, sidewalks, parking lots and rooftops and directing it to engineered systems that typically feature soils, stones, and vegetation. This process prevents stormwater runoff from entering the City's sewer systems and waterways.*

14g. Although the combined sewer overflow issue is the focus of a separate Long Term Control Plan regulatory process, the lack of specific stormwater reduction actions in the NYC Stormwater Management Report will undercut the effectiveness of both efforts. This is an enormous missed opportunity, because robust stormwater reduction efforts have the potential not just to combat stormwater pollution but to overcome some of the inadequacies of the Long Term Control Plans in improving coastal water quality. [11]

> **Response:** *As noted in the response above, the LTCP projected 98% attainment with the fecal coliform primary contact standard (see Table 8-18 in Alley Creek LTCP Supplemental Documentation), a very high level of attainment, and the GI program is focused on reducing stormwater loadings to the waterways.*

14h. Does this program address chlorine discharge from wastewater treatment plants? [15]

Response: *No, this program does not apply to wastewater treatment plants, which have their own SPDES permits to address wastewater discharges.*

Appendix 5.1

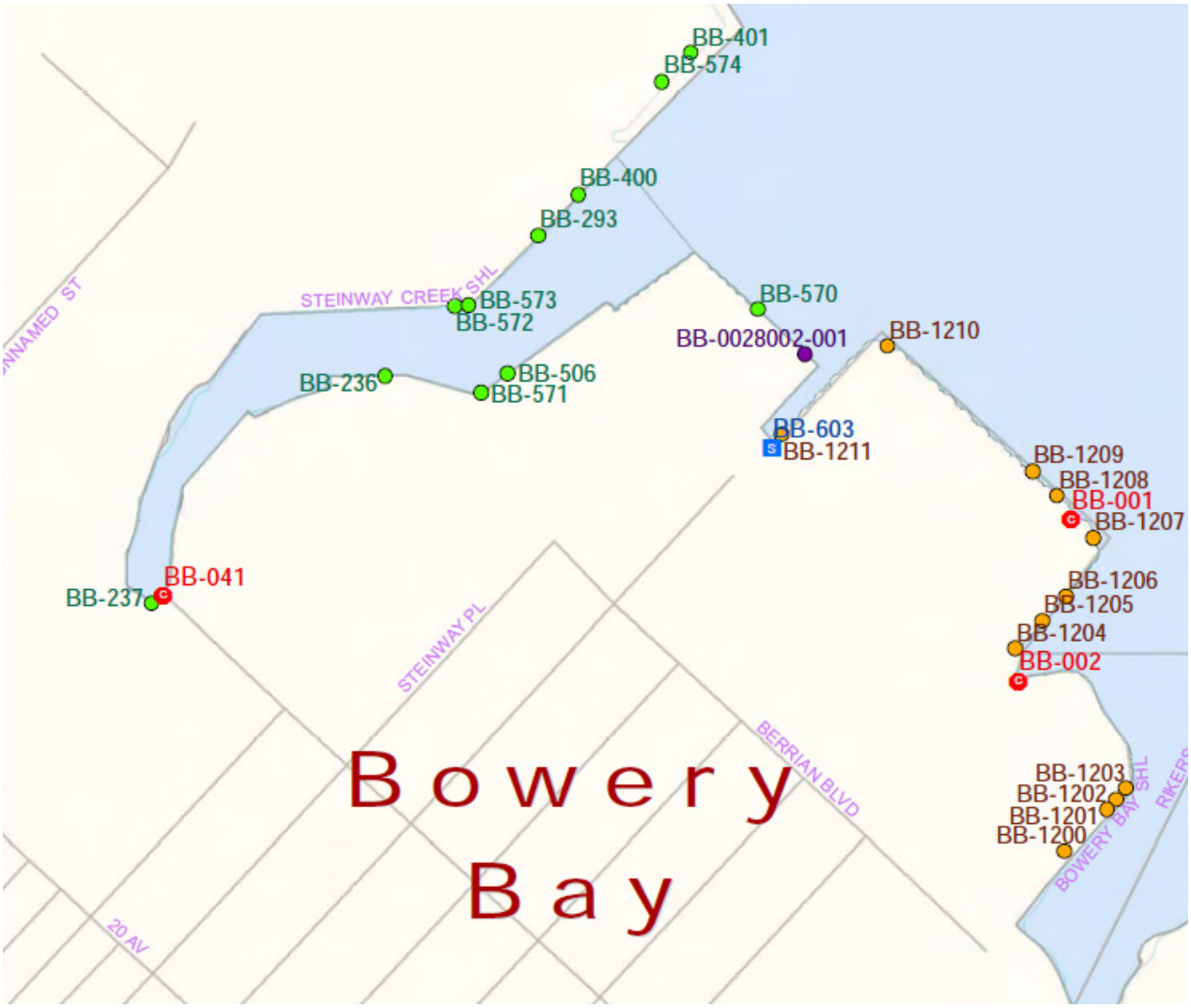
DEP IDDE Standard Operating Procedures for the Shoreline Survey and Sentinel Monitoring Program

The New York City Department of Environmental Protection's (DEP) Bureau of Wastewater Treatment's (BWT) Compliance Monitoring Section (CMS) is required by its 14 Wastewater Treatment Plant (WWTP) State Pollution Discharge Elimination System (SPDES) Permits to survey New York City's shoreline outfalls through the Shoreline Survey Program, and to monitor New York City's harbor for illicit discharges through the Sentinel Monitoring Program.

Shoreline Survey Program

The Shoreline Survey Unit (SSU) conducts field surveys and regular outfall surveillance by land, boat, and rigid inflatable rubber raft with an emphasis on boat surveillance of the entire NYC shoreline and the following inland waters within NYC boundaries: Van Cortlandt Lake (Bronx), Grasmere Lake (Staten Island), Arbutus Lake (Staten Island), and Wolfes Lake (Staten Island).

Each outfall is identified as to whether it is a City-owned sewer, highway drain, storm sewer, combine sewer outfall or SPDES-permitted discharge line, private, etc. DEP conducts an outfall reconnaissance inventory in line with the principles described in "Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments" (Center for Watershed Protection and Robert Pitt, October 2004).



Example of Shoreline Mapping from the 2013 Shoreline Survey Report

As outlined in the Schedules of Compliance part of the SPDES permit, CMS provides Shoreline Survey Reports every five years to DEC representing 50 percent of the NYC shoreline outfalls. The Report includes spreadsheets of all identified outfalls by WWTP drainage area and maps with the outfalls identified. The information includes: outfall ID, classification (CSO, MS4, direct, etc.), location by description and GIS coordinates, size, and receiving water. Through the Shoreline Survey, 4,861 outfalls have been identified between 1998 and 2018 to date, including 431 DEP-owned CSO outfalls and 376 DEP-owned MS4 outfalls.

If a dry weather discharge is observed from a city-owned outfall during the shoreline survey, laboratory analysis may be conducted to test for fecal coliform levels. The nature of the discharge is determined based on laboratory analysis of samples collected. The discharge is identified as either an illicit discharge, such as sewage, or an allowable discharge authorized by the DEP Commissioner. DEP tracks discharges authorized by the DEP Commissioner, which helps determine if an observed dry weather flow is allowable. If the lab confirms a discharge is sanitary flow, then SSU will begin the trackdown process for the discharge source. SSU also uses visual indicators for all types of illicit discharges (e.g. oil, soap suds, etc.) that may initiate the trackdown process.

Trackdown includes various procedures, such as dye testing, to attempt to identify the discharge. Once the source of an illicit discharge is identified, SSU works to eliminate the issue.

Discharge from collection system, due to failures such as blockage or mechanical failure of regulator and pump is usually identifiable. Such discharges are reported immediately upon discovery to the SPDES Compliance Section and Collection Facilities Operations that are responsible for undertaking immediate corrective actions.

Discharge from suspected illegal sanitary connections to the storm sewer, is reported to DEC by SPDES Compliance Section within two hours of the confirmation, and is followed by a letter within 5 days that an untreated discharge exists. CMS normally prepares abatement schedules and conducts investigations. However, appropriate Bureaus/Sections within DEP are contacted if jurisdiction requires their approval or cooperation.

Discharges that are identified as non-sanitary are reported to DEC. If the non-sanitary discharge is coming out of a City-owned storm sewer, the shoreline crew will investigate and attempt to mitigate the discharge. However, if the discharge is not under City ownership, the crew will defer to DEC for investigation.

When DEP identifies that the source of an illegal discharge will require lengthy investigation, it follows up with a phone call to DEC within 2 hours and a letter to DEC within 5 days. Then, within 30 days, DEP submits a two-phase abatement schedule to DEC. The first phase indicates a timetable for the completion of the investigation to determine the source(s) of the discharge. The second phase is submitted upon the identification of the source(s) and reflects a schedule for the ultimate abatement.

Between 1998 and 2017, the Citywide IDDE Program identified 412 contaminated discharges, representing 4.38 million gallons per day (MGD) of flow. Of the contaminated discharges identified in that timeframe, 402 discharges or 4.35 MGD have been abated, with 8 discharges or 0.03 MGD currently under continued investigation. The City will continue to implement its well-developed IDDE program while exploring additional actions to prevent, detect, and eliminate illicit discharges to all City agencies' storm sewers.

Shoreline Survey Investigation Procedure:

1. Prior to commencement of the field survey, the shoreline crew reviews the sewer map of the outfall(s)/area(s) that are in question. The crew needs to trace back the sewer lines leading to the outfall and their locations. This knowledge will then allow for proper preparedness in the field.
2. When the crew arrives at the site in question, crew members first begin to note observations and details of possible discharge sources. All observations are documented in an investigation report and photographed; if needed, a sample will be collected (procedures below).
3. The crew then follows all possible sources of discharge to its source as much as is physically and safely possible, noting all observations of possible sources of illicit discharge.

4. If a sample needs to be collected for testing, the crew:
   - Uses a clean Fecal Coliform 500 ml Clear Plastic Bottle to collect the water using either rubber gloves and personal protective equipment (PPE) or a rope and PPE.
   - Preserves the sample with sodium thiosulfate.
   - Labels the sample and place immediately on Ice to thermo-preserve the sample.
   - Delivers the sample to Newtown Creek Microbiology Lab upon completion of the job.

Dye Testing Procedure:

If it has been determined that a facility requires a dye test for confirmation of discharge location, the following steps are taken:

1. All necessary equipment is gathered:
   - Dye (red or green)
   - Hook, crow bar & sledge hammer
   - Traffic safety cones
   - Flashlights
   - PPE
   - Two-way radios
   - DEP vehicle
   - Camera
   - Sewer map of the location
   - Notepad & pen
   - Gas techs (Lower Explosive Limit gas analyzer or Photoionization Detector gas analyzer)
   - GPS
2. A traffic work zone safety area around the manhole(s) of interest is created using the DEP Vehicle, traffic safety zone cones, traffic flags, traffic signs and lights.
3. Crew members open the manhole(s) in question.
   - Using a hook, sledgehammer and/or crow bar, CMS Employees open the manhole(s) and take a step back to allow any tapped gasses to be expelled. A gas tech must be used for this task.
   - Traffic safety cones are to surround the open manhole at all times. A DEP Employee is to remain with the open manhole at all times until the job is completed.
4. A crew member pours the dye into the drain and then notifies the other crew members outside using the two-way radio.
5. When the dye is observed in the manhole, the crew member takes a picture noting the result.
6. A field report is completed and submitted the CMS Supervisor.

Sentinel Monitoring Program

The Sentinel Monitoring Program is an enhancement and modification of the Shoreline Survey Program's procedures for identifying and eliminating transitory and intermittent illicit discharges. The Program was designed, in cooperation with NYSDEC, to monitor specific sampling areas for fecal coliform in water bodies throughout New York City. As of October 2017, DEP is now also collecting samples for enterococcus to be consistent with the Harbor Survey Monitoring Program. DEP currently performs sentinel monitoring at 80 ambient monitoring stations in accordance with the WWTP SPDES Permits and MS4 Permit.

Sampling for fecal coliform at these stations is done quarterly. It is performed after a dry antecedent period of 48-hours and during various tidal cycles and seasons to ensure statistical integrity. The sampling results are compared to an established baseline. Currently, the fecal coliform baseline is 200 colonies/100 ml.

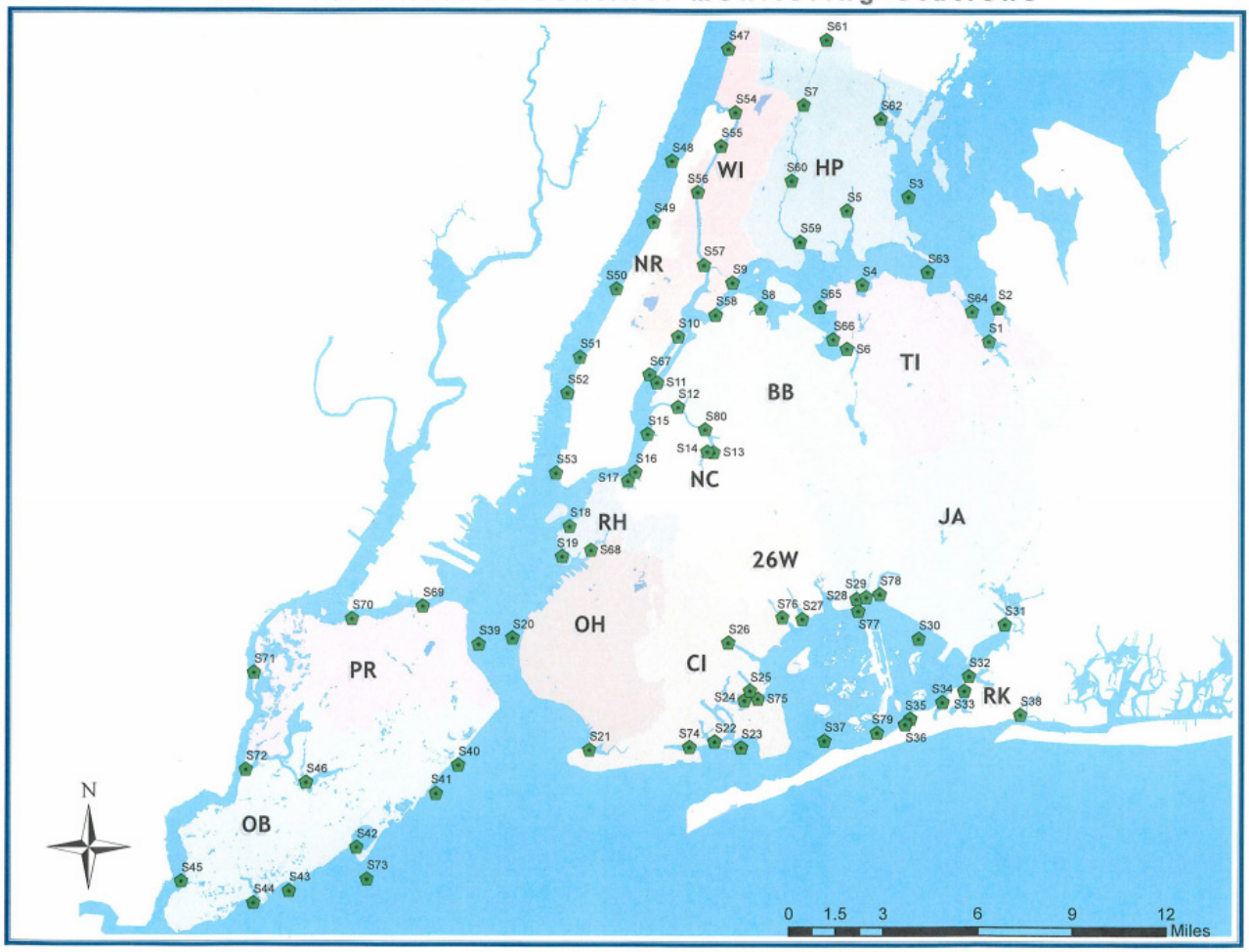
If sampling results are above the baseline trigger limits, DEP aggressively pursues field investigations and surveillance of the adjacent shoreline. The goal of these "mini-shoreline surveys" is to determine the source of the contamination and take immediate action to abate any found illegal discharges.

Sentinel Sampling Procedure:

Prior to sampling, arrangements are made with the Marine Section and Newtown Creek Lab as there is a 6 hour timeframe window to deliver the samples to Newtown Creek Lab. The timeframe begins when the first sentinel sample is collected. Typically samples from 10-12 stations are collected each run after a dry weather period of 48 hours or longer.

1. Materials are collected for sampling:
   - Sample vials from Newtown Creek Lab
   - Preservative Sodium Thiosulfate
   - Ice cooler and ice can
2. Using GPS coordinates, the boat arrives at the sampling location and the sample vial is affixed to the sampling pole located on the boat via rubber bands. The pole is then immersed in the water to the indicated mark.
3. As the sample is collected, air bubbles will be seen. Once the bubbling ceases, the pole is carefully lifted out of the water and the vial removed from the pole.
4. 3 pellets of sodium thiosulfate are added to the vial and capped.
5. The vial is labeled with the sampling point location and time of sampling.
6. The sample is then placed on ice in the cooler. Sampling is continued until all of the days locations are taken, unless the captain of the boat cancels the job and/or precipitation begins.
7. Once back on land, the samples are immediately delivered to Newtown Creek Microbiology Lab.

New York Harbor Sentinel Monitoring Stations



Appendix 5.2

Rules, Sewer Design Standards, and Standard Sewer and Water Main Specifications for the City

Title 15 of the **Rules of the City of New York** Chapter 31, section 31-05 outlines standards for installation of sanitary sewer connections and has multiple design requirements for all new sewer connections, which limit the potential for infiltration or exfiltration problems. Examples include minimum cover/encasement, specific pipe and bedding materials for connections to sewers on piles, and repairs of damages during installation.

The **Sewer Design Standards** include multiple design requirements that may also aid in preventing seepage from sanitary sewers or into storm sewers. Examples include specific design standards for sewers, manholes, and catch basins intended to ensure durability based on their material; location in earth, rock, piles, cradles, wet locations and dry locations; whether they are precast or cast in place; and whether they are new construction or reconstruction. Additionally, there are loading requirements for watertight and non-watertight sheeting.

Section 53.11 pg. V-66 of the 2014 NYCDEP **Standard Sewer and Water Main Specifications** manual, and section 5.05D.7, pg.V-58 of the 2009 manual explains the inspection process and digital audio-visual recording of all new sewers constructed for sewer pipes 54 inches or smaller in their least inside dimension. All the inspection results and recordings are documented in a report that includes information of all sections of sewers inspected, all audio-visual digital recordings, collected data and specific details as to service connections, water infiltration from the joints, and other points of interest noted during the inspection and the report is the property of the Department of Design and Construction.

Both the 2014 and 2009 NYCDEP **Standard Sewer and Water Main Specifications** (Section 40.11.9 and Section 4.11, respectively) describe leakage and leakage tests for sewer lines and the allowable quantity of leakage or infiltration, which is important to detect and eliminate any infiltration from newly constructed sewers. Furthermore, DEP is initiating a study to understand the infiltration and inflow (I&I) issues in the areas of Rockaways, Coney Island and Oakwood Beach.

Both NYCDEP **Standard Sewer and Water Main Specifications Section 40.11.2**, pg. 31 sets forth requirements for all sewers (whether tested or not) to be constructed such that the quality and quantity of leakage or infiltration are not to exceed specified criteria. The quantity of leakage for concrete pressure sewer lines shall not exceed one hundred fifty gallons per inch of inner diameter, per mile of sewer, per day. No individual joint in any completed sewer under test shall leak an amount in excess of one-eighth gallon per hour per inch of inner diameter.

Appendix 6.1

Lot Size Soil Disturbance Threshold Study for Construction and Post-Construction Stormwater Management

1.0 Introduction

The New York City (NYC) Department of Environmental Protection (DEP) received its first Municipal Separate Storm Sewer System (MS4) permit in 2015 that covers approximately 40% of the NYC land area. DEP has been preparing a Stormwater Management Program (SWMP) plan due by August 2018. One of the SWMP components is to determine the lot size soil disturbance/new impervious area threshold for triggering the applicability of construction and post-construction stormwater runoff management requirements at new development and redevelopment sites within NYC. This report summarizes the Lot Size Threshold Study and supporting analysis.

DEP pursued a multi-step approach to guide the selection of an appropriate lot size threshold for MS4 drainage areas, beginning with a peer survey from utilities across the U.S to develop an inventory of stormwater regulatory requirements in other cities. The second step in this study consisted of a statistical analysis of historical new and redevelopment permit applications within NYC to determine the extent of potential disturbed acres, with consideration given to properties that would be constrained by space and/or soil conditions. Representative properties were selected under the broad land use categories of industrial, mixed use commercial, and residential to develop conceptual designs of stormwater control measures (SCMs) and associated construction and long-term operation and maintenance (O&M) costs. Stormwater system modeling was then performed to estimate the benefits associated with implementation of SCMs to meet the New York State (NYS) water quality volume requirements. The results of the study were combined to complete cost-benefit evaluations of various new and redevelopment lot size thresholds for construction and post-construction stormwater controls while taking into account site constraint and watershed characteristics. Multiple stakeholder workshops with industry professionals and technical experts were held in collaboration with the Real Estate Board of New York (REBNY) and Urban Green Council (UGC) to solicit input on the typical SCM designs, costs, and potential constraints.

2.0 Utility Survey

For guiding the selection of thresholds for construction and post-construction stormwater management requirements, DEP surveyed selected utilities from across the country. This survey was designed specifically to assemble technical as well as administrative elements such as the different departments within a municipal government that manage the construction and post-construction requirements, staffing, and regulatory flexibility.

DEP compiled a list of utilities that NYC had been interfacing with, and the Arcadis team supplemented it with additional utilities with similar technical/administrative elements. Specifically, the selected peer utilities have advanced stormwater management programs hence adopted regulations to reflect that. These utilities are subject to national regulations for 1+ acre lots based on United States Environmental Protection Agency's (USEPA) or their respective state's MS4 programs, and have adopted thresholds of one acre or less for construction and post-construction stormwater control requirements. Most of the surveyed utilities also have combined and separate sanitary sewer systems or predominantly separate systems and administer their stormwater management programs related to construction and post-construction requirements. DEP and the Arcadis team developed a detailed questionnaire for soliciting input from these utilities. This detailed questionnaire is presented in Appendix A, and the 12 peer utilities chosen for the utility survey from across the U.S. are listed in **Table 2-1: Utility Name and Location**.

Table 2-1: Utility Name and Location

Utility Name	Municipality
Department of Watershed Management	Atlanta, GA
Watershed Protection Department	Austin, TX
Department of Public Works (DPW)	Baltimore, MD
Boston Water and Sewer Commission (BWSC)	Boston, MA
Department of Water Management	Chicago, IL
Department of Sanitation	Los Angeles, CA
Philadelphia Water Department (PWD)	Philadelphia, PA
Bureau of Environmental Services (BES)	Portland, OR
Transportation and Storm Water Department	San Diego, CA
San Francisco Public Utilities Commission (SFPUC)	San Francisco, CA
Seattle Public Utilities (SPU)	Seattle, WA
District Department of the Environment (DOEE) for MS4 areas, DC Water for Combined areas	Washington, DC

The utility survey was performed as a two-step process. A review of each utility's stormwater technical manual and other publicly available guidance/policy documents served as the first step of completing the questionnaire. In the second step, the utilities were contacted directly to fill in any information gaps based on documents that are not publicly available, including the specific administrative information that is not typically listed on utilities' websites.

In addition to the 12 peer utilities that were directly surveyed, information readily available from Fairfax County, VA; Indianapolis, IN; Miami, FL; New Orleans, LA; and Richmond, VA were compiled for the construction and post-construction runoff threshold size (minimum new impervious or soil disturbance cover that triggers stormwater control requirements) and performance standard (criterion/criteria that the stormwater controls must meet).

The survey documented the utilities' stormwater management programs/procedures including but not limited to: (a) adopted thresholds based on soil disturbance and/or creation of new impervious area for new and redevelopment projects and if any analyses were done for determining a particular threshold and associated retention/detention or treatment standards; (b) off-site mitigation or in-lieu fee applications; (c) administrative process including Stormwater Pollution Prevention Plan (SWPPP) review times, and (d) staffing resources for managing permits and performing inspections and fees charged by the utilities.

The utilities' stormwater management programs for construction and post-construction differed based on factors such as geographical location, maturity of the MS4 program, size of the community served, and various local priorities. Some programs have been around for over 10 years with well-established staffing and financial resources to successfully manage the permitting and inspections, while others are in the early to mid-stages of their programs.

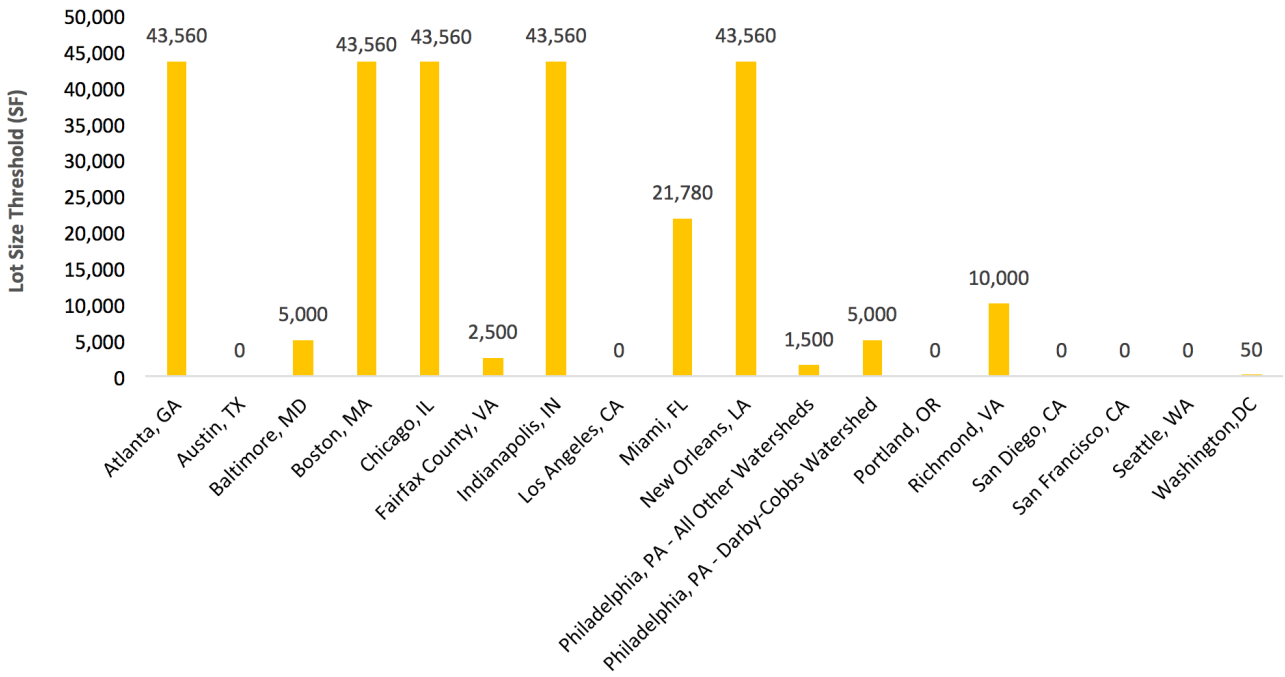
2.1 Performance Standard

2.1.1 Threshold Size

Peer utilities focus on threshold size as an important performance standard. As the threshold size that determines construction or post-construction requirements decreases, the resulting number of permits or inspections that the utility staff perform increases significantly. On the other hand, the improvement in water quality in terms of volume and pollutant load reductions is minimal with smaller lots in comparison to the larger lots. Therefore, the information from peer utilities on threshold size provided insight on the tradeoffs between administrative and technical costs versus the achieved benefits.

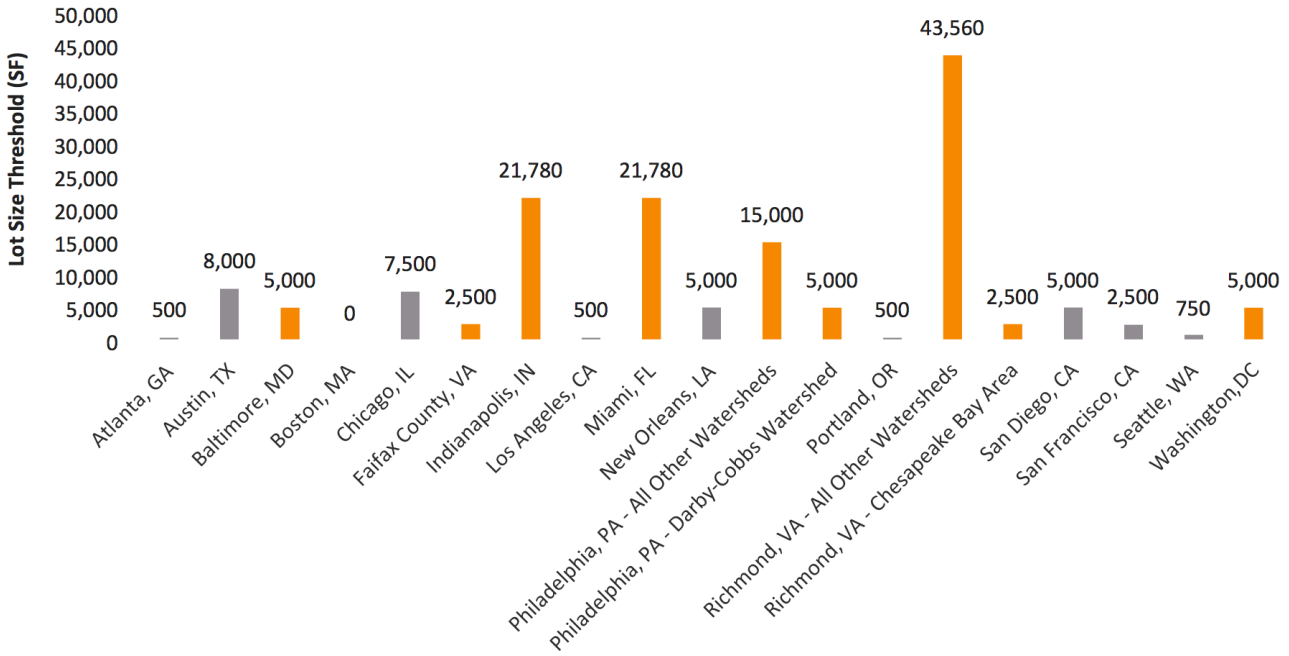
The thresholds for the utilities surveyed for the construction runoff control requirement (i.e., erosion and sediment control) are summarized in **Figure 2-1. Lot Size Disturbance Construction Thresholds**. While Austin, Los Angeles, Portland, San Diego, San Francisco and Seattle require all construction activities to adhere to the requirement, Atlanta, Boston, Chicago, Indianapolis, and New Orleans use the recommended U.S. EPA Phase 2 Stormwater Guidance of one acre and above for construction runoff control. The remaining surveyed utilities use construction thresholds of less than one acre with Baltimore, Fairfax County, Miami and Philadelphia applying the same thresholds for both construction and post-construction runoff control (see **Figure 2-2** below).

Figure 2-1. Lot Size Disturbance Construction Thresholds



The post-construction threshold size was specified based on the extent of soil disturbance within a new or redevelopment site or the increase in impervious cover resulting from new/redevelopment. The interviewed utilities and those reviewed based on available literature used either the new impervious or soil disturbance as thresholds, and **Figure 2-2** summarizes these threshold sizes for these utilities. Several observations were made from the responses on threshold size (expressed in square feet, SF, in this report).

Figure 2-2. Lot Size Disturbance Post-Construction Thresholds



Grey bars indicate impervious area creation threshold, Orange bars indicate soil disturbance area threshold

As shown in **Figure 2-2**, the selection of minimum post-construction thresholds varies significantly among cities of varied sizes and program development levels with respect to stormwater management in MS4 areas, including some with as high a threshold as one acre.

Most of the interviewed utilities implement a smaller than one-acre post-construction threshold, which refers to the condition that necessitates the permanent application of the stormwater control requirement for a property after construction.

While Portland has a low threshold of 500 SF, the permitting and inspections are done through a self-certification process for single family residential homes. Boston does not have a minimum soil disturbance threshold. Instead, every new or redevelopment project requires a construction permit, but not a post-construction (inspection) requirement, which reduces the administrative burden.

DEP was also interested in whether the utilities with combined and separately sewered systems have different permit requirements for these two systems. Most of the utilities have the same performance standards and administrative requirements for both systems. However, some utilities such as Philadelphia, Portland, and San Francisco each impose requirements that differ between combined and separate areas for certain criteria. San Francisco has the same retention standard for combined areas and for large MS4 areas (>5,000 SF), and a less stringent standard for smaller MS4 areas (2,500-5,000 SF). Philadelphia has different infiltration volume requirements for combined and MS4 areas (i.e., 20% of directly connected impervious area to be routed through volume reduction stormwater management practice (SMP) in combined areas, whereas 100% of water quality control volume to be routed through infiltrating or treatment SMPs in MS4 areas). Similarly, Portland has different allowable discharge rates for the combined and MS4 areas (i.e., maintenance of pre-development rates for 2, 5 and 10-year 24-hour storms in all areas, whereas half the pre-development rates for 2-year 24-hour storm for areas that drain into waterways directly or MS4 outfalls to prevent channel erosion).

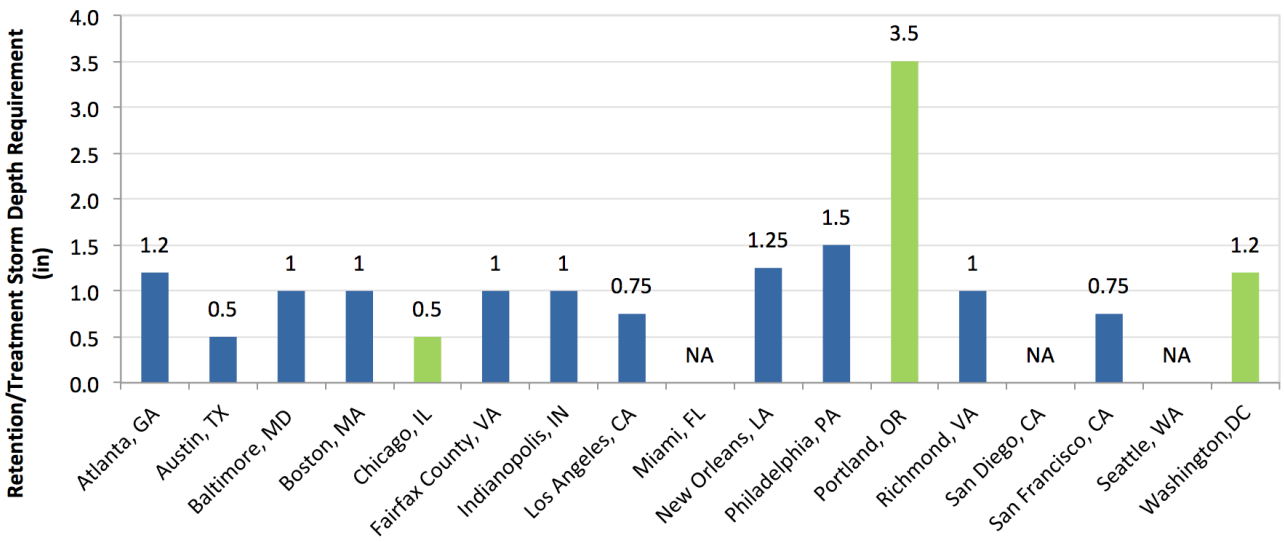
2.1.2 Stormwater Water Quality Volume Standard

The stormwater management or control volume standard specifies the extent of stormwater volume to be managed from disturbed areas (whether new impervious cover or soil disturbance area) with stormwater control measures (SCM). This volume standard can be adopted from state guidelines or developed to meet specific water quality improvement levels of service sought by individual utilities. It is often referred to as water quality volume (WQv).

Figure 2-3 depicts the distribution of rainfall depths used to compute WQv volumes as defined by each municipal utility. East coast utilities such as Boston and Philadelphia had a WQv in the range of 1 to 1.5 inches, which is typically the 90th percentile storm based on historical analysis of local precipitation records. San Diego and Seattle did not adhere to a uniformly applied volume value, instead defining their WQv requirements based on the 85th and 91st percentile storms, respectively, around the stormwater management asset.

Potential soil and space constraints can limit the implementation of retention-based stormwater controls. This is particularly relevant to dense urban areas with compacted soils or underlying soil with poor permeability. It is important to recognize the soil and space constraints for SCM implementation and develop alternative compliance measures to achieve the same water quality improvement goals. One of the questions in the utility survey focused on whether the utilities offered alternative compliance strategies when individual lots have soil and/or space constraints. Some utilities (e.g., San Francisco, Portland, and Philadelphia) have developed a stormwater management hierarchy that requires retention and water reuse whenever possible, and provides detention and treatment of stormwater as secondary options.

Figure 2-3. Retention/Treatment Storm Depth Requirement



Blue bars indicate retention and/or treatment requirement, **Green bars** indicate retention requirement -- treatment not an allowed alternative

Most utilities who participated in the survey offer alternative measures for sites that may not be able to meet the stormwater management requirements in the forms of in-lieu fees and offsite mitigation options.

The alternative measures are in the form of in-lieu fee (penalty for not implementing an SCM so that the money can be used to implement SCM in another feasible lot), offsite mitigation (implementation of SCM in another feasible lot to compensate for not being able to implement at the site seeking a permit), or stormwater credit (similar to a trading model, where credits are created for implementation of SCMs and the site not being able to implement SCMs can buy credits from other lots that have already implemented more-than-required SCMs to create a credit).

These allowances tend to be awarded on a case-by-case basis, and usually the site needs to demonstrate an inability to infiltrate the necessary volume that would preclude it from offering stormwater management potential. **Table 2-2** summarizes the options allowed by different utilities. An "X" for a measure indicates that this option is not offered by the utility and NA indicates that there was no reference as to whether this option was allowed or not.

Table 2-2. Alternative Compliance Measures

Utility Name	In-lieu Fee	Offsite Mitigation	Stormwater Credit
Atlanta	X	✓	✓
Austin	✓	✓	NA
Baltimore	✓	✓	✓
Boston	X	X	X
Chicago	X	X	X
Los Angeles	X	✓	NA
Philadelphia	✓	✓	✓
Portland	X	✓	NA
San Diego	✓	✓	✓
San Francisco	✓	✓	NA
Seattle	X	NA	✓
Washington, DC	X	NA	✓

Boston and Chicago were the only cities that strictly adhere to on-site stormwater management regulations. Both Seattle and Washington, DC did not explicitly state as to whether they would accept in-lieu fees or offsite mitigation, but they do utilize a stormwater credit system that offers some flexibility for developers to meet the stormwater management regulations.

2.2 Resource Utilization

This is a key consideration for a utility for overall management of the permits and inspections that need to be administered for a given threshold size. As the number of permits and inspections increase with smaller threshold sizes, more staff resources are needed to manage them effectively and efficiently. This consideration was sought in the questionnaire to peer utilities and the specific metrics requested are discussed below.

2.2.1 Staffing Allocation

Most utilities have different departments (e.g., Department of Public Works or Stormwater Programs or Buildings and Inspections) for review and approval of permits for construction requirements and for inspections after construction and long-term operation and maintenance. The utility survey focused on contacting these different departments to get a holistic picture of staff allocation and administration.

The number of staff utilized for review during construction varies significantly, from 1-2 staff dedicated to reviews and inspections in Boston to as many as 33 dedicated staff in Atlanta, with mostly engineers performing the permit reviews. There is also a wide range in the number of inspection staff for post-construction. Some utilities such as Boston do not currently have an inspection program, so there is no dedicated staff for inspections, whereas Washington, DC and Seattle have more than 10 dedicated inspection staff.

While some cities such as Boston, Portland, and Seattle concentrate permit reviews and inspections within only one or two departments, other cities such Los Angeles, Philadelphia, and San Diego involve at least three departments in permit review and inspection tasks.

2.2.2 Production Using Given Resources

The survey also requested information from utilities on how many permits/inspections were performed to get information on the production aspects. This information can be used to guide the number of staff members needed for New York City's program based on the chosen threshold size.

Fewer responses were received for the number of permit reviews and inspections performed over the given period and the average time spent on SWPPP reviews by the permit reviewer. Therefore, any conclusions regarding trends between utilities could not be drawn. However, the responses received present some interesting points for consideration.

The economic downturn affected the number of projects being constructed and the number of permits reviewed in Portland. As far as the average time spent on SWPPP reviews, all respondents noted that it depends on the complexity of the project. However, Portland also indicated that incorporating a web-based interface had increased the speed of the review process.

The level of automation and online interfacing each utility has in its permit application process were also reviewed. Portland has an electronic application process, and both Philadelphia and Washington, DC utilize similar web-based processes to accelerate the review process and ease some of the administrative burden. San Francisco allows for electronic submission of some applications, and Chicago offers a stormwater detention calculation tool for developers to use in developing their applications. However, most utilities still work with print-based applications.

2.3 Administrative Costs

The indicators for administrative costs included the number of staff to manage permits, perform construction permit inspections and post-construction periodic inspections, as well as the number of permits/inspections handled and the departments/municipal jurisdictions that manage the permitting and inspections. Full-time salary and benefits of permitting/inspection staff and the supervisors' time increase significantly with smaller threshold sizes due to the large number of permits/inspections involved. Considering the minimal water quality improvement associated with smaller threshold sizes, the overall cost-benefit comparison needs to include both technical costs for implementation of SCMs by property owners and the administrative costs for utility staff to administer them.

Based on the survey responses, it was observed that mature stormwater management programs have a larger number of staff as well as dedicated funding mechanisms (e.g., stormwater utility, component stormwater bill to customers, etc.), whereas the newer programs are still establishing the staffing and funding needs.

Administrative costs must be recovered through appropriation of additional budget to the permitting/inspection operations (thereby increasing the financial burden on the utility) or through full-cost recovery with permitting/inspection fees charged to the property owners. One of the survey questions (included in Appendix A) focused on whether specific utilities adopted financial models based on discussions with ratepayers and elected officials.

The fees charged for stormwater management applications, reviews, and inspections vary. Most utilities have fees for construction review, but do not have post-construction inspection fees. Fees range from no fee in San Francisco, where stormwater fees are included as part of the regular water and sewer fees; to Los Angeles, where there is a city fee for construction and only a state fee for post-construction; to over $10,000 for a combination of several different fees in Washington, DC.

Another consideration that was of interest to DEP was whether the utilities imposed surcharges or additional fees for expedited review of permit applications. Of the utilities surveyed, only Los Angeles and Philadelphia have a formal expedited permit review process and additional fees charged for an expedited review. While Los Angeles requires a higher cost for an expedited review, Philadelphia offers it as an incentive depending on the SCMs used.

2.4 Key Findings from Survey

The responses gathered from 12 interviewed utilities represent stormwater management programs in various stages of development and implementation. The findings also indicated that there is a wide variation among the responding utilities in the administration of stormwater management and the performance standards that developers are required to follow. Some programs are mature (more than 10 years old) and efficiently manage the permitting and inspections, while others are in the early to mid-stages of the program with evolving staffing and financial resources.

Most utilities establish performance standards for stormwater management to address their water quality and watershed-based (e.g., TMDL or healthy streams) requirement needs. Peak flow mitigation, WQv, and detention performance standards are developed to achieve these goals. Some utilities offer a tiered approach to the developer community, in which retention is the highly preferred strategy, and detention or connection to combined sewers is the least preferred strategy and only an option when retention or treatment-based controls are infeasible.

Both construction and post-construction thresholds vary significantly among cities of varied sizes and program development levels with respect to stormwater management in MS4 areas. Construction stormwater runoff threshold varies from all activities (Austin, Los Angeles, Portland, San Diego, San Francisco and Seattle) to one acre (Atlanta, Boston, Chicago, Indianapolis, and New Orleans) with several utilities in-between. Baltimore, Fairfax County, Miami and Philadelphia use the same thresholds for both construction and post-construction runoff control.

The minimum post-construction stormwater runoff threshold based on soil disturbance or increase in impervious cover ranges from no-minimum value for Boston to one acre for Richmond (outside Chesapeake Bay Area) with most of the interviewed utilities using a smaller than one-acre threshold based on local needs and priorities. Some utilities have low threshold requirements for post-construction, but they allow self-certification by single family residential thereby reducing their administrative workload significantly. Philadelphia for Darby Cobbs watershed and Richmond for Chesapeake Bay Preservation Areas have different thresholds for the rest of their respective communities to meet their specific watershed-based requirements.

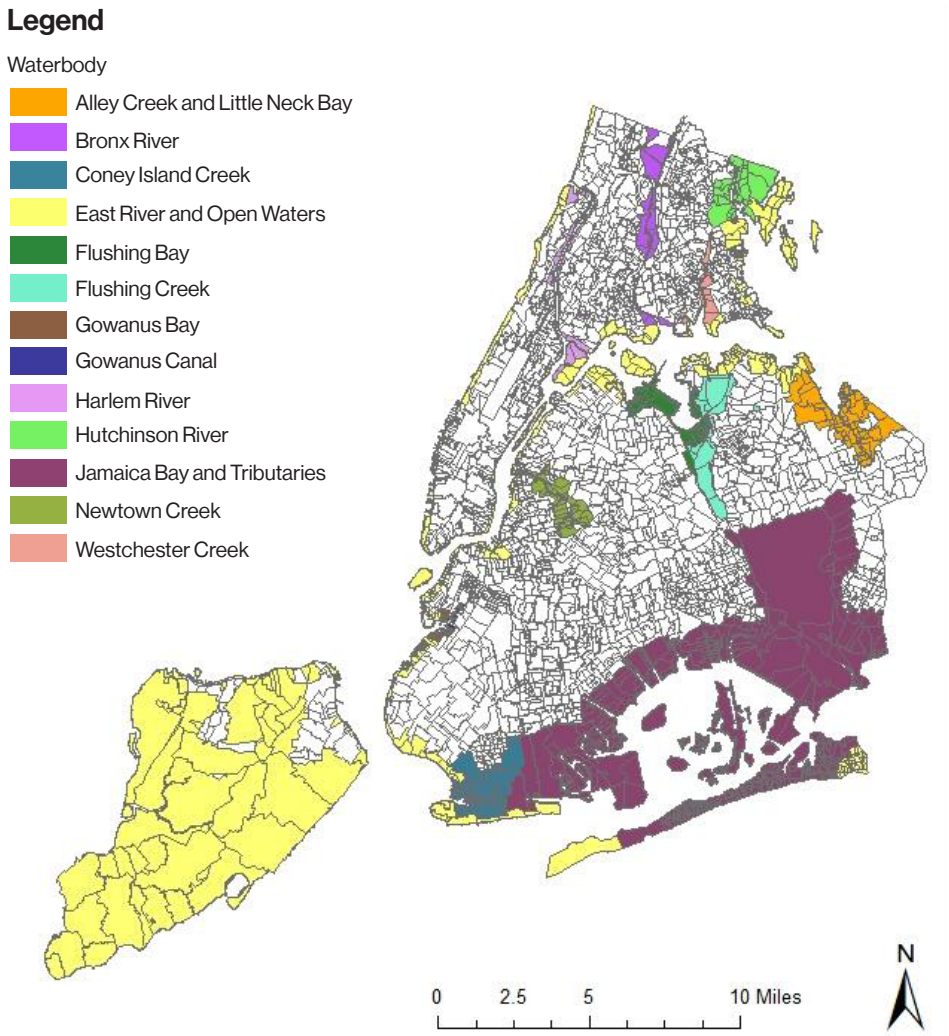
Most utilities that have combined and MS4 areas have chosen the same minimum threshold for stormwater controls. Some utilities (e.g., Philadelphia and San Francisco) have developed specific provisions for combined and MS4 areas. Even though this questionnaire was primarily aimed at on-site projects, one of the questions focused on the right-of-way (ROW) stormwater control from a standpoint of watershed-based pollutant sources mitigation. Most utilities follow the national guideline of >1 acre for ROW projects. Some utilities have developed policies and associated performance standards for ROW projects (e.g., Portland's Green Street policy developed in 2007 to reduce flows and pollutant loads from over 60% of the city's stormwater that was estimated to be generated from ROW and adjacent private driveways).

3.0 NYC MS4 Drainage Areas

DEP had previously compiled MS4 subcatchment delineations for internal use. Prior watershed modeling efforts undertaken to support the Long Term Control Plan (LTCP) and other CSO-related water quality studies had also approximated delineations for the MS4 and direct drainage (MS4/DD) areas. Therefore, in this project, any overlaps of these delineations were reconciled in ArcGIS. This resulted in a MS4/DD subcatchment layer that integrated and reconciled the information available as of October 2016.

Consistent with the LTCP designation, each MS4 subcatchment was assigned a waterbody based on where the runoff from the area drained. Typically, the tributary drainage areas that do not drain into one of the 10 LTCP priority waterbodies are considered to drain into a waterbody referred to as the East River Open Water (EROW). However, it was understood that EROW tributary areas within each borough would not share similar space and subsurface characteristics, factors important for SCM selection. Therefore, the EROW waterbody was further broken down into four separate categories by respective boroughs: EROW Manhattan, EROW Bronx, EROW Brooklyn/Queens, and EROW Staten Island. The waterbody-specific drainage areas are shown in **Figure 3-1: NYC Waterbodies and Drainage Areas**. Areas shown in white color are served by combined sewers, therefore, are not included in the analyses described herein.

Figure 3-1: NYC Waterbodies and Drainage Areas



4.0 Statistical Analysis of New and Redeveloped Lots

NYC Department of Buildings (DOB) construction permit data from the 15-year period between 2000 and 2014 was analyzed to determine an annual average number of lots and acres for new and redevelopment for both public and private projects within each watershed of the NYC's MS4 drainage area. All permits were assigned to one of the three main property type categories based on land use designations:

1. Industrial;
2. Commercial/Mixed Use; and
3. Residential.

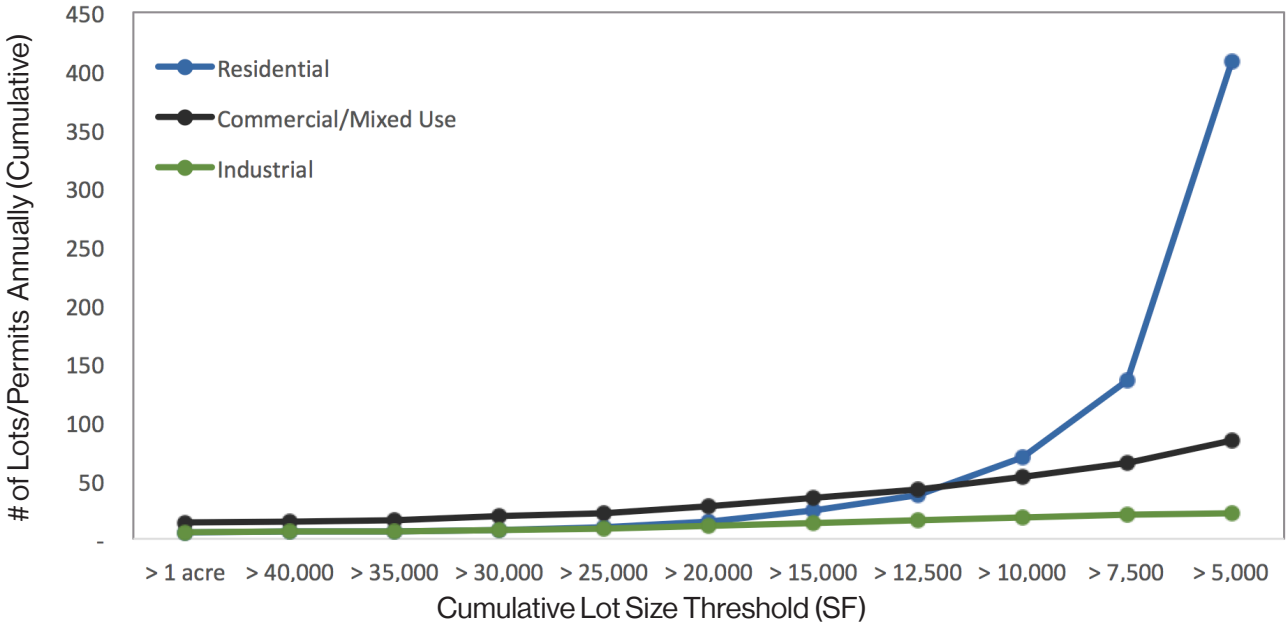
Many lots had two or more permits in the DOB record but, the data was normalized by assuming that each lot had only one permit and as such number of lots was used in lieu of DOB permits for the subsequent evaluations. The DOB permit data did not provide any information on the percentage of the lot disturbed for each new and redevelopment construction. To account for the fact that some of the larger size lots may be only partially disturbed by construction, percent disturbance discount factors were applied to the historical new and redeveloped acres which varied based on the lot size as shown in **Table 4-1: Disturbance Discount Factors**.

Table 4-1: Disturbance Discount Factors

Lot Size	Amount of Lot Area Used for Analyses
50 – 75 ac	15%
25 – 50 ac	20%
10 – 25 ac	30%
5 – 10 ac	40%
2 – 5 ac	50%
1 – 2 ac	55%
40,000 SF – 1 ac	70%
30,000 – 40,000 SF	75%
25,000 – 30,000 SF	85%
5,000 – 25,000 SF	100%

The new and redeveloped lot and acre data for each of the three property types was then sorted into nine lot size bins with 5,000 SF lot size increments representing potential construction and post-construction stormwater management thresholds. Two additional thresholds, 7,500 SF and 12,500 SF, were added for subsequent evaluations to address stakeholder's feedback. Cumulative values for the number of lots and acres were then developed for each potential lot size threshold starting with greater than 1 acre. **Figure 4-1: Cumulative number of lots vs. potential lot size threshold** presents the cumulative number of lots and **Figure 4-2: Cumulative number of acres vs. potential lot size threshold** presents the cumulative number of acres for each potential lot size threshold.

Figure 4-1: Cumulative number of lots vs. potential lot size threshold



As shown in **Figure 4-1: Cumulative number of lots vs. potential lot size threshold**, the number of residential lots increases significantly for thresholds below 15,000 to 20,000 SF with residential lots heavily dominating the smaller sized properties. Commercial properties also see a slight increase in the number of lots for smaller sized properties, while industrial properties remain relatively flat.

Figure 4-2: Cumulative number of acres vs. potential lot size threshold

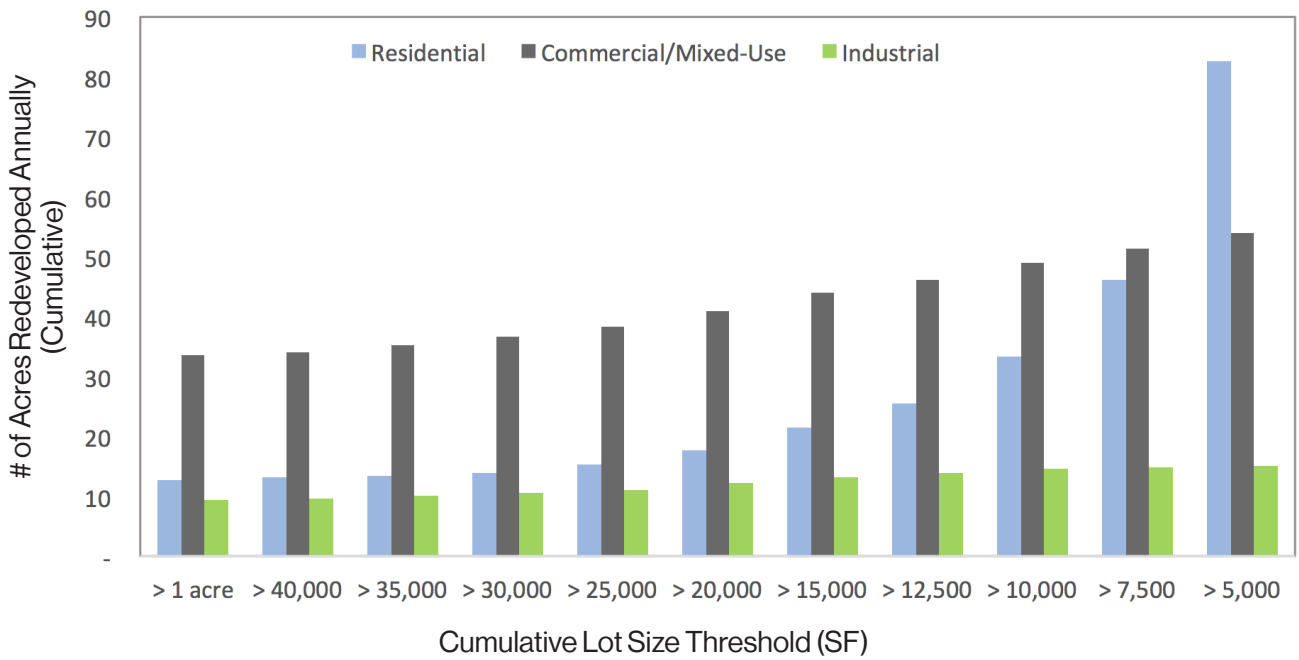
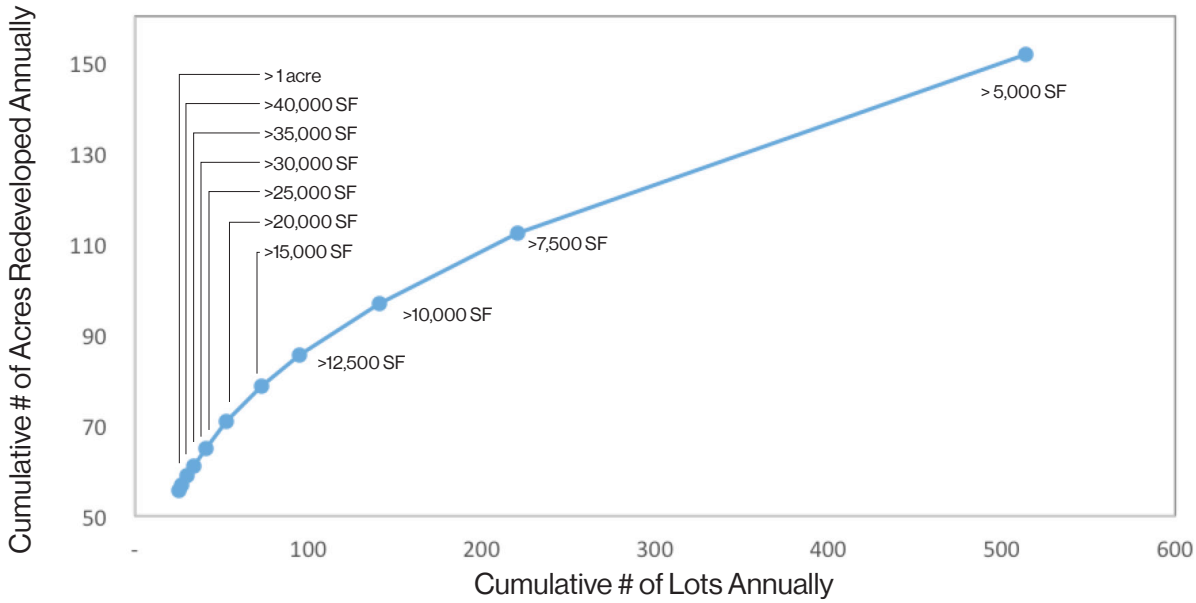


Figure 4-2: Cumulative number of acres vs. potential lot size threshold indicates that commercial properties represent over 50% of the total number of acres for all lot sizes above 12,500 SF. The number of residential acres increases exponentially for smaller lots (below 15,000 to 20,000 SF) while commercial acres increase moderately and industrial acres stay relatively flat with most industrial properties having lot sizes greater than 1 acre.

presents the cumulative number of acres versus number of lots for all evaluated thresholds. The figure indicates that the rate of increase in number of lots significantly outpaces the rate of increase in number of acres for thresholds below 20,000 SF. As previously indicated in **Figure 4-1**, this rate of increase is heavily dominated by smaller sized residential properties.

Figure 4-3: Cumulative Number of Acres vs. Lots



The type and extent of SCMs can vary extensively for individual lot size thresholds. Selection of properties under each lot size threshold and associated SCM design and cost estimation was not practical. Instead, two representative lot sizes for each land use type were identified using cumulative probability versus lot size curves for the 15 years of historical new and redevelopment data.

The cumulative probability versus lot size curves for the commercial/mixed use, industrial, and residential properties are presented in **Figure 4-4: Lot Size Distribution of All Commercial and/or Mixed-Use Properties**, **Figure 4-5: Lot Size Distribution of All Industrial Properties** and **Figure 4-6: Lot Size Distribution of All Residential Properties** respectively. The 25th (1st Quartile) and 75th (3rd Quartile) percentiles were used as targets for selecting two representative lot sizes for the industrial and commercial properties.

Figure 4-4: Lot Size Distribution of All Commercial and/or Mixed-Use Properties

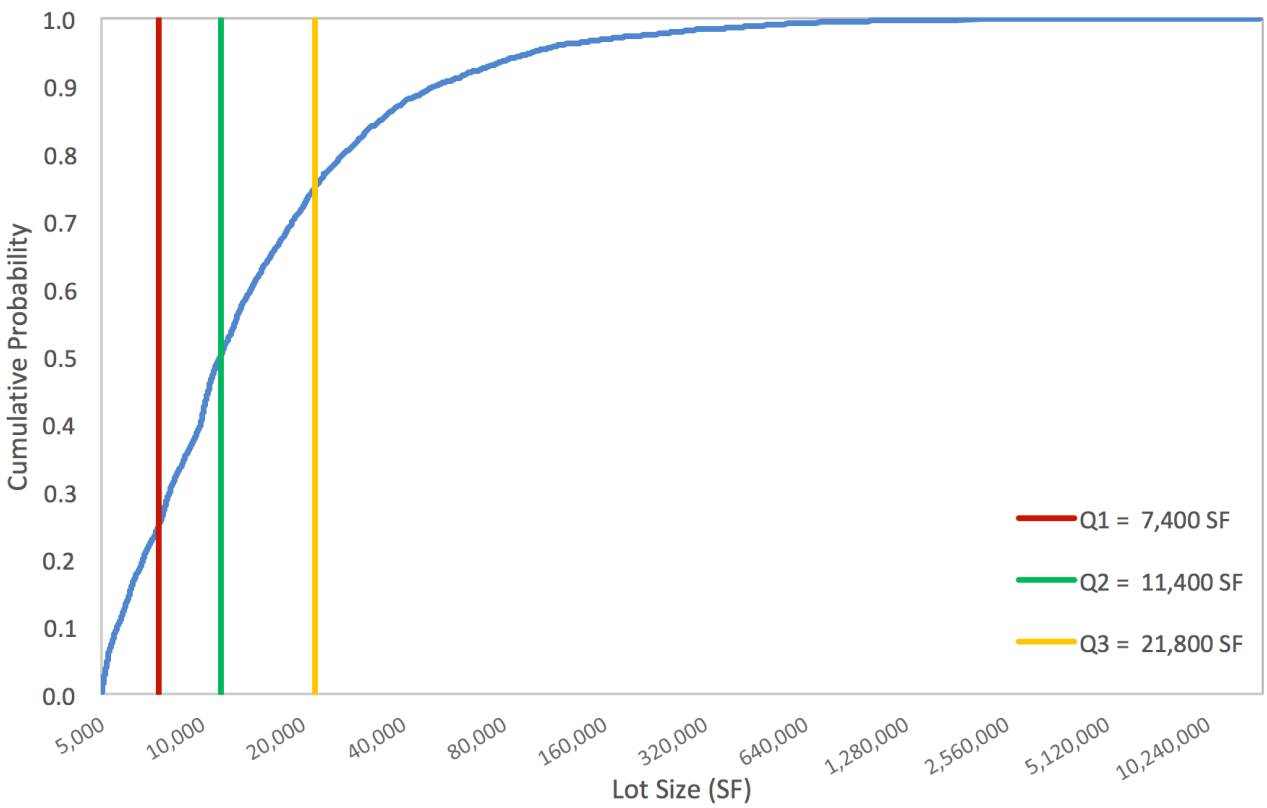


Figure 4-5: Lot Size Distribution of All Industrial Properties

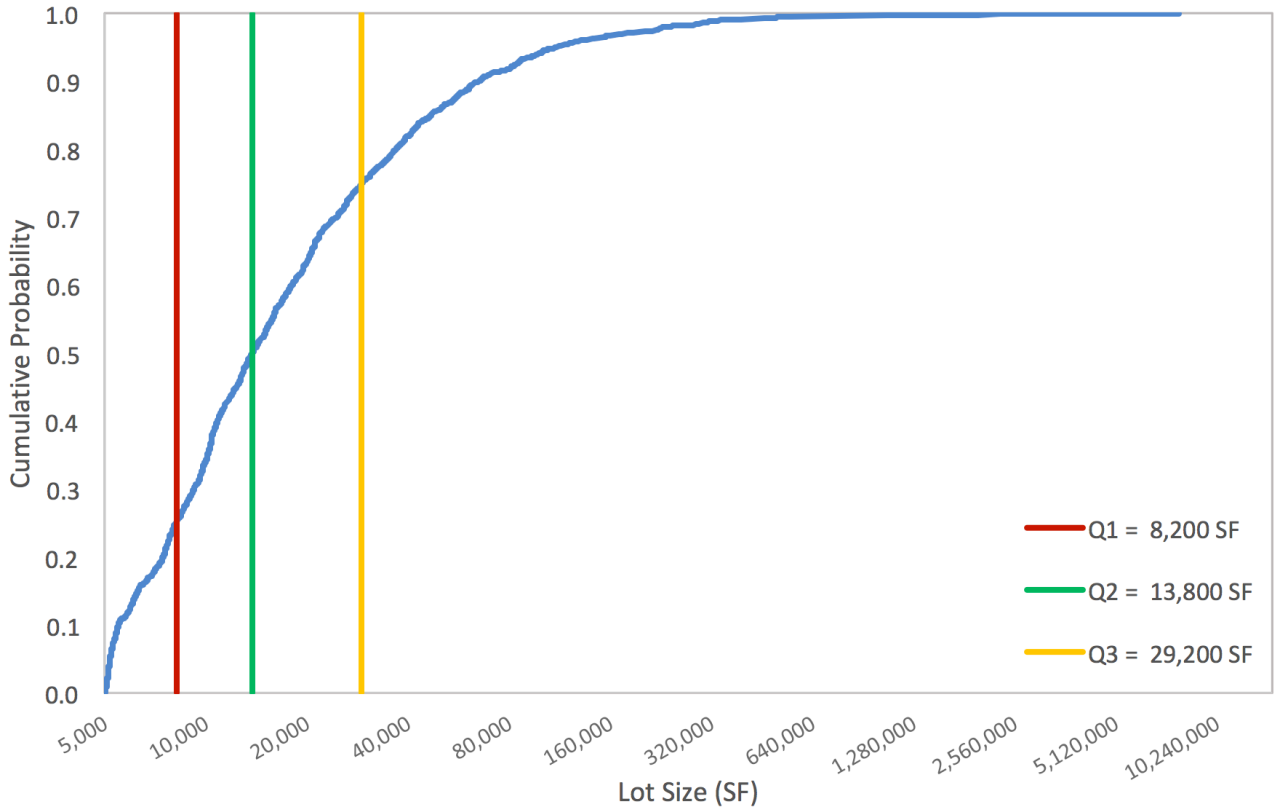
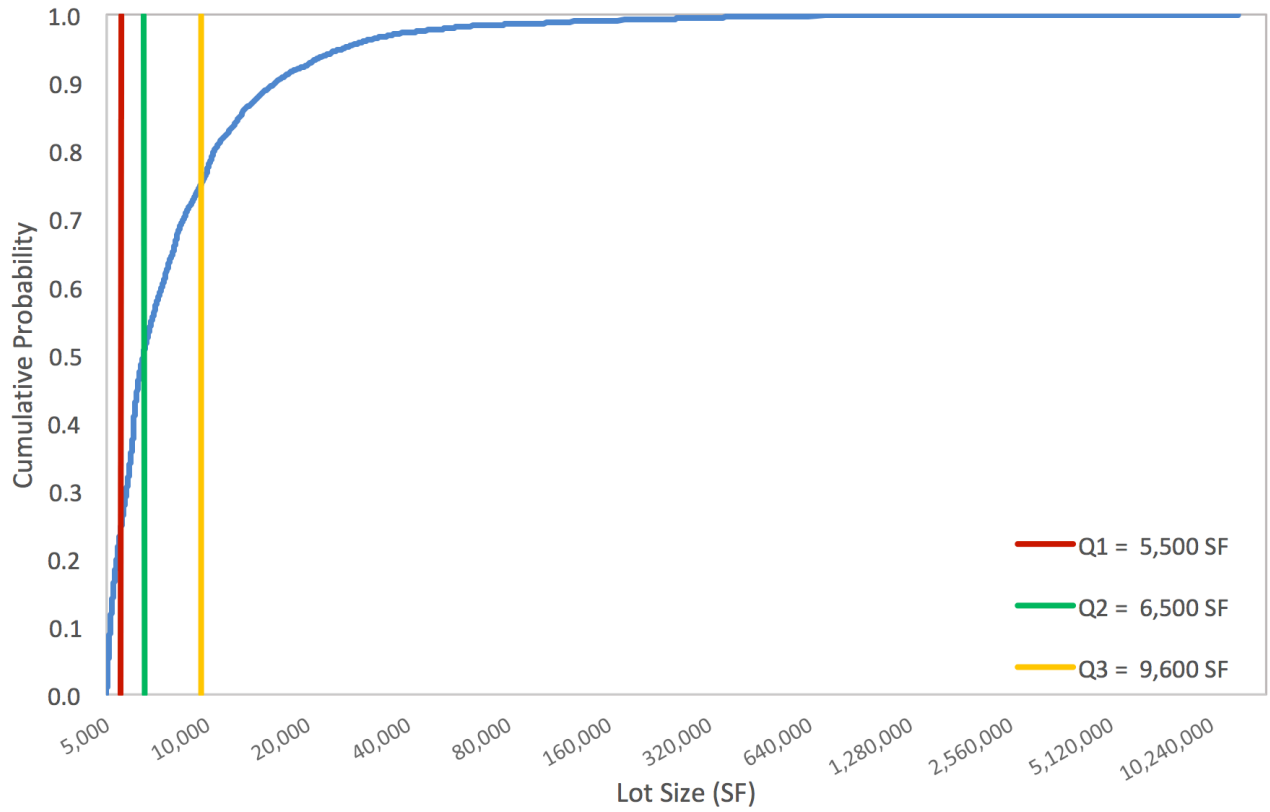
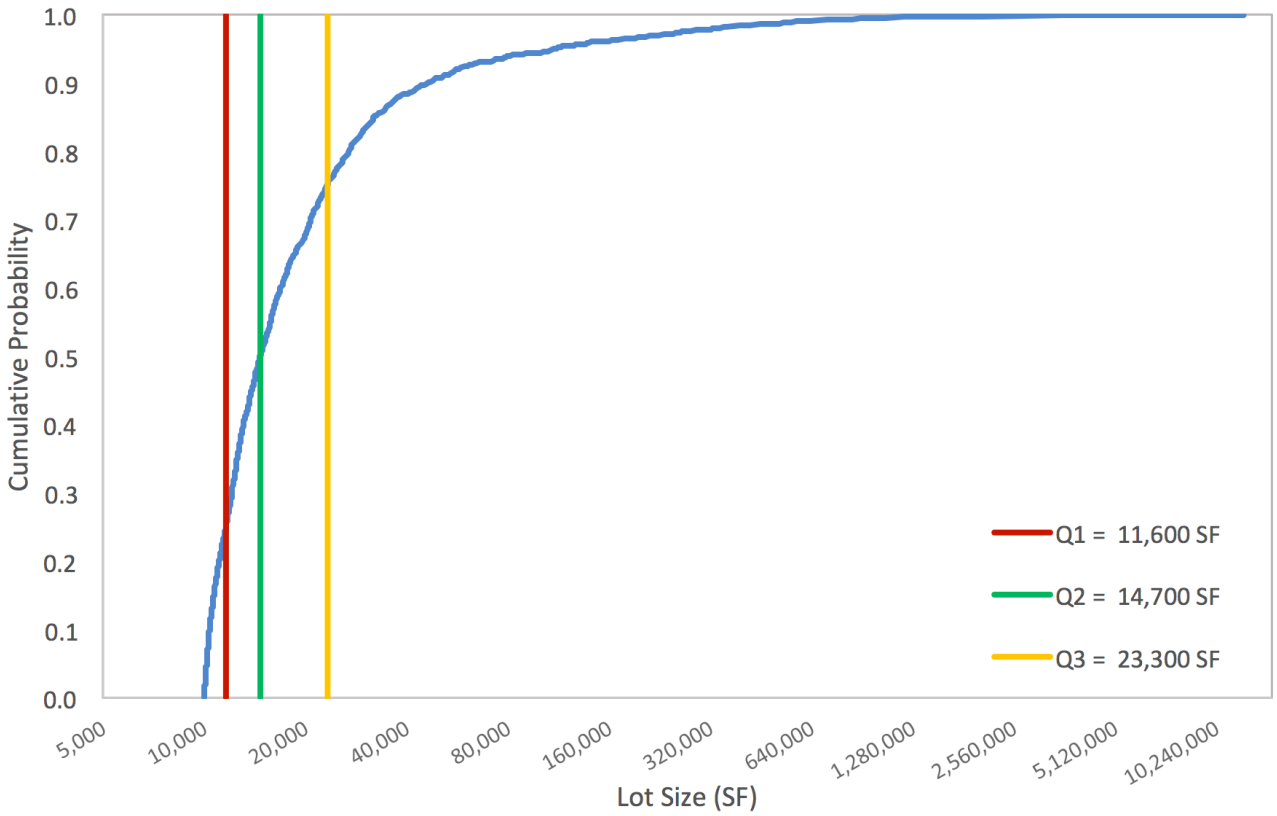


Figure 4-6: Lot Size Distribution of All Residential Properties



As shown in **Figure 4-6: Lot Size Distribution of All Residential Properties**, the cumulative probability curve for the residential property types is heavily skewed towards smaller lot sizes with the 25th and 75th percentiles representing two smallest potential thresholds (approximately 5,000 SF and 10,000 SF). A subset of the historical residential new and redevelopment data with lot sizes greater than 10,000 SF was further evaluated and presented in **Figure 4-7. Lot Size Distribution of Residential Properties Greater than 10,000 SF**.

Figure 4-7. Lot Size Distribution of Residential Properties Greater than 10,000 SF



The two representative lot sizes for residential properties were selected as the median lot size for the entire residential dataset as illustrated on **Figure 4-6: Lot Size Distribution of All Residential Properties** and median lot size for the residential properties above 10,000 SF as illustrated on **Figure 4-7. Lot Size Distribution of Residential Properties Greater than 10,000 SF**. A summary of representative lot sizes for industrial, commercial, and residential property types used for the concept-ual SCM design and cost evaluations presented in the subsequent sections of this report is presented in **Table 4-2**.

Category A lot size bins highlighted in blue represent lot sizes for smaller properties. Category B bins are highlighted in green to indicate larger properties. Properties that fell in between the two categories (purple) were later interpolated during the cost analyses. It should be noted that the actual lot sizes for representative properties selected for subsequent cost evaluations (as presented in Section 7) varied slightly from the breakdown analyses targets due to the limited availability of data (e.g., impervious cover, space potential for certain SCMs, etc.) for the actual properties reviewed during this lot size study.

Table 4-2: Lot Size Breakdown

Lot Size Bins, SF	Residential	Commercial/ Mixed Use	Industrial
> 1ac			
40,000 - 1 ac			
35,000 - 40,000			
30,000 - 35,000			
25,000 - 30,000			
20,000 - 25,000			
15,000 - 20,000			
10,000 - 15,000			
5,000 - 10,000			

Legend:

Category A – 25th Percentile & Below

Category B – 75th Percentile & Above

Interpolated

5.0 Constraint Analysis

Each SCM practice must be designed specifically for each required location, with factors such as available space and localized soil conditions driving the design. Therefore, for the purpose of this study, it was important to understand the space limitations and subsurface conditions across the NYC MS4 areas. The constraint analysis was performed for the citywide MS4 areas and then grouped into the waterbodies used by the LTCP. This section describes the analysis that was completed to define space and soil constrains within each waterbody.

5.1 Space Constraint Analysis

A space constraint analysis was performed to understand the amount of space available to construct an SCM practice within a range of NYC lots. The goal of this analysis was to quantify the percentage of properties that could be considered space-constrained within each MS4 waterbody area of the NYC. It was completed using ArcGIS and publicly available datasets. Information for the city lots was taken from MapPLUTO v.16 developed by the NYC Department of City Planning (DCP) and information for the building footprints was taken from DOB shapefiles. Using ArcGIS, the building shapefile was mapped to the lot shapefile, and the data was exported to Excel for post-processing.

The percentage of each lot covered by a building footprint was calculated and summed on a subcatchment and ultimately a waterbody basis. The decision of the percentage of free space that should allow the lot to be considered "space unconstrained" was generally based on the suitability to accommodate an infiltration-based SCM to manage stormwater runoff within the property lot. For this analysis, space constrained and space unconstrained were defined as the following:

- For lots between 5,000 SF and 14,999 SF
  - Space Unconstrained: less than 50% of the lot is covered by a building footprint
  - Space Constrained: more than 50% of the lot is covered by a building footprint
- For lots equal to or greater than 15,000 SF
  - Space Unconstrained: less than 75% of the lot is covered by a building footprint
  - Space Constrained: more than 75% of the lot is covered by a building footprint

The results of this analysis (summarized in **Table 5-1**) defined the overall percentage of space unconstrained and constrained lots within the tributary areas for each waterbody and citywide.

5.2 Subsurface Suitability Analysis

In addition to understanding the space available for the construction of an SCM practice, it is important to understand the subsurface conditions. If the subsurface conditions are favorable, meaning there is low groundwater table, low bedrock, and good soil permeability, then an infiltration-based practice can typically be used. However, if any of these conditions are not met, then an alternative SCM practice must be selected.

This analysis was completed using ArcGIS and two datasets provided by DEP: "Depth to Groundwater" and "Depth to Bedrock". The data was spot checked using existing soil permeability and boring data previously collected by DEP as part of the Green Infrastructure (GI) Program. Consistent with DEP's GI standards, a minimum depth of 10 feet (ft) was used for both groundwater and bedrock, defining high and low subsurface suitability as follows:

- High subsurface suitability: groundwater depth > 10 ft and bedrock depth > 10 ft
- Low subsurface suitability: groundwater depth < 10 ft and bedrock depth > 10 ft
- Low subsurface suitability: groundwater depth > 10 ft and bedrock depth < 10 ft
- Low subsurface suitability: groundwater depth < 10 ft and bedrock depth < 10 ft

The results of this analysis (summarized in Table 5) defined the overall percentage of high subsurface suitability lots within the tributary areas for each waterbody.

5.3 Combining Space Constraint and Subsurface Suitability Analysis

The final step in this analysis was to combine the space constraint analysis and the subsurface suitability analysis, defining the average conditions of each waterbody. To do so, the matrix shown in **Figure 5-1** was developed and applied to each subcatchment, and ultimately each waterbody and citywide.

Figure 5-1: Matrix Used to Define Space and Subsurface Constraints

	High Subsurface Suitability	Low Subsurface Suitability
Low Space Availability	• Depth to bedrock and groundwater > 10 ft • Building footprint covers > 75% of the lot	• Depth to bedrock and groundwater < 10ft • Building footprint covers > 75% of the lot
High Space Availability	• Depth to bedrock and groundwater > 10 ft • Building footprint covers < 75% of the lot*	• Depth to bedrock and groundwater < 10ft • Building footprint covers < 75% of the lot*

*50% for lots <15,000 SF

All properties in each waterbody were divided into one of four categories: 1.) unconstrained, 2.) space constrained, 3.) subsurface constrained, and 4.) space and subsurface constrained. The results of this analysis are presented in .

Table 5-1. Constraint Characterization of Each Waterbody

Waterbody	Unconstrained	Space Constrained	Subsurface Constrained	Space and Subsurface Constrained
Confined Tributaries	34%	1%	62%	3%
EROW	40%	1%	57%	2%
Citywide	37%	1%	60%	2%

The percentages shown in were then utilized to estimate the number of lots and acres with SCM technologies assigned to each of the four constraint categories.

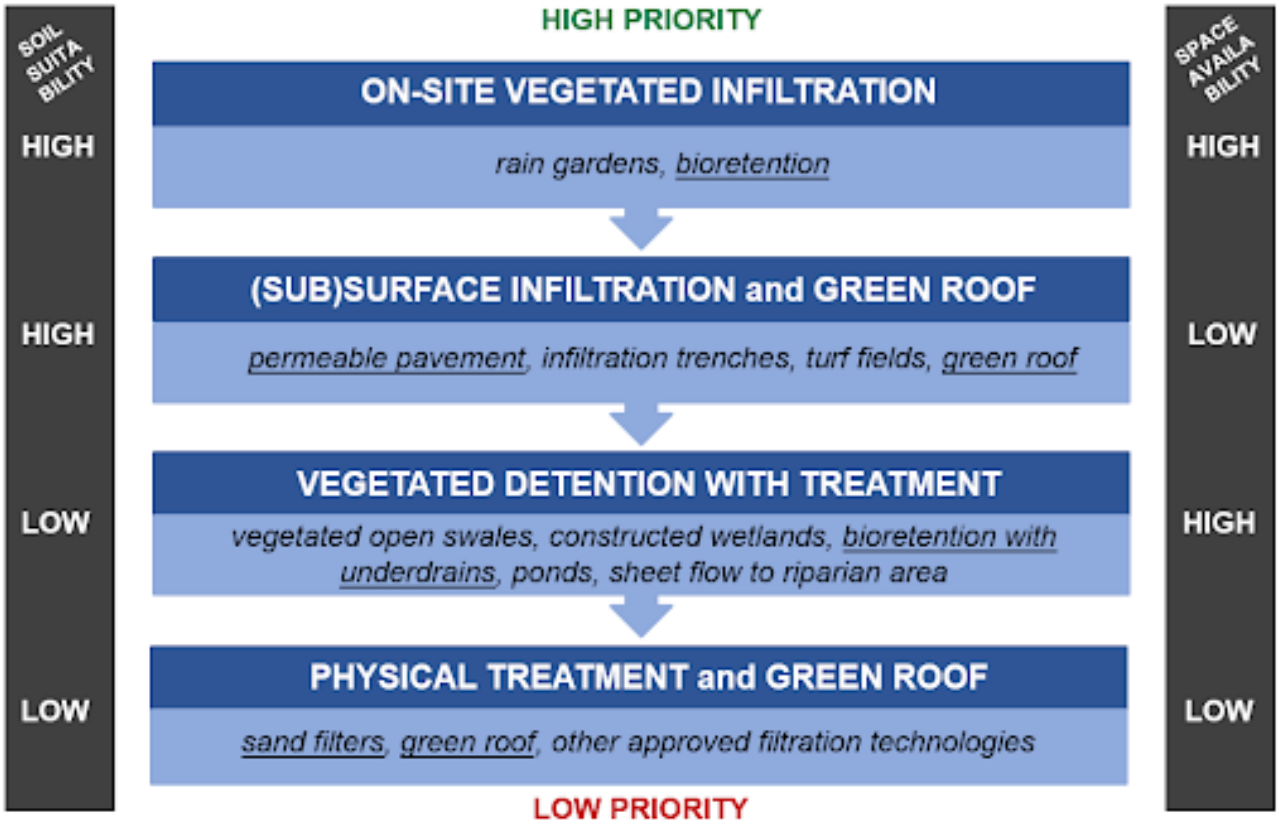
6.0 Post-Construction Stormwater Control Measure Selection

Representative Stormwater Control Measure (SCM) technologies for each of the constraint types were selected based on DEP's expertise on Green Infrastructure Program implementation and technical information obtained from the peer utility surveys. Designs for the SCM practices were then prepared for each of the representative properties identified in Section 4 and cost estimates were developed. This section discusses the selection, ranking, and design of the representative SCM technologies used.

6.1 SCM Selection and Ranking

A hierarchy of SCM technologies considered for evaluations was determined based on DEP's expertise on GI implementation, discussion with developers and their technical experts and information obtained from utility surveys. SCM technologies were divided into two categories given subsurface conditions: infiltration and treatment. Infiltration practices can be either on-site vegetated practices or subsurface infiltration. Treatment practices can be either vegetated detention with treatment or physical treatment. In locations with favorable subsurface conditions, infiltration practices are preferred over treatment processes. However, as infiltration practices typically require more space, the size and configuration of the lot will also dictate which SCM can be implemented. A preliminary matrix of preferred SCM technologies is shown in **Figure 6-1: Preliminary Post-Construction SCM Hierarchy Matrix for MS4 Tributary Areas**. Within each category, multiple examples of SCM technologies are shown and the preferred technology used for the evaluations in this study is underlined. Further refinement of the hierarchy of preferred SCM technologies may be performed as the program evolves.

Figure 6-1: Preliminary Post-Construction SCM Hierarchy Matrix for MS4 Tributary Areas



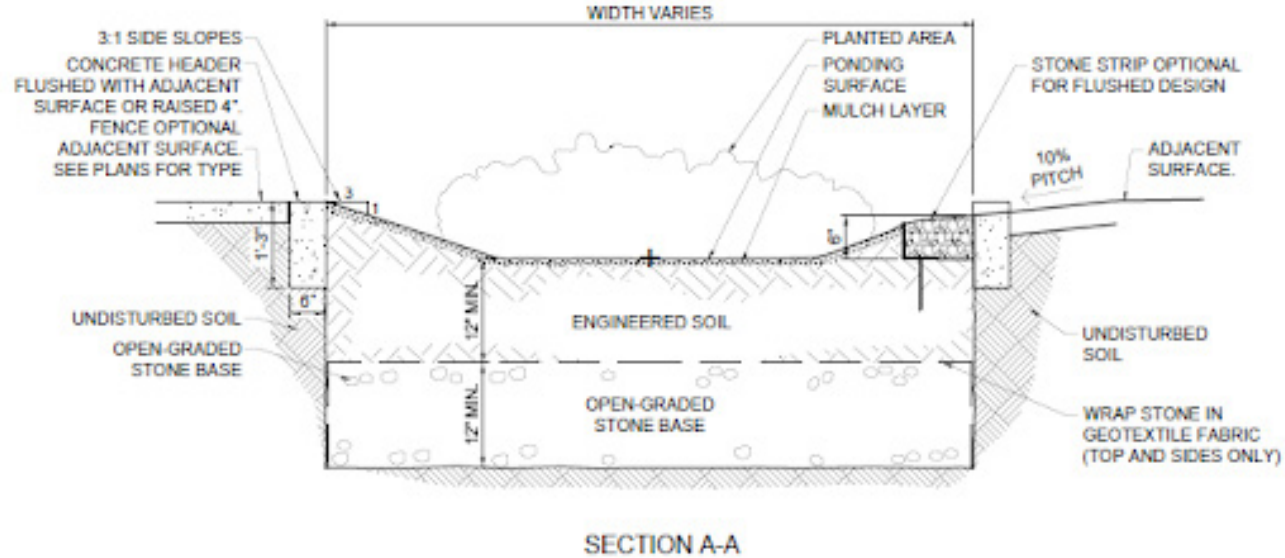
Infiltration practices are ranked higher than treatment practices, with on-site vegetated infiltration being the preferred SCM category. While permeable pavement is a preferred option when space availability is low, it is most often used in open areas such as parking lots. Green roofs may be considered if the space is constrained due to the building footprint. It should be noted that green roofs do not fall exclusively into a single category. They were instead placed into the two categories designated as having low space availability, the condition most likely to lead to the consideration of a green roof. Descriptions of the preferred SCMs utilized in this analysis are provided below.

6.2 Bioretention

Bioretention is the preferred SCM technology because it prevents stormwater from entering the sewer system via storage and infiltration and provides numerous co-benefits. This technology is utilized in locations where subsurface conditions are favorable and there is adequate space for construction. Thousands of bioretention practices, most commonly Right-of-Way Bioswales (ROWBs), have been constructed across NYC based on a standard design developed by DEP[1]) and shown in **Figure 6-2: DEP Standard Design for a Bioretention Practice**.

1 DEP Bureau of Engineering Design and Construction – Green Infrastructure, Standard Designs and Guidelines for Green Infrastructure Practices, March 2016

Figure 6-2: DEP Standard Design for a Bioretention Practice



This DEP standard design for a bioretention practice was used in this analysis, as shown in **Figure 6-3: Example Bioretention Design (Residential Category B – Subsurface Unconstrained, Space Unconstrained)** on a representative residential property. The depth of the engineered soil and open-graded stone base remained unchanged, and the footprint of the practice varied depending on the size of the lot and volume of stormwater management required. Bioretention practice sizing was based on the ROWB Performance Calculator developed by DEP.

Figure 6-3: Example Bioretention Design (Residential Category B – Subsurface Unconstrained, Space Unconstrained)

6.3 Bioretention with Underdrain and Permeable Pavement

Bioretention with underdrain practices can be utilized in locations in which the subsurface conditions are not favorable but there is adequate space. These practices store and treat the stormwater as it passes through the engineered soil and open-graded stone base before the treated stormwater is returned to the collection system through an underdrain. In order to increase the storage capacity of the bioretention units, DEP standard designs incorporate permeable pavement strips which collect the extra stormwater and slowly feed it into the bioretention system, as shown in **Figure 6-4: DEP Standard Design for a Bioretention Practice with Underdrain and Permeable Pavement**.

Figure 6-4: DEP Standard Design for a Bioretention Practice with Underdrain and Permeable Pavement

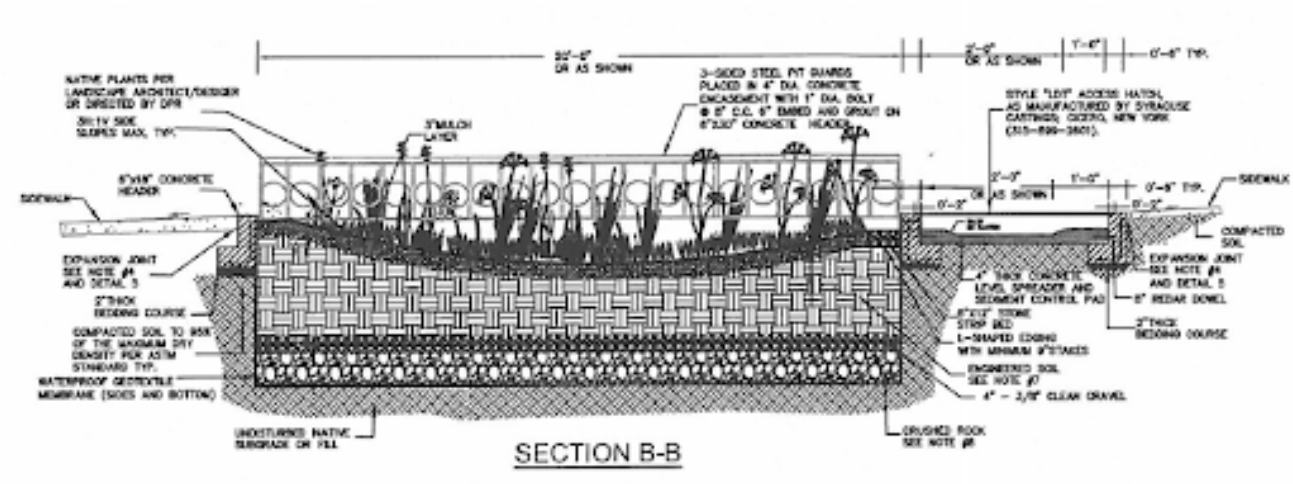


Figure 6-5: Example Bioretention Practice with Underdrain and Permeable Pavement (Commercial and/or Mixed-Use Category B – Subsurface Constrained, Space Unconstrained)

This DEP standard design for a bioretention practice with underdrain and permeable pavement was utilized in this analysis, as shown in **Figure 6-5: Example Bioretention Practice with Underdrain and Permeable Pavement**. The relative amount of bioretention and permeable pavement varied for each site, to accommodate space availability and to incorporate the design into the lot. The unit sizing was based on the ROWB Performance Calculator developed by DEP.

Sand Filters

Sand filters are one of the two preferred technologies that were utilized for locations with both space and soil constraints. Collected stormwater is fed to the sand filter where it is treated as it trickles through the sand before being returned to the collection system. DEP does not currently have a standard design[2] for this SCM practice, so the New York State standard design was utilized. The section view of the DEC standard design is shown in **Figure 6-6. Section View of the Sand Filter Standard Design Developed by NYS DEC**, and the plan and profile are shown in **Figure 6-7. Plan and Profile Views of the Sand Filter Standard Design Developed by NYS DEC**. An example of the sand filter SCM practice is shown in **Figure 6-8: Example Sand Filter Practice (Commercial and/or Mixed-Use Category B – Subsurface Unconstrained, Space Constrained)**.

Figure 6-6. Section View of the Sand Filter Standard Design Developed by NYS DEC

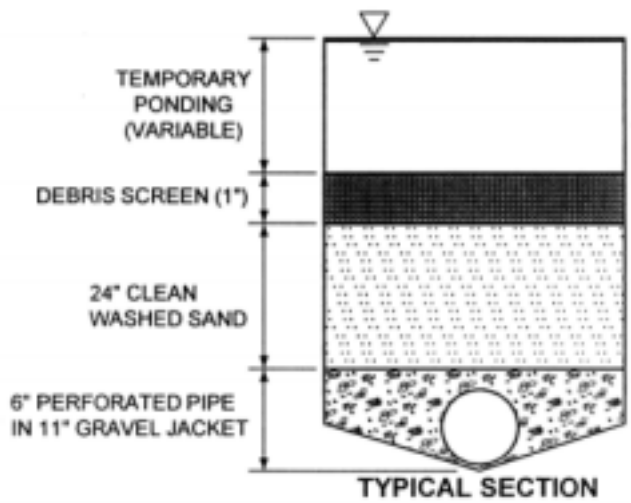
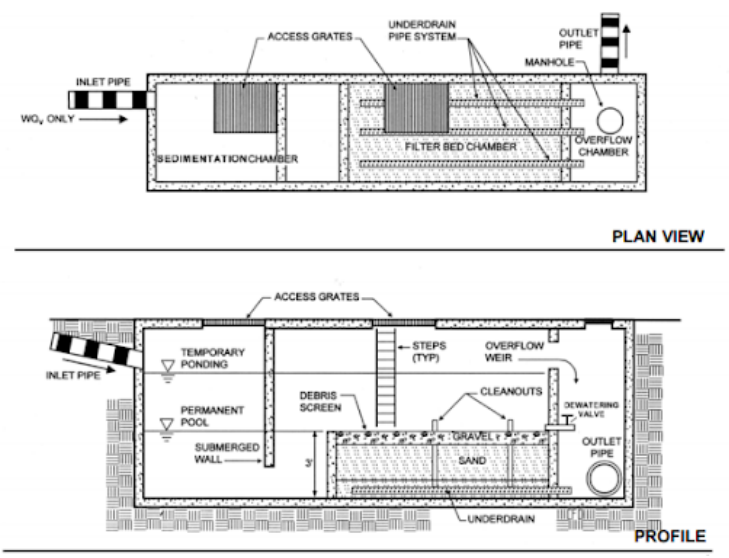
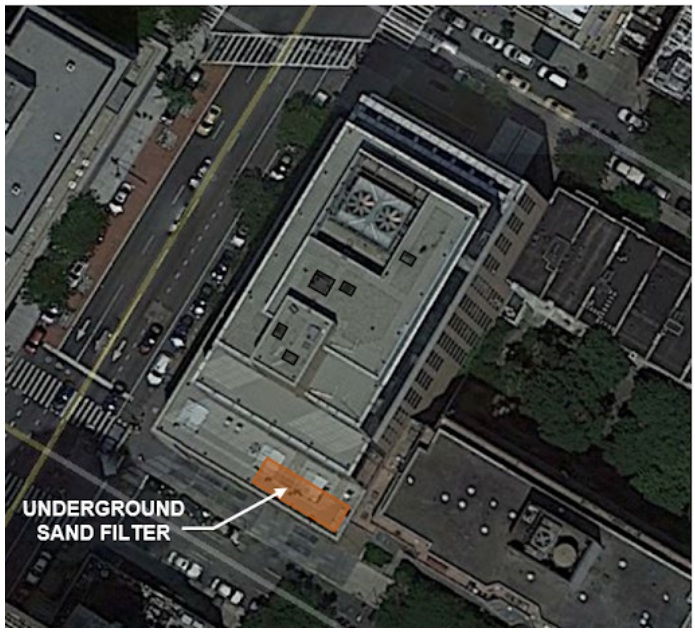


Figure 6-7. Plan and Profile Views of the Sand Filter Standard Design Developed by NYS DEC



2 New York State Department of Environmental Conservation, New York State Stormwater Management Design Manual, January 2015

Figure 6-8: Example Sand Filter Practice (Commercial and/or Mixed-Use Category B – Subsurface Unconstrained, Space Constrained)



For this analysis, it was assumed that the sand filters would be constructed in the basement of a building to minimize the value of the real estate devoted to this practice. Sand filter sizing was done using the methodology outlined in the NYS Stormwater Management Design Manual.

6.5 Green Roofs

Green roofs can be implemented under almost any condition, providing that the roof is flat and has sufficient structural capacity. As shown in the hierarchy matrix, green roofs were only used in space constrained locations as an alternative to sand filters. Green roofs collect and store rainwater, allowing it to slowly return to the atmosphere via evapotranspiration. Due to building codes in NYC, green roofs cannot cover the entire surface of the roof; space must be left around the perimeter of the roof and around interior items such as windows and utilities to allow for access. Permeable pavers can fill in these areas to collect and detain the remaining stormwater, slowly feeding it to the collection system. The green roof design used in this analysis was a 6" deep modular green roof tray provided by a vendor, examples of which are shown in **Figure 6-9. Modular 6" Deep Green Roof Tray** and **Figure 6–10. Dimensions of the 6" Deep Modular Green Roof Tray**.

Figure 6-9. Modular 6" Deep Green Roof Tray

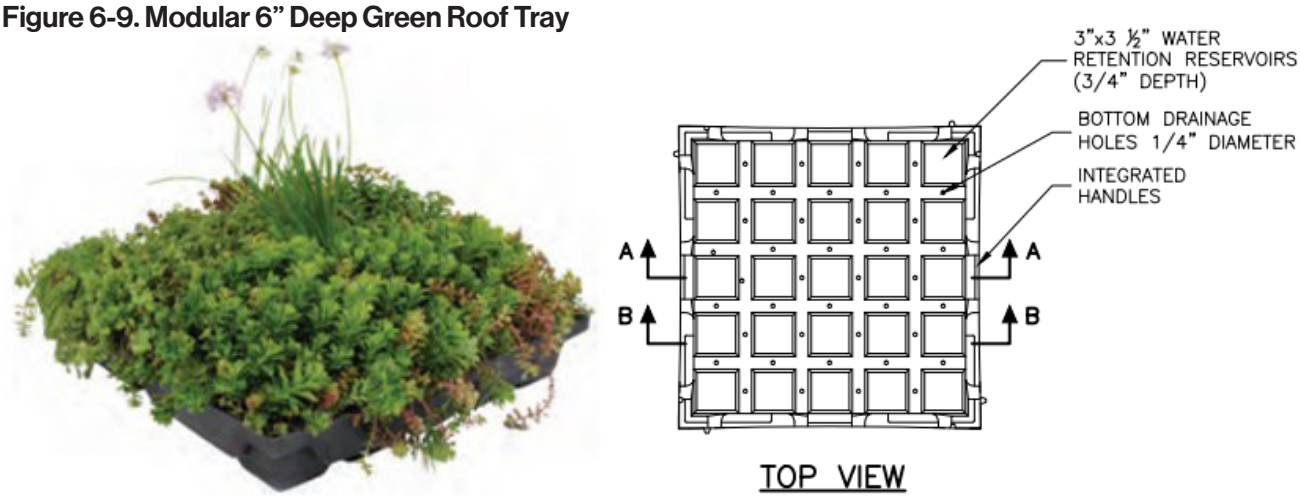
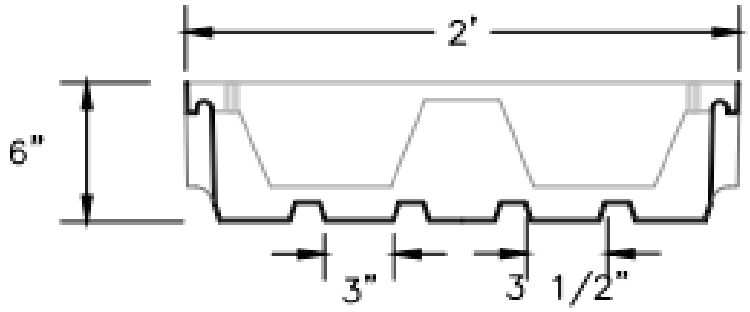


Figure 6–10. Dimensions of the 6" Deep Modular Green Roof Tray



For this analysis, it was estimated that 70% of space constrained lots have buildings with flat roofs capable of accommodating a green roof, as depicted in **Figure 6-11. Example Green Roof Practice (Industrial Category A – Subsurface Unconstrained, Space Constrained)**.

Figure 6-11. Example Green Roof Practice (Industrial Category A – Subsurface Unconstrained, Space Constrained)

6.6 Selection of Representative SCM Technologies

For each property type (residential, commercial/mixed-use, and industrial), two Category A and two Category B (as defined in section 4) properties were selected, representing space constrained and space unconstrained property types. For each of these properties, two SCM designs were selected to represent the scenario of favorable subsurface conditions and unfavorable subsurface conditions. The technology selected for each type of constraint are shown in **Table 6-1. Selected Technologies Used Under Each Constraint Type**.

Table 6-1. Selected Technologies Used Under Each Constraint Type

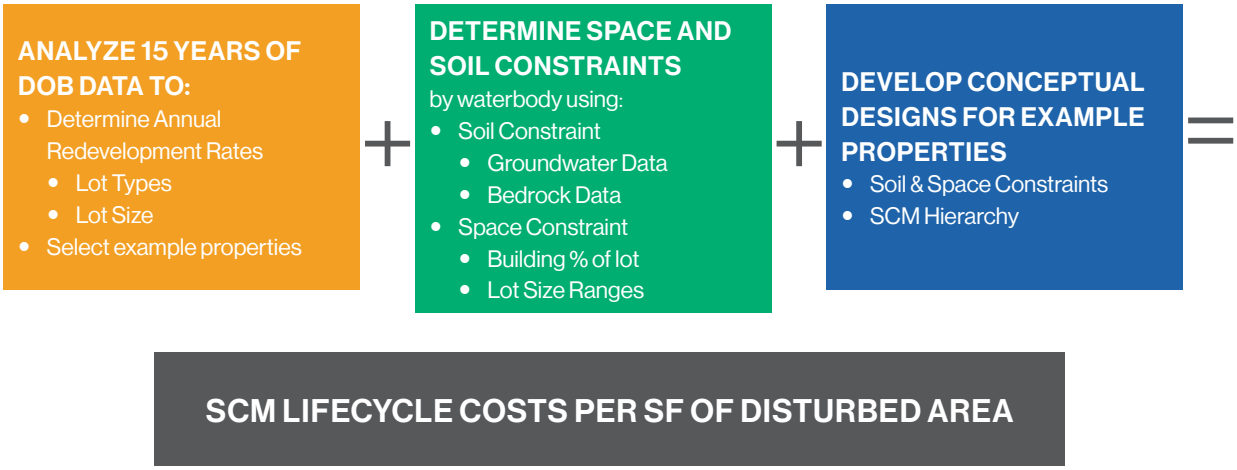
Constraint	Technology
Unconstrained	Bioretention
Subsurface Constrained	Bioretention w/ Underdrain + Permeable Pavement
Space Constrained	Sand Filter or Green Roof
Subsurface and Space Constrained	Sand Filter or Green Roof

A total of 24 conceptual designs utilizing these representative SCM technologies for two size categories and a variety of subsurface and space conditions were developed and are presented in Appendix B.

7.0 Post-Construction SCM Cost Analysis

The next step in the analysis was to develop capital and operation and maintenance (O&M) costs for the representative SCM technologies. Based on discussions with DEP and feedback from stakeholders, a 30-year SCM lifecycle was selected. The cost evaluation approach outlined in **Figure 7–1: Cost Evaluation Approach** combined the earlier analyses of lot type, size, and constraints with conceptual designs to estimate the SCM lifecycle cost for each SF of disturbed area. The methodology is further described in the following subsections.

Figure 7–1: Cost Evaluation Approach



7.1 Capital Cost Development

The conceptual designs for the representative SCM technologies were utilized to develop capital costs for each project. It was assumed that the SCM practices would be incorporated as part of a larger redevelopment or new development project, so line items for mobilization were not included. For areas that are considered "space constrained," the costs for disposal of excavated material was not included, as the cost for disposal was assumed to be necessary regardless of the inclusion of the SCM practice. The line item cost estimates were shared with industry professionals and technical experts at stakeholder workshops and revised based on feedback received. Unlike the other SCM types, the capital costs for the modular green roof trays were obtained from a vendor. Additionally, no engineering cost markups were used for the green roof capital cost estimates as they are assumed to be designed by a vendor. A list of the markups used is shown in **Table 7-1. Markups Used in the Development of Capital Costs for SCM Practices**.

Table 7-1. Markups Used in the Development of Capital Costs for SCM Practices

Markup	Percentage of Subtotal
General conditions, bonds and insurance	10%
General contractor overhead and profit	21%
Contingency	20%
Engineering (not included for green roofs)	15%

Once the capital costs were developed, the unit capital cost per SF of disturbed area was estimated for each type of property so that it could be utilized to scale costs for the historical new and redevelopment properties in the DOB data.

7.2 O&M Cost Development

O&M costs were developed over a 30-year lifecycle based on familiarity with the SCM technologies and experience in other cities. For SCM practices with vegetation, the first two years focus on plant establishment and subsequent years on maintenance and plant replacement. A conservative assumption was used for replacing bioretention and filter media once over the lifecycle of the respective SCMs based on feedback received at stakeholder workshops. This includes replacement of engineered soil and stone base for the bioretention practices and sand media for the sand filter. It was assumed that all green roof trays would be replaced once over the lifecycle. **Table 7-2. O&M Activities included in SCM Lifecycle Costs** summarized the major categories of O&M and media replacement activities for each SCM type.

Table 7-2. O&M Activities included in SCM Lifecycle Costs

Bioretention Maintenance Tasks and Description
Years One and Two
• Establishment watering, establishment weeding, plant replacement, pest management, mulching • Debris and sediment removal, general site cleanup • Painting, structural repair, erosion/settling repair
After the First Two Years
• Weeding, plant replacement, pest management • Debris and sediment removal, general site cleanup • Painting, structural repair, erosion/settling repair
One-time Media Replacement
• Replacement of open graded stone base, engineered soil, and mulch layer
Bioretention with Underdrain and Porous Pavement Maintenance Tasks and Description
Years One and Two
• Establishment watering, establishment weeding, plant replacement, pest management, mulching • Debris and sediment removal, general site cleanup • Painting, structural repair, erosion/settling repair • Vacuuming porous pavement strip(s)
After First Two Years
• Weeding, plant replacement, pest management • Debris and sediment removal, general site cleanup • Painting, structural repair, erosion/settling repair • Vacuuming porous pavement strip(s)
One-time Media Replacement
• Replacement of open graded stone base, engineered soil and mulch layers • Replacement of permeable pavers and open graded stone base for permeable pavers
Sand Filter Maintenance Tasks and Description
Annually
• Inlet/pre-treatment inspection and vacuuming (sedimentation and overflow chambers) • Subsurface inspection and maintenance of pipes and detention areas and the dewatering system and vacuuming gravel layer • Replacement of gravel and/or sand media as necessary • Observe drawdown rate following a large storm
One-time Media Replacement
• Vacuum removal of the sand using a vac truck • Replacement of stone base, clean, washed sand, debris screen, and gravel
Green Roof Maintenance Tasks and Description
Years One and Two
• Establishment watering, establishment weeding, plant replacement, and pest management

After First Two Years
• Weeding, plant replacement, and pest management • Soil testing and amendments
One-time Media Replacement
• Complete replacement of green roof trays

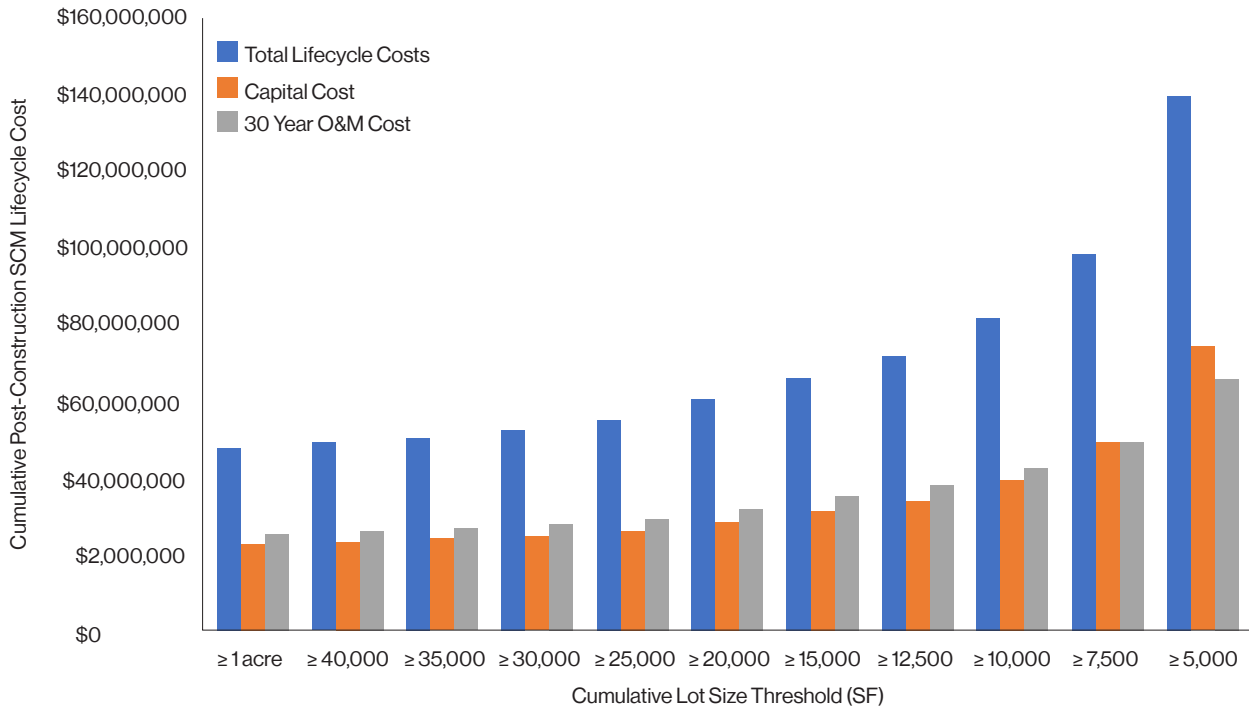
Once the 30-year O&M costs were developed, they were converted into a unit cost per SF of disturbed area. This was then added to the capital cost to determine the overall lifecycle post-construction stormwater management cost per SF of disturbed area. The unit costs for each lot size threshold are presented in Appendix C.

The unit costs for Category A and Category B properties were applied based on the size of the sample properties utilized to develop the example SCM designs. For the lot size thresholds that fell between these two categories, the unit costs were interpolated to incorporate an economy of scale into the costs. These unit costs were then applied to the historical DOB new and redevelopment data to estimate citywide post-construction SCM lifecycle costs.

7.3 Development of Cost Curves

The 15 years of historical DOB data was also analyzed to estimate the average annual new and redeveloped acres in NYC. The acreage was broken down by waterbody, and divided into one of the four constraint categories. The lifecycle unit costs were then applied to each of these areas to calculate the total lifecycle cost required to manage up to 1.5 inches of stormwater runoff from the annually disturbed acres in each lot size threshold. The citywide MS4 area cumulative post-construction lifecycle cost for each evaluated lot size threshold is presented in **Figure 7-2: Annual Cumulative Cost Citywide for Post-Construction Stormwater Management**. Note that this cost represents the total estimated lifecycle SCM cost for one year of new and redeveloped properties with 30 years of operation and maintenance. Each year of new and redevelopment construction would result in repeat costs.

Figure 7-2: Annual Cumulative Cost Citywide for Post-Construction Stormwater Management



The capital and O&M costs each contribute to approximately 50% of the total lifecycle costs at all lot sizes. The costs remain relatively constant until roughly the 20,000 SF lot size threshold, after which the costs increase exponentially. This can be attributed to the increased unit costs for small lot SCMs combined with the increase in smaller lots and acres for lower thresholds.

Figure 7–3: Non-Cumulative Annual Post-Construction SCM Lifecycle Costs by Property Type

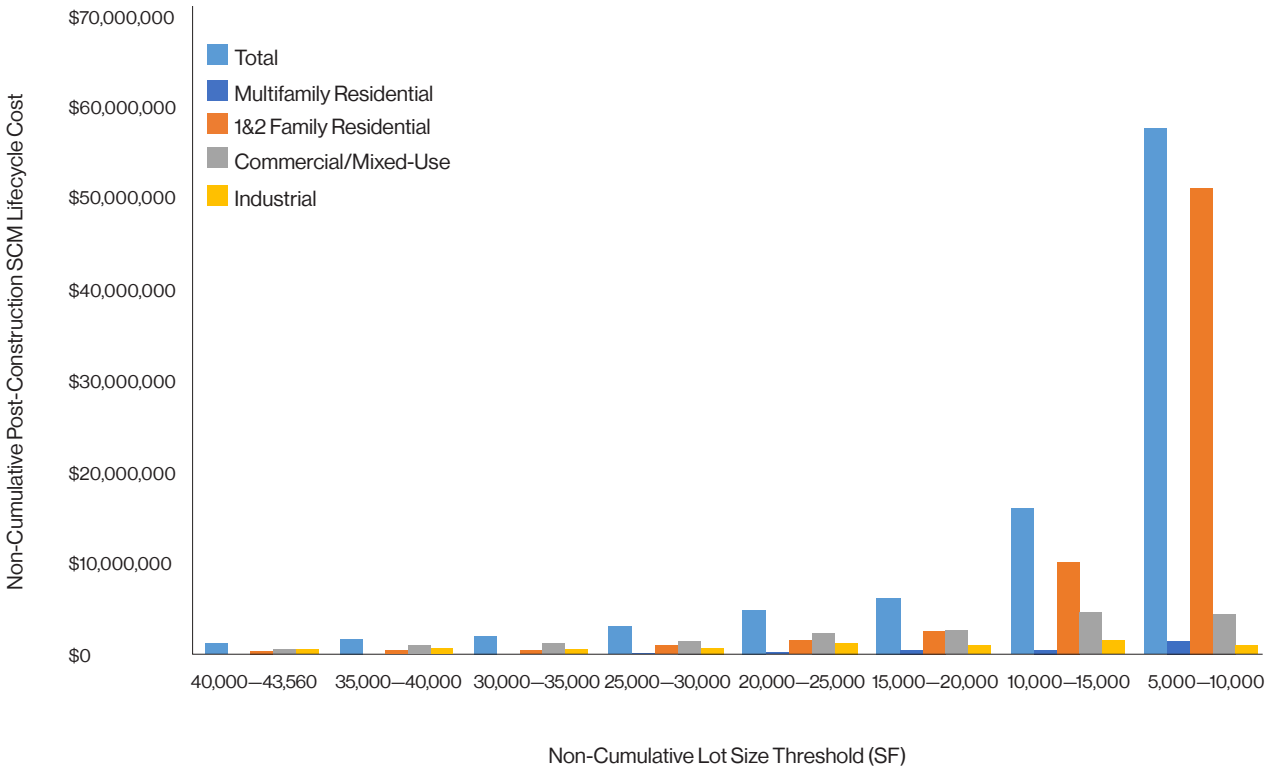
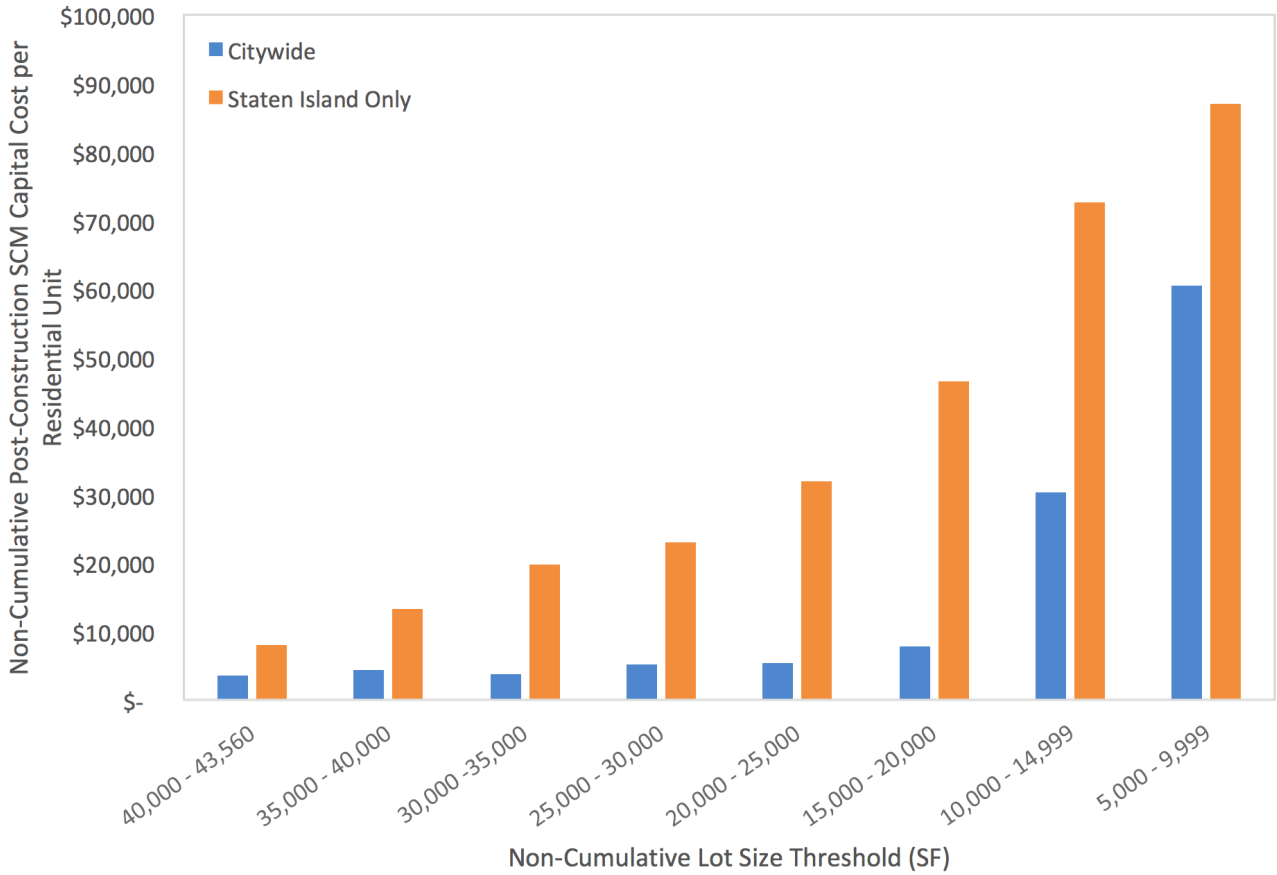


Figure 7–3: Non-Cumulative Annual Post-Construction SCM Lifecycle Costs by Property Type represents the non-cumulative annual post-construction SCM lifecycle cost by property type. Since residential properties make up most properties at thresholds below 15,000 SF, they were further broken down into one- and two-family residential and multifamily residential properties. This figure indicates that the SCM costs for lower lot size thresholds are predominantly driven by one- and two-family residential properties, with commercial and/or mixed-use properties becoming predominant at the thresholds larger than 20,000 SF.

provides the post-construction SCM capital costs per residential unit for each evaluated lot size bin. Majority of the Staten Island is managed by a separate storm sewer system and roughly 51% of the permit data evaluated came from Staten Island, much of which is residential properties. To understand the potential impact to Staten Island residential developers and/or homeowners, that borough is shown separately, in addition to the citywide results.

Figure 7-4: Non-Cumulative Post Construction SCM Capital Cost per Residential Unit Citywide and Staten Island Only



At lot size thresholds below 20,000 SF, the SCM cost per residential unit increases exponentially and would present a significant burden to the developer and/or owner as compared to the cost of the property. Additionally, the SCM cost per residential unit in Staten Island is significantly higher than the citywide average, likely due to "horizontal" residential construction as opposed to the "vertical" construction which is more predominant in Brooklyn and Queens.

8.0 Post-Construction Stormwater Control Measure Benefit Analysis

Benefit analyses in terms of SCM implementation related stormwater runoff and pollutant load reductions were performed for each waterbody and then combined on a citywide basis. A summary of the approach and results are presented in this section.

8.1 InfoWorks Modeling

Existing InfoWorks models were reviewed for all wastewater treatment plant (WWTP) services areas, except for Oakwood Beach WWTP. This review allowed MS4 areas that eventually connect to combined sewers to be excluded from further evaluation. MS4 areas that are connected to CSO outfalls downstream of the regulator structures were retained.

The Oakwood Beach WWTP area was characterized in earlier studies using a simple rainfall-runoff model.

Consistent with the LTCP methodology, the baseline scenario for the benefit analysis was setup with the following conditions:

1. rainfall from John F. Kennedy International Airport for the calendar year 2008 as typical hydrologic year;
2. no delineation of drainage areas and runoff estimation at the scale of private outfalls, but modeling was performed for lumped areas that may be discharging to a single waterbody through numerous small outfalls or directly as overland flow; and
3. unless provided by DEP from ongoing studies, no effort was undertaken in this project to delineate or confirm drainage areas for individual MS4 outfalls.

DEP is currently undertaking a major mapping effort to delineate subcatchments in MS4 areas hence the loading estimates may require revisions. **Table 8-1: Baseline Scenario - Summary of Areas and Annual Stormwater Runoff Volumes** shows the summary of drainage area characteristics (total and impervious areas in acres, ac) and baseline scenario runoff volumes (in million gallons, MG) for the typical hydrologic year, developed from the 14 WWTP drainage area InfoWorks models.

Table 8-1: Baseline Scenario - Summary of Areas and Annual Stormwater Runoff Volumes

Waterbodies	Total Area (ac)	Impervious Area (ac)	Baseline Runoff (MG)
Confined Tributaries	44,684	27,594	19,774
EROW	43,332	17,824	19,586
Citywide	88,016	45,418	39,360

Although there may be some SCMs implemented in public and private lots or the public right-of-way, it was conservatively assumed that no SCMs existed in the MS4/DD areas under baseline or existing conditions.

The benefit assessment phase of InfoWorks modeling incorporated the SCMs for disturbed acres in the MS4/DD areas for each waterbody. The goal is to represent the disturbed acres explicitly in InfoWorks models so that the benefits associated with implementation of retention- and treatment-based SCMs can be quantified.

The impervious acres within each subcatchment drainage area were divided into three categories in the models:

a. impervious areas that are not managed by SCMs;
b. impervious areas that are managed with retention-based SCMs; and
c. impervious areas that are managed with treatment-based SCMs.

The disturbed areas managed by retention were categorized as "unconstrained" for subsurface and space. For subcatchment areas with retention controls, consistent with the LTCP methodology for modeling bioretention, storage nodes (designed as 5-foot depth retention tanks) were added to the baseline model to capture and infiltrate up to 1.5 inches of stormwater volume from the contributing drainage area. A 1.5-inch event was selected as a conservative value for the 90th percentile storm in NYC area. Infiltration rates were set to 1 inch per hour so that the captured stormwater would be depleted before the next storm. Bypasses from these storage elements were estimated using the storage-infiltration methodology.

Similarly, the disturbed areas managed by treatment-based controls were divided into areas managed by bioretention with underdrains (for subsurface constrained lots), sand filters (for subsurface and space constrained lots), and green roofs (for space-constrained or subsurface and space constrained portions). These were individually modeled in the InfoWorks models or clustered and segregated proportionally in the post-processing step, as applicable. The 1.5-inch target runoff capture was used for both retention and treatment calculations. For treatment using sand filters, an orifice was sized to drain stormwater runoff in two days. The incorporation of the green roofs assumed that they would provide 50% retention and 50% treatment benefit.

The retention and treatment SCMs were modeled for four threshold lot sizes: greater than 5,000 SF, greater than 10,000 SF, greater than 20,000 SF, and greater than 1 acre. The greater than 5,000 SF threshold size had the most stringent stormwater management requirement, with the most managed disturbed areas being included in the benefit analysis. Alternatively, the greater than 1 acre threshold size had the smallest area to be managed by SCMs. For a given waterbody and threshold, the InfoWorks models generated the unmanaged runoff volume, bypass volume from the retention tank, treated volume, and the treated bypass volume, all expressed in millions of gallons per year (MG/Year).

The unmanaged impervious areas and pervious areas contributed the same amount of stormwater discharges and pollutant loads in all scenarios including the baseline, and only the managed impervious areas contributed reduced runoff and/or pollutant loads based on the extent of retention or treatment-based SCMs used. Because the thresholds were cumulative, the unmanaged runoff increased and the rate of treated runoff decreased as the threshold size increased.

8.2 Post-Processing

Based on the vendor data and literature review a conservative assumption was used for green roof performance with the retention benefit assumed to be 50% of the generated runoff treatment benefit assumed for the remaining 50% of the runoff. This process was implemented using linear interpolation in the post-processing step.

Additional threshold sizes were considered beyond the four that were modeled using InfoWorks. The disturbed areas to be managed for the threshold sizes of greater than 7,500 SF, greater than 7,500 SF, greater than 15,000 SF and greater than 25,000 SF were also linearly interpolated from the results of four modeled thresholds. Once the managed areas were estimated, the unmanaged runoff volume, the bypass volume from the retention tank, the treated volume, the treated bypass volume, and the green roof runoff volume were apportioned linearly to assess the resulting stormwater flow volume reductions from the MS4/DD areas.

8.3 Event Mean Concentrations

Pollutant loads were estimated using time-variant or representative pollutant concentrations applied for the various runoff components. Extensive water quality monitoring data and associated model calibration/validation helped justify a complex representation of time-variant concentrations. Based on limited monitoring data available in the NYC's MS4/DD areas, the concept of event mean concentrations (EMCs) was adopted in this analysis.

The EMCs for total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP), fecal coliforms (FC) and enterococci (ENT) were sourced from the Nationwide Urban Runoff Program (NURP), National Stormwater Quality Database (NSQD), and NYC's LTCP reports. For TSS and TN, a pooled mean was calculated from NURP and NSQD. Data from NYC were given the highest consideration to develop representative EMCs, and the concentrations from literature were supplemented where limited or no NYC-specific information was available. Selected EMC values for these parameters are summarized in **Table 8-2: Selected EMC Values for Key Water Quality Parameters**, which were used consistently for baseline and the varying threshold size scenarios.

Table 8-2: Selected EMC Values for Key Water Quality Parameters

Parameter	TSS (mg/L)	TN (mg/L)	TP (mg/L)	FC (#/100mL)	ENT (#/100mL)
EMC Value	80	2.50	0.37	35,000	15,000

Baseline pollutant loadings were calculated for each waterbody by multiplying the waterbody's baseline runoff volumes with each of the five water quality parameters' EMCs. **Table 8-3: Baseline Pollutant Load by Waterbody** summarizes these pollutant loads, which were used to compare against and estimate the incremental benefits of adopting different disturbance threshold sizes and implementing SCMs to achieve the pollutant load reductions at the corresponding lifecycle costs.

Table 8-3: Baseline Pollutant Load by Waterbody

Waterbody	TSS (Lb/yr)	TN (Lb/yr)	TP (Lb/yr)	FC (Trillion/yr)	Ent (Trillion/yr)
Confined Tributaries	13,205,600	412,900	61,000	26,229,500	11,241,214
EROW	13,080,700	408,900	60,600	25,981,800	11,135,100
Citywide	13,080,700	408,900	60,600	25,981,800	11,135,100

The EMCs were also applied to the unmanaged runoff and bypasses from the implementation of SCMs. For each threshold scenario, the bypass volume from the retention tank, the treated volume, the treated bypass volume, and the green roof retained and treated runoff volume were multiplied by the EMC to get the pollutant load for each type of runoff. Partial treatment of bypassed volume during the retention or treatment-based unit process is not accounted for as a conservative assumption in this analysis. Reductions in pollutant loads due to treatment are discussed in terms of percent reduction factors in the next section.

8.4 Performances of Stormwater Control Measures

The effectiveness of SCMs for the various water quality parameters were extracted from the *Preliminary Data of Urban Stormwater Best Management Practices*[3], the *National Pollutant Removal Performance Database*[4] , the Pathogens in Urban Stormwater Systems (International BMP Database 2014), the *Stormwater Best Management Practices Performance Analysis*[5], and the Literature Review of Existing Treatment Technologies for Industrial Stormwater[6].

Pollutant reduction effectiveness of individual SCMs have been reported in the literature in the form of percent removal (a constant reduction applied irrespective of storm patterns) or effective reduction (varied performance based on storm patterns). The percent removal methodology was adopted for this study, again with the limited performance data available in NYC's MS4/DD areas, to quantify the reductions achieved with the selected SCM technologies. The selected percent removals for treatment-based SCMs are shown in **Table 8-4: Percent Removals for Water Quality Performance of SCMs**. Retention-based SCMs were considered to provide 100% removal for all pollutants associated with the eliminated stormwater runoff.

Table 8-4: Percent Removals for Water Quality Performance of SCMs

Selected SCMs	Removal Rate per Pollutant				
	TSS*	TN	TP*	FC	ENT
Green Roof	80%	42%	40%	65%	65%
Bioretention with Underdrain	80%	24%	40%	30%	30%
Sand Filter	80%	30%	40%	30%	30%

*Performance targets established by NYS for TSS and TP load reductions from stormwater are used as removal rates in this analysis, with the intent that these regulatory requirements can be included as part of permits for on-site projects.

3 United States Environmental Protection Agency, EPA-821-R-99-012, August 1999
4 Center for Watershed Protection, Version 3 , September 2007
5 United States Environmental Protection Agency, Revised March 2010
6 Science Applications International Corporation and Washington Department of Ecology, July 22, 2011

The reduced pollutant load associated with retention-based controls resulted from the direct reduction in runoff due to storage and infiltration of up to the 1.5-inch design event. There were no removal rates applied to the stormwater that bypasses the retention-based SCMs for the portion of events greater than 1.5 inches, as a conservative assumption. However, trapping of suspended solids and other nutrients and pathogens could occur from runoff that enters an SCM even if bypasses occur due to capacity constraints.

For the treatment-based controls, including the sand filter and the green roof, the pollutant loading was an outcome of applying the appropriate pollutant removal rate and EMC to the managed runoff. Once the EMCs and removal rates were applied, the total pollutant load for a given threshold size was estimated by adding the pollutant loads from unmanaged runoff volume, the bypass volume from the retention tank, the treated volume, the treated bypass volume, and the green roof treated volume. This total number corresponds to the remnant pollutant load to each waterbody after the SCMs are implemented in all the new or re-development projects in public and private lots for a given threshold size.

In each waterbody, the final water quality benefit for each threshold scenario was determined by calculating the percent difference between the baseline and the threshold scenarios with stormwater management. The percent difference was determined for each water quality parameter as well as the total runoff volume using the citywide MS4 area onsite runoff and pollutant load values as a basis. The citywide water quality benefits were assessed by summing the baseline and threshold scenarios from each waterbody. The reductions were then translated to annual benefit by dividing by 15 years for normalizing the benefits that are summarized in **Table 8-5: Annual Post-Construction Flow and Water Quality Benefits (Cumulative)**.

Table 8-5: Annual Post-Construction Flow and Water Quality Benefits (Cumulative)

Threshold Size (SF)	Runoff Volume Reduction (%)	TSS Reduction (%)	TN Reduction (%)	TP Reduction (%)	FC Reduction (%)	ENT Reduction (%)
>5,000	0.63%	0.91%	0.71%	0.77%	0.74%	0.74%
>7,500	0.46%	0.68%	0.53%	0.57%	0.55%	0.55%
>10,000	0.40%	0.59%	0.46%	0.50%	0.47%	0.47%
>12,500	0.35%	0.52%	0.40%	0.44%	0.42%	0.42%
>15,000	0.32%	0.48%	0.37%	0.40%	0.38%	0.38%
>20,000	0.29%	0.43%	0.33%	0.36%	0.35%	0.35%
>25,000	0.26%	0.40%	0.31%	0.33%	0.32%	0.32%
>1 acre	0.23%	0.34%	0.26%	0.29%	0.27%	0.27%

Figure 8-1: Cumulative Tons of TSS Removed vs. Number of Lots and Acres presents the cumulative TSS reduction benefits associated with the cumulative accumulation of the number of lots and disturbed acres being managed by SCMs. Pollutant load reduction is linearly proportional to the managed impervious acres, and the rate of increase in pollutant load reduction decreases generally with lower lot size thresholds (as reflected by the increase in lots with lower threshold sizes).

Figure 8-1: Cumulative Tons of TSS Removed vs. Number of Lots and Acres

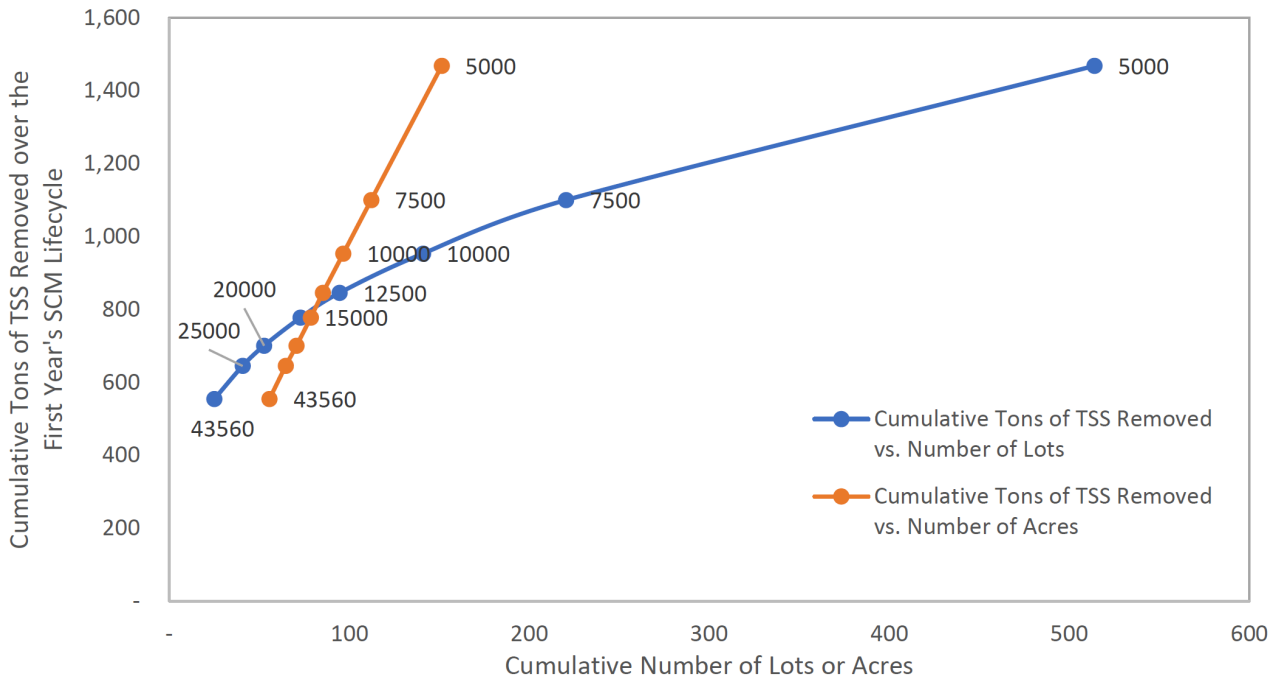


Figure 8-2: Cumulative cost benefit curves for pollutant percent removal shows the relationship between life cycle costs and percent reductions in runoff/pollutant loads estimated for different lot size thresholds. Generally, these relationships become steeper with lower thresholds, indicating that the incremental costs of SCMs are higher to achieve the unit reductions in pollutant loads for smaller thresholds.

Figure 8-2: Cumulative cost benefit curves for pollutant percent removal

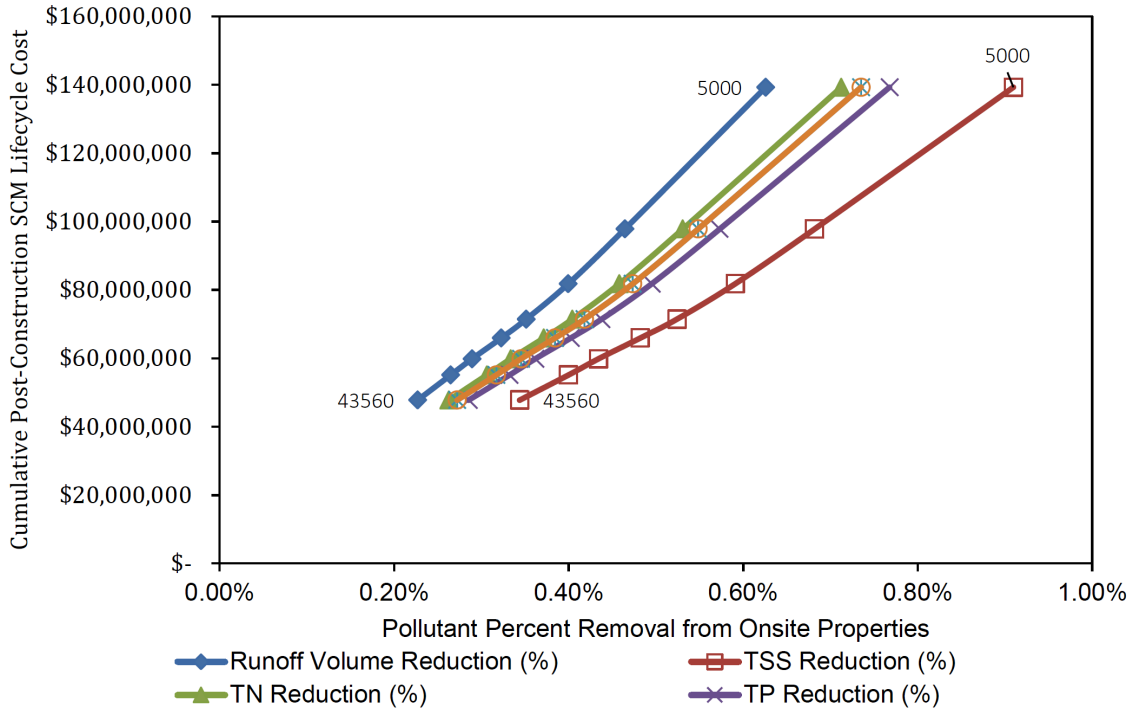


Table 8–6: Summary of Post-Construction Cost/Benefit Analysis (Cumulative) provides an overall summary of disturbed acres, number of lots, SCM costs to developers and associated administrative costs to DEP, and the corresponding pollutant load reductions and cost/unit reduction in pollutant loads. The increases in benefits (pollutant load reductions) with incremental costs show similar trends seen in **Figure 8-2: Cumulative cost benefit curves for pollutant percent removal**, for the various lot size thresholds.

Table 8–6: Summary of Post-Construction Cost/Benefit Analysis (Cumulative)

Lot Size Threshold	Annual # of Acres	Annual # of Permits/ Lots	Post-Construction Lifecycle Cost to Developer	Annual Cost to DEP	Tons of TSS Removed from First Year's Lots over 30 Years	Developer Cost Per Ton of TSS Removed
≥ 1 Acre (Baseline)	56	25	$47,744,400	$ 2,540,500	555	$86,000
≥ 30,000 SF	61	34	$52,241,300	$2,764,800	604	$86,500
≥ 25,000 SF	65	41	$55,098,800	$2,876,900	643	$85,700
≥ 20,000 SF	71	53	$59,845,000	$ 2,989,100	701	$85,400
≥ 15,000 SF	79	73	$65,903,000	$ 3,213,300	778	$84,700
≥ 12,500 SF	85	95	$71,418,500	$ 3,325,500	846	$84,400
≥ 10,000 SF	97	141	$81,762,100	$3,920,400	954	$85,700
≥ 7,500 SF	112	220	$97,772,500	$4,481,100	1,100	$88,900
≥ 5,000 SF	152	514	$139,255,600	$6,646,000	1,468	$94,900

9.0 Construction Stormwater Management Cost-Benefit Analysis

This section presents the results of cost-benefit analyses for lot size threshold selection for stormwater runoff management during construction. Typical construction stormwater runoff management requirements include erosion and sedimentation controls and, unlike the post-construction SCMs, the construction runoff technology selection is mostly independent of the space and subsurface conditions. The construction runoff management evaluations were built off the post-construction SCM cost-benefit analyses presented in the previous sections and include the key steps described in the following sections.

9.1 Develop conceptual designs and construction cost estimates

For the purposes of evaluations in this study, it was assumed that each construction site, independently of the lot size and space and subsurface conditions, would include the following erosion and sedimentation controls:

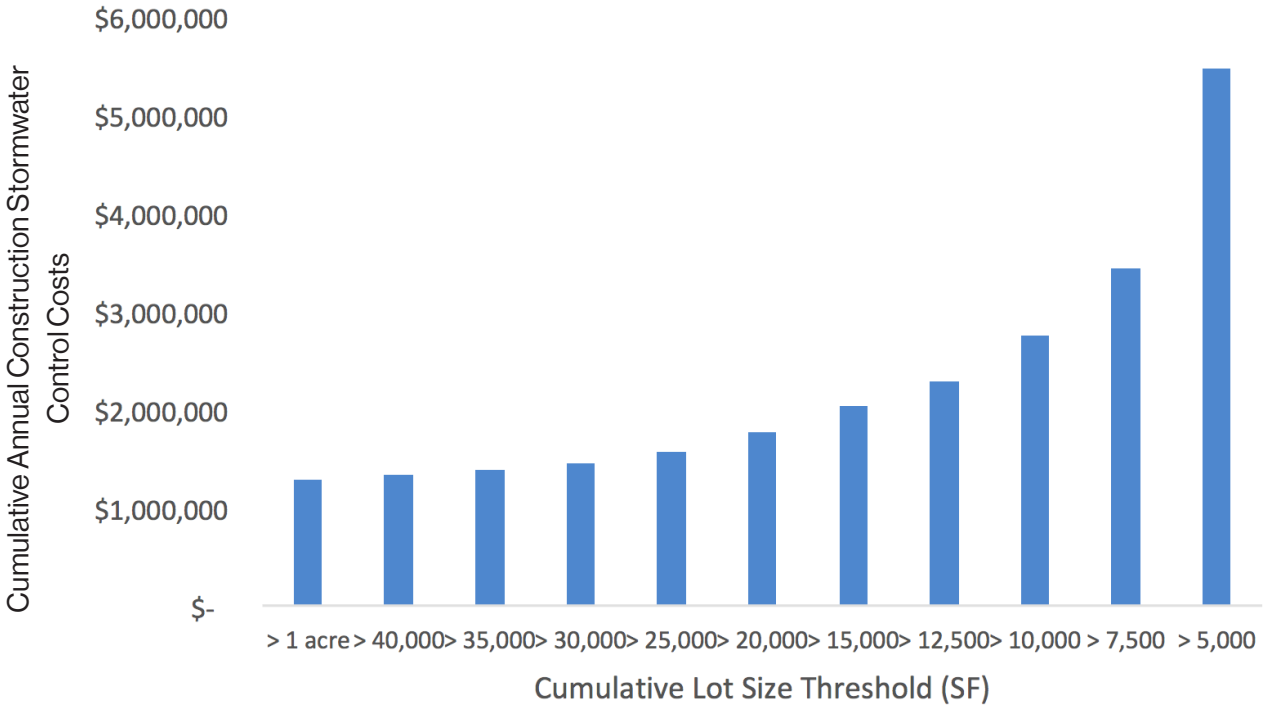
- Perimeter Silt Fence
- Construction Entrance
- Sedimentation Basin

These controls were selected based on the 2016 NYS Blue Book[7]. Average construction lot dimensions, including area and perimeter were estimated for each lot size bin using the historical permit data. These dimensions were used for estimating silt fence and sedimentation basin quantities for representative lots in each lot size bin. Standard Blue Book construction details were assumed for the silt fence and sedimentation basin. One standard stabilized construction (SCE) site entrance was assumed for each lot.

Upper ranges of the Blue Book cost tables were then applied to the estimated quantities within each lot size bin to develop cost estimates for construction stormwater runoff management.

Cumulative construction stormwater management costs for each evaluated threshold are presented in **Figure 9-1: Annual Cumulative Cost Citywide for Construction Stormwater Management**. The costs increase exponentially below the 20,000 SF threshold, mostly due to the significant increase in number of lots and acres.

Figure 9-1: Annual Cumulative Cost Citywide for Construction Stormwater Management
Note that these construction costs do not include engineering, SWPPP preparation, or the O&M costs.



7 New York State Department of Environmental Conservation, New York State Standards and Specifications for Erosion and Sediment Control, November 2016

9.2 Estimate Construction Runoff Management WQ Benefits

The next step in evaluations was to estimate pollutant loading reductions associated with the construction stormwater management controls. TSS was assumed under this evaluation as the primary pollutant of concern associated with the construction site stormwater runoff. Based on the literature review, a typical TSS EMC value of 200 mg/L[8] and an average TSS removal efficiency for the selected stormwater runoff controls of 50%[9] were used for the WQ benefit analyses.

InfoWorks modeling results, as described in Section , were post-processed to estimate the annual stormwater runoff volumes, TSS loads, and corresponding TSS load reduction from construction sites. An average construction duration of one year and the 2008 rainfall from John F. Kennedy International Airport were used for estimating TSS removals for each lot size threshold. **Table 9-1** presents cumulative annual TSS load reduction and percent removal benefits (using TSS load from citywide onsite properties in MS4 area as a basis) for construction stormwater controls for the various lot size thresholds.

Table 9-1: Annual Construction TSS Reduction Benefits (Cumulative)

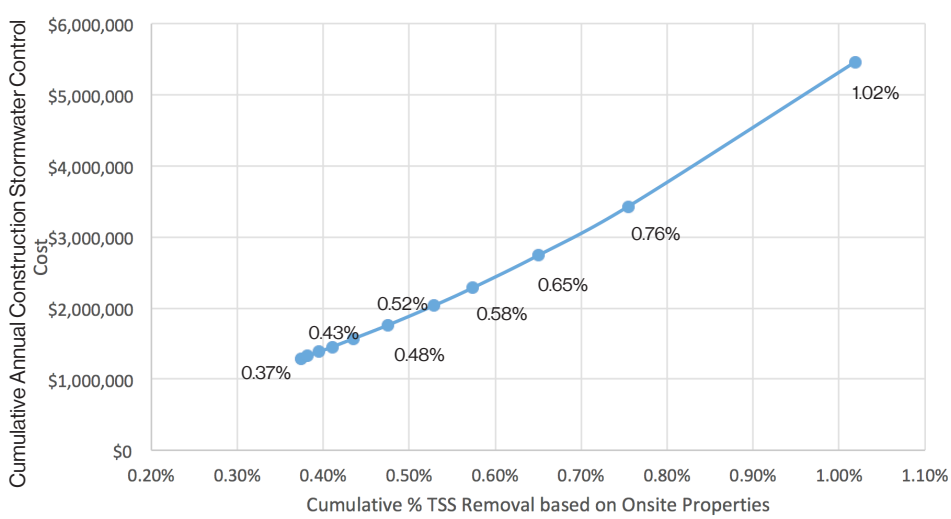
Threshold Size (SF)	TSS Removal (tons)	TSS Reduction (%)*
>5,000	55	1.02%
>7,500	41	0.76%
>10,000	35	0.65%
>12,500	31	0.58%
>15,000	28	0.52%
>20,000	26	0.48%
>25,000	23	0.43%
>1 acre	20	0.37%

*Based on load from onsite properties in MS4 area citywide

9.3 Develop Cost-Benefit Curve

The costs and benefit data for the construction stormwater runoff management were assembled in a curve presented in **Figure 9-2: Annual Construction Runoff Management Costs vs. Benefits,** which shows a relationship between the annual costs and cumulative TSS removal expressed as percentage of the baseline TSS loads from all onsite properties within the NYC MS4 area. As indicated in the figure, both costs and benefits increase with the smaller lot threshold sizes; however, no explicit knee of the curve could be observed.

Figure 9-2: Annual Construction Runoff Management Costs vs. Benefits



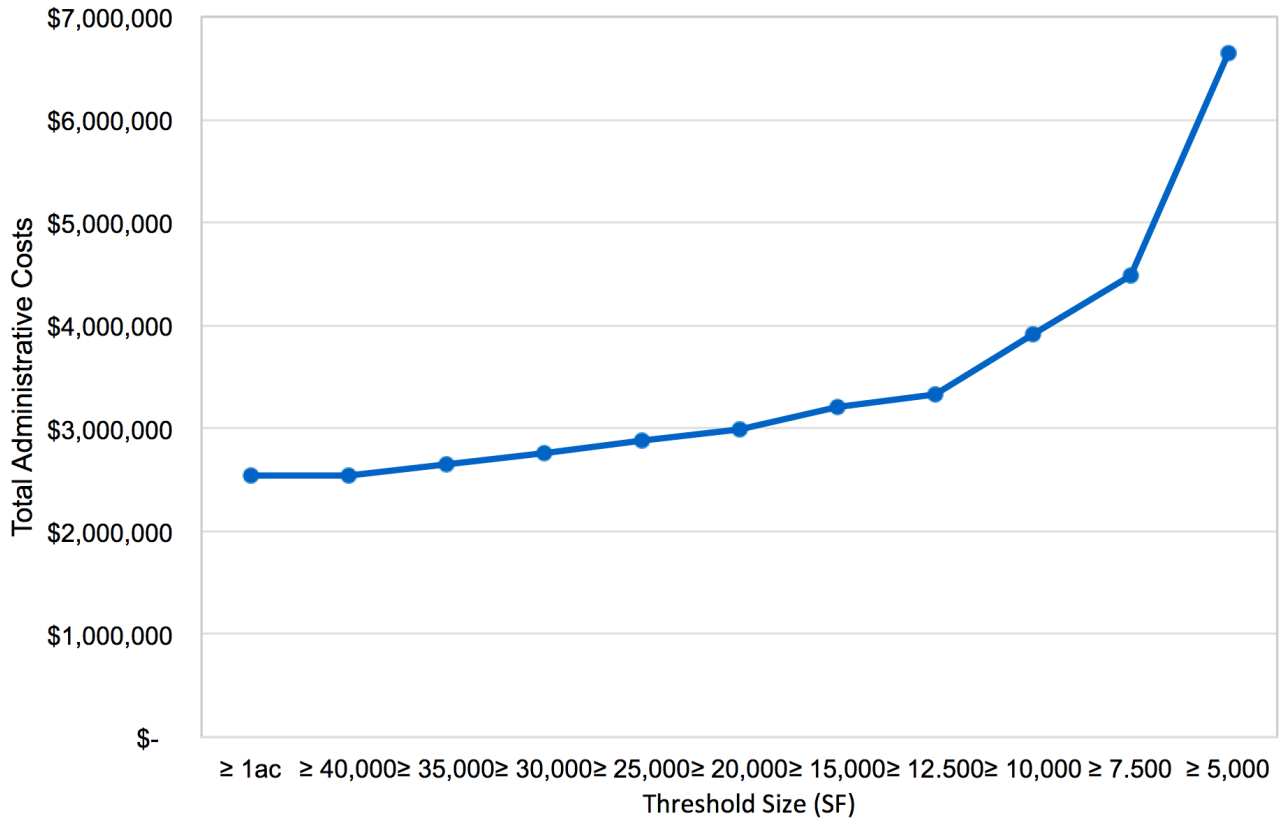
8 The Hows and Whys of Controlling Runoff Pollution, University of Wisconsin DNR Extension, PUB WT-922-2009

9 New Jersey Stormwater Best Management Practices Manual, February 2014. The manual provides a range of 40-90%, based on specific SCM. A conservative 50% is assumed here.

10.0 Administrative Cost Benefit Analysis

To analyze administrative costs versus the benefits of reducing the lot size threshold, the team performed a statistical analysis using the estimated number of annual permits from the DOB permit data and the associated resources anticipated for the overall management of the permit review and inspections for a given threshold size. The analysis includes the base salaries of an executive director that spends one third of their time on MS4 issues, a director to oversee implementation of the program, senior level engineers to assist in the review, inspection and implementation of enforcement actions and assistant level engineers and technicians to perform reviews and inspections. Additionally, the study includes the cost of one IT professional for maintaining the permitting and enforcement group database including the online application systems, the review database, the inspection database and the supporting information such as certifications, contact information and registrations. Finally, the study does not include support staff that will be required to field phone calls, assist with nontechnical application questions and assist the public on retrieving information. **Figure 10-1** presents the administrative costs to DEP for each lot size threshold.

Figure 10-1: Total Administrative Costs to DEP



Under the existing permit, DEP is required to review all permits and prioritize sites for inspection during and after construction. Using the DOB permit data and the lot size disturbance thresholds, larger projects are assumed to require more review time with additional assistance from high-level staff and more time for construction and post-construction site inspection and enforcement. As the area of disturbance, the threshold, is reduced, the staff effort to get and maintain compliance through permit reviews is also reduced since it is likely that smaller projects will take less time to review. However, visiting each project in the field for inspections during construction will become a challenge as the number of permits rises. Since the number of permits increases dramatically below the 20,000 square foot threshold, the need for additional staff increases dramatically even though the additional area covered is minimal.

Reducing the threshold increases the need for staff. The area impacted by the program grows with the reduced the threshold, but the number of permits grows at a quicker rate than the area covered as the threshold falls below 20,000 square feet. Additionally, allocating resources to lower thresholds does not support the minimal water quality benefits that would be associated with the smaller threshold sizes. The overall cost-benefit comparison favors larger thresholds both administratively and technically.

11.0 Recommendation of Lot Size Threshold

DEP is proposing to adopt a 20,000 SF threshold as a recommendation for reduction from 1 acre; applicable to both construction and post construction stormwater management. This recommendation is supported by most of the evaluations performed in this study, including:

- number of managed lots and acres,
- cost-benefit analyses and
- administrative costs

A 20,000 SF threshold size also takes into consideration costs to individual households and borough-specific impacts. The selected threshold considers staffing resources to accommodate permit reviews and inspections and it provides flexibility for site constraints through a hierarchy for stormwater control measures (i.e., soil suitability, site availability). For these reasons, a 20,000 SF disturbance threshold is the maximum extent practicable (MEP) in NYC.

Appendix 6.1 A

Utility Survey Memorandum

Summary

On August 1, 2015, New York State Department of Environmental Conservation (DEC) issued a permit to the City of New York, which includes a multitude of requirements on stormwater discharges including those related to construction and post-construction activities. Accordingly, the New York City Department of Environmental Protection (DEP) sought to understand how other peer utilities with combined and/or separate sewer systems comply with their local ordinances or stormwater regulations. The following twelve (12) utilities of various sizes across the country, with the local population served ranging from about 600,000 to 4,000,000 people, were shortlisted for literature review and follow-up interviews: Atlanta (GA), Austin (TX), Baltimore (MD), Boston (MA), Chicago (IL), Los Angeles (CA), Philadelphia (PA), Portland (OR), San Diego (CA), San Francisco (CA), Seattle (WA), and Washington (DC).

The questionnaire that was developed by DEP and the Arcadis team to support this survey focused on performance standards, administrative process, number of applications received and staffing resources, etc. related to stormwater management of construction and post-construction activities (see Attachment A at the end of this appendix for the questionnaire). All 12 of the utilities participated in interviews, providing partial or full responses to the questionnaire.

The first step was a literature review of each utility's stormwater manual and other publicly available guidance. Following this, the second step was to reach out to the utilities directly with a standardized interview questionnaire to fill in any gaps in information, particularly the administrative information that is not typically listed on utilities' websites.

There are various technical and administrative topics included in the questionnaire, including but not limited to the stormwater regulations: (a) adopted thresholds based on soil disturbance and/or creation of new impervious area for new and redevelopment projects and if any analyses were done for determining a particular threshold and associated retention/detention or treatment standards; (b) off-site mitigation or in-lieu fee applications; (c) administrative process including stormwater management pollution prevention plan review times, and (d) staffing resources for managing permits and performing inspections and fees charged by the utilities.

Utilities with Phase 2 MS4 permits typically have applied construction and post-construction thresholds in the range of one acre and above, expressed in terms of either the soil disturbance or new impervious cover as trigger for post-construction stormwater runoff control.

Most of the 12 utilities interviewed under this task applied construction thresholds of less than one acre with the remainder using a one-acre national threshold recommended in the US EPA Phase 2 Stormwater Guidance.

All the 12 interviewed utilities have adopted a minimum soil disturbance or new impervious area post-construction threshold that ranged from no-minimum value (i.e., all new or redevelopment applications require permits) to 15,000 square feet (sq ft.). About half specified a post-construction threshold be between 5,000 and 10,000 sq ft., with four out of the 12 utilities using 5,000 sq ft.

In addition to the 12 utilities surveyed under this task, DEP has been communicating with other utilities on CSO and stormwater regulations compliance matters, and the information on post-construction threshold from these additional utilities (included below) was used in the comparative evaluations:

- City of Miami (half acre);
- New Orleans (5,000 sq ft.);
- Fairfax County (2,500 sq ft.);
- Indianapolis (half acre); and
- Richmond (one acre for all areas and 2,500 sq ft. only for Chesapeake Bay Preservation Area).

Three out of these five additional utilities have established larger thresholds of half to one acre. Overall, out of 17 utilities considered for the post-construction threshold survey, seven have established thresholds of greater than 5,000 sq ft.

Most of the 17 utilities also have combined sewers as part of their service area and almost all have adopted the same minimum threshold for post-construction runoff requirements in both MS4 and combined areas.

It is also important to note that some utilities with smaller thresholds have provisions to significantly minimize the administrative workload for inspections. For example, Portland (OR), with 500 sq ft. as threshold, only requires self-certification for single family residential lots and Boston, with no-minimum threshold, does not have any post-construction inspection requirement at this time. Some other utilities have watershed-based varying thresholds to meet their flood control or water quality end goals, e.g., Philadelphia, Washington, DC and Richmond.

Most of 12 interviewed utilities offered alternative measures for sites that may not be able to meet the stormwater management requirements, specifically in the forms of in-lieu fees and offsite mitigation options. Boston and Chicago are the only cities that strictly adhere to on-site stormwater management regulations. Neither Seattle nor DC explicitly state whether they accept in-lieu fees or offsite mitigation, but they do utilize a stormwater credit system that offers some flexibility for developers to meet the stormwater management regulations.

Performance standard requirements varied among the utilities interviewed, but some general trends were observed. Most utilities listed a water quality control volume (WQv) retention standard below 1.5 inches, with only Portland that has a significantly larger standard of 3.5 inches over a 24-hour period. Some of the utilities have peak flow (i.e., flood control) reduction standard in addition to WQv.

Potential soil and space constraints can limit the implementation of retention-based stormwater controls. This is particularly relevant to dense urban areas with compacted soils or underlying soil with poor permeability. Several utilities (e.g., San Francisco, Philadelphia and Portland) have developed tiered approaches to controlling stormwater – starting with retention as the first tier to the maximum extent practicable and using detention or treatment based controls as lower tiered options.

The indicators for administrative costs included the number of staff to manage permits, perform construction permit inspections and post-construction periodic inspections, as well as the number of permits/inspections handled and the departments/municipal jurisdictions that manage the permitting and inspections. Mature stormwater management programs appear to have larger number of staff as well as dedicated funding mechanisms (e.g., stormwater utility, component stormwater bill to customers, etc.), whereas the newer programs are still in the midst of establishing the staffing and funding needs.

Another topic of interest to DEP was whether the utilities with both combined and separately sewered systems had different permit (stormwater management) requirements. It appears that most have the same performance standards and administrative requirements for both combined and separate systems. However, some utilities such as Philadelphia, Portland, and San Francisco each impose requirements that differ between combined and separate areas for certain criteria. San Francisco, for example, has the same standard for retention in combined and large MS4 areas (>5,000 sq ft.), whereas a less stringent standard for 2,500-5,000 sq ft. in smaller MS4 areas. Philadelphia has different infiltration volume requirements and Portland has different allowable discharge rates for the combined and MS4 areas.

The responses gathered from 12 interviewed utilities represent stormwater management programs in various stages of development and implementation, some dating back nearly 10 years and some others being relatively new – established within the last two years. The findings also indicate that there is a wide variation among the responding utilities in the administration of stormwater management and the performance standards that developers are required to follow.

This technical memorandum summarizes the data and information obtained from the interviews conducted by DEP staff and the Arcadis team and a review of existing documentation. This memorandum will be shared with utilities that have participated in this survey for reference upon DEP approval. Due to the wide variation in stormwater rule implementation by the responding utilities, only the key topics of interest to DEP are summarized in this memorandum.

1.0 Introduction

Since 2010, DEP has been constructing and funding stormwater management assets throughout the City's combined sewer tributary areas. The types of stormwater management assets include but are not limited to bio infiltration, permeable paving, subsurface retention systems, and green roofs. In 2012, DEP established a new stormwater performance standard (Stormwater Rule) with which developers must comply for any new construction or major alteration in the combined sewer areas. This performance standard took effect in 2012, and since then DEP has certified more than 5,300 site or house connection permits. Stormwater management systems constructed so far, to comply with this rule, are primarily detention-based and designed to meet the reduced 0.25 cubic feet per second (cfs) stormwater release rate or 10% of the allowable flow, whichever is greater, or if the allowable flow is less than 0.25 cfs then no more than allowable flow (NYC DEP Green Infrastructure Annual Report, 2016).

On August 1, 2015, New York City received its first municipal separate storm sewer system (MS4) permit, and is required to develop a stormwater management program (SWMP) plan within three years to address the various permit provisions. Two provisions specifically apply to construction and post-construction stormwater controls, of which there are two key components. The first component is to implement a program to enforce the existing state requirements for soil disturbances greater than or equal to one acre by August 1, 2018. These existing DEC requirements include a performance standard that prescribes a water quality control volume (WQv) ranging from 1.4 to 1.5 inches over different parts of New York City, which corresponds to the 90th percentile 24-hour storm volume appropriate for the City's geographic area. The second key component of this permit is to determine an appropriate reduction below one acre for the threshold triggering construction and post-construction stormwater management requirements. Accordingly, the City convened a group of stakeholders, including representatives from the developer and environmental advocacy communities, to determine a new threshold based on soil disturbance and/or creation of new impervious area for new and redevelopment projects. The determination of this threshold is guided by the anticipated benefits (stormwater volume and pollutant load reductions) and associated costs (construction and post-construction stormwater control implementation and operation and maintenance costs incurred by developers to meet the performance standard and municipal costs to administer the program).

In order to gain additional information from other urban cities and their stormwater regulations and associated administrative requirements for the long-term management of a construction and post-construction stormwater program, DEP conducted a survey of peer utilities across the U.S. The utility survey was performed as a two-step process. A review of each utility's stormwater technical manual and other publicly available guidance/policy documents served as the first step of completing the questionnaire. In the second step, the utilities were contacted directly to fill in any information gaps based on documents that are not publicly available, including the specific administrative information that is not typically listed on utilities' websites.

Responses were recorded from participating utilities pertinent to a variety of construction and post-construction stormwater management implementation, regulation, and management topics.

This technical memorandum summarizes the data and information acquired from the questionnaire's responses as well as information resulting from interviews conducted by DEP and the Arcadis team, and is supplemented by a review of existing publicly-available information. As noted earlier, key selected topics are highlighted in subsequent subsections.

2.0 Data Collection

In order to assess the administration of the construction and post-construction aspects of stormwater management programs across the U.S, the DEP and Arcadis team began by gathering data from other large utilities and regional utilities. A questionnaire was developed, and the team compiled more comprehensive information from 12 U.S. utilities. Most utilities provided responses to all questions, whereas some were only able to complete the questionnaire partially.

In addition to the 12 municipalities interviewed in this task, DEP has been communicating with five other utilities on combined sewer and MS4 regulatory requirements. Additional information from these five other municipal utilities (Fairfax County, VA; Indianapolis, IN; Miami, FL; New Orleans, LA; and Richmond, VA) on post-construction runoff threshold size and performance standard was also included in this memorandum.

Specifically, the selected peer utilities have advanced stormwater management programs hence adopted regulations to reflect that. These utilities are subject to national regulations for 1+ acre lots based on United States Environmental Protection Agency's (USEPA) or their respective state's MS4 programs, and have adopted thresholds of one acre or less for construction and post-construction stormwater control requirements. Most of the surveyed utilities also have combined and separate sanitary sewer systems or predominantly separate systems and administer their stormwater management programs related to construction and post-construction requirements. The 12 peer utilities chosen for the utility survey from across the U.S. are listed in **Table 2-1: Utility Name and Location.**

Table 2-1: Utility Name and Location

Utility Name	Municipality
Department of Watershed Management	Atlanta, GA
Watershed Protection Department	Austin, TX
Department of Public Works (DPW)	Baltimore, MD
Boston Water and Sewer Commission (BWSC)	Boston, MA
Department of Water Management	Chicago, IL
Department of Sanitation	Los Angeles, CA
Philadelphia Water Department (PWD)	Philadelphia, PA
Bureau of Environmental Services (BES)	Portland, OR
Transportation and Storm Water Department	San Diego, CA
San Francisco Public Utilities Commission (SFPUC)	San Francisco, CA
Seattle Public Utilities (SPU)	Seattle, WA
District Department of the Environment (DOEE) for MS4 areas, DC Water for Combined areas	Washington, DC

The utilities' stormwater management programs have differed based on factors such as geographical location, maturity of the MS4 program, size of the community served, and various local priorities. Some programs have been around for over 10 years with well-established technical and administrative resources, while others are in the early to mid-stages of their programs.

2.1 Questionnaire Development

DEP sought to understand how other peer utilities with combined and separate sanitary sewer systems were administrating their stormwater management programs related to construction and post-construction requirements. A questionnaire was developed by the DEP and Arcadis team to support the documentation of other selected utilities' stormwater management programs/procedures in the areas including, but are not limited to, the following:

- Performance standards for stormwater best management practices (BMPs), such as WQv, peak flow reduction, erosion and sedimentation control (ESC), etc.
- Water quality and any watershed-specific requirements, such as total maximum daily loads (TMDLs)
- Compliance cost to the developer/owner, that can include total permit fee and cost of stormwater control measures (see Appendix C for municipal guidance documents with cost information)
- Administrative cost to the utility, that can include the number of staff required to review and administer permit applications and perform inspections, staff time required for reviews and inspections, and a typical number of permit applications received during construction and inspection applications received during post-construction
- Alternative means to meet the stormwater control requirements (e.g., offsets, credits, or in-lieu fees) if the implementation of controls is technically infeasible, and the associated waiver process if applicable.

The survey topics included technical, regulatory, administrative and financial elements and the full questionnaire is shown in Attachment A.

2.2 Interviews with Utilities

Once the questionnaire was prepared, DEP and the Arcadis team identified key utilities to target for responses. The utilities selected included some large utilities, regional utilities and utilities with known contacts. As reviewed in Table 2-1, the final list of utilities included: Atlanta, Austin, Baltimore, Boston, Chicago, Los Angeles, Philadelphia, Portland, San Diego, San Francisco, Seattle, and Washington, DC.

The responding utilities comprise a broad range of utility size and customer accounts, ranging from service areas of 32 sq. miles to 735 sq. miles and populations ranging from 600,000 to 4,000,000 residents. Physical sewer system statistics also varied greatly in terms of miles of sewers and number of combined sewer overflow outfalls (CSOs) and stormwater (MS4) drainage areas and outfalls. **Table 2-2** summaries key characteristics for each responding utility. The fields marked with "X" indicate that this characteristic data was not readily available in the utility's website and the utility did not provide a response during interviews.

Table 2-2. Utility Characteristics

Utility Name	Number of Customer Accounts/ Taps	Service Area Size (Sq. Miles)	Population Served	Total Miles of Public Storm Sewers	Total Miles of Public Sanitary Sewers	Total Miles of Public Combined Sewers	MS4 Drainage Area (Sq Miles)	Number of MS4 Outfalls
Atlanta	160,000	267	X	158	1900	300	146	1,503
Austin	213,310	548	X	2,789	X	0	X	X
Baltimore	200,000	X	1,800,000	1,146	3100	0	81.6	1,709
Boston	88,000	32	667,137	595	622	238	24	224
Chicago	X	234	2,700,000	50	>10	4,400	X	156
Los Angeles	X	600	4,000,000	X	X	0	103.9	38
Philadelphia	640,000	143	1,500,000	774	765	1,856	39.6	434
Portland	182,221	145	592,000	460	1001	910	24.2	39
San Diego	311,000	342	1,300,000	900	X	0	X	502
San Francisco	2,600,000	47	800,000	1000	3.84	7.91	2.3	97
Seattle	X	84	630,000	X	448	520	X	X
Washington, DC	X	735	2,000,000	X	1900	X	31.2	566

From February 2016 through August 2016, all 12 utilities were initially contacted for discussions on the questionnaire. E-mail follow-up and phone calls were held with utility staff from one or more departments (divisions) that manage the construction and post-construction requirements for onsite and public ROW projects. All the participating utilities expressed interest in the findings of the study.

2.3 Information from Additional Utilities

In addition to the 12 interviewed municipalities in this task, DEP has been communicating on CSO and MS4 program requirements with five additional utilities (New Orleans LA; Miami FL; Richmond VA; Fairfax County VA; and Indianapolis IN). A separate survey questionnaire was used to compile information from these additional utilities. Information pertinent to post-construction stormwater management requirement in terms of soil disturbance or new impervious cover threshold lot size was extracted by DEP from the responses of these five utilities and incorporated in the summary presented in this memorandum.

3.0 Findings

Once all the 12 completed questionnaires were collected and the preliminary interviews were conducted, the results were compiled and summarized to provide a review of construction and post-construction stormwater management requirements and administrative processes. In general, all utilities have minor differences in performance standards as well as the administrative elements pertinent to the implementation and management of their respective stormwater management programs. The differences can be attributed to factors such as geographical location, maturity of the MS4 program, size of the community served, and various local priorities. The key findings are highlighted in the subsequent subsections and were divided into three major areas for organizational purposes, as below. The remaining subject areas are included in the questionnaire in Attachment A, for which only some municipalities provided additional information. These partial information is not discussed in this memorandum.

- Performance standard (soil disturbance threshold and stormwater retention volume standard) and if in lieu fee or offsite mitigation is applied;
- Resource utilization (number of staff utilized, and the departments in which these staff reside); production using the given resources (number of permit reviews and inspections performed over a given period, average time spent on Stormwater Pollution Prevention Plan (SWPPP) reviews, and level of automation and web-based interfacing in the permit application process); and
- Administrative costs (fees charged for stormwater management applications, reviews, and inspections, and where applicable, the costs for an expedited permit review).

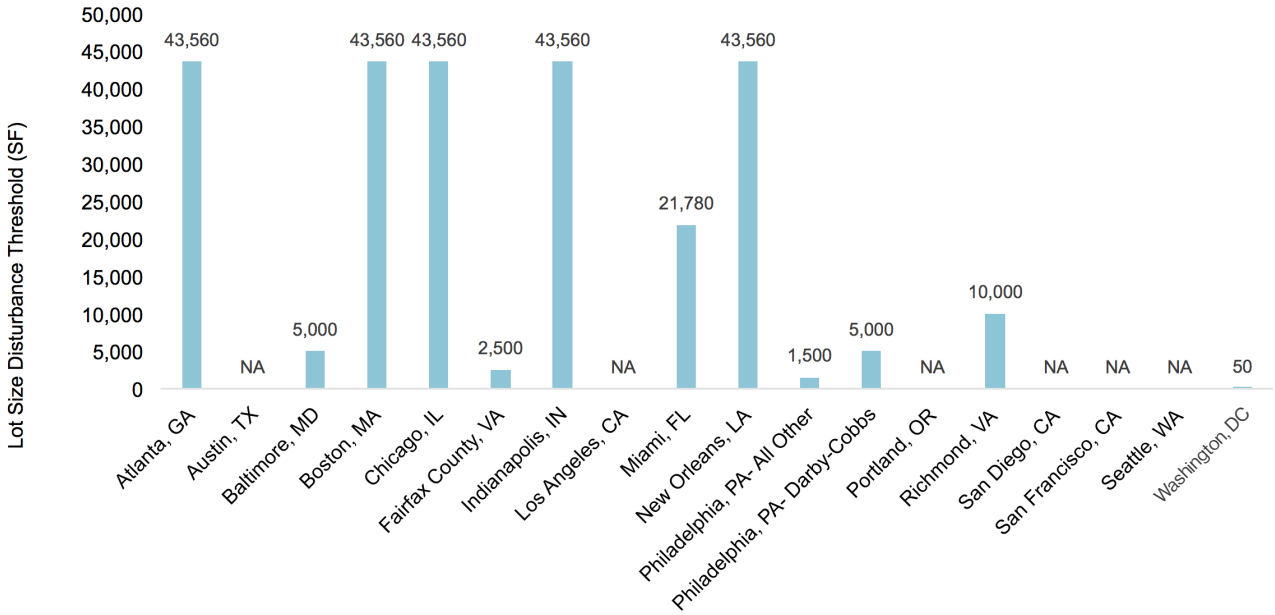
3.1 Performance Standard

3.1.1 Threshold Size

Peer utilities focus on threshold size as an important performance standard. As the threshold size that determines construction or post-construction requirements decreases, the resulting number of permits or inspections that the utility staff perform increases significantly. On the other hand, the improvement in water quality in terms of volume and pollutant load reductions is minimal with smaller lots in comparison to the larger lots. Therefore, the information from peer utilities on threshold size provided insight on the tradeoffs between administrative and technical costs versus the achieved benefits.

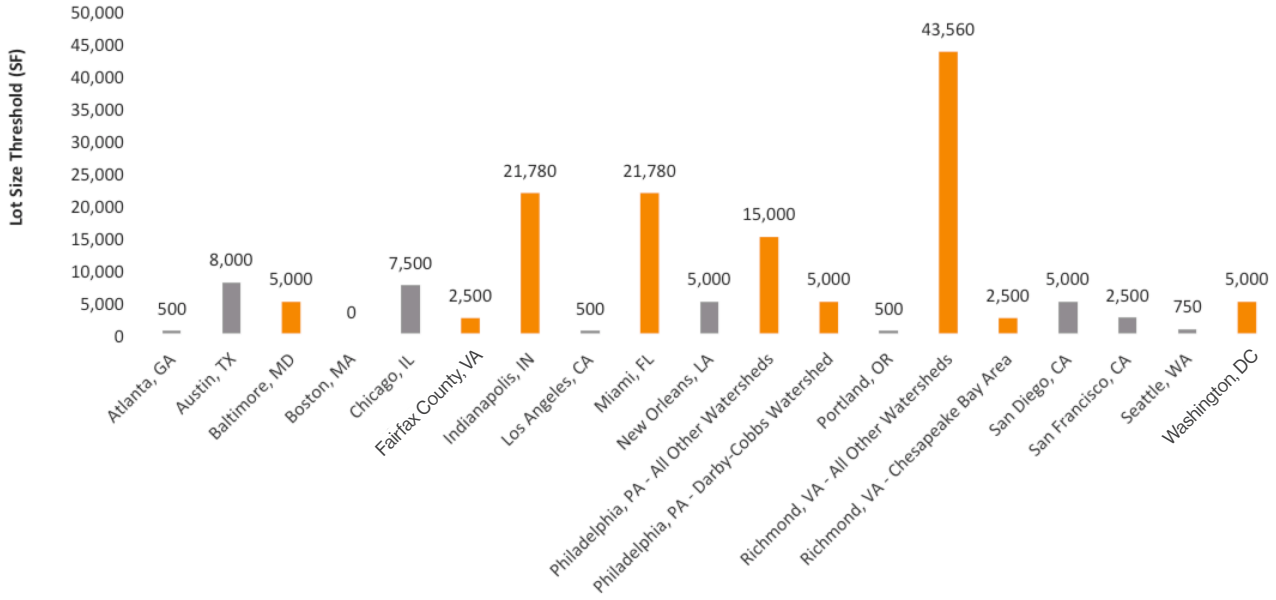
The EPA Stormwater Phase II rule on Construction and Post-Construction Site Runoff Control mandates that an operator of a regulated small MS4 develops, implements, and enforces a pollutant reduction program for stormwater runoff from construction activities that result in a land disturbance greater than or equal to one acre (NPDES stormwater permit requirement). The thresholds for the utilities surveyed directly or literature compiled for the construction runoff control requirement (i.e., erosion and sediment control) are summarized in Figure 3-1. Lot Size Disturbance Construction Thresholds. The utilities that require all construction activities include Austin, Los Angeles, Portland, San Diego, San Francisco and Seattle. On the other hand, Atlanta, Boston, Chicago, Indianapolis, and New Orleans use the recommended U.S. EPA Phase 2 Stormwater Guidance of one acre and above for construction runoff control. Richmond (VA) has implemented a 10,000 sq ft. threshold for meeting the construction runoff control requirement. The remaining surveyed utilities use construction thresholds of less than one acre with Baltimore, Fairfax County, Miami and Philadelphia applying the same thresholds for both construction and post-construction runoff control (see **Figure 3-1** below).

Figure 3-1. Lot Size Disturbance Construction Thresholds



The post-construction threshold size was specified based on the extent of soil disturbance within a new or redevelopment site or the increase in impervious cover resulting from new/redevelopment. The interviewed utilities and those reviewed based on available literature used either the new impervious or soil disturbance as thresholds, and Figure 3-2. Lot Size Disturbance Post-Construction Thresholds summarizes these threshold sizes for these utilities. Several observations were made from the responses on threshold size.

Figure 3-2. Lot Size Disturbance Post-Construction Thresholds



Grey bars indicate impervious area creation threshold, Orange bars indicate soil disturbance area threshold

As shown in **Figure 3-2. Lot Size Disturbance Post-Construction Thresholds**, the selection of minimum post-construction thresholds varies significantly among cities of varied sizes and program development levels with respect to stormwater management in MS4 areas, including some with as high a threshold as one acre.

Most of the interviewed utilities or those with compiled literature have implemented a smaller than one-acre post-construction threshold, which refers to the condition that necessitates the permanent application of the stormwater control requirement for a property after construction (e.g., creation of XX sq. ft. of new impervious area, soil disturbance of YY sq. ft. during construction, etc.). This threshold is reported in Figure 3-1. Some cities such as Portland and Los Angeles have a very low threshold for their stormwater management programs (500 sq. ft.), and other cities such as Philadelphia have higher thresholds (15,000 sq. ft.), even for priority watersheds (5,000 sq. ft.). Additional utilities contacted by DEP have the following minimum thresholds:

- City of Miami and Indianapolis - half-acre,
- New Orleans – 5,000 sq. ft.,
- Fairfax County - 2,500 sq ft., and
- Richmond (VA) - one acre or 2,500 sq ft. for developments in the Chesapeake Bay Preservation Area.

While Portland has a low threshold of 500 sq ft., the permitting and inspections are done through a self-certification process for single family residential homes. Boston does not have a minimum soil disturbance threshold, indicating that every new or redevelopment project requires a construction permit. On the other hand, Boston does not have a post-construction (inspection) requirement at this time, that reduces the administrative burden significantly. Therefore, the selection of minimum thresholds seems to vary significantly among cities of different sizes and varying maturity levels with respect to stormwater management in MS4 areas, with some even with as high a threshold as one acre.

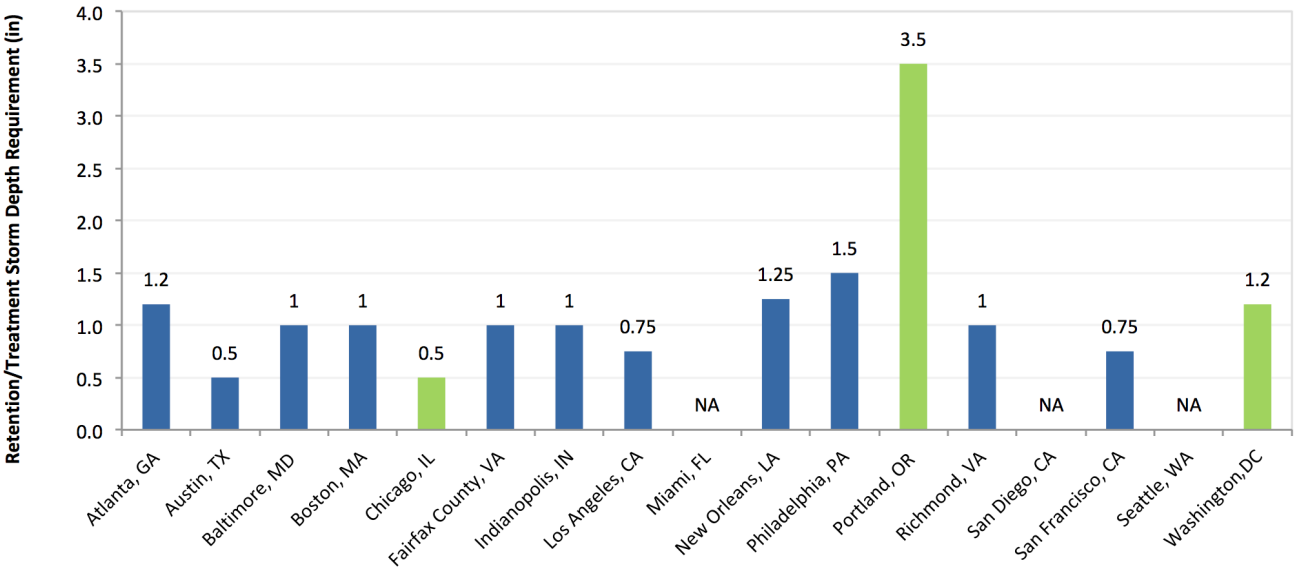
DEP was also interested in whether the utilities with combined and separately sewered systems have different permit requirements for these two systems. Most of the utilities have the same performance standards and administrative requirements for both systems. However, some utilities such as Philadelphia, Portland, and San Francisco each impose requirements that differ between combined and separate areas for certain criteria. San Francisco has the same retention standard for combined areas and for large MS4 areas (>5,000 SF), and a less stringent standard for smaller MS4 areas (2,500-5,000 SF). Philadelphia has different infiltration volume requirements for combined and MS4 areas (i.e., 20% of directly connected impervious area to be routed through volume reduction stormwater management practice (SMP) in combined areas, whereas 100% of water quality control volume to be routed through infiltrating or treatment SMPs in MS4 areas). Similarly, Portland has different allowable discharge rates for the combined and MS4 areas (i.e., maintenance of pre-development rates for 2, 5 and 10-year 24-hour storms in all areas, whereas half the pre-development rates for 2-year 24-hour storm for areas that drain into waterways directly or MS4 outfalls to prevent channel erosion).

3.1.2 Stormwater Retention Volume Standard

The stormwater management or control volume standard specifies the extent of stormwater volume to be managed from disturbed areas (whether new impervious cover or soil disturbance area) with stormwater control measures (SCM). This volume standard can be adopted from state guidelines or developed to meet specific water quality improvement levels of service sought by individual utilities. It is often referred to as water quality volume (WQv).

Figure 3–3 depicts the distribution of rainfall depths used to compute WQv volumes as defined by each municipal utility. East coast utilities such as Boston and Philadelphia had a WQv in the range of 1 to 1.5 inches, which is typically the 90th percentile storm based on historical analysis of local precipitation records. San Diego and Seattle did not adhere to a uniformly applied volume value, instead defining their WQv requirements based on the 85th and 91st percentile storms, respectively, around the stormwater management asset.

Figure 3-3. Retention/Treatment Storm Depth Requirement



Blue bars indicate retention and/or treatment requirement, **Green bars** indicate retention requirement -- treatment not an allowed alternative

Potential soil and space constraints can limit the implementation of retention-based stormwater controls. This is particularly relevant to dense urban areas with compacted soils or underlying soil with poor permeability. It is important to recognize the soil and space constraints for SCM implementation and develop alternative compliance measures to achieve the same water quality improvement goals. One of the questions in the utility survey focused on whether the utilities offered alternative compliance strategies when individual lots have soil and/or space constraints. Some utilities (e.g., San Francisco, Portland, and Philadelphia) have developed a stormwater management hierarchy that requires retention and water reuse whenever possible, and provides detention and treatment of stormwater as secondary options.

Most utilities who participated in the survey offer alternative measures for sites that may not be able to meet the stormwater management requirements in the forms of in-lieu fees and offsite mitigation options.

The alternative measures are in the form of in-lieu fee (penalty for not implementing an SCM so that the money can be used to implement SCM in another feasible lot), offsite mitigation (implementation of SCM in another feasible lot to compensate for not being able to implement at the site seeking a permit), or stormwater credit (similar to a trading model, where credits are created for implementation of SCMs and the site not being able to implement SCMs can buy credits from other lots that have already implemented more-than-required SCMs to create a credit).

These allowances tend to be awarded on a case-by-case basis, and usually the site needs to demonstrate an inability to infiltrate the necessary volume that would preclude it from offering stormwater management potential. summarizes the options allowed by different utilities. An "X" for a measure indicates that this option is not offered by the utility and NA indicates that there was no reference as to whether this option was allowed or not.

Table 3-1. Alternative Compliance Measures

Utility Name	In-lieu Fee	Offsite Mitigation	Stormwater Credit
Atlanta	X	✓	✓
Austin	✓	✓	NA
Baltimore	✓	✓	✓
Boston	X	X	X
Chicago	X	X	X
Los Angeles	X	✓	NA
Philadelphia	✓	✓	✓
Portland	X	✓	NA
San Diego	✓	✓	✓
San Francisco	✓	✓	NA
Seattle	X	NA	✓
Washington, DC	X	NA	✓

Boston and Chicago were the only cities that strictly adhere to on-site stormwater management regulations. Both Seattle and Washington, DC did not explicitly state as to whether they would accept in-lieu fees or offsite mitigation, but they do utilize a stormwater credit system that offers some flexibility for developers to meet the stormwater management regulations.

3.2 Resource Utilization

This is a key consideration for a utility for overall management of the permits and inspections that need to be administered for a given threshold size. As the number of permits and inspections increase with smaller threshold sizes, more staff resources are needed to manage them effectively and efficiently. This consideration was sought in the questionnaire to peer utilities and the specific metrics requested are discussed below.

3.2.1 Staffing Allocation

Most utilities have different departments (e.g., Department of Public Works or Stormwater Programs or Buildings and Inspections) for review and approval of permits for construction requirements and for inspections after construction and long-term operation and maintenance. The utility survey focused on contacting these different departments to get a holistic picture of staff allocation and administration.

Table 3–2. Number of Staff Performing Permit Reviews and Inspections presents the number of staff performing permit reviews and inspections. The number of staff utilized for review during construction varies significantly, from 1-2 staff dedicated to reviews and inspections in Boston to as many as 33 dedicated staff in Atlanta, with mostly engineers performing the permit reviews. There is also a wide range in the number of inspection staff for post-construction. Some utilities such as Boston do not currently have an inspection program, so there is no dedicated staff for inspections, whereas Washington, DC and Seattle have more than 10 dedicated inspection staff.

Table 3–2. Number of Staff Performing Permit Reviews and Inspections

Utility Name	Construction Related	Post-Construction Related
Atlanta	• 33 full-time equivalents (FTEs) dedicated to implementing SWMP	• 33 FTEs dedicated to implementing SWMP
Austin	• No response given	• No response given
Baltimore	• Five staff doing both reviews and inspections	• Five staff in addition to review staff
Boston	• 1-2 for reviews and inspections • 2-3 for review of site plans for new development projects	• None specifically for inspections
Chicago	• Three Stormwater Reviewers (consultants) + Six Mason Inspectors (sewer inspectors)	• Three Stormwater Reviewers (consultants) + Six Mason Inspectors (sewer inspectors)
Los Angeles	• No staff dedicated- City does not inspect GI on a regular basis, but initial inspection is carried out during Certificate of Occupancy review	• Inspections of construction BMPs (conducted by Sanitation Department): Five staff including one supervisor, plus time contributed by Public Works and Building and Safety Departments (FTE estimate not known by respondent)
Philadelphia	• Four FTE conceptual review staff, Seven FTE technical review staff, 5-6 FTE Active construction inspection group, Four FTE Data analysis/Project Tracking support group.	• Consultant augmentation for review and inspection (Six Consultants), in addition to the City Staff.
Portland	• 8-10 staff from Bureau of Development Services (BDS) do permit and design reviews • Four more staff provide early assistance in preparing the permit applications. • Five more staff for public projects. • 8-10 more engineers in Bureau of Environmental Services Engineering Services Division to support the review. • Six staff positions do construction phase inspections. Those staff do both Inspection and review, and rotate duties.	• Inspections: Eight FTE + periodic inspection involvement by BES staff • Inspections of large commercial/industrial projects (occur every three years): 1.5 FTE • Additional as-needed support from contractors: 1-2 FTE

Utility Name	Construction Related	Post-Construction Related
San Diego	• 4-6 stormwater pollution prevention plan - SWPPP/Water Pollution Control Plan reviewers for City projects • 4-6 for City projects and grading on private developments	• For private project review, One Senior Engineer, three Associate Engineers, and three Assistant/Junior Engineers. • For City project review, one Assistant Engineer and four consultants.
San Francisco	• Two FTE Staff	• Stormwater control plan review: 2.5 FTEs • Coordination of post-construction inspection: 1.5 FTE • Construction permit-related work: One FTE • Inspections carried out by Department of Building Inspections: 18 (one per zone) + two senior management staff
Seattle	• No response given	• Building inspections: 10 (one per region), plus 2-3 management staff • SWPPP and design reviews: Additional staff as-needed (FTE estimate not provided)
Washington, DC	• Two staff at permit office performing erosion and sediment control (E&SC) reviews • 12-15 in-house staff for full reviews (including post-construction) • 2-3 consultant staff assisting in full reviews (including post-construction)	• 12 staff performing inspections

Table 3-3. Departments/Contractors Involved In/Tasked with Permit Reviews and Inspections details the departments and contractors (if applicable) involved in or tasked with permit reviews and inspections. While some cities such as Boston, Portland, and Seattle concentrate permit reviews and inspections within only one or two departments, other cities such Los Angeles, Philadelphia, and San Diego involve at least three departments in permit review and inspection tasks. This was partly the reasoning for not being able to obtain complete responses to the questionnaire, as the staff from different departments who were responsible for administrative aspects were not present during the telephone interviews.

Table 3-3. Departments/Contractors Involved In/Tasked with Permit Reviews and Inspections

Utility Name	Construction Related	Post-Construction Related
Atlanta	• Department of Watershed Management	• Department of Watershed Management
Austin	• Watershed Protection Department	• Watershed Protection Department
Baltimore	• Department of Public Works	• Department of Housing and Community Development (HCD) • Department of Planning • Department of Public Works (DPW).
Boston	• Boston Water and Sewer Commission	• Boston Water and Sewer Commission
Chicago	• Department of Buildings (consultant stormwater reviewers) • Department of Water Management (mason inspectors)	• Department of Buildings (consultant stormwater reviewers) • Department of Water Management (mason inspectors)
Los Angeles	• Department of Sanitation • Department of Public Works – Bureau of Contract Administration	• Department of Sanitation • Department of Public Works – Bureau of Contract Administration • Department of Building and Safety Inspection

Utility Name	Construction Related	Post-Construction Related
Philadelphia	• Philadelphia Water Department	• Philadelphia Water Department
Portland	• Bureau of Environmental Services • Bureau of Development Services	• Bureau of Environmental Services • Bureau of Development Services
San Diego	• Public Works Department - Construction Management & Field Services • Development Services Department (either Drainage & Grades section, Storm Water section, or Utilities Section) reviews the SWPPP/WPCP for private projects depending on project type.	• The City's Storm Water Division (Construction & Development Standards section) • Each asset owning department maintains structural best management practices - BMPs (Public Utilities, libraries, fire stations, etc). • The Storm Water operations and maintenance (O&M) division maintains structural BMPs on park parcels and in the right-of-way. • Development Services Department conducts reviews for private development projects.
San Francisco	• Port of San Francisco • San Francisco Public Utilities Commission	• Stormwater regulations: Port of San Francisco or San Francisco Public Utilities Commission (jointly) • Utility inspections: Department of Building Inspections
Seattle	• Seattle Public Utilities • Review and permitting for lots >1 acre: Department of Ecology (state)	• Seattle Public Utilities • Seattle Department of Construction and Inspections
Washington, DC	• DC Water for Combined areas • District Department of Environment (DDOE) for MS4 areas	• DC Water for Combined areas • District Department of Environment (DDOE) for MS4 areas

3.2.2 Production Using Given Resources

The survey also requested information from utilities on how many permits/inspections were performed to get information on the production aspects. This information can be used to guide the number of staff members needed for New York City's program based on the chosen threshold size.

Fewer responses were received for the number of permit reviews and inspections performed over the given period and the average time spent on SWPPP reviews by the permit reviewer. Therefore, any conclusions regarding trends between utilities could not be drawn. However, the responses received present some interesting points for consideration. As far as permit application reviews, the economic downturn affected the number of projects being constructed and therefore the number of permits reviewed in Portland. As far as the average time spent on SWPPP reviews, all respondents note that it depends on the complexity of the project. However, Portland has also indicated that incorporating a web-based interface has increased the speed of the review process. **Table 3-4** details the number of permit reviews and inspections performed over the given period and **Table 3-5** provides the average time spent on SWPPP reviews by the permit reviewer, who is usually an engineer, planner, or architect.

Table 3-4. Number of Permit Reviews and Inspections Performed

Utility Name	Construction Related	Post-Construction Related
Atlanta	• 5,283 Site Plan Reviews Conducted (2016 Annual MS4 Report)	• 47 Inspections of Industrial Facilities (2016 Annual MS4 Report) • 14,087 Construction Sites Inspections (2016 Annual MS4 Report) • 59 Highly Visible Pollutant Source Facilities Inspected (2016 Annual MS4 Report)
Austin	• 1,754 Site Development Plans Reviewed (Fiscal Year 2015)	• 455 Inspections by Stormwater Discharge Permit Program (Fiscal Year 2015) • 20,824 Inspections by Environmental Inspection Program (Fiscal Year 2015) • 156 Inspection by On-site Sewage Facility (Fiscal Year 2015) • 866 residential and 1,322 commercial water quality and detention ponds by Watershed Protection Department (Fiscal Year 2015)
Baltimore	• 130 Concept Plans Received (Fiscal Year 2015) • 94 Site Development Plans Received (Fiscal Year 2015) • 2,164 Inspections of ESD treatment practices and stormwater management facilities during construction phase (Fiscal Year 2015)	• 211 Inspections of ESD treatment practices and structural stormwater management facilities as preventive maintenance inspections (Fiscal Year 2015)
Boston	• ~480 Site Plans Reviewed	• None - BMPs inspected following construction, but not regularly inspected after construction
Chicago	• 250 to 300	• 300 to 500 inspections performed by stormwater reviewers
Los Angeles	• No response given	• No response given
Philadelphia	• 1,400 Reviews total (conceptual, post construction stormwater management plan, Erosion and Sediment Control, and record drawing reviews combined) • 650 reviews performed for PCSM. Most projects undergo 3-5 reviews before they are approved. • Active construction projects may be inspected as frequently as once/week or more during SMP installation	• Since 2011, performed over 3,100 inspections per year. Of that, 200 (6%) are post-construction inspections.
Portland	• Before recession: 100-150/year for projects over 500 sq. ft. • After recession: 25/year (average)	• Green streets (public right-of-way): 1,700 facilities inspected 4 times per year. • Private facilities: 1,340 facilities at 645 properties were inspected during fiscal year 2015 (does not currently included single-family residential).
San Diego	• No response given	• In Fiscal Year 2015, 339 projects that required structural BMPs were approved. Number of construction inspections depend on whether construction takes place during the wet or dry season and the disturbance area of the project, ranging from weekly, biweekly, monthly to as-needed.
San Francisco	• FY 2014 – 38, FY 2015 - 26	• Over 100 approved projects and associated inspections on a 3-year cycle (approx. 25% of final projects in the MS4 area, rest in combined areas)
Seattle	• No response given	• No response given
Washington, DC	• 3,775 in 2015 (of which ~200 include post-construction controls)	• In 2015: 1,085 for projects including post-construction controls and 1,150 for E&SC

Table 3-5. Average Time Spent on SWPPP Reviews

Utility Name	Construction Related
Atlanta	• No response given
Austin	• No response given
Baltimore	• No response given
Boston	• 0.5 Days for SWPPP (Site plan could take longer depending on complexity of site)
Chicago	• 5 to 10 business days to review a submittal • Typically, three rounds of reviews plus the final approval takes 6-10 weeks, depending mostly on the responsiveness of the designer.
Los Angeles	• Depends on the project. Some projects have taken up to a week for review.
Philadelphia	• Approximately 36 hours in PCSM Review total per project. • All projects reviewed within 15 days of receipt (five days for expedited review).
Portland	• Depends on the project.
San Diego	• 1-3 hours depending on project size, submittal quality, and reviewer experience.
San Francisco	• 3 -5 days depending on complexity of the plan
Seattle	• No response given
Washington, DC	• Current average of 34 days per review round (target of 30 days)

The economic downturn affected the number of projects being constructed and the number of permits reviewed in Portland. As far as the average time spent on SWPPP reviews, all respondents noted that it depends on the complexity of the project. However, Portland also indicated that incorporating a web-based interface had increased the speed of the review process.

Table 3-6. Level of Automation/Web Interfacing in the Permit Application Process describes the level of automation and online interfacing each utility has in its permit application process were also reviewed. Portland has an electronic application process, and both Philadelphia and Washington, DC utilize similar web-based processes to accelerate the review process and ease some of the administrative burden. San Francisco allows for electronic submission of some applications, and Chicago offers a stormwater detention calculation tool for developers to use in developing their applications. However, most utilities still work with print-based applications.

Table 3-6. Level of Automation/Web Interfacing in the Permit Application Process

Utility Name	Construction Related
Atlanta	• No automation
Austin	• No automation
Baltimore	• No automation
Boston	• No automation
Chicago	• Yes, spreadsheet Tool provided via website for aid in calculating required stormwater detention
Los Angeles	• No response given
Philadelphia	• Yes, customized online application and applicant login. All technical guidance is web based.
Portland	• Yes, web-based interface for permit application preparation
San Diego	• No automation
San Francisco	• No automation, but Construction Runoff Permit Application and E&SC Plan can be submitted electronically, Construction Runoff Permit can be filled in online in PDF form
Seattle	• No automation
Washington, DC	• Yes all projects must use online Stormwater Database (including standalone E&SC), and DDOE provides a compliance calculator spreadsheet for developer use

3.3 Administrative Costs

The indicators for administrative costs included the number of staff to manage permits, perform construction permit inspections and post-construction periodic inspections, as well as the number of permits/inspections handled and the departments/municipal jurisdictions that manage the permitting and inspections. Full-time salary and benefits of permitting/inspection staff and the supervisors' time increase significantly with smaller threshold sizes due to the large number of permits/inspections involved. Considering the minimal water quality improvement associated with smaller threshold sizes, the overall cost-benefit comparison needs to include both technical costs for implementation of SCMs by property owners and the administrative costs for utility staff to administer them.

Based on the survey responses, it was observed that mature stormwater management programs have a larger number of staff as well as dedicated funding mechanisms (e.g., stormwater utility, component stormwater bill to customers, etc.), whereas the newer programs are still establishing the staffing and funding needs.

Compliance cost to the developer/owner includes the total permit fee and cost of stormwater control measures. Since this overall cost depends on the size of the project, the number of inspections required during construction and post-construction, soil type that will guide the type of feasible control measures, and other preferences of developer/owner such as the LEED certification. Therefore, utility-specific compliance costs were unavailable from this utility survey.

Administrative costs must be recovered through appropriation of additional budget to the permitting/inspection operations (thereby increasing the financial burden on the utility) or through full-cost recovery with permitting/inspection fees charged to the property owners. One of the survey questions focused on whether specific utilities adopted financial models based on discussions with ratepayers and elected officials.

The fees charged for stormwater management applications, reviews, and inspections vary as shown in Table 3-7. Fees Charged for Stormwater Management Applications, Reviews, and Inspections. Most utilities have fees for construction review, but do not have post-construction inspection fees. Fees range from no fee in San Francisco, where stormwater fees are included as part of the regular water and sewer fees; to Los Angeles, where there is a city fee for construction and only a state fee for post-construction; to over $10,000 for a combination of several different fees in Washington, DC.

Table 3-7. Fees Charged for Stormwater Management Applications, Reviews, and Inspections

Utility Name	Construction Related	Post-Construction Related
Atlanta	• No specific stormwater fee in Land Development Permit application	• No post-construction inspection fees
Austin	• Street and Drainage Full Development Application - $1,796.40. • Initial permit fee is in the $4,000-6,000 range for residential and increases for commercial	• No post-construction inspection fees
Baltimore	• Initial plan review - $500; • Permit fee - $2,500 to $8,000 by DPW	• No post-construction inspection fees
Boston	• No specific stormwater fee, generic application fee applies	• Fees vary by type of inspection, as seen in Exhibit C – Special Service Fee Schedule in 2015 Rate Document
Chicago	• $1,000 stormwater review fee (developments <50,000 sq ft) • $3,000 stormwater review fee (developments >50,000 sq ft)	• Fees vary by type of inspection, as seen in 2005 Sewer Permit Requirements and Fees document
Los Angeles	• Single-family residential: $204 (starting) • Industrial, commercial, multi-family residential (greater than 5 units): $1,000 (starting)	• City doesn't charge separately, but there is a State fee for post-construction inspection.

Utility Name	Construction Related	Post-Construction Related
Philadelphia	• Conceptual SWMP review and approval: $600 • Post Construction SWMP: $600 + $90/hour for review	• No post-construction inspection fees
Portland	• Fee: $715	• Commercial Stormwater Facility Inspection Fee - $473 • Additional fees listed in 2015-2016 Sewer and Drainage Rates and Charges
San Diego	• No fee for public project review • Private development projects subject to fees as per Bulletin 501 (January 2016)	• Stormwater high-priority inspection: $240 (covers the first four) • Additional: $240 (each)
San Francisco	• None at this time	• None at this time (no stormwater fees); included as part of water/wastewater fees • Review fee to recover some of the program costs is currently in development
Seattle	• $95 minimum fee for drainage review, additional fee at $190 hourly rate	• No post-construction inspection fees
Washington, DC	• Range of fees based on review type (E&SC, SWMP, etc.), stage of review, and land disturbance area	• No post-construction fees

Another consideration that was of interest to DEP was whether the utilities imposed surcharges or additional fees for expedited review of permit applications documented on Table 3-8. Presence of an Expedited Review Process and Additional Fees Charged for an Expedited Review. Of the utilities surveyed, only Los Angeles and Philadelphia have a formal expedited permit review process and additional fees charged for an expedited review. While Los Angeles requires a higher cost for an expedited review, Philadelphia offers it as an incentive depending on the SCMs used.

Table 3-8. Presence of an Expedited Review Process and Additional Fees Charged for an Expedited Review

Utility Name	Construction Related
Atlanta	• No process
Austin	• No process
Baltimore	• Not currently, but expedited review process for small restoration projects is being explored
Boston	• No process
Chicago	• Yes – "Green Permit Process" • Additional cost not given
Los Angeles	• Yes- expedited timeframe for review offered if surcharge fee paid • Fee is a surcharge of 50% on the regular fee
Philadelphia	• Yes- Disconnection Green Review and Surface green Review • No additional costs; expedited review is one incentive offered based on the type of BMP used
Portland	• No formal process for expedited review
San Diego	• Yes – "Express Plan Check" • Additional cost not given
San Francisco	• None, but special request by involved properties can be accommodated. • Additional cost not given
Seattle	• No response given
Washington, DC	• Only for special District projects (e.g., DC Water) • Additional cost not given

4.0 Conclusions

The responses gathered from 12 interviewed utilities represent stormwater management programs in various stages of development and implementation. The findings also indicated that there is a wide variation among the responding utilities in the administration of stormwater management and the performance standards that developers are required to follow. Some programs are mature (more than 10 years old) and efficiently manage the permitting and inspections, while others are in the early to mid-stages of the program with evolving staffing and financial resources.

In addition to the 12 interviewed utilities, DEP has been communicating with five other utilities for CSO and MS4 permitting programs. These utilities included Richmond VA, Fairfax County VA, Indianapolis IN, Miami FL, and New Orleans LA. Arcadis team also compiled information from its major clients across the country.

Most utilities establish performance standards for stormwater management to address their water quality and watershed-based (e.g., TMDL or healthy streams) requirement needs. Peak flow mitigation, WQv, and detention performance standards are developed to achieve these goals. Some utilities offer a tiered approach to the developer community, in which retention is the highly preferred strategy, and detention or connection to combined sewers is the least preferred strategy and only an option when retention or treatment-based controls are infeasible. WQv typically ranged from 1.2 to 1.5 inches.

Both construction and post-construction thresholds vary significantly among cities of varied sizes and program development levels with respect to stormwater management in MS4 areas. Construction stormwater runoff threshold varies from all activities (Austin, Los Angeles, Portland, San Diego, San Francisco and Seattle) to one acre (Atlanta, Boston, Chicago, Indianapolis, and New Orleans) with a number of utilities in-between (e.g., Richmond VA with 10,000 SF). Baltimore, Fairfax County, Miami and Philadelphia use the same thresholds for both construction and post-construction runoff control.

The minimum post-construction stormwater runoff threshold based on soil disturbance or increase in impervious cover ranges from no-minimum value for Boston to one acre for Richmond (outside Chesapeake Bay Area) with most of the interviewed utilities using a smaller than one acre threshold based on local needs and priorities. Some utilities have low threshold requirements for post-construction, but they allow self-certification by single family residential thereby reducing their administrative workload significantly. Philadelphia for Darby Cobbs watershed and Richmond for Chesapeake Bay Preservation Areas have different thresholds for the rest of their respective communities to meet their specific watershed-based requirements.

Most utilities that have combined and MS4 areas have chosen the same minimum threshold for stormwater controls. Some utilities (e.g., Philadelphia and San Francisco) have developed specific provisions for combined and MS4 areas.

Even though this questionnaire was primarily aimed at on-site projects, one of the questions focused on the right-of-way (ROW) stormwater control from a standpoint of watershed-based pollutant sources mitigation. Most utilities follow the national guideline of >1 acre for ROW projects. Some utilities have developed policies and associated performance standards for ROW projects (e.g., Portland's Green Street policy developed in 2007 to reduce flows and pollutant loads from over 60% of the city's stormwater that was estimated to be generated from ROW and adjacent private driveways).

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- City of Richmond (VA), Chesapeake Bay Preservation Program, Public Information Manual, Adopted in March 2009.
- City of Richmond (VA), Stormwater Management Design and Construction Standards Manual, Department of Public Utilities, July 2012.

Attachment A

The blank questionnaires for construction and post-construction related criteria circulated to and discussed with various municipalities are shown in the following two tables.

	Construction Related	City 1	City 2
Technical Criteria	Retention Citerion		
	Water Quality (WQv) Criterion		
	Public Right of Way		
	Detention (Peak Discharge Reduction) Criterion		
	Extreme Storm		
	Erosion and Sediment Control Plan/SWPPP Requirement		
	Offsite alternative (Offsets, trade credits, etc.)		
	Watershed-based Criterion (Geomorphology, TMDL, Instream Erosion Control, etc.) - Please specify		
	Existence of variance opportunities (waviers, offsite alternatives, in-lieu fees, etc.)? If so, briefly describe the process (distinguish those allowed "by-right" and those require special approval).		
Administrative Criteria	Number of Reviews performed Per Year		
	Number of Staff Performing Reviews (in-house or contractor)		
	Number of Staff Performing both Reviews and Inspections		
	Any automation in permit application (e.g, eNOI, customized online applications)		
	Municipal Department tasked with Reviews and Inspections, or Private if conducted by contractors		
	Fees charged for stormwater management applications, reviews, and inspections		
	Provision of waiver for post-construction BMP Requirement? If so what qualifies for waiver?		
	How many waiver applications per year?		
	Average time spent for SWPP Reviews?		
	Existence of an expedited review process? If so briefly describe the process		
	Additional fees charged for expedited review		
	Type of BMP applied for by developer and cost, if available.		

	Post-Construction Related	City 1	City 2
Technical Criteria	Retention Citerion		
	Water Quality (WQv) Criterion		
	Public Right of Way		
	Difference in criteria for MS4 vs. Combined Areas		
	Detention (Peak Discharge Reduction) Criterion		
	Extreme Storm (Flood Control)		
	Offsite alternative (Offsets, trade credits, etc.)		
	Watershed-based Criterion (Geomorphology, TMDL, Instream Erosion Control, etc.) - Please specify		
	Existence of variance opportunities (waviers, offsite alternatives, in-lieu fees, etc.)? If so, briefly describe the process (distinguish those allowed "by-right" and those require special approval).		
Administrative Criteria	Number of Inspections performed Per Year		
	Number of Staff Performing Inspections (in-house or contractor)		
	Number of Staff Performing both Reviews and Inspections		
	Existence of a Maintenance/ Inspection Checklist		
	Municipal Department tasked with Reviews and Inspections, or Private if conducted by contractors		
	Fees charged for stormwater management applications, reviews, and inspections		
	Provision of waiver for post-construction BMP Requirement? If so what qualifies for waiver?		
	How many waiver applications per year?		
	Type of BMP applied for by developer and cost, if available.		

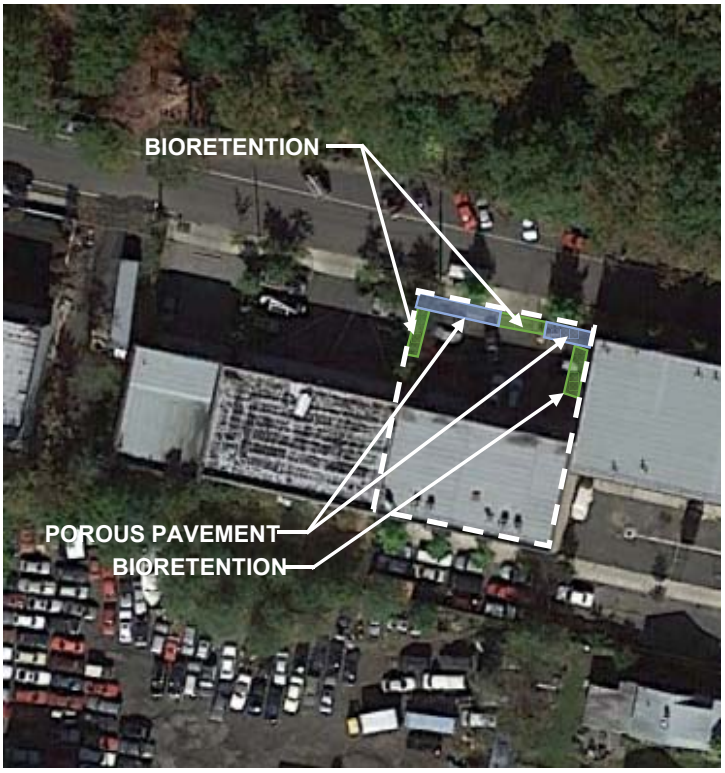
Appendix 6.1 B

Conceptual SCM Designs

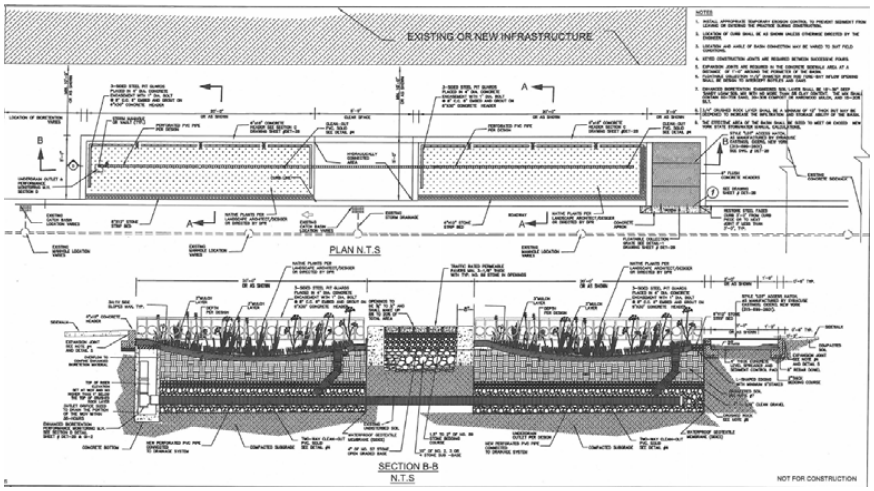
CATEGORY A - INDUSTRIAL PROPERTY

MS4 - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



SITE INFORMATION

Address: 141 Storer Avenue, SI
BBL: 5073110035
Block: 7311
Lot: 35

DESIGN CRITERIA

Area Disturbed: 8,000 sf
New Impervious Area: 8,000 sf
Runoff Volume: 1,000 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 400 sf
SCM Area as % of Total Lot: 5%
Retention Volume: 650 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 460 sf
Impervious Coverage: 6%
Retention Volume: N/A
Detention Volume: 360 cf
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

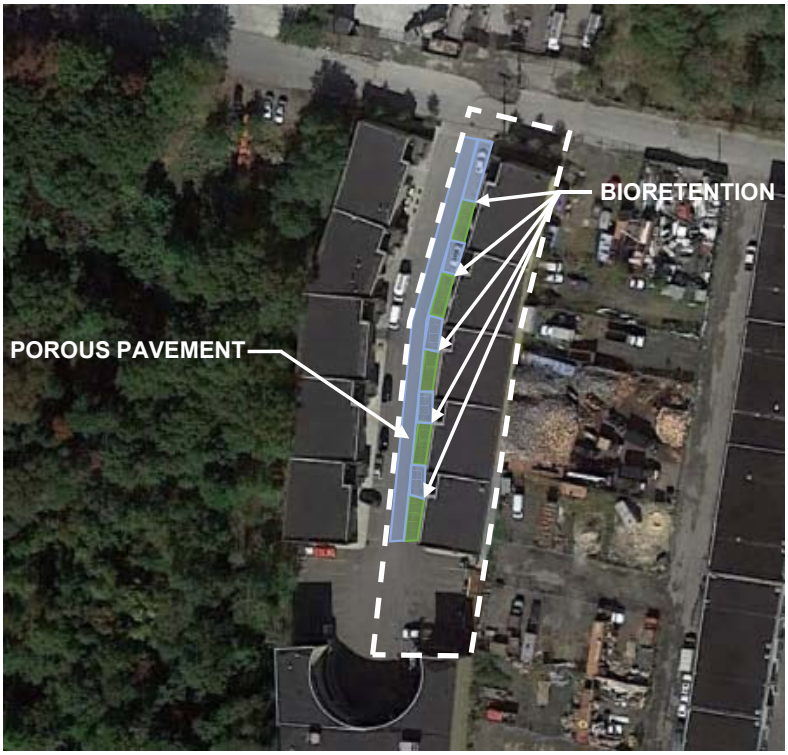
SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 22'L x 6'W x 4'H
22'L x 6'W x 4'H
22'L x 6'W x 4'H
Porous Pave.: 28'L x 6'W x 2'H
48'L x 6'W x 2'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 9" Permeable Paver
10" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

CATEGORY B - INDUSTRIAL PROPERTY

MS4 - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SITE INFORMATION

Address: 11 Brick Ct, SI
BBL: 5074000100
Block: 7400
Lot: 100

DESIGN CRITERIA

Area Disturbed: 27,900 sf
New Impervious Area: 27,900 sf
Runoff Volume: 3,490 cf
Peak Runoff Rate: N/A

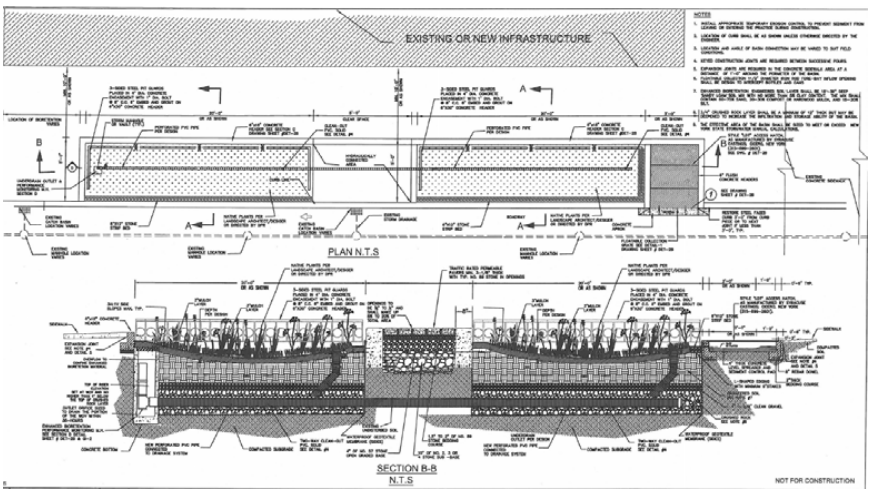
CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 1,620 sf
SCM Area as % of Total Lot: 4%
Retention Volume: 650 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 2,370 sf
Impervious Coverage: 8%
Retention Volume: N/A
Detention Volume: 1,870 cf
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

SCM SCHEMATIC



GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

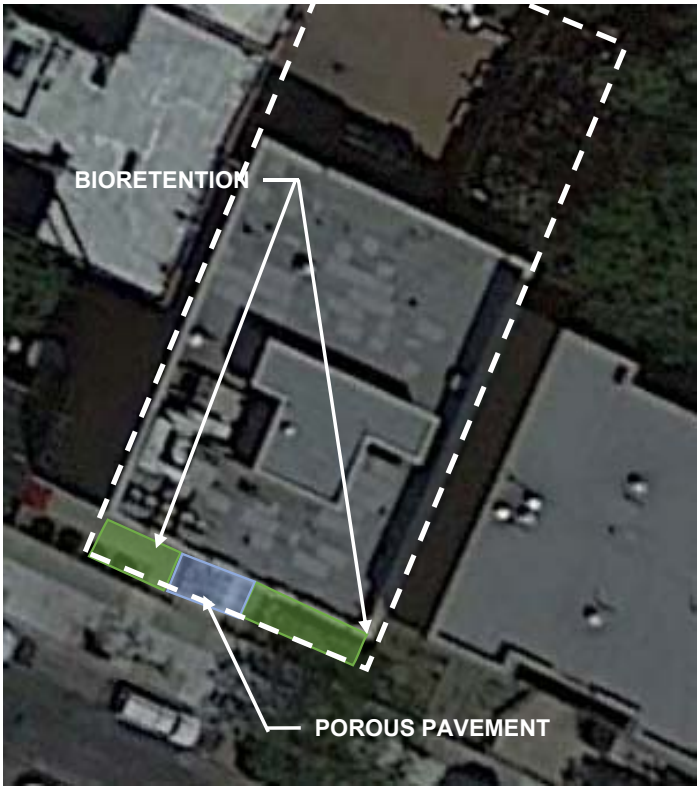
SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 33'L x 6'W x 4'H
33'L x 6'W x 4'H
33'L x 6'W x 4'H
33'L x 6'W x 4'H
33'L x 6'W x 4'H
Porous Pave.: 20'L x 6'W x 2'H
20'L x 6'W x 2'H
20'L x 6'W x 2'H
20'L x 6'W x 2'H
35'L x 6'W x 2'H
280'L x 6'W x 2'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 9" Permeable Paver
10" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

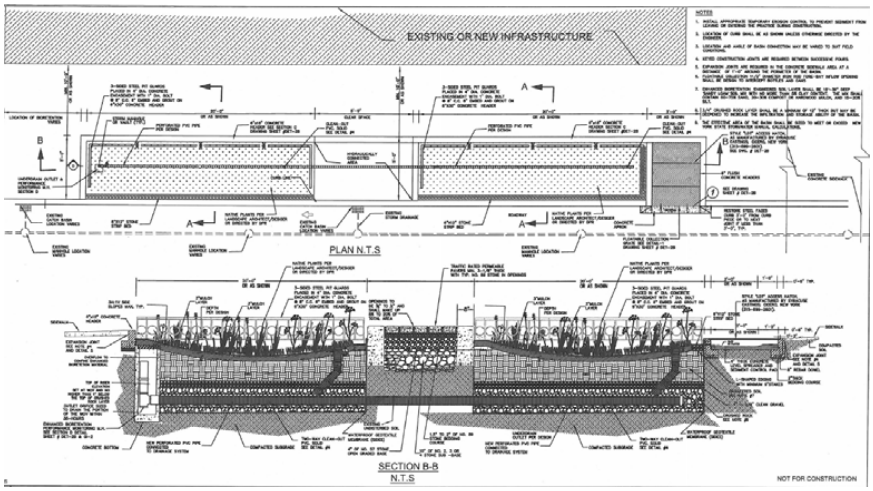
CATEGORY A - COMMERCIAL PROPERTY

MS4 - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



SITE INFORMATION

Address: 141 South 3 Street, BK
BBL: 3024180045
Block: 2418
Lot: 45

DESIGN CRITERIA

Area Disturbed: 7,450 sf
New Impervious Area: 6,710 sf
Runoff Volume: 840 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 400 sf
SCM Area as % of Total Lot: 5%
Retention Volume: 650 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 460 sf
Impervious Coverage: 6%
Retention Volume:
Detention Volume: 360 cf
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

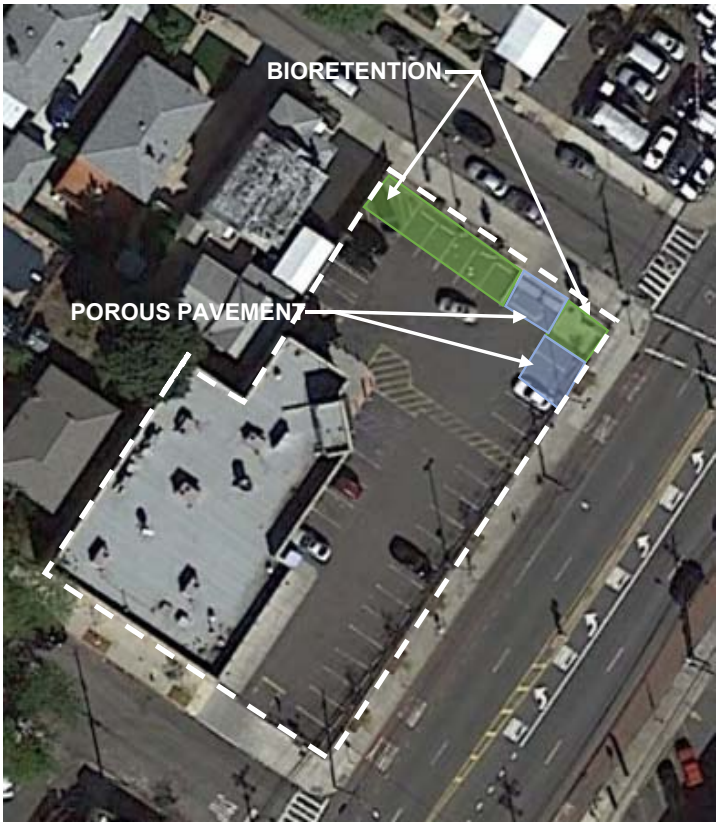
SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 22'L x 9'W x 4'H
17'L x 9'W x 4'H
Porous Pave.: 18'L x 10'W x 4'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 24" Permeable Paver
24" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

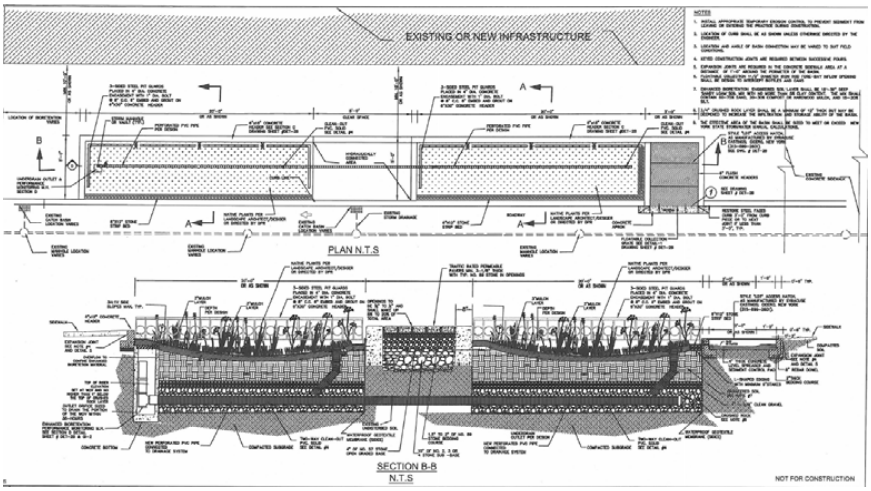
CATEGORY B - COMMERCIAL PROPERTY

MS4 - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



SITE INFORMATION

Address: 1759 Hylan Blvd, SI
BBL: 5033450032
Block: 3345
Lot: 32

DESIGN CRITERIA

Area Disturbed: 21,600 sf
New Impervious Area: 21,600 sf
Runoff Volume: 2,700cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 1,220 sf
SCM Area as % of Total Lot: 9%
Retention Volume: 1,990 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 910 sf
Impervious Coverage: 3%
Retention Volume: N/A
Detention Volume: 710 cf
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

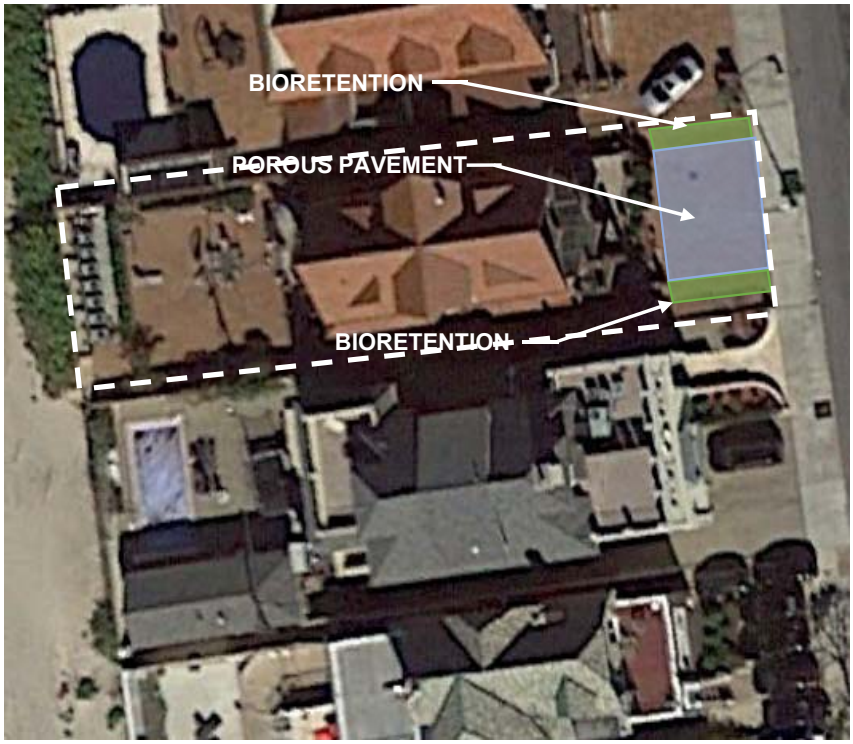
SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 60'L x 16'W x 4'H
16'L x 16'W x 4'H
Porous Pave.: 22'L x 16'W x 2'H
35'L x 16'W x 2'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 9" Permeable Paver
10" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

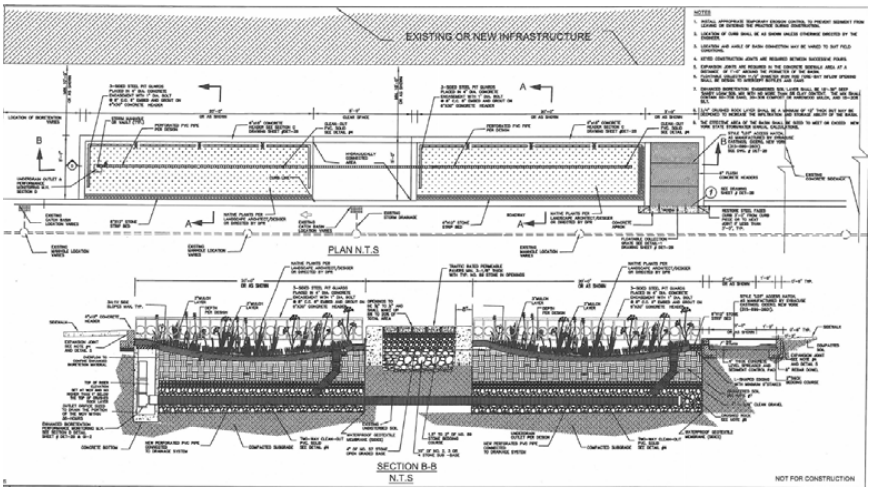
CATEGORY A - RESIDENTIAL PROPERTY

MS4 - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



SITE INFORMATION

Address: 262 Corbin Place, BX
BBL: 3087230267
Block: 8723
Lot: 267

DESIGN CRITERIA

Area Disturbed: 6,440 sf
New Impervious Area: 6,440 sf
Runoff Volume: 804 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 240 sf
SCM Area as % of Total Lot: 4%
Retention Volume: 390 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 560 sf
Impervious Coverage: 9%
Retention Volume: 830 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 20'L x 6'W x 4'H
20'L x 6'W x 4'H
Porous Pave.: 28'L x 20'W x 2'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 9" Permeable Paver
10" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

CATEGORY B - RESIDENTIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SITE INFORMATION

Address: 14 Ottavio Promenade, SI
BBL: 5077750135
Block: 7775
Lot: 135

DESIGN CRITERIA

Area Disturbed: 14,940 sf
New Impervious Area: 6,720 sf
Runoff Volume: 840 cf
Peak Runoff Rate: N/A

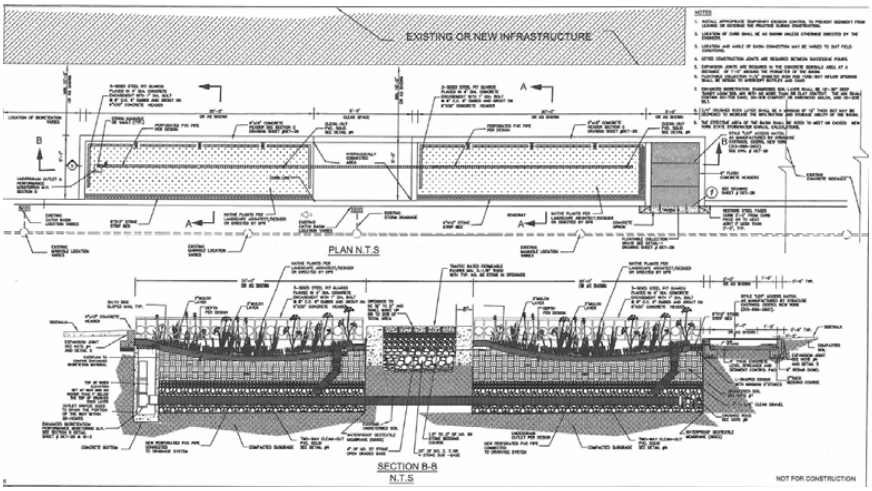
CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 270 sf
SCM Area as % of Total Lot: 4%
Retention Volume: 430 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 530 sf
Impervious Coverage: 8%
Retention Volume: N/A
Detention Volume: 420 cf
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

SCM SCHEMATIC



GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

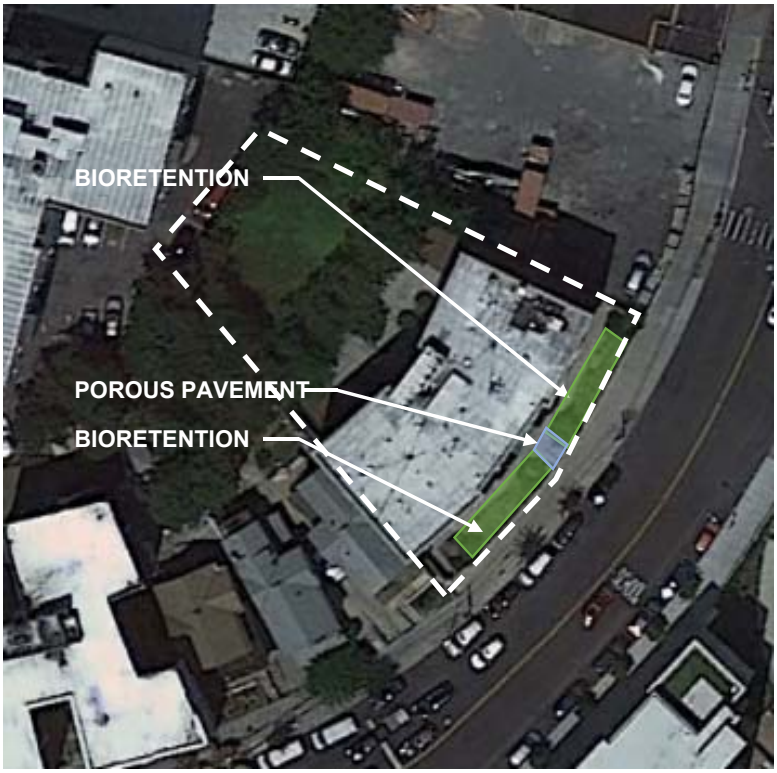
SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 24'L x 11'W x 4'H
Porous Pave.: 24'L x 22'W x 2'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 9" Permeable Paver
10" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

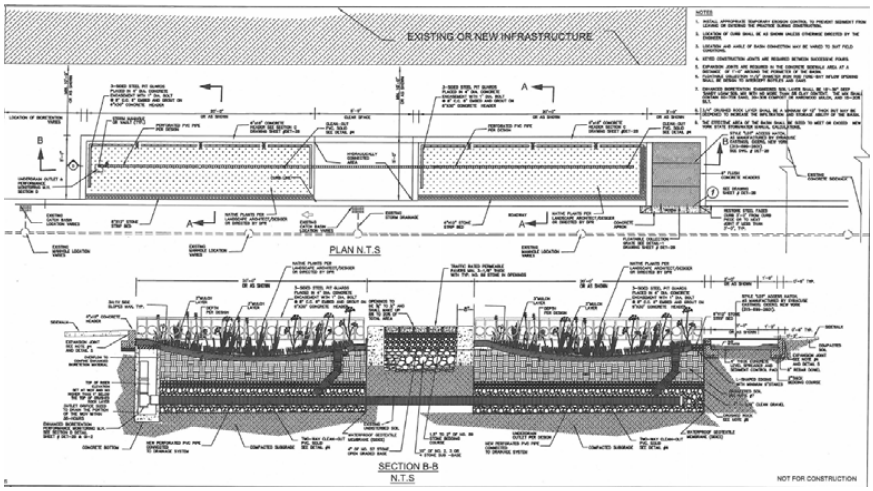
CATEGORY B - INDUSTRIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



SITE INFORMATION

Address: 89 West Tremont Ave, BX
BBL: 2028690047
Block: 2869
Lot: 47

DESIGN CRITERIA

Area Disturbed: 19,150 sf
New Impervious Area: 11,490 sf
Runoff Volume: 1,440 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention w/ UD
SCM Area: 840 sf
SCM Area as % of Total Lot: 7%
Retention Volume: 1,380 cf
Detention Volume: N/A
Treatment Volume: N/A

SCM Practice 2: Porous Pavement Bridge
SCM Area: 100 sf
Impervious Coverage: 9%
Retention Volume: N/A
Detention Volume: 80 cf
Treatment Volume: N/A

Total Runoff Retention: 0%
Total Runoff Detention: 100%
Total Runoff Treatment: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

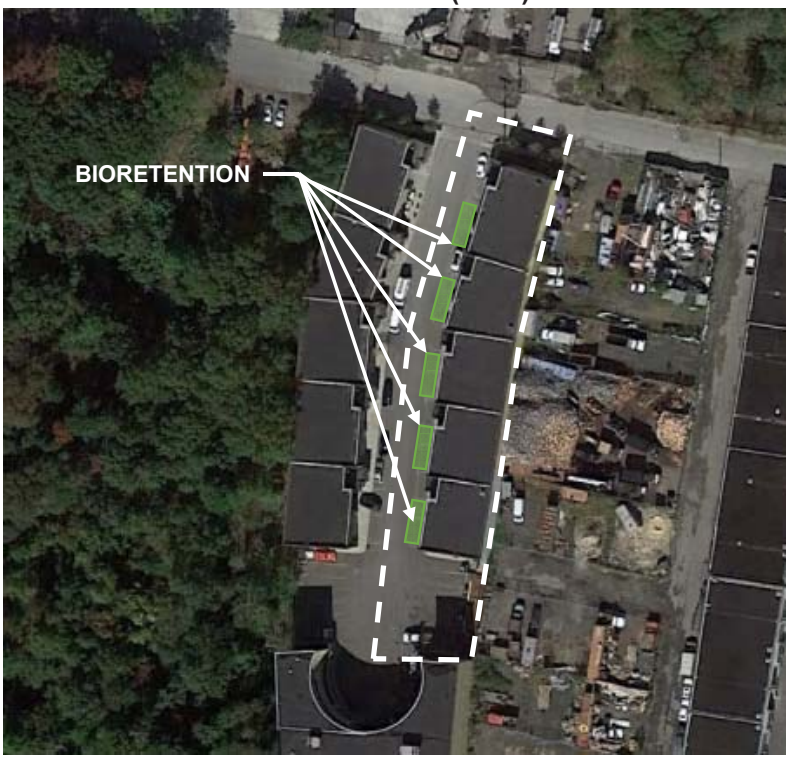
SCM ASSUMPTIONS

Type: Bioretention w/ Underdrain
BR Dim.: 42'L x 10'W x 4'H
42'L x 10'W x 4'H
Porous Pave.: 10'L x 10'W x 2'H
Permanent Pooling: 6"
BR Media Depth: 36" Engineered Soil
12" Open-Graded Stone Base
6" Perforated PVC
Media Porosity: 25 % vol, 33% vol
PP Media Depth: 9" Permeable Paver
10" Open-Graded Stone Base
Media Porosity: 40 % vol, 33% vol

CATEGORY B - INDUSTRIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEAURE (SCM)



SITE INFORMATION

Address: 11 Brick Ct, SI
BBL: 5074000100
Block: 7400
Lot: 100

DESIGN CRITERIA

Area Disturbed: 27,900 sf
New Impervious Area: 27,900 sf
Runoff Volume: 3,490 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 990 sf
SCM Area as % of Total Lot: 4%
Retention Volume: 3,490 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

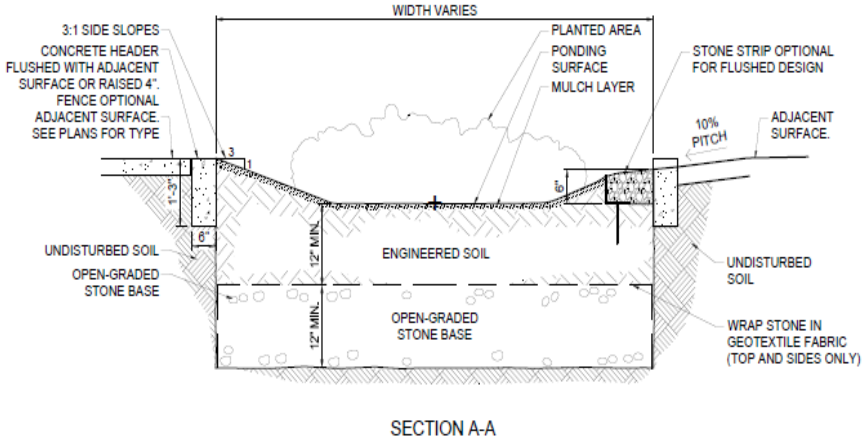
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
SCM Dim.: 33'L x 6'W x 4.5'H
33'L x 6'W x 4.5'H
33'L x 6'W x 4.5'H
33'L x 6'W x 4.5'H
33'L x 6'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC

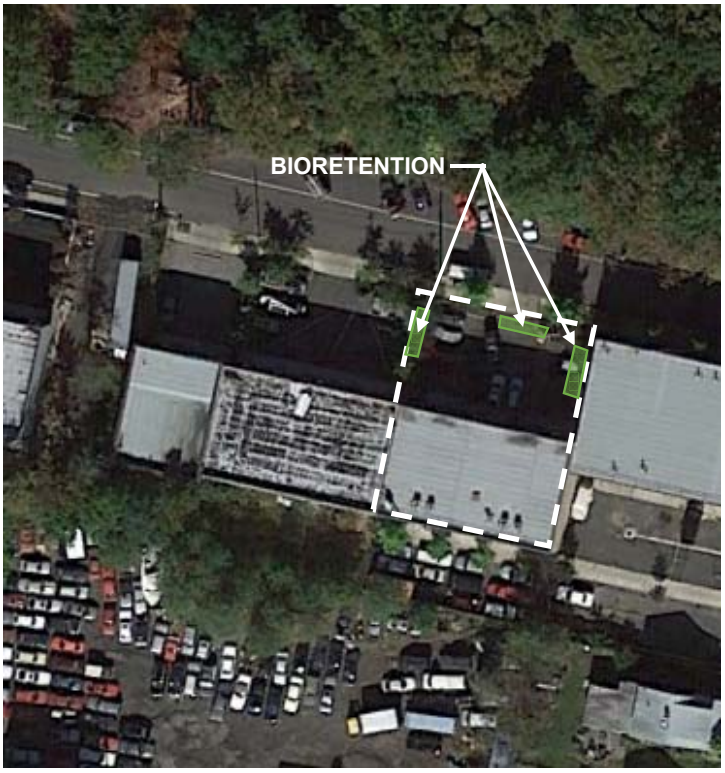


Vegetation at a Bronx River Houses bioretention area.

CATEGORY A - INDUSTRIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SITE INFORMATION

Address: 141 Storer Avenue, SI
BBL: 5073110035
Block: 7311
Lot: 35

DESIGN CRITERIA

Area Disturbed: 8,000 sf
New Impervious Area: 8,000 sf
Runoff Volume: 1,000 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 252 sf
SCM Area as % of Total Lot: 3%
Retention Volume: 1001 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

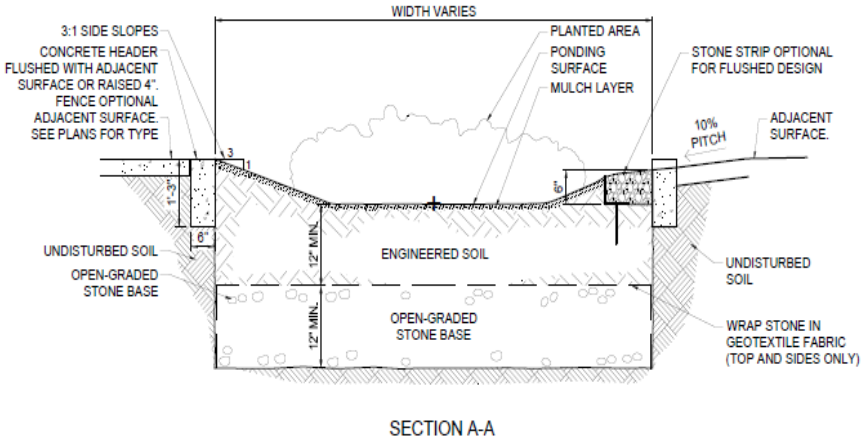
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
SCM Dim.: 21'L x 4'W x 4.5'H
21'L x 4'W x 4.5'H
21'L x 4'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC

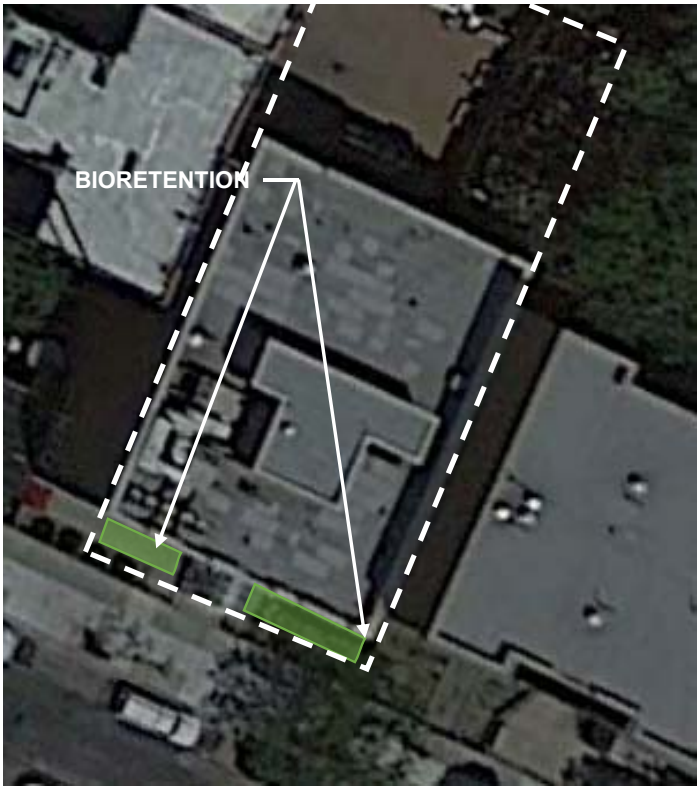


Vegetation at a Bronx River Houses bioretention area.

CATEGORY A - COMMERCIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SITE INFORMATION

Address: 141 South 3 Street, BK
BBL: 3024180045
Block: 2418
Lot: 45

DESIGN CRITERIA

Area Disturbed: 7,450 sf
New Impervious Area: 6,710 sf
Runoff Volume: 840 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 240 sf
SCM Area as % of Total Lot: 3%
Retention Volume: 850 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

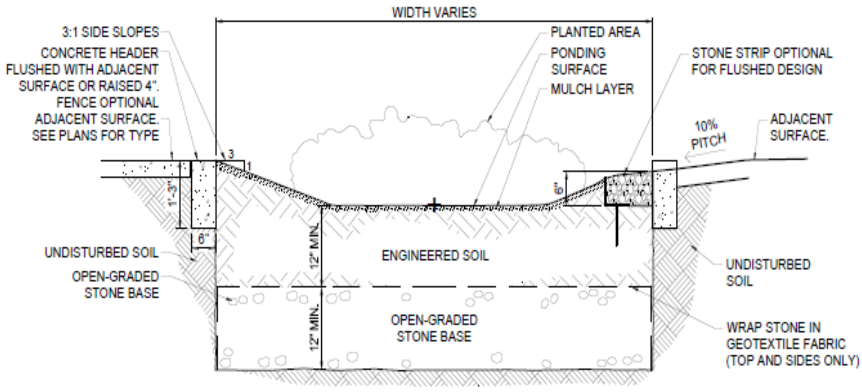
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
SCM Dim.: 17'L x 6'W x 4.5'H
22'L x 6'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC



SECTION A-A

Vegetation at a Bronx River Houses bioretention area.

CATEGORY B - COMMERCIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEAUSURE (SCM)

SITE INFORMATION

Address: 1759 Hylan Blvd, SI
BBL: 5033450032
Block: 3345
Lot: 32

DESIGN CRITERIA

Area Disturbed: 21,600 sf
New Impervious Area: 21,600 sf
Runoff Volume: 2,700 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 860 sf
SCM Area as % of Total Lot: 4%
Retention Volume: 2,700 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

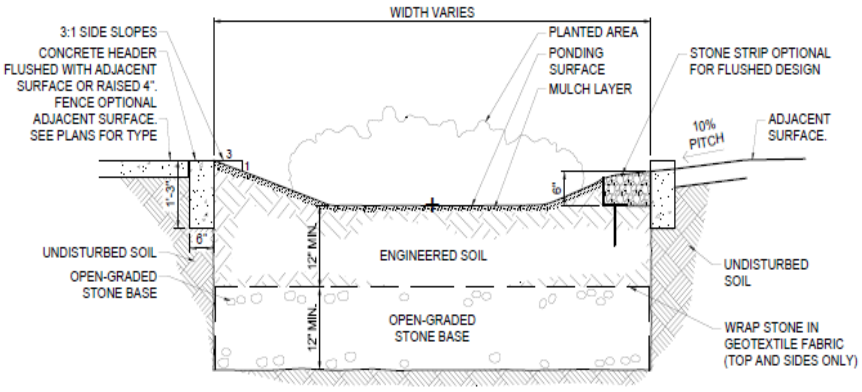
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
SCM Dim.: 60'L x 10'W x 4.5'H
16'L x 16'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC

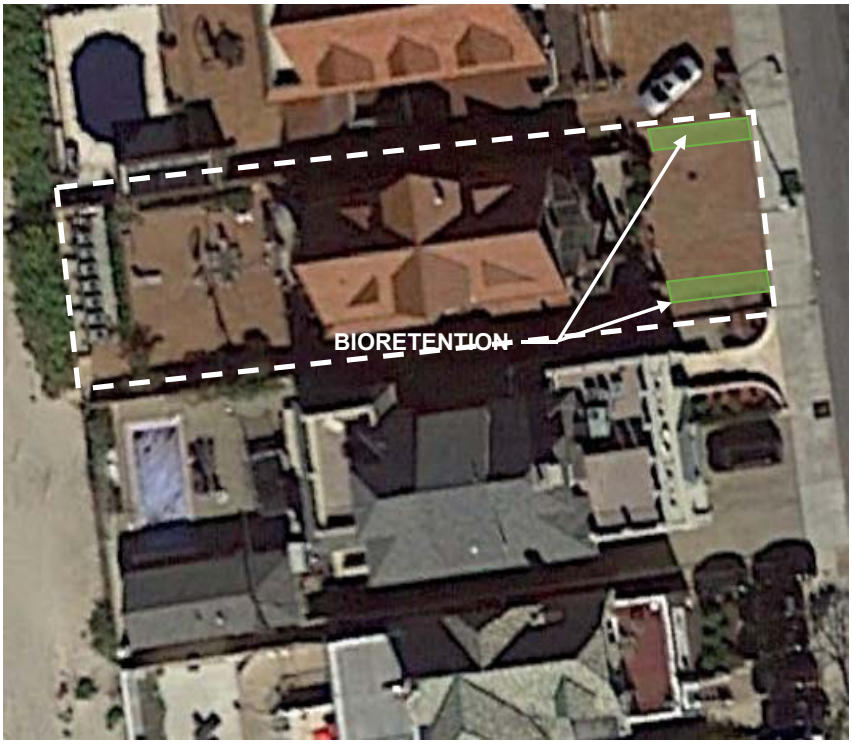


Vegetation at a Bronx River Houses bioretention area.

CATEGORY A - RESIDENTIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SITE INFORMATION

Address: 262 Corbin Place, BX
BBL: 3087230267
Block: 8723
Lot: 267

DESIGN CRITERIA

Area Disturbed: 6,434 sf
New Impervious Area: 6,440 sf
Runoff Volume: 810 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 220 sf
SCM Area as % of Total Lot: 3%
Retention Volume:810 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

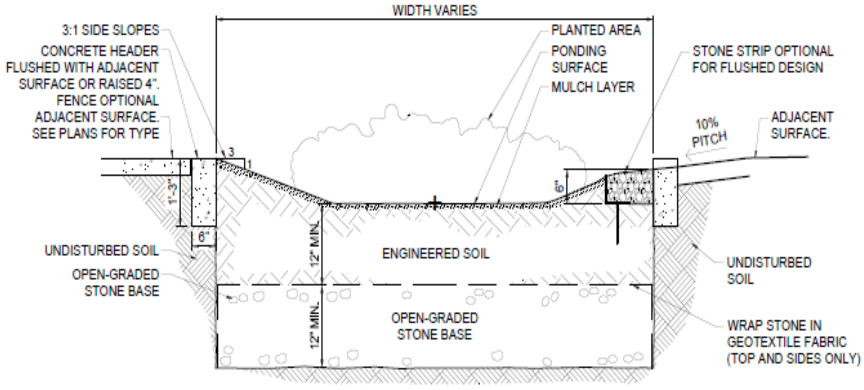
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
SCM Dim.: 18.5'L x 6'W x 4.5'H
18.5'L x 6'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC



SECTION A-A

Vegetation at a Bronx River Houses bioretention area.

CATEGORY B - RESIDENTIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SITE INFORMATION

Address: 14 Ottavio Promenade, SI
BBL: 5077750135
Block: 7775
Lot: 135

DESIGN CRITERIA

Area Disturbed: 14,940 sf
New Impervious Area: 6,720 sf
Runoff Volume: 840 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 260 sf
SCM Area as % of Total Lot: 4%
Retention Volume:840 cf
Detention Volume: N/A
Treatment Volume

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

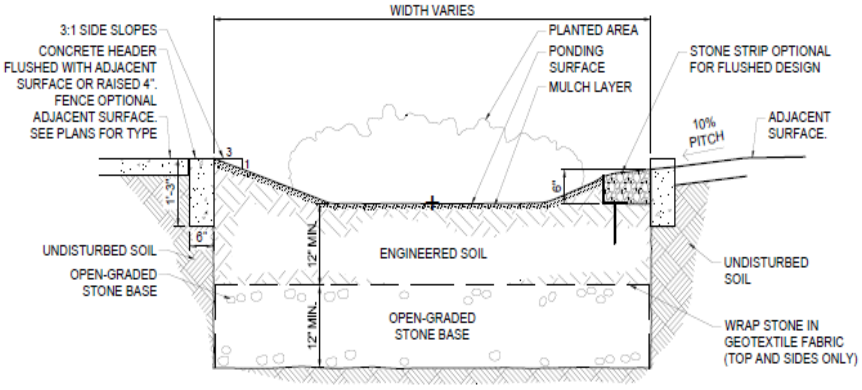
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
Media Dim.: 23'L x 12'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC



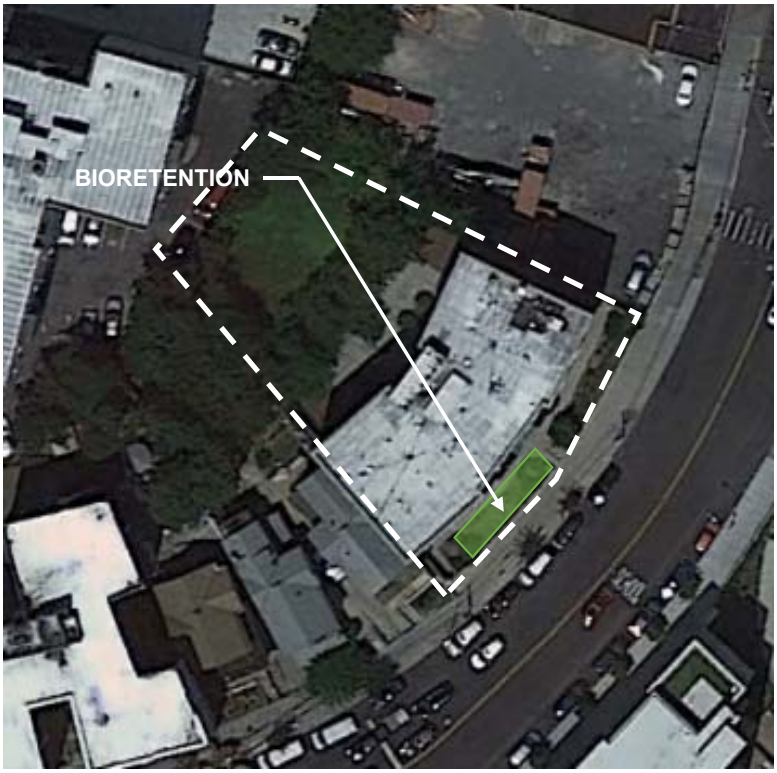
SECTION A-A

Vegetation at a Bronx River Houses bioretention area.

CATEGORY B - INDUSTRIAL PROPERTY

CS/MS4 - SPACE UNCONSTRAINED - SOIL UNCONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SITE INFORMATION

Address: 89 West Tremont Ave, BX
BBL: 2028690047
Block: 2869
Lot: 47

DESIGN CRITERIA

Area Disturbed: 19,150 sf
New Impervious Area: 11,490 sf
Runoff Volume: 1,440 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Bioretention
SCM Area: 460 sf
SCM Area as % of Total Lot: 4%
Retention Volume:1,450 cf
Detention Volume: N/A
Treatment Volume: N/A

Total Runoff Retention: 100%
Total Runoff Detention: 0%
Total Runoff Treatment: 0%

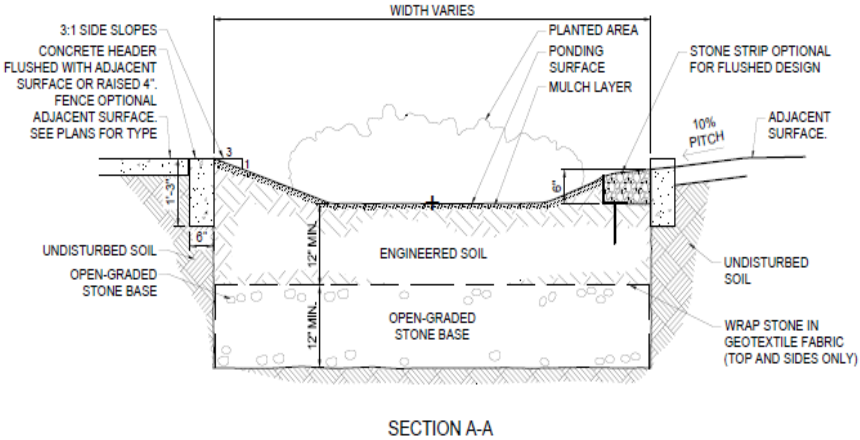
GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

Type: Bioretention
Media Dim.: 45.5'L x 10'W x 4.5'H
Permanent Pooling: 3"
Media Depth: 24" Engineered Soil
30" Open-Graded Stone Base
Media Porosity: 25 % vol, 33% vol

SCM SCHEMATIC



SECTION A-A

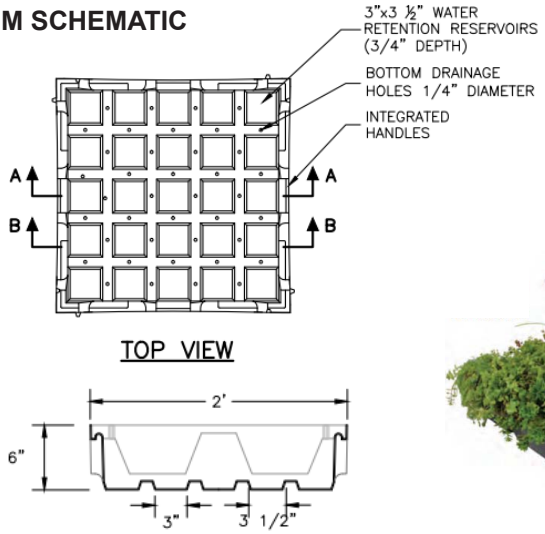
Vegetation at a Bronx River Houses bioretention area.

CATEGORY A - INDUSTRIAL PROPERTY

CS / MS4 - SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



WESTON LTD. Weston Solutions, Inc. & GreenGrid 124 Hebron Ave., Suite 3B Glastonbury, CT 06033 888-404-4743	GREENGRID G4 MODULE DESIGN 2'x2'x6" MODULE

SITE INFORMATION

Address: 508 Smith Street, BK
BBL: 3004790027
Block: 479
Lot: 27

DESIGN CRITERIA

Area Disturbed: 8,800 sf
New Impervious Area: 8,800 sf
Runoff Volume: 1,100 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 7,210 sf
Pavers Area: 1,530 sf
SCM Area as % of Total Roof: 83%
Retention Volume: 900 cf
Detention Volume: 190 cf

SCM Practice 2: N/A
SCM Area: N/A
Impervious Coverage: N/A
Retention Volume: N/A
Detention Volume: N/A

Total Runoff Retention: 83%
Total Runoff Detention: 17%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

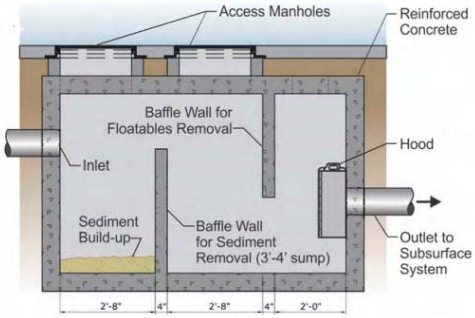
Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Depth in MS4 Areas: 6 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
1 foot perimeter with porous pavers

CATEGORY A - INDUSTRIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



Pretreatment Structure

Detention Vault (SingeTrap® shown)

SITE INFORMATION

Address: 141 Storer Avenue, SI
BBL: 5073110035
Block: 7311
Lot: 35

DESIGN CRITERIA

Area Disturbed: 8,000 sf
New Impervious Area: 8,000 sf
Runoff Volume: 1,000 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 2,890 sf
Pavers Area: 920 sf
SCM Area as % of Total Roof : 76%
Retention Volume: 360 cf
Detention Volume: 120 cf

SCM Practice 2: Detention Vault
SCM Area: 130 sf
Paved Lot Coverage: 3%
Retention Volume: N/A
Detention Volume: 530 cf

Total Runoff Retention: 36 %
Total Runoff Detention: 64%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

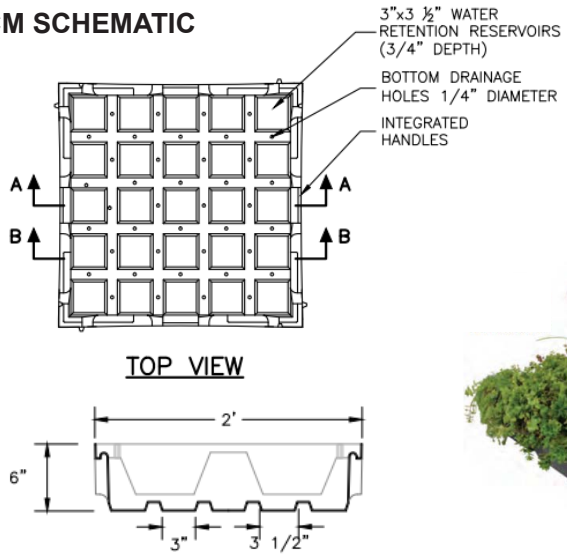
Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
Detention: No Rooftop Connection
Effective Vault Storage Depth: 1.5 ft
1 foot perimeter with porous pavers

CATEGORY B - INDUSTRIAL PROPERTY

CS/MS4 - SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



Weston Solutions, Inc.
& GreenGrid
124 Hebron Ave., Suite 3B
Glastonbury, CT 06033
888-404-4743

GREENGRID G4 MODULE DESIGN
2'x2'x6" MODULE

SITE INFORMATION

Address: 305 Johnson Avenue, BK
BBL: 3030560240
Block: 3056
Lot: 240

DESIGN CRITERIA

Area Disturbed: 24,580 sf
New Impervious Area: 24,580 sf
Runoff Volume: 3,070 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 22,560 sf
Pavers Area: 2,020
SCM Area as % of Total Roof: 89%
Retention Volume: 2,820 cf
Detention Volume: 350 cf

SCM Practice 2: N/A
SCM Area: N/A
Impervious Coverage: N/A
Retention Volume: N/A
Detention Volume: N/A

Total Runoff Retention:92%
Total Runoff Detention: 8%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

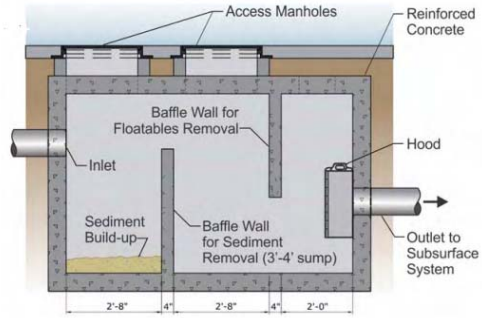
Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Depth in MS4 Areas: 6 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
1 foot perimeter with porous pavers

CATEGORY B - RESIDENTIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



Pretreatment Structure

Detention Vault (SingeTrap® shown)

SITE INFORMATION

Address: 89 West Tremont Ave, BX
BBL: 2028690047
Block: 2869
Lot: 47

DESIGN CRITERIA

Area Disturbed: 19,150 sf
New Impervious Area: 11,490 sf
Runoff Volume: 1,440 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 4,220 sf
Pavers Area: 1,220 sf
SCM Area as % of Total Roof: 78%
Retention Volume: 530 cf
Detention Volume: 150 cf

SCM Practice 2: Detention Vault
SCM Area: 190 sf
Paved Lot Coverage: 3%
Retention Volume: N/A
Detention Volume: 760 cf

Total Runoff Retention: 37%
Total Runoff Detention: 63%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

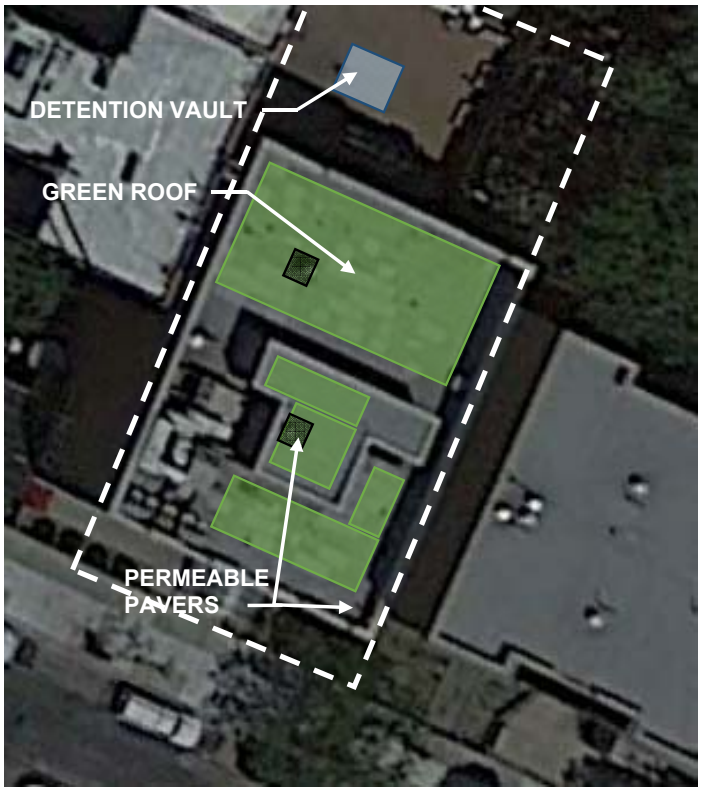
SCM ASSUMPTIONS

Type: Modular Tray System
Media Depth: 5 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
Detention: No Rooftop Connection
Effective Vault Storage Depth: 1.5 ft
1 foot perimeter with porous pavers

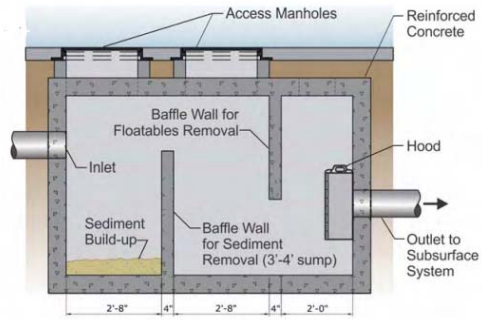
CATEGORY A - COMMERCIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



Pretreatment Structure

Detention Vault (SingeTrap® shown)

SITE INFORMATION

Address: 141 South 3 Street, BK
BBL: 3024180045
Block: 2418
Lot: 45

DESIGN CRITERIA

Area Disturbed: 7,450 sf
New Impervious Area: 6,710 sf
Runoff Volume: 840 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 2,530 sf
Pavers Area: 1,040 sf
SCM Area as % of Total Roof: 71%
Retention Volume: 320 cf
Detention Volume: 130 cf

SCM Practice 2: Detention Vault
SCM Area: 100 sf
Paved Lot Coverage: 3%
Retention Volume: N/A
Detention Volume: 400 cf

Total Runoff Retention: 38%
Total Runoff Detention: 62%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

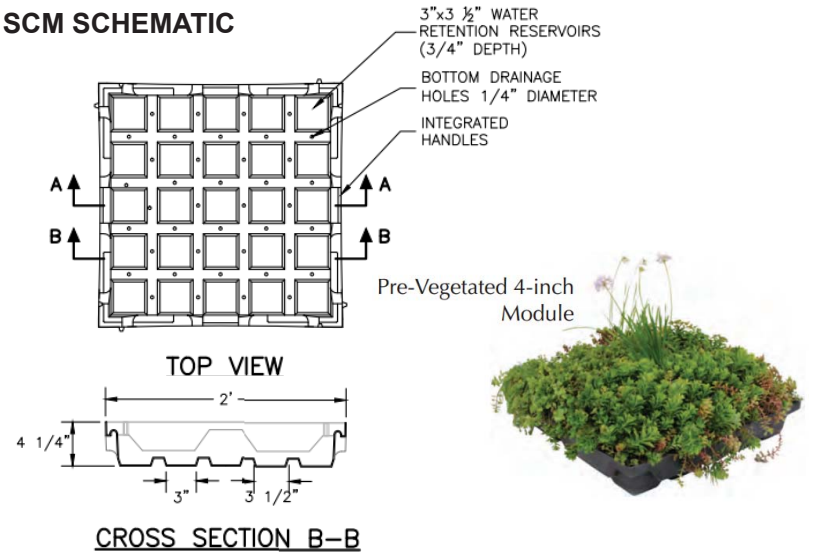
Type: Modular Tray System
Media Depth: 5 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
Detention: No Rooftop Connection
Effective Vault Storage Depth: 1.5 ft
1 foot perimeter with porous pavers

CATEGORY A - COMMERCIAL PROPERTY

CS/MS4 - SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



WESTON SOLUTIONS — Weston Solutions, Inc. & GreenGrid, 124 Hebron Ave., Suite 3B, Glastonbury, CT 06033, 888-404-4743	GREENGRID G4 MODULE DESIGN 2'x2'x4.25" MODULE

SITE INFORMATION

Address: 132-08 Pople Ave, QN
BBL: 4051040009
Block: 5104
Lot: 9

DESIGN CRITERIA

Area Disturbed: 6,500 sf
New Impervious Area: 6,500 sf
Runoff Volume: 810 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 1,580 sf
Pavers Area: 4,600 sf
SCM Area as % of Total Roof : 26%
Retention Volume: 200 cf
Detention Volume: 610 cf

SCM Practice 2: N/A
SCM Area: N/A
Impervious Coverage: N/A
Retention Volume: N/A
Detention Volume: N/A

Total Runoff Retention: 24%
Total Runoff Detention: 76%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

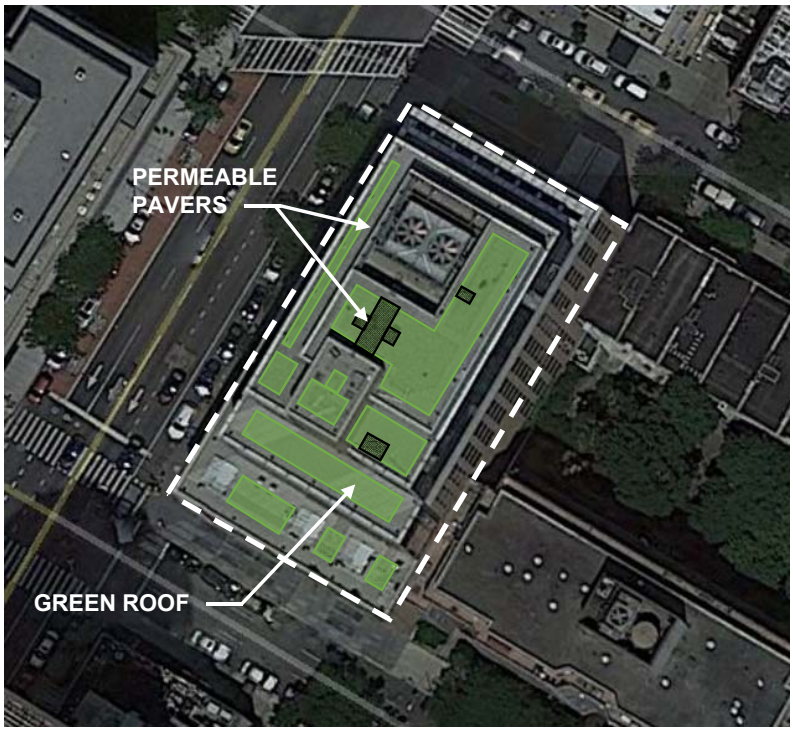
SCM ASSUMPTIONS

Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Depth in MS4 Areas: 6 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Rooftop: Gravel Ballast
Private Balcony: No Green Roof
Uncovered Balcony: No Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 2 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
1 foot perimeter with porous pavers

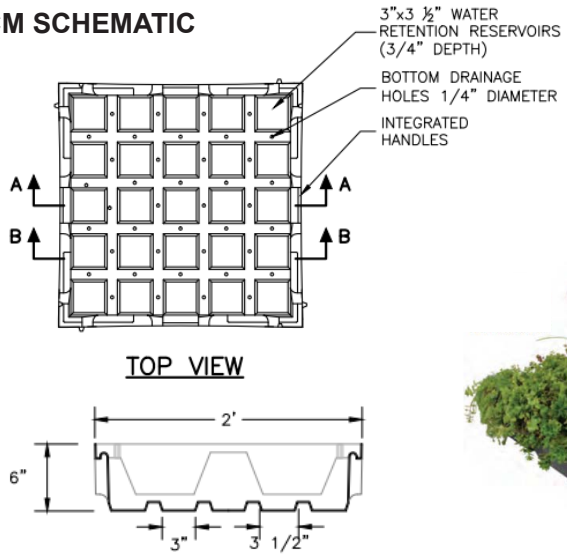
CATEGORY B - COMMERCIAL PROPERTY

CS/MS4 - SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



WESTON Weston Solutions, Inc. & GreenGrid 124 Hebron Ave., Suite 3B Glastonbury, CT 06033 888-404-4743	GREENGRID G4 MODULE DESIGN 2'x2'x6" MODULE

SITE INFORMATION

Address: 1256 2 Avenue, MN
BBL: 1014400049
Block: 1440
Lot: 49

DESIGN CRITERIA

Area Disturbed: 20,160 sf
New Impervious Area: 17,500 sf
Runoff Volume: 2,190 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Area
Green Roof Area: 6,790 sf
Pavers Area: 10,700 sf
SCM Area as % of Total Roof : 39%
Retention Volume: 850 cf
Detention Volume: 1,340 cf

SCM Practice 2: N/A
SCM Area: N/A
Impervious Coverage: N/A
Retention Volume: N/A
Detention Volume: N/A

Total Runoff Retention: 39%
Total Runoff Detention: 61%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

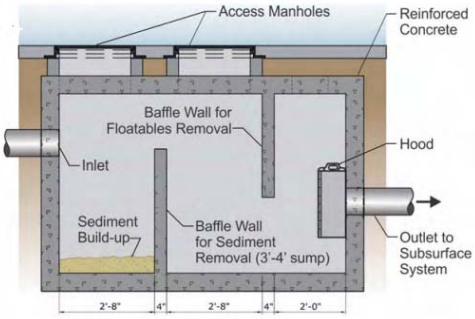
Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Depth in MS4 Areas: 6 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Building Height: >100 ft
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: >100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
1 foot perimeter with porous pavers

CATEGORY B - COMMERCIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



Pretreatment Structure

Detention Vault (SingeTrap® shown)

SITE INFORMATION

Address: 1759 Hylan Blvd, SI
BBL: 5033450032
Block: 3345
Lot: 32

DESIGN CRITERIA

Area Disturbed: 21,600 sf
New Impervious Area: 21,600 sf
Runoff Volume: 2,700 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 4,940 sf
Pavers Area: 2,000 sf
SCM Area as % of Total Roof: 71%
Retention Volume: 620 cf
Detention Volume: 250 cf

SCM Practice 2: Detention Chamber
SCM Area: 460 sf
Paved Lot Coverage: 3%
Retention Volume: N/A
Detention Volume: 18,300 cf

Total Runoff Retention: 23%
Total Runoff Detention: 77%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

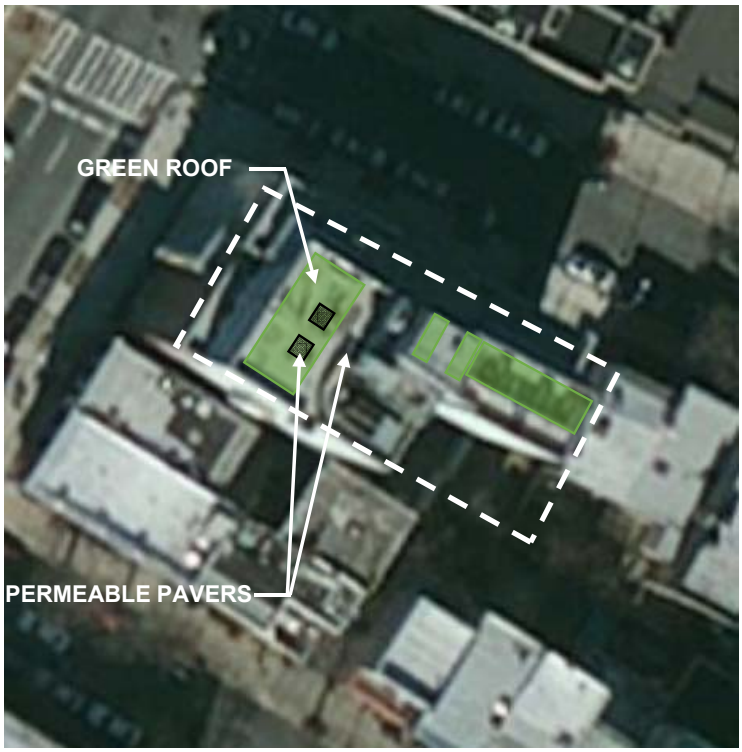
SCM ASSUMPTIONS

Type: Modular Tray System
Media Depth: 5 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
Detention: No Rooftop Connection
Effective Vault Storage Depth: 1.5 ft
1 foot perimeter with porous pavers

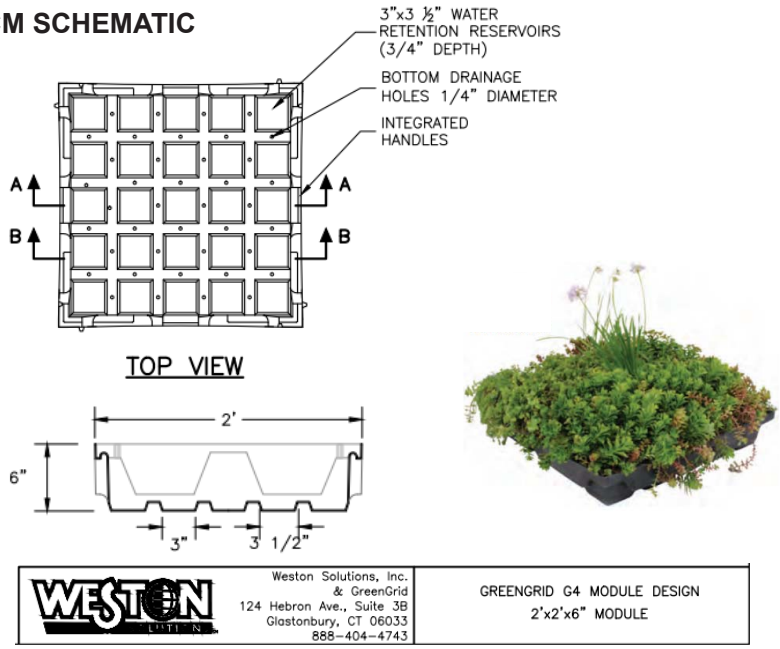
CATEGORY A - RESIDENTIAL PROPERTY

CS/MS4 - SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



SITE INFORMATION

Address: 560 Carroll Street, BK
BBL: 3009610003
Block: 961
Lot: 3

DESIGN CRITERIA

Area Disturbed: 6,120 sf
New Impervious Area: 4,850 sf
Runoff Volume: 610 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 1,500 sf
Pavers Area: 3,350 sf
SCM Area as % of Total Roof : 31%
Retention Volume: 190 cf
Detention Volume: 420 cf

SCM Practice 2: N/A
SCM Area: N/A
Impervious Coverage: N/A
Retention Volume: N/A
Detention Volume: N/A

Total Runoff Retention: 31%
Total Runoff Detention: 69%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM ASSUMPTIONS

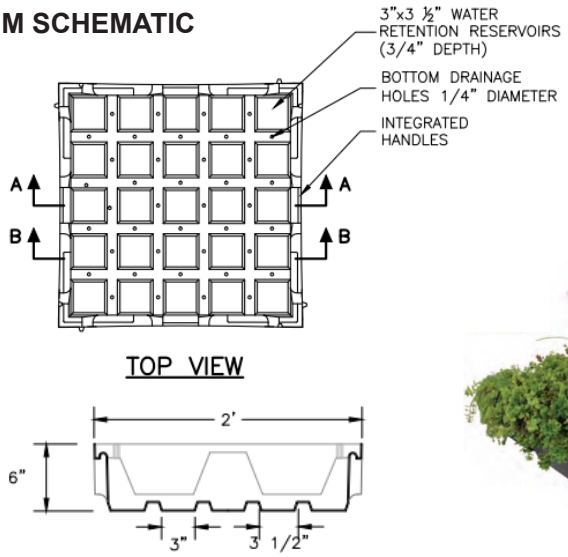
Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Depth in MS4 Areas: 6 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Rooftop: Gravel Ballast
Private Balcony: No Green Roof
Uncovered Balcony: No Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: >100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
1 foot perimeter with porous pavers

CATEGORY B - RESIDENTIAL PROPERTY

CS/MS4 - SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SCM SCHEMATIC



WESTON SOLUTIONS Weston Solutions, Inc. & GreenGrid 124 Hebron Ave., Suite 3B Glastonbury, CT 06033 888-404-4743	GREENGRID G4 MODULE DESIGN 2'x2'x6" MODULE

SITE INFORMATION

Address: 462 West 58 St, MN
BBL: 1010670057
Block: 1067
Lot: 57

DESIGN CRITERIA

Area Disturbed: 14,100 sf
New Impervious Area: 14,100 sf
Runoff Volume: 1,760 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 4,070 sf
Pavers Area: 10,000 sf
SCM Area as % of Total Roof: 34%
Retention Volume: 510 cf
Detention Volume: 1,250 cf

SCM Practice 2: N/A
SCM Area: N/A
Impervious Coverage: N/A
Retention Volume: N/A
Detention Volume: N/A

Total Runoff Retention: 29%
Total Runoff Detention: 71%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

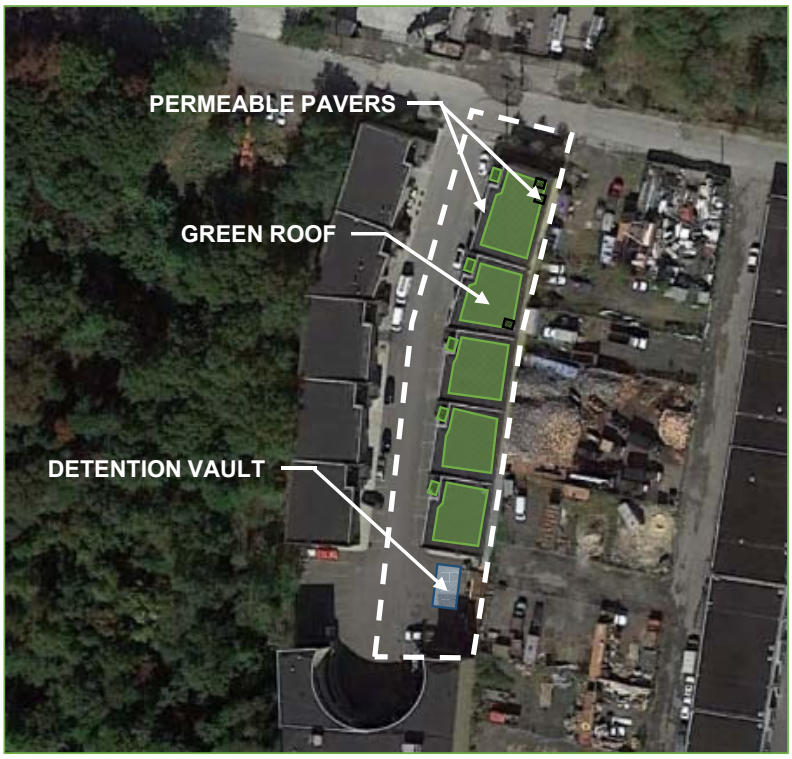
SCM ASSUMPTIONS

Type: Modular Tray System
Media Depth in CS Areas: 5 inch
Media Depth in MS4 Areas: 6 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Rooftop: Gravel Ballast
Private Balcony: No Green Roof
Uncovered Balcony: No Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
1 foot perimeter with porous pavers

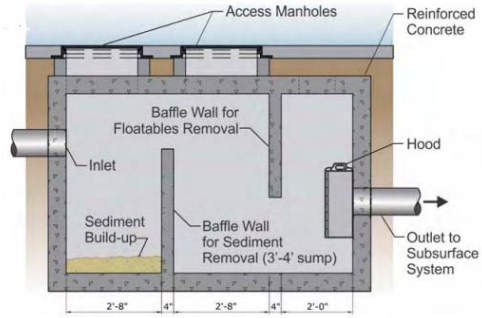
CATEGORY B - INDUSTRIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SCM SCHEMATIC



Pretreatment Structure

Detention Vault (SingeTrap® shown)

SITE INFORMATION

Address: 11 Brick Ct, SI
BBL: 5074000100
Block: 7400
Lot: 100

DESIGN CRITERIA

Area Disturbed: 27,900 sf
New Impervious Area: 27,900 sf
Runoff Volume: 3,490 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

SCM Practice 1: Green Roof + Permeable Pavers
Green Roof Area: 10,670 sf
Pavers Area:1,660 sf
SCM Area as % of Total Roof: 87%
Retention Volume: 1,335 cf
Detention Volume: 210 cf

SCM Practice 2: Detention Vault
SCM Area: 490 sf
Paved Lot Coverage: 3%
Retention Volume: N/A
Detention Volume: 1,950 cf

Total Runoff Retention: 38%
Total Runoff Detention: 62%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

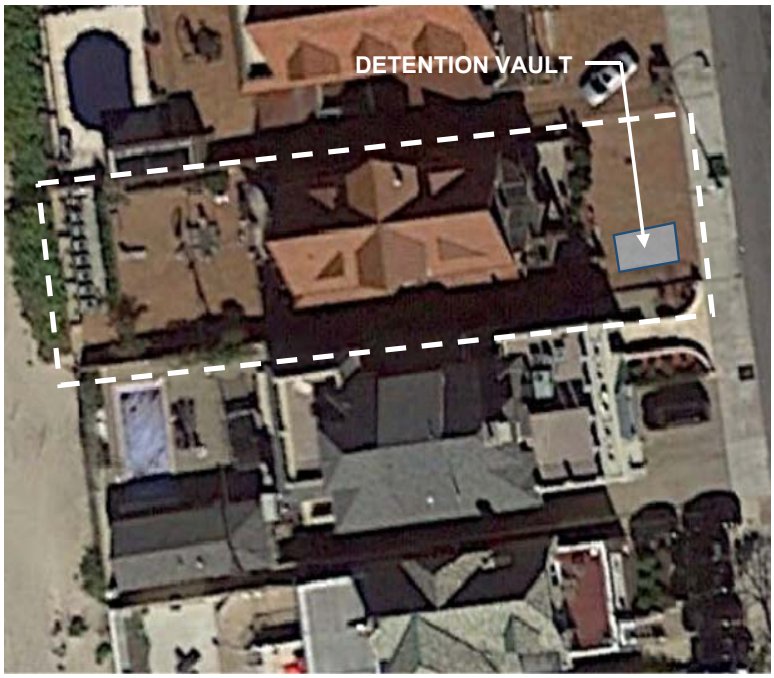
SCM ASSUMPTIONS

Type: Modular Tray System
Media Depth: 5 inch
Media Porosity: 55 %vol
Media Field Capacity: 36 %vol
Media Water Content: 0 %vol
Uncovered Area: Gravel Ballast
Ballast Storage: 0.08 inch
Depression Storage: 0.06 inch
Building Height: <100 ft
Perimeter Edging: 1 ft wide
Mechanical Edging: 3 ft wide
Landing and Clear Paths: 6 ft wide
Detention: No Rooftop Connection
Effective Vault Storage Depth: 1.5 ft
1 foot perimeter with porous pavers

CATEGORY A - RESIDENTIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)



SITE INFORMATION

Address: 262 Corbin Place, BK
BBL: 3087230267
Block: 8723
Lot: 267

DESIGN CRITERIA

Area Disturbed: 6,440 sf
New Impervious Area: 6,440 sf
Runoff Volume: 810 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

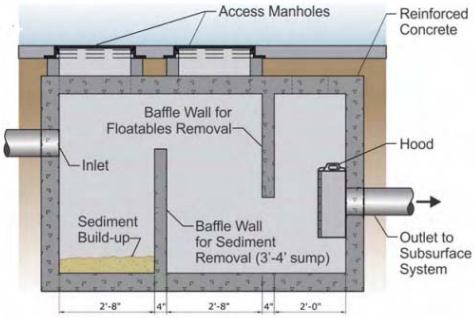
SCM Practice 1: Detention Vault
SCM Area: 200 sf
SCM Area as % of Total Lot: 3%
Vault Dimensions: 3'H x 20'W x 10'D
Pretreatment Dimensions: 1.5'H x 10'W x 13.5'D
Retention Volume: N/A
Detention Volume: 810 cf

Total Runoff Retention: 0%
Total Runoff Detention: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM SCHEMATIC



Pretreatment Structure

SCM ASSUMPTIONS

Detention: Rooftop Connected
Effective Vault Storage Depth: 1.5 ft

Detention Vault (SingeTrap® shown)

CATEGORY B - RESIDENTIAL PROPERTY

CS - SPACE UNCONSTRAINED - SOIL CONSTRAINED

SITE SCHEMATIC with STORMWATER CONTROL MEASURE (SCM)

SITE INFORMATION

Address: 14 Ottavio Promenade, SI
BBL: 5077750135
Block: 7775
Lot: 135

DESIGN CRITERIA

Area Disturbed: 14,940 sf
New Impervious Area: 7,550 sf
Runoff Volume: 950 cf
Peak Runoff Rate: N/A

CONCEPTUAL DESIGN

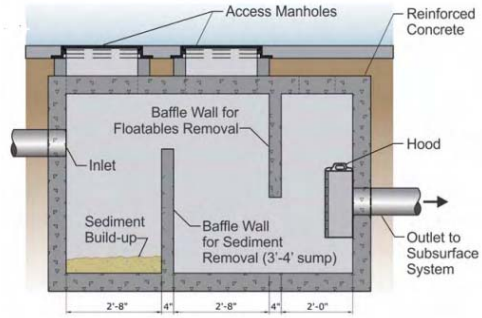
SCM Practice 1: Detention Vault
SCM Area: 240 sf
SCM Area as % of Total Lot: 3%
Vault Dimensions: 3'H x 20'W x 12'D
Pretreatment Dimensions: 1.5'H x 10'W x 16'D
Retention Volume: N/A
Detention Volume: 950 cf

Total Runoff Retention: 0%
Total Runoff Detention: 100%

GENERAL ASSUMPTIONS

Event: 1.5 inch over 24 hours
Rainfall distribution: Type III
Maximum Discharge: 0.1 cfs/acre

SCM SCHEMATIC



Pretreatment Structure

SCM ASSUMPTIONS

Detention: Rooftop Connected
Effective Vault Storage Depth: 1.5 ft

Detention Vault (SingeTrap® shown)

Appendix 6.1 C

Post-Construction Capital and O&M Unit Costs

BIORETENTION CAPITAL COST ESTIMATE

MEDIUM SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED					
141 Storer Avenue, Staten Island					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	252	SF	(21' x 4' x 4.5' depth x 3)		
DISTURBED AREA	8,000	SF			
RETENTION VOL	1,001	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	51	CY	$ 100.00	$ 5,133	
- truck away spoil- add 20%	62	CY	$ 50.00	$ 3,080	
Install geotech fabric at stone-wrap top & sides	627	SF	$ 0.75	$ 470	
Install 30" open graded stone base	23	CY	$ 82.00	$ 1,913	
Install 24" engineered soil	19	CY	$ 106.00	$ 1,979	
Install mulch layer (allow 3")	2	CY	$ 40.00	$ 93	
Conveyance	50	LF		$ 7,100	
Planting Area	252	SF	$ 7.50	$ 1,890	
				SUBTOTAL	$ 21,659
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$2,141
				SUBTOTAL	$23,800
				G.C. OH & P - 21.0%	$5,000
				SUBTOTAL	$28,800
				CONTINGENCY - 20.0%	$5,800
				SUBTOTAL	$34,600
				ENGINEERING- 15.0%	$5,200
				TOTAL CONSTRUCTION COST	**$39,800**
LARGE SIZED INDUSTRIALL PROPERTY					
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED					
11 Brick Court, Staten Island					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	990	SF	(33' x 6' x 4.5' depth x 5)		
DISTURBED AREA	27,903	SF			
RETENTION VOL	3,487	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	202	CY	$ 100.00	$ 20,167	
- truck away spoil- add 20%	242	CY	$ 50.00	$ 12,100	
Install geotech fabric at stone-wrap top & sides	1,173	SF	$ 0.75	$ 880	
Install 30" open graded stone base	92	CY	$ 82.00	$ 7,517	
Install 24" engineered soil	73	CY	$ 106.00	$ 7,773	
Install mulch layer (allow 3")	9	CY	$ 40.00	$ 367	
Conveyance	50	LF		$ 7,100	
Planting Area	990	SF	$ 7.50	$ 7,425	
				SUBTOTAL	$ 63,328
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$6,372
				SUBTOTAL	$69,700
				G.C. OH & P - 21.0%	$14,600
				SUBTOTAL	$84,300
				CONTINGENCY - 20.0%	$16,900
				SUBTOTAL	$101,200
				ENGINEERING - 15%	$15,200
				TOTAL CONSTRUCTION COST	**$116,400**

BIORETENTION CAPITAL COST ESTIMATE

MEDIUM SIZED COMMERCIAL PROPERTY
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED
141 South 3 Street, Brooklyn

DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	234	SF	(17' x 6' x 4.5' depth)		
			(22' x 6' x 4.5' depth)		
DISTURBED AREA	7,450	SF			
RETENTION VOL	846	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	48	CY	$ 100.00	$ 4,767	
- truck away spoil- add 20%	57	CY	$ 50.00	$ 2,860	
Install geotech fabric at stone-wrap top & sides	489	SF	$ 0.75	$ 367	
Install 30" open graded stone base	22	CY	$ 82.00	$ 1,777	
Install 24" engineered soil	17	CY	$ 106.00	$ 1,837	
Install mulch layer (allow 3")	2	CY	$ 40.00	$ 87	
Conveyance	50	LF		$ 7,100	
Planting Area	234	SF	$ 7.50	$ 1,755	
				SUBTOTAL	$ 20,549
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$2,051
				SUBTOTAL	$22,600
				G.C. OH & P - 21.0%	$4,700
				SUBTOTAL	$27,300
				CONTINGENCY - 20.0%	$5,500
				SUBTOTAL	$32,800
				ENGINEERING - 15%	$4,900
				TOTAL CONSTRUCTION COST	**$37,700**

LARGE SIZED COMMERCIAL PROPERTY
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED
1759 Hylan Blvd, Staten Island

DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	856	SF	(60' x 10' x 4.5' depth)		
DISTURBED AREA	21,600	SF	(16' x16' x 4.5' depth)		
RETENTION VOL	2,715	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	174	CY	$ 100.00	$ 17,437	
- truck away spoil- add 20%	209	CY	$ 50.00	$ 10,462	
Install geotech fabric at stone-wrap top & sides	1,366	SF	$ 0.75	$ 1,025	
Install 30" open graded stone base	79	CY	$ 82.00	$ 6,499	
Install 24" engineered soil	63	CY	$ 106.00	$ 6,721	
Install mulch layer (allow 3")	8	CY	$ 40.00	$ 317	
Conveyance	50	LF		$ 7,100	
Planting Area	856	SF	$ 7.50	$ 6,420	
				SUBTOTAL	$ 55,981
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$5,619
				SUBTOTAL	$61,600
				G.C. OH & P - 21.0%	$12,900
				SUBTOTAL	$74,500
				CONTINGENCY - 20.0%	$14,900
				SUBTOTAL	$89,400
				ENGINEERING - 15%	$13,400
				TOTAL CONSTRUCTION COST	**$102,800**

MEDIUM SIZED RESIDENTIAL PROPERTY

BIORETENTION CAPITAL COST ESTIMATE

SPACE UNCONSTRAINED - SOIL UNCONSTRAINED
262 Corbin Place, Bronx

DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	222	SF	(18.5' x 6' x 4.5' depth)		
DISTURBED AREA	6,434	SF	(18.5' x 6' x 4.5' depth)		
RETENTION VOL	806	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	45	CY	$ 100.00	$ 4,522	
- truck away spoil- add 20%	54	CY	$ 50.00	$ 2,713	
Install geotech fabric at stone-wrap top & sides	467	SF	$ 0.75	$ 350	
Install 30" open graded stone base	21	CY	$ 82.00	$ 1,686	
Install 24" engineered soil	16	CY	$ 106.00	$ 1,743	
Install mulch layer (allow 3")	2	CY	$ 40.00	$ 82	
Conveyance	50	LF		$ 7,100	
Planting Area	222	SF	$ 7.50	$ 1,665	
				SUBTOTAL	$ 19,862
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$1,938
				SUBTOTAL	$21,800
				G.C. OH & P - 21.0%	$4,600
				SUBTOTAL	$26,400
				CONTINGENCY - 20.0%	$5,300
				SUBTOTAL	$31,700
				ENGINEERING - 15%	$4,800
				TOTAL CONSTRUCTION COST	**$36,500**

LARGE SIZED RESIDENTIAL PROPERTY
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED
14 Ottavio Promanade, Staten Island

DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	260	SF	(23' x 12' x 4.5' depth)		
DISTURBED AREA	14,935	SF			
RETENTION VOL	840	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	53	CY	$ 100.00	$ 5,296	
- truck away spoil- add 20%	64	CY	$ 50.00	$ 3,178	
Install geotech fabric at stone-wrap top & sides	435	SF	$ 0.75	$ 326	
Install 30" open graded stone base	24	CY	$ 82.00	$ 1,974	
Install 24" engineered soil	19	CY	$ 106.00	$ 2,041	
Install mulch layer (allow 3")	2	CY	$ 40.00	$ 96	
Conveyance	50	LF		$ 7,100	
Planting Area	260	SF	$ 7.50	$ 1,950	
				SUBTOTAL	$ 21,962
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$2,238
				SUBTOTAL	$24,200
				G.C. OH & P - 21.0%	$5,100
				SUBTOTAL	$29,300
				CONTINGENCY - 20.0%	$5,900
				SUBTOTAL	$35,200
				ENGINEERING - 15%	$7,000
				TOTAL CONSTRUCTION COST	**$42,200**

BIORETENTION CAPITAL COST ESTIMATE

LARGE SIZED INDUSTRIAL PROPERTY
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED
89 West Tremont Avenue, Bronx

DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	455	SF	(45.5' x 10' x 4.5' depth)		
DISTURBED AREA	19,146	SF			
RETENTION VOL	1,449	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	93	CY	$ 100.00	$ 9,269	
- truck away spoil- add 20%	111	CY	$ 50.00	$ 5,561	
Install geotech fabric at stone-wrap top & sides	733	SF	$ 0.75	$ 549	
Install 30" open graded stone base	42	CY	$ 82.00	$ 3,455	
Install 24" engineered soil	34	CY	$ 106.00	$ 3,573	
Install mulch layer (allow 3")	4	CY	$ 40.00	$ 169	
Conveyance	50	LF		$ 7,100	
Planting Area	455	SF	$ 7.50	$ 3,413	
				SUBTOTAL	$ 33,087
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$3,313
				SUBTOTAL	$36,400
			G.C. OH & P - 21.0%		$7,600
				SUBTOTAL	$44,000
			CONTINGENCY - 20.0%		$8,800
				SUBTOTAL	$52,800
			ENGINEERING - 15%		$7,900
			TOTAL CONSTRUCTION COST		**$60,700**

BIORETENTION CAPITAL COST ESTIMATE

LARGE SIZED INDUSTRIAL PROPERTY
SPACE UNCONSTRAINED - SOIL UNCONSTRAINED
89 West Tremont Avenue, Bronx

DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA	455	SF	(45.5' x 10' x 4.5' depth)		
DISTURBED AREA	19,146	SF			
RETENTION VOL	1,449	CF			
ENGIN SOIL DEPTH	24	INCH			
STONE BASE DEPTH	30	INCH			
Excavate to specfied depth	93	CY	$ 100.00	$ 9,269	
- truck away spoil- add 20%	111	CY	$ 50.00	$ 5,561	
Install geotech fabric at stone-wrap top & sides	733	SF	$ 0.75	$ 549	
Install 30" open graded stone base	42	CY	$ 82.00	$ 3,455	
Install 24" engineered soil	34	CY	$ 106.00	$ 3,573	
Install mulch layer (allow 3")	4	CY	$ 40.00	$ 169	
Conveyance	50	LF		$ 7,100	
Planting Area	455	SF	$ 7.50	$ 3,413	
				SUBTOTAL	$ 33,087
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$3,313
				SUBTOTAL	$36,400
			G.C. OH & P - 21.0%		$7,600
				SUBTOTAL	$44,000
			CONTINGENCY - 20.0%		$8,800
				SUBTOTAL	$52,800
			ENGINEERING - 15%		$7,900
			TOTAL CONSTRUCTION COST		**$60,700**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

MEDIUM SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
141 STORER AVE , STATEN ISLAND					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	396	SF	(22x 6 x4 x3)		
RETENTION VOL	648	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	456	SF	(28 x 6 x2)	(48 x 6x 2)	
RETENTION VOL	358	CF			
DISTURBED AREA	8,000	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth (142' x 6' x 4')	126	CY	$ 100.00	$ 12,622	
- truck away spoil- add 20%	151	CY	$ 50.00	$ 7,573	
Install 12" open graded stone base	15	CY	$ 82.00	$ 1,203	
6" PVC perforated pipe	142	LF	$ 25.00	$ 3,550	
Perforated pipe cleanouts	3	EA	$ 150.00	$ 450	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	792	SF	$ 0.75	$ 594	
Install 36" engineered soil-	44	CY	$ 106.00	$ 4,664	
Install mulch layer (allow 3")	4	CY	$ 40.00	$ 147	
18 x 18" concrete header curb	120	LF	$ 25.00	$ 3,000	
Install 3-1/2" permeable paver on 5-1/2" stone bed	456	SF	$ 40.00	$ 18,240	
Install 10" open graded stone base	14	CY	$ 82.00	$ 1,149	
24" x 8" concrete curb	24	LF	$ 55.00	$ 1,320	
Install 24" controlled backfill	34	CY	$ 75.00	$ 2,533	
Deduct Concrete Paving	(456)	SF	$ 25.00	$ (11,400)	
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	8,000	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	396	SF	$ 7.50	$ 2,970	
				SUBTOTAL	$ 70,366
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$7,034
				SUBTOTAL	$77,400
				G.C. OH & P - 21.0%	$16,300
				SUBTOTAL	$93,700
				CONTINGENCY - 20.0%	$18,700
				SUBTOTAL	$112,400
				ENGINEERING- 15.0%	$16,900
			TOTAL CONSTRUCTION COST		**$129,300**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

MEDIUM SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
11 Brick Court, Staten Island					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	1,620	SF	33 x 6 x 4 x 5ea)		
RETENTION VOL	648	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	2,370	SF	(395 x6 x2)		
RETENTION VOL	1,867	CF			
DISTURBED AREA	27,903	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth (560' x 6' x 4') +	498	CY	$ 100.00	$ 49,778	
- truck away spoil- add 20%	597	CY	$ 50.00	$ 29,867	
Install 12" open graded stone base	60	CY	$ 82.00	$ 4,920	
6" PVC perforated pipe	560	LF	$ 25.00	$ 14,000	
Perforated pipe cleanouts	5	EA	$ 150.00	$ 750	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	3,240	SF	$ 0.75	$ 2,430	
Install 36" engineered soil-	180	CY	$ 106.00	$ 19,080	
Install mulch layer (allow 3")	15	CY	$ 40.00	$ 600	
18 x 18" concrete header curb	900	LF	$ 25.00	$ 22,500	
Install 3-1/2" permeable paver on 5-1/2" stone bed	2,370	SF	$ 40.00	$ 94,800	
Install 10" open graded stone base	73	CY	$ 82.00	$ 5,974	
24" x 8" concrete curb	60	LF	$ 55.00	$ 3,300	
Install 24" controlled backfill	176	CY	$ 75.00	$ 13,167	
Deduct Concrete Paving	(2,370)	SF	$ 25.00	$ (59,250)	
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	27,903	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	1,620	SF	$ 7.50	$ 12,150	
				SUBTOTAL	$ 235,815
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$23,585
				SUBTOTAL	$259,400
			G.C. OH & P - 21.0%		$54,500
				SUBTOTAL	$313,900
			CONTINGENCY - 20.0%		$62,800
				SUBTOTAL	$376,700
			ENGINEERING- 15.0%		$56,500
			TOTAL CONSTRUCTION COST		**$433,200**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

MEDIUM SIZED COMMERCIA PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
141 South 3 Street, Brooklyn					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	396	SF	(22 x 9 x 4)	(17x9x4)	
RETENTION VOL	648	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	456	SF	(18 x 10 x 4)		
RETENTION VOL	358	CF			
DISTURBED AREA	7,450	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth (142' x 6' x 4')	51	CY	$ 100.00	$ 5,067	
- truck away spoil- add 20%	61	CY	$ 50.00	$ 3,040	
Install 12" open graded stone base	15	CY	$ 82.00	$ 1,203	
6" PVC perforated pipe	57	LF	$ 25.00	$ 1,425	
Perforated pipe cleanouts	2	EA	$ 150.00	$ 300	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	792	SF	$ 0.75	$ 594	
Install 36" engineered soil-	44	CY	$ 106.00	$ 4,664	
Install mulch layer (allow 3")	4	CY	$ 40.00	$ 147	
18 x 18" concrete header curb - +/-	140	LF	$ 25.00	$ 3,500	
Install 3-1/2" permeable paver on 5-1/2" stone bed	456	SF	$ 40.00	$ 18,240	
Install 10" open graded stone base	34	CY	$ 82.00	$ 2,770	
24" x 8" concrete curb	12	LF	$ 55.00	$ 660	
Install 24" controlled backfill	34	CY	$ 75.00	$ 2,533	
Deduct Concrete Paving	(456)	SF	$ 25.00	$ (11,400)	
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	7,450	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	396	SF	$ 7.50	$ 2,970	
				SUBTOTAL	$ 57,462
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$5,738
				SUBTOTAL	$63,200
			G.C. OH & P - 21.0%		$13,300
				SUBTOTAL	$76,500
			CONTINGENCY - 20.0%		$15,300
				SUBTOTAL	$91,800
			ENGINEERING- 15.0%		$13,800
			TOTAL CONSTRUCTION COST		**$105,600**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

LARGE SIZED COMMERCIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
1759 Hylan Blvd, Staten Island					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	1,216	SF	(60 x 16 x 4)	(16 x16 x 4)	
RETENTION VOL	1,989	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	912	SF	(22 x16 x 2)	(35 x16 x2)	
RETENTION VOL	712	CF			
DISTURBED AREA	21,600	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth	315	CY	$ 100.00	$ 31,526	
- truck away spoil- add 20%	378	CY	$ 50.00	$ 18,916	
Install 12" open graded stone base	45	CY	$ 82.00	$ 3,693	
6" PVC perforated pipe	133	LF	$ 25.00	$ 3,325	
Perforated pipe cleanouts	2	EA	$ 150.00	$ 300	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	2,432	SF	$ 0.75	$ 1,824	
Install 36" engineered soil-	135	CY	$ 106.00	$ 14,322	
Install mulch layer (allow 3")	11	CY	$ 40.00	$ 450	
18 x 18" concrete header curb	276	LF	$ 25.00	$ 6,900	
Install 3-1/2" permeable paver on 5-1/2" stone bed	912	SF	$ 40.00	$ 36,480	
Install 10" open graded stone base	68	CY	$ 82.00	$ 5,540	
24" x 8" concrete curb	12	LF	$ 55.00	$ 660	
Install 24" controlled backfill	68	CY	$ 75.00	$ 5,067	
Deduct Concrete Paving	(912)	SF	$ 25.00	$ (22,800)	
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	21,600	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	1,216	SF	$ 7.50	$ 9,120	
				SUBTOTAL	$ 137,072
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$13,728
				SUBTOTAL	$150,800
			G.C. OH & P - 21.0%		$31,700
				SUBTOTAL	$182,500
			CONTINGENCY - 20.0%		$36,500
				SUBTOTAL	$219,000
			ENGINEERING- 15.0%		$32,900
			TOTAL CONSTRUCTION COST		**$251,900**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

LARGE SIZED RESIDENTIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
14 Ottavio Promanade, Staten Island					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	264	SF	(24 x 11 x 4)		
RETENTION VOL	432	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	528	SF	(24 x22 x 2)		
RETENTION VOL	415	CF			
DISTURBED AREA	7,450	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth	78	CY	$ 100.00	$ 7,822	
- truck away spoil- add 20%	94	CY	$ 50.00	$ 4,693	
Install 12" open graded stone base	10	CY	$ 82.00	$ 802	
6" PVC perforated pipe	48	LF	$ 25.00	$ 1,200	
Perforated pipe cleanouts	1	EA	$ 150.00	$ 150	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	528	SF	$ 0.75	$ 396	
Install 36" engineered soil-	29	CY	$ 106.00	$ 3,109	
Install mulch layer (allow 3")	2	CY	$ 40.00	$ 98	
18 x 18" concrete header curb	114	LF	$ 25.00	$ 2,850	
Install 3-1/2" permeable paver on 5-1/2" stone bed	528	SF	$ 40.00	$ 21,120	
Install 10" open graded stone base	16	CY	$ 82.00	$ 1,331	
24" x 8" concrete curb	12	LF	$ 55.00	$ 660	
Install 24" controlled backfill	39	CY	$ 75.00	$ 2,933	
Deduct Concrete Paving	(528)	SF	$ 25.00	$ (13,200)	
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	7,450	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	264	SF	$ 7.50	$ 1,980	
				SUBTOTAL	$ 57,695
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$5,805
				SUBTOTAL	$63,500
				G.C. OH & P - 21.0%	$13,300
				SUBTOTAL	$76,800
				CONTINGENCY - 20.0%	$15,400
				SUBTOTAL	$92,200
				ENGINEERING- 15.0%	$13,800
			TOTAL CONSTRUCTION COST		**$106,000**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

LARGE SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
89 West Tremont Avenue, Bronx					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	840	SF	(42 x 10 x 4 x 2 ea)		
RETENTION VOL	1,374	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	100	SF	(10 x10 x 2)		
RETENTION VOL	79	CF			
DISTURBED AREA	19,146	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth	139	CY	$ 100.00	$ 13,926	
- truck away spoil- add 20%	167	CY	$ 50.00	$ 8,356	
Install 12" open graded stone base	31	CY	$ 82.00	$ 2,551	
6" PVC perforated pipe	94	LF	$ 25.00	$ 2,350	
Perforated pipe cleanouts	2	EA	$ 150.00	$ 300	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	1,680	SF	$ 0.75	$ 1,260	
Install 36" engineered soil-	93	CY	$ 106.00	$ 9,893	
Install mulch layer (allow 3")	8	CY	$ 40.00	$ 311	
18 x 18" concrete header curb	124	LF	$ 25.00	$ 3,100	
Install 3-1/2" permeable paver on 20-1/2" stone bed	100	SF	$ 55.00	$ 5,500	
Install 24" open graded stone base	3	CY	$ 82.00	$ 252	
24" x 8" concrete curb	12	LF	$ 55.00	$ 660	
Install 24" controlled backfill	7	CY	$ 75.00	$ 556	
Deduct Concrete Paving	(100)	SF	$ 25.00	$ (2,500)	
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	19,146	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	840	SF	$ 7.50	$ 6,300	
				SUBTOTAL	$ 74,565
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$7,435
				SUBTOTAL	$82,000
			G.C. OH & P - 21.0%		$17,200
				SUBTOTAL	$99,200
			CONTINGENCY - 20.0%		$19,800
				SUBTOTAL	$119,000
			ENGINEERING- 15.0%		$17,900
			TOTAL CONSTRUCTION COST		**$136,900**

BIORETENTION WITH POROUS PAVERS AND UNDERDRAIN CAPITAL COST ESTIMATE

MEDIUM SIZED RESIDENTIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
262 Corbin Place, Bronx, NY					
DESCRIPTION	QUANTITY		UNIT PRICE	AMOUNT	TOTAL
SMP AREA - BIORETENSION	240	SF	(20 x 6 x 4 x 2 ea)		
RETENTION VOL	393	CF			
SMP AREA - POROUS PAVEMENT BRIDGE	560	SF	(28 x20 x 2)		
RETENTION VOL	833	CF			
DISTURBED AREA	6,434	SF			
ENGIN SOIL DEPTH	36	INCH			
STONE BASE DEPTH	12	INCH			
PERFORATED PIPE SIZE	6	INCH			
Excavate to specfied depth	77	CY	$ 100.00	$ 7,704	
- truck away spoil- add 20%	92	CY	$ 50.00	$ 4,622	
Install 12" open graded stone base	9	CY	$ 82.00	$ 729	
6" PVC perforated pipe	40	LF	$ 25.00	$ 1,000	
Perforated pipe cleanouts	2	EA	$ 150.00	$ 300	
Concrete trough for overflow pipe	1	LS	$ 2,500.00	$ 2,500	
Install geotech fabric at stone-wrap top & bottom	480	SF	$ 0.75	$ 360	
Install 36" engineered soil-	27	CY	$ 106.00	$ 2,827	
Install mulch layer (allow 3")	2	CY	$ 40.00	$ 89	
18 x 18" concrete header curb	92	LF	$ 25.00	$ 2,300	
Install 3-1/2" permeable paver on 20-1/2" stone bed	560	SF	$ 55.00	$ 30,800	
Install 24" open graded stone base	17	CY	$ 82.00	$ 1,412	
24" x 8" concrete curb	24	LF	$ 55.00	$ 1,320	
Install 24" controlled backfill	41	CY	$ 75.00	$ 3,111	
Deduct Concrete Paving	(560)	SF			
3' x 6' Access Hatch by Syracuse Castings	1	EA	$ 3,000.00	$ 3,000	
4" wide concrete apron at Hatch	1	LS	$ 1,000.00	$ 1,000	
Outlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Repair disturbed area	6,434	SF	$ 2.50		
Conveyance	50	LF		$ 9,000	
Planting Area	240	SF	$ 7.50	$ 1,800	
				SUBTOTAL	$ 80,123
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$7,977
				SUBTOTAL	$88,100
			G.C. OH & P - 21.0%		$18,500
				SUBTOTAL	$106,600
			CONTINGENCY - 20.0%		$21,300
				SUBTOTAL	$127,900
			ENGINEERING- 15.0%		$19,200
			TOTAL CONSTRUCTION COST		**$147,100**

GREEN ROOF CAPITAL COST ESTIMATE

MEDIUM INDUSTRIAL
SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

508 Smith Street, BK

DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT	TOTAL
Green Roof SCM Area	7,210	SF			
SCM Volume	134	CY			
Managed Area	7,210	SF			
Retention Volume	901	CF			
Greened Acre	0.17	Ac			
Pavers SCM Area	1,525	SF			
Managed Area	1,525	SF			
Detention Volume	191	CF			
	-				
6" deep green roof trays (installation included)	7,210	SF	$ 15.25	$ 109,953	
1' square pavers (instalation included)	1,525	SF	$ 15.00	$ 22,875	
				SUBTOTAL	$ 132,828
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$13,283
				SUBTOTAL	$146,110
				G.C. OH & P - 21.0%	$30,683
				SUBTOTAL	$176,793
				CONTINGENCY - 20.0%	$35,359
				SUBTOTAL	$212,152
				TOTAL CONSTRUCTION COST	**$212,152**

GREEN ROOF CAPITAL COST ESTIMATE

MEDIUM INDUSTRIAL
SPACE UNCONSTRAINED - SOIL CONSTRAINED

141 Storer Avenue, SI

DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT	TOTAL
Green Roof SCM Area	2,890	SF			
Green Roof SCM Volume	54	CY			
Managed Area	2,890	SF			
Retention Volume	361	CF			
Greened Acre	0.07	Ac			
Pavers SCM Area	920	SF			
Managed Area	920	SF			
Detention Volume	115	CF			
Detention Vault SCM Area	130	SF			
Managed Area	4,190	SF			
Detention Volume	530	CF			
Engineered Chamber Depth	3	LF			
Engineered Chamber Width	8	LF			
Engineer Chamber Length	16	LF			
Wall Thickness	6	IN.			
6" deep green roof trays (installation included)	2,890	SF	$ 15.25	$ 44,073	
1' square pavers (instalation included)	920	SF	$ 15.00	$ 13,800	
Excavate to specfied depth (assume 24' x 16')	57	CY	$ 100.00	$ 5,689	
Finish grade for bottom slab	131	SF	$ 5.00	$ 655	
- truck away spoil- add 20%	68	CY	$ 50.00	$ 3,413	
Bottom Reinf Concrete Slab - assume 6"/wwm	554	SF	$ 30.00	$ 16,620	
Reinf Concrete Chamber Walls 6"	150	CY	$ 70.00	$ 10,500	
Reinf Concrete Top Supp. Slab - 6"	131	SF	$ 40.00	$ 5,240	
Reinf Interior Concrete Chamber Walls - 4"	28	CY	$ 80.00	$ 2,240	
Gravel Backfill at Chamber	43	CY	$ 65.00	$ 2,795	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 6.5 x 1.5)					
Excavate to specfied depth (assume 19' x 16')	19	CY	$ 100.00	$ 1,852	
Finish grade for bottom slab	131	SF	$ 5.00	$ 655	
- truck away spoil- add 20%	22	CY	$ 50.00	$ 1,111	
Bottom Reinf Concrete Slab - assume 6"/wwm	65	SF	$ 30.00	$ 1,950	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	65	SF	$ 40.00	$ 2,600	
Reinf Interior Concrete Chamber Walls - 4"	11	SF	$ 80.00	$ 880	
Gravel Backfill at Chamber	15	CY	$ 65.00	$ 969	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	

SUBTOTAL	$ 139,357
GENERAL CONDITIONS, BONDS & INS - 10.0%	$13,936
SUBTOTAL	$153,292
G.C. OH & P - 21.0%	$32,191
SUBTOTAL	$185,484
CONTINGENCY - 20.0%	$37,097
SUBTOTAL	$222,580
TOTAL CONSTRUCTION COST	**$222,580**

GREEN ROOF CAPITAL COST ESTIMATE

LARGE INDUSTRIAL
SPACE CONSTRAINED - SOIL (UN)CONSTRAINED

305 Johnson Ave. BK

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	22,560	SF			
Green Roof SCM Volume	418	CY			
Managed Area	22,560	SF			
Retention Volume	2,820	CF			
Greened Acre	0.52	Ac			
Pavers SCM Area	2,020	SF			
Managed Area	2,020	SF			
Detention Volume	253	CF			
6" deep green roof trays (installation included)	22,560	SF	$ 15.25	$ 344,040	
1' square pavers (instalation included)	2,020	SF	$ 15.00	$ 30,300	

SUBTOTAL	$ 374,340
GENERAL CONDITIONS, BONDS & INS - 10.0%	$37,434
SUBTOTAL	$411,774
G.C. OH & P - 21.0%	$86,473
SUBTOTAL	$498,247
CONTINGENCY - 20.0%	$99,649
SUBTOTAL	$597,896
TOTAL CONSTRUCTION COST	**$597,896**

GREEN ROOF CAPITAL COST ESTIMATE

LARGE RESIDENTIAL
SPACE UNCONSTRAINED - SOIL CONSTRAINED

89 West Tremont Ave. BX

DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT	TOTAL
Green Roof SCM Area	4,220	SF			
Green Roof SCM Volume	78	CY			
Managed Area	4,220	SF			
Retention Volume	528	CF			
Greened Acre	0.10	Ac			
Pavers SCM Area	1,220	SF			
Managed Area	1,220	SF			
Detention Volume	153	CF			
Detention Vault SCM Area	190	SF			
Managed Area	6,050	SF			
Detention Volume	756	CF			
Engineered Chamber Depth	3	LF			
Engineered Chamber Width	10	LF			
Engineer Chamber Length	19	LF			
Wall Thickness	6	IN.			
6" deep green roof trays (installation included)	4,220	SF	$ 15.25	$ 64,355	
1' square pavers (instalation included)	1,220	SF	$ 15.00	$ 18,300	
Detention Vault (10 x19 x3)					
Excavate to specfied depth (25'x 16' x 4')	59	CY	$ 100.00	$ 5,926	
Finish grade for bottom slab	0	SF	$ 5.00	$ -	
- truck away spoil- add 20%	71	CY	$ 50.00	$ 3,556	
Bottom Reinf Concrete Slab - assume 6"/wwm	0	SF	$ 30.00	$ -	
Reinf Concrete Chamber Walls - 6"	0	SF	$ 70.00	$ -	
Reinf Concrete Top Supp. Slab - 6"	0	SF	$ 40.00	$ -	
Reinf Interior Concrete Chamber Walls - 4"	48	SF	$ 80.00	$ 3,840	
Gravel Backfill at Chamber	45	CY	$ 65.00	$ 2,913	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 6.5 x 1.5)					
Excavate to specfied depth (assume 19' x 16')	19	CY	$ 100.00	$ 1,852	
Finish grade for bottom slab	65	SF	$ 5.00	$ 325	
- truck away spoil- add 20%	22	CY	$ 50.00	$ 1,111	
Bottom Reinf Concrete Slab - assume 6"/wwm	65	SF	$ 30.00	$ 1,950	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	65	SF	$ 40.00	$ 2,600	
Reinf Interior Concrete Chamber Walls - 4"	11	SF	$ 80.00	$ 880	
Gravel Backfill at Chamber	15	CY	$ 65.00	$ 987	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	

SUBTOTAL	$ 132,509
GENERAL CONDITIONS, BONDS & INS - 10.0%	$13,251
SUBTOTAL	$145,760
G.C. OH & P - 21.0%	$30,610
SUBTOTAL	$176,370
CONTINGENCY - 20.0%	$35,274
SUBTOTAL	$211,644
TOTAL CONSTRUCTION COST	**$211,644**

GREEN ROOF CAPITAL COST ESTIMATE

LARGE COMMERCIAL
SPACE UNCONSTRAINED - SOIL CONSTRAINED

141 South 3rd Street, BK

DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT	TOTAL
Green Roof SCM Area	2,530	SF			
Green Roof SCM Volume	47	CY			
Managed Area	2,530	SF			
Retention Volume	316	CF			
Greened Acre	0.06	GA			
Pavers SCM Area	1,040	SF			
Managed Area	1,040	SF			
Detention Volume	130	CF			
Detention Vault SCM Area	100	SF			
Managed Area	3,135	SF			
Detention Volume	400	CF			
Engineered Chamber Depth	3	LF			
Engineered Chamber Width	10	LF			
Engineer Chamber Length	10	LF			
Wall Thickness	6	IN.			
6" deep green roof trays (installation included)	2,530	SF	$ 15.25	$ 38,583	
1' square pavers (instalation included)	1,040	SF	$ 15.00	$ 15,600	
Detention Vault (10 x 10 x3)					
Excavate to specfied depth (16'x 16' x 4')	38	CY	$ 100.00	$ 3,793	
Finish grade for bottom slab	100	SF	$ 5.00	$ 500	
- truck away spoil- add 20%	46	CY	$ 50.00	$ 2,276	
Bottom Reinf Concrete Slab - assume 6"/wwm	100	SF	$ 30.00	$ 3,000	
Reinf Concrete Chamber Walls - 6"	120	SF	$ 70.00	$ 8,400	
Reinf Concrete Top Supp. Slab - 6"	100	SF	$ 40.00	$ 4,000	
Reinf Interior Concrete Chamber Walls - 4"	36	SF	$ 80.00	$ 2,880	
Gravel Backfill at Chamber	23	CY	$ 65.00	$ 1,526	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 5 x 1.5)					
Excavate to specfied depth (11' x 16' X 2.5)	17	CY	$ 100.00	$ 1,704	
Finish grade for bottom slab	50	SF	$ 5.00	$ 250	
- truck away spoil- add 20%	20	CY	$ 50.00	$ 1,022	
Bottom Reinf Concrete Slab - assume 6"/wwm	50	SF	$ 30.00	$ 1,500	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	50	SF	$ 40.00	$ 2,000	
Reinf Interior Concrete Chamber Walls - 4"	8	SF	$ 80.00	$ 640	
Gravel Backfill at Chamber	14	CY	$ 65.00	$ 927	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	

SUBTOTAL	$ 112,115
GENERAL CONDITIONS, BONDS & INS - 10.0%	$11,211
SUBTOTAL	$123,326
G.C. OH & P - 21.0%	$25,899
SUBTOTAL	$149,225
CONTINGENCY - 20.0%	$29,845
SUBTOTAL	$179,070
TOTAL CONSTRUCTION COST	**$179,070**

GREEN ROOF CAPITAL COST ESTIMATE

LARGE COMMERCIAL
SPACE CONSTRAINED - SOIL (UN)CONSTRAINED
1256 2nd Avenue, MN

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	6,790	SF			
Green Roof SCM Volume	126	CY			
Managed Area	6,790	SF			
Retention Volume	850	CF			
Greened Acres	0.16	Ac			
Pavers SCM Area	10,700	SF			
Managed Area	10,700	SF			
Detention Volume	1,340	CF			
6" deep green roof trays (installation included)	6,790	SF	$ 15.25	$ 103,548	
1' square pavers (instalation included)	10,700	SF	$ 15.00	$ 160,500	
				SUBTOTAL	$ 264,048
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$26,405
				SUBTOTAL	$290,452
				G.C. OH & P - 21.0%	$60,995
				SUBTOTAL	$351,447
				CONTINGENCY - 20.0%	$70,289
				SUBTOTAL	$421,737
				TOTAL CONSTRUCTION COST	**$421,737**

GREEN ROOF CAPITAL COST ESTIMATE

LARGE COMMERCIAL
SPACE UNCONSTRAINED - SOIL CONSTRAINED
1759 Hylan Blvd, SI

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	4,940	SF			
Green Roof SCM Volume	91	CY			
Managed Area	4,940	SF			
Retention Volume	620	CF			
Greened Acre	0.11	Ac			
Pavers SCM Area	2,000	SF			
Managed Area	2,000	SF			
Detention Volume	250	CF			
Detention Vault SCM Area	460	SF			
Managed Area	14,660	SF			
Detention Volume	1,883	CF			
Engineered Chamber Depth	3	LF			
Engineered Chamber Width	16	LF			
Engineer Chamber Length	30	LF			
Wall Thickness	6	IN.			
6" deep green roof trays (installation included)	4,940	SF	$ 15.25	$ 75,335	
1' square pavers (instalation included)	2,000	SF	$ 15.00	$ 30,000	
Detention Vault (30 x 15.5 x 3)					
Excavate to specfied depth (36'x 21 x 4')	112	CY	$ 100.00	$ 11,200	
Finish grade for bottom slab	465	SF	$ 5.00	$ 2,325	
- truck away spoil- add 20%	134	CY	$ 50.00	$ 6,720	
Bottom Reinf Concrete Slab - assume 6"/wwm	465	SF	$ 30.00	$ 13,950	
Reinf Concrete Chamber Walls - 6"	273	SF	$ 70.00	$ 19,110	
Reinf Concrete Top Supp. Slab - 6"	465	SF	$ 40.00	$ 18,600	
Reinf Interior Concrete Chamber Walls - 4"	62	SF	$ 80.00	$ 4,960	
Gravel Backfill at Chamber	60	CY	$ 65.00	$ 3,922	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 5 x 1.5)					
Excavate to specfied depth (11' x 16' X 2.5)	17	CY	$ 100.00	$ 1,704	
Finish grade for bottom slab	50	SF	$ 5.00	$ 250	
- truck away spoil- add 20%	20	CY	$ 50.00	$ 1,022	
Bottom Reinf Concrete Slab - assume 6"/wwm	50	SF	$ 30.00	$ 1,500	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	50	SF	$ 40.00	$ 2,000	
Reinf Interior Concrete Chamber Walls - 4"	8	SF	$ 80.00	$ 640	
Gravel Backfill at Chamber	17	CY	$ 65.00	$ 1,107	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	

SUBTOTAL	$ 218,260
GENERAL CONDITIONS, BONDS & INS - 10.0%	$21,826
SUBTOTAL	$240,086
G.C. OH & P - 21.0%	$50,418
SUBTOTAL	$290,504
CONTINGENCY - 20.0%	$58,101
SUBTOTAL	$348,605
TOTAL CONSTRUCTION COST	**$348,605**

GREEN ROOF CAPITAL COST ESTIMATE

MEDIUM RESIDENTIAL
SPACE CONSTRAINED - SOIL (UN)CONSTRAINED
560 Carroll Street, BK

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	1,500	SF			
Green Roof SCM Volume	28	CY			
Managed Area	1,500	SF			
Retention Volume	188	CF			
Greened Acre	0.03	Ac			
Pavers SCM Area	3,350	SF			
Managed Area	3,350	SF			
Detention Volume	419	CF			
6" deep green roof trays (installation included)	1,500	SF	$ 15.25	$ 22,875	
1' square pavers (instalation included)	3,350	SF	$ 15.00	$ 50,250	
				SUBTOTAL	$ 73,125
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$7,313
				SUBTOTAL	$80,438
				G.C. OH & P - 21.0%	$16,892
				SUBTOTAL	$97,329
				CONTINGENCY - 20.0%	$19,466
				SUBTOTAL	$116,795
				TOTAL CONSTRUCTION COST	**$116,795**

LARGE RESIDENTIAL
SPACE CONSTRAINED - SOIL (UN)CONSTRAINED
462 West 58th Street, MN

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	4,070	SF			
Green Roof SCM Volume	75	CY			
Managed Area	4,070	SF			
Retention Volume	509	CF			
Greened Acre	0.09	Ac			
Pavers SCM Area	10,000	SF			
Managed Area	10,000	SF			
Detention Volume	1,250	CF			
6" deep green roof trays (installation included)	4,070	SF	$ 15.25	$ 62,068	
1' square pavers (instalation included)	10,000	SF	$ 15.00	$ 150,000	
				SUBTOTAL	$ 212,068
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$21,207
				SUBTOTAL	$233,274
				G.C. OH & P - 21.0%	$48,988
				SUBTOTAL	$282,262
				CONTINGENCY - 20.0%	$56,452
				SUBTOTAL	$338,714
				TOTAL CONSTRUCTION COST	**$338,714**

GREEN ROOF CAPITAL COST ESTIMATE

LARGE INDUSTRIAL
SPACE UNCONSTRAINED - SOIL CONSTRAINED
11 Brick Ct, SI

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	10,670	SF			
Green Roof SCM Volume	198	CY			
Managed Area	10,670	SF			
Retention Volume	1,334	CF			
Greened Acre	0.24	Ac			
Pavers SCM Area	1,660	SF			
Managed Area	1,660	SF			
Detention Volume	208	CF			
Detention Vault SCM Area	485	SF			
Managed Area	15,570	SF			
Detention Volume	1947	CF			
Engineered Chamber Depth	3	LF			
Engineered Chamber Width	16.2	LF			
Engineer Chamber Length	30	LF			
Wall Thickness	6	IN.			
6" deep green roof trays (installation included)	10,670	SF	$ 15.25	$ 162,718	
1' square pavers (instalation included)	1,660	SF	$ 15.00	$ 24,900	
Detention Vault (30 x 16.2 x 3)					
Excavate to specfied depth (36'x 23 x 4')	123	CY	$ 100.00	$ 12,267	
Finish grade for bottom slab	486	SF	$ 5.00	$ 2,430	
- truck away spoil- add 20%	147	CY	$ 50.00	$ 7,360	
Bottom Reinf Concrete Slab - assume 6"/wwm	486	SF	$ 30.00	$ 14,580	
Reinf Concrete Chamber Walls - 6"	276	SF	$ 70.00	$ 19,320	
Reinf Concrete Top Supp. Slab - 6"	486	SF	$ 40.00	$ 19,440	
Reinf Interior Concrete Chamber Walls - 4"	61	SF	$ 80.00	$ 4,864	
Gravel Backfill at Chamber	51	CY	$ 65.00	$ 3,293	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (20 x 12.5 x 1.5)					
Excavate to specfied depth (11' x 16' X 2.5)	17	CY	$ 100.00	$ 1,704	
Finish grade for bottom slab	50	SF	$ 5.00	$ 250	
- truck away spoil- add 20%	20	CY	$ 50.00	$ 1,022	
Bottom Reinf Concrete Slab - assume 6"/wwm	50	SF	$ 30.00	$ 1,500	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	50	SF	$ 40.00	$ 2,000	
Reinf Interior Concrete Chamber Walls - 4"	8	SF	$ 80.00	$ 640	
Gravel Backfill at Chamber	4	CY	$ 65.00	$ 277	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00		
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	

SUBTOTAL	$ 302,479
GENERAL CONDITIONS, BONDS & INS - 10.0%	$30,248
SUBTOTAL	$332,727
G.C. OH & P - 21.0%	$69,873
SUBTOTAL	$402,600
CONTINGENCY - 20.0%	$80,520
SUBTOTAL	$483,120
TOTAL CONSTRUCTION COST	**$483,120**

GREEN ROOF CAPITAL COST ESTIMATE

MEDIUM COMMERCIAL
SPACE CONSTRAINED - SOIL (UN)CONSTRAINED
132-08 Pople Ave, QN

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
Green Roof SCM Area	1,549	SF			
Green Roof SCM Volume	29	CY			
Managed Area	1,549	SF			
Retention Volume	194	CF			
Greened Acre	0.04	Ac			
Pavers SCM Area	4,600	SF			
Managed Area	4,600	SF			
Detention Volume	575	CF			
6" deep green roof trays (installation included)	1,549	SF	$ 15.25	$ 23,622	
1' square pavers (instalation included)	4,600	SF	$ 15.00	$ 69,000	
				SUBTOTAL	$ 92,622
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$9,262
				SUBTOTAL	$101,884
				G.C. OH & P - 21.0%	$21,396
				SUBTOTAL	$123,280
				CONTINGENCY - 20.0%	$24,656
				SUBTOTAL	$147,936
				TOTAL CONSTRUCTION COST	**$147,936**

SAND FILTER CAPITAL COST ESTIMATE

MEDIUM SIZED INDUSTRIAL PROPERTY					
SPACE CONSTRAINED - SOIL UNCONSTRAINED					
508 Smith Street, Brooklyn					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	204	SF			
DISTURBED AREA	8,800	SF			
RETENTION VOL	1,103	CF			
ENGIN CHAMBER DEPTH	9	LF			
ENGIN. CHAMBER WIDTH	8	LF			
ENGIN CHAMBER LENGTH	31.58	LF			
WALL THICKNESS-	12	INCH			
Excavate to specfied depth (assume 14' x 44')	228	CY	$ 100.00	$ 22,815	
Finish grade for bottom slab	253	SF	$ 5.00	$ 1,263	
- truck away spoil- add 20%	274	CY	$ 50.00	$ 13,689	
Bottom Reinf Concrete Slab - 12"	253	SF	$ 25.00	$ 6,316	
Reinf Concrete Chamber Walls - 12"	20.7	CY	$ 1,500.00	$ 31,111	
Reinf Concrete Top Supp. Slab - 12"	253	SF	$ 75.00	$ 18,948	
Reinf Interior Concrete Chamber Walls - assume 6	1.9	CY	$ 1,500.00	$ 2,833	
Gravel Backfill at Chamber	144	CY	$ 65.00	$ 9,356	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: (assume 15' x 8' X 3')	120	SF			
Install 11" stone base-M	4	CY	$ 100.00	$ 409	
Install 6" PVC Perf. Pipe Underdrain	45	LF	$ 25.00	$ 1,125	
Install 24" clean washed sand	8.9	CY	$ 75.00	$ 667	
Install 1" debris screen	120	SF	$ 5.00	$ 600	
Install 12" +/- gravel	4.4	CY	$ 75.00	$ 333	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 126,465
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$12,635
				SUBTOTAL	$139,100
				G.C. OH & P - 21.0%	$29,200
				SUBTOTAL	$168,300
				CONTINGENCY - 20.0%	$33,700
				SUBTOTAL	$202,000
				ENGINEERING- 15.0%	$30,300
			TOTAL CONSTRUCTION COST		**$232,300**

SAND FILTER CAPITAL COST ESTIMATE

LARGE SIZED INDUSTRIAL PROPERTY					
SPACE CONSTRAINED - SOIL UNCONSTRAINED					
305 Johnson Ave, Bronx					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	565.5	SF			
DISTURBED AREA	24,580	SF			
RETENTION VOL	3,086	CF			
ENGIN CHAMBER DEPTH -	9	LF			
ENGIN. CHAMBER WIDTH -	13	LF			
ENGIN CHAMBER LENGTH	49.58	LF			
WALL THICKNESS-	12	INCH			
Excavate to specfied depth (assume 15' x 49')	394	CY	$ 100.00	$ 39,407	
Finish grade for bottom slab	650	SF	$ 5.00	$ 3,250	
- truck away spoil- add 20%	473	CY	$ 50.00	$ 23,644	
Bottom Reinf Concrete Slab - 12"	650	SF	$ 25.00	$ 16,250	
Reinf Concrete Chamber Walls - 12"	32.7	CY	$ 1,500.00	$ 49,000	
Reinf Concrete Top Supp. Slab - 12"	650	SF	$ 75.00	$ 48,750	
Reinf Interior Concrete Chamber Walls - assume 6	3.5	CY	$ 1,500.00	$ 5,194	
Gravel Backfill at Chamber	286	CY	$ 65.00	$ 18,573	
				$ -	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: (assume 25' x13' X 3')	325	SF			
Install 11" stone base-M	4	CY	$ 100.00	$ 409	
Install 6" PVC Perf. Pipe Underdrain	75	LF	$ 25.00	$ 1,875	
Install 24" clean washed sand	24.1	CY	$ 75.00	$ 1,806	
Install 1" debris screen	325	SF	$ 5.00	$ 1,625	
Install 12" +/- gravel	12.0	CY	$ 75.00	$ 903	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 227,687
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$22,813
				SUBTOTAL	$250,500
				G.C. OH & P - 21.0%	$52,600
				SUBTOTAL	$303,100
				CONTINGENCY - 20.0%	$60,600
				SUBTOTAL	$363,700
				ENGINEERING- 15.0%	$54,600
			TOTAL CONSTRUCTION COST		**$418,300**

SAND FILTER CAPITAL COST ESTIMATE

LARGE SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
11 Brick Court, Staten Island					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	644	SF			
DISTURBED AREA	27,903	SF			
RETENTION VOL	1,541	CF			
ENGIN CHAMBER DEPTH	9	LF			
ENGIN. CHAMBER WIDTH	14	LF			
ENGIN CHAMBER LENGTH	52.08	LF			
WALL THICKNESS-	12	INCH			
Excavate to specfied depth (assume 20' x 58')	430	CY	$ 100.00	$ 42,963	
Finish grade for bottom slab	728	SF	$ 5.00	$ 3,640	
- truck away spoil- add 20%	516	CY	$ 50.00	$ 25,778	
Bottom Reinf Concrete Slab - 12"	700	SF	$ 50.00	$ 35,000	
Reinf Concrete Chamber Walls - 12"	34.2	CY	$ 1,500.00	$ 51,333	
Reinf Concrete Top Supp. Slab - 12"	700	SF	$ 75.00	$ 52,500	
Reinf Interior Concrete Chamber Walls - assume 6	4.7	CY	$ 1,500.00	$ 7,000	
Gravel Backfill at Chamber	187	CY	$ 65.00	$ 12,153	
				$ -	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: 27' X14' X3'	378	SF			
Install 11" stone base-M	13	CY	$ 100.00	$ 1,288	
Install 6" PVC Perf. Pipe Underdrain	81	LF	$ 25.00	$ 2,025	
Install 24" clean washed sand	28.0	CY	$ 75.00	$ 2,100	
Install 1" debris screen	378	SF	$ 5.00	$ 1,890	
Install 12" +/- gravel	14.0	CY	$ 75.00	$ 1,050	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 255,720
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$25,580
				SUBTOTAL	$281,300
				G.C. OH & P - 21.0%	$59,100
				SUBTOTAL	$340,400
				CONTINGENCY - 20.0%	$68,100
				SUBTOTAL	$408,500
				ENGINEERING- 15.0%	$61,300
			TOTAL CONSTRUCTION COST		**$469,800**

SAND FILTER CAPITAL COST ESTIMATE

MEDIUM SIZED COMMERCIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
132-08 Pople Street, Queens					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	154	SF			
DISTURBED AREA	6,500	SF			
RETENTION VOL	828	SF			
ENGIN CHAMBER DEPTH	9	LF			
ENGIN. CHAMBER WIDTH	7	LF			
ENGIN CHAMBER LENGTH	28.08	LF			
WALL THICKNESS	12	INCH			
Excavate to specfied depth (assume 13' x 35')	169	CY	$ 100.00	$ 16,852	
Finish grade for bottom slab	196	SF	$ 5.00	$ 980	
- truck away spoil- add 20%	202	CY	$ 50.00	$ 10,111	
Bottom Reinf Concrete Slab - 12"	196	SF	$ 25.00	$ 4,900	
Reinf Concrete Chamber Walls - 12"	18.1	CY	$ 1,500.00	$ 27,222	
Reinf Concrete Top Supp. Slab - 12"	196	SF	$ 75.00	$ 14,700	
Reinf Interior Concrete Chamber Walls - assume 6	1.6	CY	$ 1,500.00	$ 2,361	
Gravel Backfill at Chamber	26	CY	$ 65.00	$ 1,668	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: (assume 13' x 7' X 3')	91	SF			
Install 11" stone base-M	4	CY	$ 100.00	$ 409	
Install 6" PVC Perf. Pipe Underdrain	45	LF	$ 25.00	$ 1,125	
Install 24" clean washed sand	6.7	CY	$ 75.00	$ 506	
Install 1" debris screen	120	SF	$ 5.00	$ 600	
Install 12" +/- gravel	3.4	CY	$ 75.00	$ 253	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 98,687
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$9,913
				SUBTOTAL	$108,600
				G.C. OH & P - 21.0%	$22,800
				SUBTOTAL	$131,400
				CONTINGENCY - 20.0%	$26,300
				SUBTOTAL	$157,700
				ENGINEERING- 15.0%	$23,700
			TOTAL CONSTRUCTION COST		**$181,400**

SAND FILTER CAPITAL COST ESTIMATE

LARGE SIZED COMMERCIAL PROPERTY					
SPACE CONSTRAINED - SOIL UNCONSTRAINED					
1256 2nd Avenue. Manhattan					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	402	SF			
DISTURBED AREA	20,164	SF			
RETENTION VOL	2,192	SF			
ENGIN CHAMBER DEPTH	9	LF			
ENGIN. CHAMBER WIDTH	11	LF			
ENGIN CHAMBER LENGTH	42.58	LF			
WALL THICKNESS	12	INCH			
Excavate to specfied depth (assume 16' x 49')	290	CY	$ 100.00	$ 29,037	
Finish grade for bottom slab	468	SF	$ 5.00	$ 2,342	
- truck away spoil- add 20%	348	CY	$ 50.00	$ 17,422	
Bottom Reinf Concrete Slab - 12"	468	SF	$ 25.00	$ 11,710	
Reinf Concrete Chamber Walls - 12"	28.0	CY	$ 1,500.00	$ 42,000	
Reinf Concrete Top Supp. Slab - 12"	468	SF	$ 75.00	$ 35,129	
Reinf Interior Concrete Chamber Walls - assume 6	2.8	CY	$ 1,500.00	$ 4,250	
Gravel Backfill at Chamber	151	CY	$ 65.00	$ 9,837	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: - 21' x 11' X 3')	231	SF			
Install 11" stone base-M	8	CY	$ 100.00	$ 787	
Install 6" PVC Perf. Pipe Underdrain	63	LF	$ 25.00	$ 1,575	
Install 24" clean washed sand	17.1	CY	$ 75.00	$ 1,283	
Install 1" debris screen	231	SF	$ 5.00	$ 1,155	
Install 12" +/- gravel	8.6	CY	$ 75.00	$ 642	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 174,168
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$17,432
				SUBTOTAL	$191,600
				G.C. OH & P - 21.0%	$40,200
				SUBTOTAL	$231,800
				CONTINGENCY - 20.0%	$46,400
				SUBTOTAL	$278,200
				ENGINEERING- 15.0%	$41,700
			TOTAL CONSTRUCTION COST		**$319,900**

SAND FILTER CAPITAL COST ESTIMATE

MEDIUM SIZED RESIDENTIAL PROPERTY					
SPACE CONSTRAINED - SOIL UNCONSTRAINED					
560 Carroll Street, Bronx					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	114	SF			
DISTURBED AREA	6,114	SF			
RETENTION VOL	618	SF			
ENGIN CHAMBER DEPTH	9	LF			
ENGIN. CHAMBER WIDTH	6	LF			
ENGIN CHAMBER LENGTH	25.08	LF			
WALL THICKNESS- GIVEN	12	INCH			
Excavate to specfied depth (assume 15' x 49')	138	CY	$ 100.00	$ 13,778	
Finish grade for bottom slab	150	SF	$ 5.00	$ 750	
- truck away spoil- add 20%	165	CY	$ 50.00	$ 8,267	
Bottom Reinf Concrete Slab - 12"	150	SF	$ 25.00	$ 3,750	
Reinf Concrete Chamber Walls - 12"	18.7	CY	$ 1,500.00	$ 28,000	
Reinf Concrete Top Supp. Slab - 12"	150	SF	$ 75.00	$ 11,250	
Reinf Interior Concrete Chamber Walls - assume 6	1.3	CY	$ 1,500.00	$ 1,889	
Gravel Backfill at Chamber	88	CY	$ 65.00	$ 5,720	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: - 11' x 6' X 3')	66	SF			
Install 11" stone base-M	2	CY	$ 100.00	$ 225	
Install 6" PVC Perf. Pipe Underdrain	33	LF	$ 25.00	$ 825	
Install 24" clean washed sand	4.9	CY	$ 75.00	$ 367	
Install 1" debris screen	66	SF	$ 5.00	$ 330	
Install 12" +/- gravel	2.4	CY	$ 75.00	$ 183	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 92,333
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$9,267
				SUBTOTAL	$101,600
				G.C. OH & P - 21.0%	$21,300
				SUBTOTAL	$122,900
				CONTINGENCY - 20.0%	$24,600
				SUBTOTAL	$147,500
				ENGINEERING- 15.0%	$22,100
			TOTAL CONSTRUCTION COST		**$169,600**

SAND FILTER CAPITAL COST ESTIMATE

MEDIUM SIZED REIDENTIAL PROPERTY					
SPACE CONSTRAINED - SOIL UNCONSTRAINED					
462 West 58 Street, Manhattan					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	325	SF			
DISTURBED AREA	14,095	SF			
RETENTION VOL	1,763	SF			
ENGIN CHAMBER DEPTH	9	LF			
ENGIN. CHAMBER WIDTH	10	LF			
ENGIN CHAMBER LENGTH	38.58	LF			
WALL THICKNESS-	12	INCH			
Excavate to specfied depth (assume 16' x 45')	267	CY	$ 100.00	$ 26,667	
Finish grade for bottom slab	390	SF	$ 5.00	$ 1,950	
- truck away spoil- add 20%	320	CY	$ 50.00	$ 16,000	
Bottom Reinf Concrete Slab - 12"	390	SF	$ 25.00	$ 9,750	
Reinf Concrete Chamber Walls - 12"	18.7	CY	$ 1,500.00	$ 28,000	
Reinf Concrete Top Supp. Slab - 12"	390	SF	$ 75.00	$ 29,250	
Reinf Interior Concrete Chamber Walls - assume 6	2.5	CY	$ 1,500.00	$ 3,778	
Gravel Backfill at Chamber	138	CY	$ 65.00	$ 8,974	
Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Access grates at Chamber slab	2	EA	$ 500.00	$ 1,000	
Ladder to Access Grate- 6'	1	EA	$ 600.00	$ 600	
Sandfilter Chamber: - 19' x10' X 3')	190	SF			
Install 11" stone base-M	2	CY	$ 100.00	$ 225	
Install 6" PVC Perf. Pipe Underdrain	57	LF	$ 25.00	$ 1,425	
Install 24" clean washed sand	14.1	CY	$ 75.00	$ 1,056	
Install 1" debris screen	190	SF	$ 5.00	$ 950	
Install 12" +/- gravel	7.0	CY	$ 75.00	$ 528	
Cleanouts	2	EA	$ 500.00	$ 1,000	
Dewatering Valve	1	EA	$ 1,500.00	$ 1,500	
				$ -	
Outlet Pipe	50	LF	$ 125.00	$ 6,250	
Inlet Pipe	50	LF	$ 125.00	$ 6,250	
				$ -	
				SUBTOTAL	$ 145,552
	GENERAL CONDITIONS, BONDS & INS - 10.0%				$14,548
				SUBTOTAL	$160,100
				G.C. OH & P - 21.0%	$33,600
				SUBTOTAL	$193,700
				CONTINGENCY - 20.0%	$38,700
				SUBTOTAL	$232,400
				ENGINEERING- 15.0%	$34,900
			TOTAL CONSTRUCTION COST		**$267,300**

DETENTION VAULT CAPITAL COST ESTIMATE

MEDIUM SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
141 Storer Ave, Bklyn					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	131	SF			
DISTURBED AREA	8,000	SF			
DETENTION VOLUME	524	CF			
ENGIN CHAMBER DEPTH	3	LF			
ENGIN. CHAMBER WIDTH	10	LF			
ENGIN CHAMBER LENGTH	13	LF			
WALL THICKNESS	6	INCH			
Detention Vault (10 x13 x3)					
Excavate to specfied depth (assume 19' x 16' x 4)	45	CY	$ 100.00	$ 4,504	
Finish grade for bottom slab	131	SF	$ 5.00	$ 655	
- truck away spoil- add 20%	54	CY	$ 50.00	$ 2,702	
Bottom Reinf Concrete Slab - assume 6"/wwm	131	SF	$ 30.00	$ 3,930	
Reinf Concrete Chamber Walls 6"	150	SF	$ 70.00	$ 10,500	
Reinf Concrete Top Supp. Slab - 6"	131	SF	$ 40.00	$ 5,240	
Reinf Interior Concrete Chamber Walls - 4"	48	SF	$ 80.00	$ 3,840	
Gravel Backfill at Chamber	31	CY	$ 65.00	$ 1,989	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 6.5 x 1.5)					
Excavate to specfied depth (assume 19' x 16')	19	CY	$ 100.00	$ 1,852	
Finish grade for bottom slab	131	SF	$ 5.00	$ 655	
- truck away spoil- add 20%	22	CY	$ 50.00	$ 1,111	
Bottom Reinf Concrete Slab - assume 6"/wwm	65	SF	$ 30.00	$ 1,950	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	65	SF	$ 40.00	$ 2,600	
Reinf Interior Concrete Chamber Walls - 4"	11	SF	$ 80.00	$ 880	
Gravel Backfill at Chamber	15	CY	$ 65.00	$ 969	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 73,541
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$7,359
				SUBTOTAL	$80,900
				G.C. OH & P - 21.0%	$17,000
				SUBTOTAL	$97,900
				CONTINGENCY - 20.0%	$19,600
				SUBTOTAL	$117,500
				ENGINEERING- 15.0%	$17,600
				TOTAL CONSTRUCTION COST	**$135,100**

DETENTION VAULT CAPITAL COST ESTIMATE

LARGE SIZED RESIDENTIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
89 West Tremont Avenue, Bronx					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	188	SF			
DISTURBED AREA	19,146	SF			
DETENTION VOLUME	756	CF			
ENGIN CHAMBER HEIGHT	3	LF			
ENGIN. CHAMBER WIDTH	10	LF			
ENGIN CHAMBER LENGTH	19	LF			
WALL THICKNESS	6	INCH			
Detention Vault (10 x19 x3)					
Excavate to specfied depth (25'x 16' x 4')	59	CY	$ 100.00	$ 5,926	
Finish grade for bottom slab	190	SF	$ 5.00	$ 950	
- truck away spoil- add 20%	71	CY	$ 50.00	$ 3,556	
Bottom Reinf Concrete Slab - assume 6"/wwm	190	SF	$ 30.00	$ 5,700	
Reinf Concrete Chamber Walls - 6"	174	SF	$ 70.00	$ 12,180	
Reinf Concrete Top Supp. Slab - 6"	190	SF	$ 40.00	$ 7,600	
Reinf Interior Concrete Chamber Walls - 4"	48	SF	$ 80.00	$ 3,840	
Gravel Backfill at Chamber	45	CY	$ 65.00	$ 2,913	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 6.5 x 1.5)					
Excavate to specfied depth (assume 19' x 16')	19	CY	$ 100.00	$ 1,852	
Finish grade for bottom slab	65	SF	$ 5.00	$ 325	
- truck away spoil- add 20%	22	CY	$ 50.00	$ 1,111	
Bottom Reinf Concrete Slab - assume 6"/wwm	65	SF	$ 30.00	$ 1,950	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	65	SF	$ 40.00	$ 2,600	
Reinf Interior Concrete Chamber Walls - 4"	11	SF	$ 80.00	$ 880	
Gravel Backfill at Chamber	15	CY	$ 65.00	$ 987	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 82,534
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$8,266
				SUBTOTAL	$90,800
				G.C. OH & P - 21.0%	$19,100
				SUBTOTAL	$109,900
				CONTINGENCY - 20.0%	$22,000
				SUBTOTAL	$131,900
				ENGINEERING- 15.0%	$19,800
				TOTAL CONSTRUCTION COST	**$151,700**

DETENTION VAULT CAPITAL COST ESTIMATE

MEDIUM SIZED COMMERCIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
141 South 3 Street, Bronx					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	100	SF			
DISTURBED AREA	7,450	SF			
DETENTION VOLUME	397	CF			
ENGIN CHAMBER HEIGHT	3	LF			
ENGIN. CHAMBER WIDTH	10	LF			
ENGIN CHAMBER LENGTH	10	LF			
WALL THICKNESS -	6	INCH			
Detention Vault (10 x 10 x3)					
Excavate to specfied depth (16'x 16' x 4')	38	CY	$ 100.00	$ 3,793	
Finish grade for bottom slab	100	SF	$ 5.00	$ 500	
- truck away spoil- add 20%	46	CY	$ 50.00	$ 2,276	
Bottom Reinf Concrete Slab - assume 6"/wwm	100	SF	$ 30.00	$ 3,000	
Reinf Concrete Chamber Walls - 6"	120	SF	$ 70.00	$ 8,400	
Reinf Concrete Top Supp. Slab - 6"	100	SF	$ 40.00	$ 4,000	
Reinf Interior Concrete Chamber Walls - 4"	36	SF	$ 80.00	$ 2,880	
Gravel Backfill at Chamber	23	CY	$ 65.00	$ 1,526	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 5 x 1.5)					
Excavate to specfied depth (11' x 16' X 2.5)	17	CY	$ 100.00	$ 1,704	
Finish grade for bottom slab	50	SF	$ 5.00	$ 250	
- truck away spoil- add 20%	20	CY	$ 50.00	$ 1,022	
Bottom Reinf Concrete Slab - assume 6"/wwm	50	SF	$ 30.00	$ 1,500	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	50	SF	$ 40.00	$ 2,000	
Reinf Interior Concrete Chamber Walls - 4"	8	SF	$ 80.00	$ 640	
Gravel Backfill at Chamber	14	CY	$ 65.00	$ 927	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 64,182
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$6,418
				SUBTOTAL	$70,600
				G.C. OH & P - 21.0%	$14,800
				SUBTOTAL	$85,400
				CONTINGENCY - 20.0%	$17,100
				SUBTOTAL	$102,500
				ENGINEERING- 15.0%	$15,400
				TOTAL CONSTRUCTION COST	**$117,900**

DETENTION VAULT CAPITAL COST ESTIMATE

LARGE SIZED COMMERCIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
1759 Hylan Blvd, Staten Island					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	460	SF			
DISTURBED AREA	21,600	SF			
DETENTION VOLUME	1,883	CF			
ENGIN CHAMBER HEIGHT	3	LF			
ENGIN. CHAMBER WIDTH	15.5	LF			
ENGIN CHAMBER LENGTH	30	LF			
WALL THICKNESS -	6	INCH			
Detention Vault (30 x 15.5 x 3)					
Excavate to specfied depth (36'x 21 x 4')	112	CY	$ 100.00	$ 11,200	
Finish grade for bottom slab	465	SF	$ 5.00	$ 2,325	
- truck away spoil- add 20%	134	CY	$ 50.00	$ 6,720	
Bottom Reinf Concrete Slab - assume 6"/wwm	465	SF	$ 30.00	$ 13,950	
Reinf Concrete Chamber Walls - 6"	273	SF	$ 70.00	$ 19,110	
Reinf Concrete Top Supp. Slab - 6"	465	SF	$ 40.00	$ 18,600	
Reinf Interior Concrete Chamber Walls - 4"	62	SF	$ 80.00	$ 4,960	
Gravel Backfill at Chamber	60	CY	$ 65.00	$ 3,922	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 5 x 1.5)					
Excavate to specfied depth (11' x 16' X 2.5)	17	CY	$ 100.00	$ 1,704	
Finish grade for bottom slab	50	SF	$ 5.00	$ 250	
- truck away spoil- add 20%	20	CY	$ 50.00	$ 1,022	
Bottom Reinf Concrete Slab - assume 6"/wwm	50	SF	$ 30.00	$ 1,500	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	50	SF	$ 40.00	$ 2,000	
Reinf Interior Concrete Chamber Walls - 4"	8	SF	$ 80.00	$ 640	
Gravel Backfill at Chamber	17	CY	$ 65.00	$ 1,107	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 119,175
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$11,925
				SUBTOTAL	$131,100
				G.C. OH & P - 21.0%	$27,500
				SUBTOTAL	$158,600
				CONTINGENCY - 20.0%	$31,700
				SUBTOTAL	$190,300
				ENGINEERING- 15.0%	$28,500
				TOTAL CONSTRUCTION COST	**$218,800**

DETENTION VAULT CAPITAL COST ESTIMATE

LARGE SIZED INDUSTRIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
11 Brick Court, Staten Island					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	485	SF			
DISTURBED AREA	27,903	SF			
DETENTION VOLUME	1,947	CF			
ENGIN CHAMBER HEIGHT	3	LF			
ENGIN. CHAMBER WIDTH	16.2	LF			
ENGIN CHAMBER LENGTH	30	LF			
WALL THICKNESS -	6	INCH			
Detention Vault (30 x 16.2 x 3)					
Excavate to specfied depth (36'x 23 x 4')	123	CY	$ 100.00	$ 12,267	
Finish grade for bottom slab	486	SF	$ 5.00	$ 2,430	
- truck away spoil- add 20%	147	CY	$ 50.00	$ 7,360	
Bottom Reinf Concrete Slab - assume 6"/wwm	486	SF	$ 30.00	$ 14,580	
Reinf Concrete Chamber Walls - 6"	276	SF	$ 70.00	$ 19,320	
Reinf Concrete Top Supp. Slab - 6"	486	SF	$ 40.00	$ 19,440	
Reinf Interior Concrete Chamber Walls - 4"	61	SF	$ 80.00	$ 4,864	
Gravel Backfill at Chamber	51	CY	$ 65.00	$ 3,293	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (20 x 12.5 x 1.5)					
Excavate to specfied depth (11' x 16' X 2.5)	17	CY	$ 100.00	$ 1,704	
Finish grade for bottom slab	50	SF	$ 5.00	$ 250	
- truck away spoil- add 20%	20	CY	$ 50.00	$ 1,022	
Bottom Reinf Concrete Slab - assume 6"/wwm	50	SF	$ 30.00	$ 1,500	
Reinf Concrete Chamber Walls 6"	50	SF	$ 70.00	$ 3,465	
Reinf Concrete Top Supp. Slab - 6"	50	SF	$ 40.00	$ 2,000	
Reinf Interior Concrete Chamber Walls - 4"	8	SF	$ 80.00	$ 640	
Gravel Backfill at Chamber	4	CY	$ 65.00	$ 277	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 121,112
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$12,088
				SUBTOTAL	$133,200
				G.C. OH & P - 21.0%	$28,000
				SUBTOTAL	$161,200
				CONTINGENCY - 20.0%	$32,200
				SUBTOTAL	$193,400
				ENGINEERING- 15.0%	$29,000
				TOTAL CONSTRUCTION COST	**$222,400**

DETENTION VAULT CAPITAL COST ESTIMATE

LARGE SIZED RESIDENTIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
14 Ottavio Promanade, Staten Island					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	235	SF			
DISTURBED AREA	14,935	SF			
DETENTION VOLUME	943	CF			
ENGIN CHAMBER HEIGHT	3	LF			
ENGIN. CHAMBER WIDTH	12	LF			
ENGIN CHAMBER LENGTH	20	LF			
WALL THICKNESS -	6	INCH			
Detention Vault (20 x 12 x 3)					
Excavate to specfied depth (26'x 18 x 4')	69	CY	$ 100.00	$ 6,933	
Finish grade for bottom slab	235	SF	$ 5.00	$ 1,175	
- truck away spoil- add 20%	83	CY	$ 50.00	$ 4,160	
Bottom Reinf Concrete Slab - assume 6"/wwm	235	SF	$ 30.00	$ 7,050	
Reinf Concrete Chamber Walls - 6"	192	SF	$ 70.00	$ 13,440	
Reinf Concrete Top Supp. Slab - 6"	235	SF	$ 40.00	$ 9,400	
Reinf Interior Concrete Chamber Walls - 4"	40	SF	$ 80.00	$ 3,200	
Gravel Backfill at Chamber	43	CY	$ 65.00	$ 2,773	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 16 x 1.5)					
Excavate to specfied depth (16' x 22' X 2.5)	33	CY	$ 100.00	$ 3,259	
Finish grade for bottom slab	160	SF	$ 5.00	$ 800	
- truck away spoil- add 20%	39	CY	$ 50.00	$ 1,956	
Bottom Reinf Concrete Slab - assume 6"/wwm	160	SF	$ 30.00	$ 4,800	
Reinf Concrete Chamber Walls 6"	78	SF	$ 70.00	$ 5,460	
Reinf Concrete Top Supp. Slab - 6"	160	SF	$ 40.00	$ 6,400	
Reinf Interior Concrete Chamber Walls - 4"	18	SF	$ 80.00	$ 1,440	
Gravel Backfill at Chamber	24	CY	$ 65.00	$ 1,541	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 100,487
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$10,013
				SUBTOTAL	$110,500
				G.C. OH & P - 21.0%	$23,200
				SUBTOTAL	$133,700
				CONTINGENCY - 20.0%	$26,700
				SUBTOTAL	$160,400
				ENGINEERING- 15.0%	$24,100
				TOTAL CONSTRUCTION COST	**$184,500**

DETENTION VAULT CAPITAL COST ESTIMATE

MEDIUM SIZED RESIDENTIAL PROPERTY					
SPACE UNCONSTRAINED - SOIL CONSTRAINED					
262 Corbin Place, Brooklyn					
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	TOTAL
SMP AREA	200	SF			
DISTURBED AREA	6,434	SF			
DETENTION VOLUME	804	CF			
ENGIN CHAMBER HEIGHT	3	LF			
ENGIN. CHAMBER WIDTH	10	LF			
ENGIN CHAMBER LENGTH	20	LF			
WALL THICKNESS -	6	INCH			
Detention Vault (20 x 10 x 3)					
Excavate to specfied depth (26'x 16 x 4')	62	CY	$ 100.00	$ 6,163	
Finish grade for bottom slab	200	SF	$ 5.00	$ 1,000	
- truck away spoil- add 20%	74	CY	$ 50.00	$ 3,698	
Bottom Reinf Concrete Slab - assume 6"/wwm	200	SF	$ 30.00	$ 6,000	
Reinf Concrete Chamber Walls - 6"	180	SF	$ 70.00	$ 12,600	
Reinf Concrete Top Supp. Slab - 6"	200	SF	$ 40.00	$ 8,000	
Reinf Interior Concrete Chamber Walls - 4"	32	SF	$ 80.00	$ 2,560	
Gravel Backfill at Chamber	39	CY	$ 65.00	$ 2,561	
Access Manhole at Chamber slab	1	EA	$ 400.00	$ 400	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
Pretreatment Structure (10 x 13.5 x 1.5)					
Excavate to specfied depth (16' x 19.5' X 2.5)	29	CY	$ 100.00	$ 2,889	
Finish grade for bottom slab	160	SF	$ 5.00	$ 800	
- truck away spoil- add 20%	35	CY	$ 50.00	$ 1,733	
Bottom Reinf Concrete Slab - assume 6"/wwm	160	SF	$ 30.00	$ 4,800	
Reinf Concrete Chamber Walls 6"	78	SF	$ 70.00	$ 5,460	
Reinf Concrete Top Supp. Slab - 6"	160	SF	$ 40.00	$ 6,400	
Reinf Interior Concrete Chamber Walls - 4"	18	SF	$ 80.00	$ 1,440	
Gravel Backfill at Chamber	21	CY	$ 65.00	$ 1,390	
Access Manhole at Chamber slab	2	EA	$ 400.00	$ 800	
Outlet Pipe- ALLOW	50	LF	$ 125.00	$ 6,250	
Outlet Pipe Hood	1	EA	$ 500.00	$ 500	
Inlet Pipe - ALLOW	50	LF	$ 125.00	$ 6,250	
				SUBTOTAL	$ 94,195
				GENERAL CONDITIONS, BONDS & INS - 10.0%	$9,405
				SUBTOTAL	$103,600
				G.C. OH & P - 21.0%	$21,800
				SUBTOTAL	$125,400
				CONTINGENCY - 20.0%	$25,100
				SUBTOTAL	$150,500
				ENGINEERING- 15.0%	$22,600
				TOTAL CONSTRUCTION COST	**$173,100**

BIORETENTION O+M COST ESTIMATE

ASSET TYPE:	BIORETENTION
ASSUMED SURFACE AREA (SF):	400
ASSUMED VOLUME MANAGED (CF):	1,200
IMPERVIOUS AREA MANAGED (SF):	9,600

YEARS 1 & 2

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS: SURFACE CREW ($/HR)	LABOR HOURS: SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE	
		$ 156	$ 440			
Establishment watering only	15	0.75	0.00	11	$ 1,758	[once a week for 6 month growing season; assumes water source is available onsite]
Establishment weeding, plant replacement, pest managemen; establishment watering	5	1.75	0.00	9	$ 1,368	[once a month for 6 month growing season]
Debris and sediment removal; general site cleanup (painting, structural repair, erosion/settling repair, mulching; establishment weeding, plant replacement, pest management; establishment watering	4	3.50	0.00	14	$ 2,188	
Subsurface inspection and maintenance of pipes and structures	0	0.00	4.00	0	$ -	
				Total Labor Fee	$ 5,315	
				Materials Cost Mark-Up (8%)	$ 425	
				TOTAL YEARLY MAINTENANCE FEE	**$ 5,740**	

AFTER FIRST TWO YEARS

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS: SURFACE CREW ($/HR)	LABOR HOURS: SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE
		$ 156	$ 440		
Debris and sediment removal; general site cleanup (painting, structural repair, erosion/settling repair; Weeding, plant replacement, pest management	4	3.0	0	12	$ 1,876
Subsurface inspection and maintenance of pipes and structures				0	$ -
				Total Labor Fee	$ 1,876
				Materials Cost Mark-Up (8%)	$ 150
				TOTAL YEARLY POST-ESTABLISHMENT MAINTENANCE FEE	**$ 2,026**
				ANNUALIZED MAINTENANCE FEE INCL ESTABLISHMENT	**$ 2,211.47**

Complete replacement of sand media after 20 year lifespan assumed

Install 30" open graded stone base	37.0	CY	$ 82.00		$ 3,037
Install 24" engineered Soil	29.6	CY	$ 106.00		$ 3,141
Install mulch layer (3")	3.7	CY	$ 40.00		$ 148
				ADDITIONAL COST FOR REPLACEMENT OF MEDIA	**$ 6,326**

[Assumes a 400 SF bioretention asset with underdrain and planted with a mix of grasses, herbaceous, and small shrubs.]
[Assumes this is for routine maintenance only. Anything that must be completed using a professional is specifically excluded.]
[**SOURCE:** http://www.phila.gov/water/PDF/SWRetroManual.pdf AND http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf]

BIORETENTION WITH POROUS PAVERS AND UNDERDRAINS O+M COST ESTIMATE

ASSET TYPE:	BIORETENTION
ASSUMED SURFACE AREA (SF):	400
ASSUMED VOLUME MANAGED (CF):	800
IMPERVIOUS AREA MANAGED (SF):	6,400

YEARS 1 & 2

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS: SURFACE CREW ($/HR)	LABOR HOURS: SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE	
		$ 156	$ 440			
Establishment watering only	15	0.75	0	11	$ 1,758	[once a week for 6 month growing season; assumes water source is available onsite]
Establishment weeding, plant replacement, pest managemen; establishment watering	5	1.75	0	9	$ 1,368	[once a month for 6 month growing season]
Vacuuming porous pavement strip - concurrent with quarterly tasks	4	0.30	0	1	$ 188	
Debris and sediment removal; general site cleanup (painting, structural repair, erosion/settling repair, mulching; establishment weeding, plant replacement, pest management; establishment watering	4	3.50	0	14	$ 2,188	
Subsurface inspection and maintenance of pipes and structures	0	0.00	4	0	$ -	
				Total Labor Fee	$ 5,502	
				Materials Cost Mark-Up (8%)	$ 440	
				TOTAL YEARLY MAINTENANCE FEE	**$ 5,942**	

AFTER FIRST TWO YEARS

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS: SURFACE CREW ($/HR)	LABOR HOURS: SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE	
		$ 156.31	$ 439.73			
Debris and sediment removal; general site cleanup (painting, structural repair, erosion/settling repair; Weeding, plant replacement, pest management	4	3.00	0	12	$ 1,876	
Vacuuming porous pavement strip - concurrent with quarterly tasks	4	0.30	0	1	$ 188	
Subsurface inspection and maintenance of pipes and structures	1	0.00	2	2		$ 879
				Total Labor Fee	$ 2,063	
				Materials Cost Mark-Up (8%)	$ 235	
				TOTAL YEARLY POST-ESTABLISHMENT MAINTENANCE	**$ 3,178**	
				ANNUALIZED MAINTENANCE FEE INCL	**$ 3,316**	

Complete replacement of sand media after 20 year lifespan assumed

Install 36" engineered soil	44	CY	$ 106.00		$ 4,711
Install 12" open graded stone base	15	CY	$ 82.00		$ 1,215
Install mulch layer (3")	3.7	CY	$ 40.00		$ 148
Install 3-0.5" permeable paver on 20-0.5" stone bed	400	SF	$ 55.00		$ 22,000
Install 24" open graded stone base	30	CY	$ 82.00		$ 2,430
			ADDITIONAL COST FOR REPLACEMENT OF MEDIA		**$ 28,074**

[Assumes a 400 SF bioretention asset with underdrain and planted with a mix of grasses, herbaceous, and small shrubs.]
[Assumes this is for routine maintenance only. Anything that must be completed using a professional is specifically excluded.]
[**SOURCE:** http://www.phila.gov/water/PDF/SWRetroManual.pdf AND http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf]

GREEN ROOF O+M COST ESTIMATE

ASSET TYPE:	GREEN ROOF
ASSUMED SURFACE AREA (SF):	3,000

YEARS 1 & 2

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS: SURFACE CREW ($/HR)	LABOR HOURS: SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE	
		$ 156	$ 440			
Establishment watering only	3	1.0	0	3	$ 469	[Every other week for 6 month growing season]
Establishment weeding, plant replacement, pest management, and establishment watering	9	2.0	0	18	$ 2,814	[once a month for 9 month growing season]
				Total Labor Fee	$ 3,283	
				Materials Cost Mark-Up (15%)	$ 492	
				TOTAL YEARLY MAINTENANCE FEE	**$ 3,775**	

AFTER FIRST TWO YEARS

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS: SURFACE CREW ($/HR)	LABOR HOURS: SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE
		$ 156	$ 440		
Weeding, plant replacement, pest management	3	1.5	0	5	$ 703
Soil testing and amendments	1	1.5	0	2	$ 234
				Total Labor Fee	$ 938
				Materials Cost Mark-Up (15%)	$ 141
				TOTAL YEARLY POST-ESTABLISHMENT MAINTENANCE FEE	**$ 1,079**
				ANNUALIZED MAINTENANCE FEE INCL ESTABLISHMENT	**$ 1,213**

Complete replacement of green roof trays after 20 years

6" deep green roof trays (installation included)	3000	CY	$ 15.25		$ 45,750
				ADDITIONAL COST FOR REPLACEMENT OF MEDIA	**$ 45,750**

[Assumes this is for routine maintenance only. Anything that must be completed using a professional is specifically excluded.]
[**SOURCE:** http://www.phila.gov/water/PDF/SWRetroManual.pdf AND http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf]

SAND FILTER O+M COST ESTIMATE

ASSET TYPE:	SAND FILTER
ASSUMED VOLUME (CF):	2,000
MANAGED IMPERVIOUS AREA (SF):	16,000

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS			
		SURFACE CREW ($/HR)	SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE
		$ 156	$ 440		
Inlet/pre-treatment inspection and vacuuming (sedimentation and overflow chambers)	1	0	4	4	$ 1,759
Subsurface inspection and maintenance of pipes and detention areas; dewatering system and vacuuming gravel layer; replacing gravel and/or sand media as necessary	1	0	8	8	$ 3,518
Observe drawdown rate after large storm	1	1	0	1	$ 156
				Total Labor Fee	$ 5,433
				Materials Cost Mark-Up (10%)	$ 543
				TOTAL YEARLY MAINTENANCE FEE	**$ 5,976**

Complete replacement of sand media after 20 year lifespan assumed

Vacuum removal of the sand using vac truck	1		$ 16.00	12	$ 7,036
Install 11" stone base-M	8	CY	$ 100.00		$ 787
Install 24" clean washed sand	17.1	CY	$ 75.00		$ 1,283
Install 1" debris screen	231	SF	$ 5.00		$ 1,155
Install 12" +/- gravel	8.6	CY	$ 75.00		$ 642
				ADDITIONAL COST FOR REPLACEMENT OF MEDIA	**$ 10,903**

[Assumes this is for routine maintenance only. Anything that must be completed using a professional is specifically excluded.]
[**SOURCE:** http://www.phila.gov/water/PDF/SWRetroManual.pdf AND http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf]

DETENTION TANK O+M COST ESTIMATE

ASSET TYPE:	DETENTION TANK
ASSUMED VOLUME (CF):	2,000
MANAGED IMPERVIOUS AREA (SF):	16,000

Maintenance Task & Description	FREQUENCY (#/YR)	LABOR HOURS				
		SURFACE CREW ($/HR)	SUBSURFACE CREW ($/HR)	HOURS	ESTIMATED LABOR FEE	
		$ 156.31	$ 439.73			
Inspect inflow pipes, screens, and valves for debris that could cause clogs as well as for any structural damage	2	1	0	2	$	313
Subsurface inspection and maintenance of pipes and tank	1	0	4	4	$	1,759
				Total Labor Fee	$	2,072
				Materials Cost Mark-Up (5%)	$	104
				TOTAL YEARLY MAINTENANCE FEE	**$**	**2,175**

[Assumes system could be surface or subsurface tank.]
[Assumes this is for routine maintenance only. Anything that must be completed using a professional is specifically excluded.]
[**SOURCE:** http://www.phila.gov/water/PDF/SWRetroManual.pdf AND http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf]

Appendix 6.1: C

Post-Construction Capital and O&M Unit Costs

UNIT COST ESTIMATES ($/SF MANAGED AREA)

	UC	SOC	SPC	2XC	SPC	2XC
MI	141 Storer Avenue - bioretention	141-Storer Avenue - bioretention + underdrain	508 Smith Street - sand filter		508 Smith Street - green roof	
MC	141 South 3rd Street - bioretention	141 South 3rd Street - bioretention + underdrain	132-08 Pople Ave - sand filter		132-08 Pople Ave - green roof	
MR	262 Corbin Place - bioretention	262 Corbin Place - bioretention + underdrain	560 Carroll Street - sand filter		560 Carroll Street - green roof	
LI	11 Brick Ct - bioretention	11 Brick Ct - bioretention + underdrain	305 Johnson Ave - sand filter		305 Johnson Ave - green roof	
LC	1759 Hylan Blvd - bioretention	1759 Hylan Blvd - bioretention + underdrain	1256 2nd Ave - sand filter		1256 2nd Ave - green roof	
LR	14 Ottavio Prom and 89 West Tremont - bioretention	14 Ottavio Prom and 89 West Tremont - + underdrain	462 w. 58th Street - sand filter		462 w. 58th Street - green roof	

SF MANAGED AREA

	UC	SOC	SPC	2XC	SPC	2XC
MI	8,000	8,000	8,800	8,800	8,800	8,800
MC	7,450	7,450	6,500	6,500	6,500	6,500
MR	6,434	6,434	6,114	6,114	6,114	6,114
LI	27,900	27,900	24,580	24,580	24,580	24,580
LC	21,600	21,600	20,164	20,164	20,164	20,164
LR	17,043	17,043	14,095	14,095	14,095	14,095

CAPITAL COST

	UC	SOC	SPC	2XC	SPC	2XC
MI	$ 39,800	$ 129,300	$ 232,300	$ 232,300	$ 212,152	$ 212,152
MC	$ 37,700	$ 105,600	$ 181,400	$ 181,400	$ 147,936	$ 147,936
MR	$ 36,500	$ 147,100	$ 169,600	$ 169,600	$ 116,795	$ 116,795
LI	$ 116,400	$ 433,200	$ 418,300	$ 418,300	$ 597,896	$ 597,896
LC	$ 102,800	$ 251,900	$ 319,900	$ 319,900	$ 421,737	$ 421,737
LR	$ 51,450	$ 121,450	$ 267,300	$ 267,300	$ 338,714	$ 338,714

Capital Cost per SF Managed

	UC	SOC	SPC	2XC	SPC	2XC
MI	$ 4.98	$ 16.16	$ 26.40	$ 26.40	$ 24.11	$ 24.11
MC	$ 5.06	$ 14.17	$ 27.91	$ 27.91	$ 22.76	$ 22.76
MR	$ 5.67	$ 22.86	$ 27.74	$ 27.74	$ 19.10	$ 19.10
LI	$ 4.17	$ 15.53	$ 17.02	$ 17.02	$ 24.32	$ 24.32
LC	$ 4.76	$ 11.66	$ 15.86	$ 15.86	$ 20.92	$ 20.92
LR	$ 3.02	$ 7.13	$ 18.96	$ 18.96	$ 24.03	$ 24.03

Annual O&M Cost per SF Managed (30yrs 3% Disc.)

	UC	SOC	SPC	2XC	SPC	2XC
MI	$ 0.27	$ 0.66	$ 0.71	$ 0.71	$ 0.80	$ 0.80
MC	$ 0.27	$ 0.66	$ 0.97	$ 0.97	$ 0.80	$ 0.80
MR	$ 0.27	$ 0.66	$ 1.03	$ 1.03	$ 0.80	$ 0.80
LI	$ 0.27	$ 0.66	$ 0.26	$ 0.26	$ 0.80	$ 0.80
LC	$ 0.27	$ 0.66	$ 0.31	$ 0.31	$ 0.80	$ 0.80
LR	$ 0.27	$ 0.66	$ 0.45	$ 0.45	$ 0.80	$ 0.80

Discount Rate	3%
A given P (30 yr)	0.051

TOTAL NPV COST per SF MANAGED IMPERVIOUS AREA

	UC	SOC	SPC	2XC	SPC	SPC
MI	$ 10.22	$ 29.08	$ 40.38	$ 40.38	$ 39.76	$ 39.76
MC	$ 10.30	$ 27.09	$ 46.83	$ 46.83	$ 38.41	$ 38.41
MR	$ 10.91	$ 35.78	$ 47.86	$ 47.86	$ 34.75	$ 34.75
LI	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.97	$ 39.97
LC	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56
LR	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 39.68	$ 39.68

Annualized O&M Cost per SF Managed (30yrs 3% Disc.)

	UC	SOC	SPC	2XC	SPC	2XC
MI	$ 5.24	$ 12.92	$ 13.98	$ 13.98	$ 15.65	$ 15.65
MC	$ 5.24	$ 12.92	$ 18.92	$ 18.92	$ 15.65	$ 15.65
MR	$ 5.24	$ 12.92	$ 20.12	$ 20.12	$ 15.65	$ 15.65
LI	$ 5.24	$ 12.92	$ 5.00	$ 5.00	$ 15.65	$ 15.65
LC	$ 5.24	$ 12.92	$ 6.10	$ 6.10	$ 15.65	$ 15.65
LR	$ 5.24	$ 12.92	$ 8.73	$ 8.73	$ 15.65	$ 15.65

Unit Cost per SF of Disturbed Area																		
Bin Sizes	Residential						Commercial						Industrial					
	UC	SOC	SPC - SF	2XC - SF	SPC - GR	2XC - GR	UC	SOC	SPC - SF	2XC - SF	SPC - GR	2XC - GR	UC	SOC	SPC - SF	2XC - SF	SPC - GR	2XC - GR
>100ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
75-100ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
50-75ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
25-50ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
10-25ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
5-10ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
2-5ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
1-2ac	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
40,000 - 43,560	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
35,000 - 40,000	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
30,000 - 35,000	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
25,000 - 30,000	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.41	$ 28.44	$ 22.02	$ 22.02	$ 39.86	$ 39.86
20,000 - 25,000	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.00	$ 24.58	$ 21.96	$ 21.96	$ 36.56	$ 36.56	$ 9.57	$ 28.57	$ 25.69	$ 25.69	$ 39.86	$ 39.86
15,000 - 20,000	$ 8.26	$ 20.04	$ 27.69	$ 27.69	$ 37.21	$ 37.21	$ 10.08	$ 25.21	$ 28.18	$ 28.18	$ 37.02	$ 37.02	$ 9.73	$ 28.70	$ 29.36	$ 29.36	$ 39.86	$ 39.86
12,500 - 15,000	$ 9.14	$ 25.29	$ 34.41	$ 34.41	$ 37.21	$ 37.21	$ 10.15	$ 25.84	$ 34.40	$ 34.40	$ 37.48	$ 37.48	$ 9.89	$ 28.83	$ 33.03	$ 33.03	$ 39.86	$ 39.86
10,000 - 12,500	$ 10.03	$ 30.54	$ 41.14	$ 41.14	$ 37.21	$ 37.21	$ 10.23	$ 26.46	$ 40.61	$ 40.61	$ 37.95	$ 37.95	$ 10.06	$ 28.95	$ 36.70	$ 36.70	$ 39.86	$ 39.86
7,500 - 10,000	$ 10.91	$ 35.78	$ 47.86	$ 47.86	$ 37.21	$ 37.21	$ 10.30	$ 27.09	$ 46.83	$ 46.83	$ 38.41	$ 38.41	$ 10.22	$ 29.08	$ 40.38	$ 40.38	$ 39.86	$ 39.86
5,000 - 7,500	$ 10.91	$ 35.78	$ 47.86	$ 47.86	$ 37.21	$ 37.21	$ 10.30	$ 27.09	$ 46.83	$ 46.83	$ 38.41	$ 38.41	$ 10.22	$ 29.08	$ 40.38	$ 40.38	$ 39.86	$ 39.86

Appendix 9.1

Work Plan To Determine the Loading Rate of Floatable and Settleable Trash and Debris Discharged from the MS4

August 2018

Prepared in accordance with
SPDES Permit Number NY-0287890
Part IV.1.3

Appendix 9.1
Table of Contents

1.0 Introduction

The City of New York's (City) Municipal Separate Storm Sewer System (MS4) Permit requires the development of a floatable and settleable trash and debris (herein referred to as "floatables") management program as part of the Stormwater Management Program (SWMP). In particular, Part IV.I of the MS4 Permit requires the submission of a work plan "to determine the loading rate of floatable and settleable trash and debris discharged, including land-based sources, from the MS4 to waterbodies listed as impaired for floatables" (New York State Department of Environmental Conservation, 2015). This work plan includes a literature search of methods employed by other municipalities, the proposed methodology for New York City, and a discussion as to why the selected method is best for conditions in New York City.

The City submitted a draft of this work plan to NYSDEC on August 1, 2017 for review. The City also posted the draft work plan on the DEP website on August 1, 2017 and presented it publicly at a Trash Free NYC Waters Meeting on October 4, 2017. The public was encouraged to review the draft work plan and submit comments by October 16, 2017. The City modified this work plan as a result of public input. Responses to the comments received at the public meeting and in writing via electronic mail are included in this work plan as Appendix A.

2.0 Review of Methodologiesto Determine Loading Rates

The City conducted a literature review of methods employed by other municipalities to determine the loading rate of floatables from separate storm sewer systems. As the control of floatables is not a common provision of MS4 permits, and trash TMDLs are similarly infrequent, only a few municipalities attempted to determine a floatables loading rate. Those municipalities with published methodologies include San Francisco, Los Angeles County, Baltimore City and County, and Washington, DC Each of these municipalities is subject to trash TMDLs except San Francisco, and each of these municipalities calculated loading rates that include both MS4 and combined sewer areas, except Los Angeles, which includes MS4 only. Additionally, the City studied the loading rate of floatables in connection with combined sewer overflows (CSOs).

In general, each municipality conducted field monitoring to determine representative floatables loading rates for various land use types, and then applied those representative rates by land use in each catchment area to generate the overall annual loading rate by area. Municipalities selected this method because associating floatables loading rates with land use provided a logical way to extrapolate loading rates from readily available information. However, some municipalities found that land use alone was not a good predictor of loading rate, and attempted to account for other factors such as median income, proximity to "downtown" (high commuter activity) areas, frequency of street sweeping and rainfall. Table 1 summarizes the different methods that each of the other municipalities used to determine loading rates. The following sections provide additional information about the methods used by each municipality.

Table 1. Factors Included in Determination of Floatables Loading Rate

Municipality	Metric	Field Sampling	Land Use	Median Income	Rainfall	Street Sweeping
Los Angeles, CA	Volume	Yes	Yes	No	No	No
Baltimore City, MD	Weight	Yes	Yes	No	Yes (2)	No
Baltimore County, MD	Weight	Yes	Yes	No	Yes (2)	No
Washington, DC	Weight	Yes	Yes	No	Yes (2)	No
San Francisco, CA	Volume	Yes	Yes	Yes (1)	Yes (3)	Yes (3)

Notes:
(1) Used in conjunction with certain land use types
(2) Monitoring period rates per inch of rainfall normalized to long-term annual rainfall
(3) Application of ratio of frequency of rainfall and street sweeping

2.1 Los Angeles County, California

Los Angeles utilized a method to determine floatables loading rates based on land use. Field monitoring was performed between 2002 and 2004 at about 175 sites, with each site consisting of two to four storm-drain inlet structures fitted with full-capture devices (perforated plates) designed to prevent any items larger than 5 mm from exiting the structure for hourly intensities up to the one-year return period. Each site was characterized according to land use in its catchment area, with five land use types: industrial, commercial, open/parks, high-density residential, and low-density residential. Field monitoring involved quantifying the uncompressed volume of trash accumulated in the structure since the prior cleanout, with sediment and vegetation excluded. Los Angeles expressed the observed loading rate for each site as gallons per day of accumulation per acre of catchment.

2.2 Baltimore City and County, Maryland

Baltimore City and Baltimore County determined floatables loading rates using a method based upon the Los Angeles method. However, Baltimore City and Baltimore County followed different field monitoring practices and, as described below, reduced the calculation method to reflect just two land-use types, urban and non-urban (forest).

Baltimore City monitored five stormwater outfall locations to represent two of the City's three major watersheds. No stations were sampled in the Baltimore Harbor watershed due to lack of accessibility, high wet-weather flows, and limitations regarding the catchments available for characterization. Field monitoring involved collecting trash accumulated in capture devices at each outfall every two weeks. Field crews separated trash from vegetation, drained liquid from containers, and allowed the trash to air dry before measuring the trash weight. Baltimore City then calculated the observed loading rate for each outfall as weight of floatables per day of accumulation per acre of catchment.

Baltimore County monitored trash generated over a one-year period at 17 stormwater management facilities (detention ponds) and at 20 in-stream sites. The County selected in-stream sites based on their suitability for monitoring stormwater trash, safe access, and the upstream area being predominately one land use category. Monitoring at in-stream sites involved marking out a 500-foot section of the stream from which field crews collected all trash at the start of the study

and then on a monthly basis. In addition to excluding vegetative debris, draining all liquids from containers, and allowing the trash to air dry, the field crews also separated the trash into five categories (plastic bottles, glass bottles, aluminum cans, bulk "dumped" items, and other). Field crews measured dry weight for each category and counted the number of items in each of the bottle and can categories.

Baltimore County expressed the observed loading rates for each site as gallons per day of accumulation per acre of catchment. Variability between sites led Baltimore to consider just two land use types: urban and non-urban (forest).

2.3 Washington, District of Columbia

Washington, DC utilized a floatables loading rate methodology similar to that of Los Angeles and Baltimore. Using this methodology, DC conducted field monitoring at 10 outfall locations and 30 in-stream locations. Field crews collected trash from nets installed on the monitored outfalls after each storm event, and from 500-foot segments along the in-stream sites on a quarterly basis. Field crews quantified the visible trash, excluding vegetative debris, emptying liquids from containers, and allowing the trash to air dry. Field crews also separated the trash into 44 item-type categories and counted each. DC then calculated an estimate of total weight based on standardized weights for each item type.

Each site was characterized according to its catchment's predominant upstream land use, based on seven different land use types (roadways, institutional, commercial, industrial, high-density residential, low-density residential and open space/parks). For each site, DC calculated the observed loading rate as the accumulated trash weight per acre per inch of rainfall during the accumulation period, and then developed average loading rates for each land use category. DC then calculated the overall loading rate by applying each land use category's loading rate (in terms of trash weight per acre of that land use per inch of rainfall) for the total acreage of that land use in the municipality and for the total long-term average rainfall (inches per year).

2.4 San Francisco, California

San Francisco utilized a floatables loading rate methodology that, while based upon land use, also accounted for other drivers such as income level, site-specific factors, and the relative frequency of street sweeping and rainfall.

Field monitoring involved 159 stormwater inlet structures, each draining a catchment with at least 70 percent of its area representing one of 10 different categories: low-, mid-, and high-income retail; low-, mid-, and high-income residential; industrial; commercial; urban park; and schools. Each monitored site was retrofitted with a full-capture device (perforated plate) designed to prevent any items larger than 5 mm from exiting the structure for hourly intensities up to the one-year return period. During the monitoring period, field crews cleaned out all accumulated material from the inlet structure, allowed it to air dry, and separated it into eight material/item categories (plastic recyclable beverage containers, plastic single-use bags, plastic foam food ware, plastic other, paper, metal, other trash, and non-trash debris such as sediment and vegetation). Field crews would then measure the dry weight, uncompressed volume, and item counts (for trash categories).

San Francisco generated field monitoring results by site and by catchment category. Initial results indicated that there was a high variability of observed loading rates, even within a particular catchment category. San Francisco interpreted this to mean that its calculation method had not taken into account other driving factors. In order to account for this variability, San Francisco refined the method to distinguish between the monitored "trash-loading rate" from the catchment to the receiving water and the "trash-generation rates" within the catchment. The difference between the two is the "trash-interception rate," whereby some of the generated trash is captured via street sweeping or other controls, preventing material from discharging to the receiving water. Only trash remaining on the street is available for rainfall to transport to the stormwater inlet structures. San Francisco adjusted the loading rates to account for these processes by applying a factor based upon the relative frequency of street sweeping and rainfall in each catchment area.

In calibrating the refined method's results for trash-loading rate, San Francisco incorporated other refinements to manually adjust for geographic variations in loading rates. San Francisco conducted a final, limited validation of the refined method using floatables loading measurements for one cleanout period at two sites.

2.5 New York City, New York

As documented in its 2005 Citywide Comprehensive Floatables Plan - Modified Facility Planning Report, New York City Department of Environmental Protection (DEP) performed floatables monitoring to identify the sources of floatables pollution in New York Harbor and to understand the processes affecting how the City generates and controls floatables. While there are many ways floatables can reach a waterway including, but not limited to, illegal dumping, shoreline activities, direct disposal or wind action, this study determined that floatables discharging from the storm sewer system are consistent with street litter. However, this conclusion would need to be looked at further as other studies found that the amount of floatables entering the storm sewer system is rainfall dependent but does not necessarily depend on the source (Walker and Wong, December 1999). The amount of trash that enters the sewer system depends on the energy available to re-mobilize and transport deposited litter on street surfaces rather than the amount of litter deposited on street surfaces.

The 2005 DEP study also concluded that land use was not a good predictor of street litter levels. Based upon various field studies, DEP developed a model capable of calculating floatables loadings from combined and/or separately sewered areas. This model is based upon the following primary inputs for a given catchment:

1. Street litter generation rate, in terms of quantity (item count, weight, or visible area) per year. This rate was calculated for study-baseline conditions using a build-up/wash-off submodel given:
    - Average annual litter level, in terms of the City's "Street & Sidewalk Cleanliness Ratings"
    - Street sweeping schedule (and litter-removal efficiency of sweeping)
    - Annual occurrences of storms with at least 0.2 inches of rainfall (and litter-transport efficiency of such storms to flush litter into catch basins)
2. Total length of curb in the catchment
3. Percentage of hooded and non-hooded catch basins in catchment (and associated floatables-removal efficiency of each)
4. Percentage of catchment that is tributary to end-of-pipe controls such as booms or nets (and associated floatables-removal efficiency of each)

During implementation of its catch basin hooding program, DEP applied this model to track the floatables loading rate, relative to baseline conditions, on an annual basis. Along with other measures, such as yields at end-of-pipe facilities and observed levels of floatables at various locations in New York Harbor and along shorelines, the model results satisfied annual reporting requirements associated with the CSO control program.

3.0 Advantages and Disadvantages of Different Methodologies

The survey of municipalities that estimate floatables loading rates revealed a range of methods, from simple, per-day rates based solely on urban or non-urban land uses, to complex calculations based on multiple catchment categories including land use and median income, and adjusted to account for street sweeping frequency and rainfall. Differences between the methodologies do offer advantages and disadvantages. This section describes some of the key areas in which the methodologies differ and the advantages and disadvantages of the different approaches.

3.1 Metrics for Floatables Quantity and Loading Rates

The metric(s) selected for characterization of floatables is an important aspect related to the methodology selected to determine the floatables loading rate. Floatables refers to a class of varied materials that is not easily quantified and for which there is no "standard method" of analysis. Metrics used to quantify floatables include item counts, volume, drained

weight, and visible surface-area measurements. Once collected, floatables are most easily described in terms of volumes or weights. However, weight metrics are susceptible to skewing from lightweight materials (such as polystyrene) and heavier materials (such as glass or wet materials). Volume metrics can also be skewed by large-area / small-volume materials (such as plastic sheeting) or the presence of natural materials (such as leaves) that are not the target of a floatables loading rates estimate, but these instances are typically less likely or, in the case of leaves, limited to a relatively short period of time.

Another difference in the commonly applied metric for loading rate is whether to express the rate in terms of "per day" or "per inch of rain." Some municipalities, such as San Francisco, Washington, DC, and New York, see a clear relationship between loading rates and rainfall. Other municipalities, such as Los Angeles, do not see a significant correlation between loading rates and rainfall. While differences in weather patterns may in part explain this situation, direct deposition of litter into catch basins (such as by pedestrians and/or mechanical street sweeping equipment) and the practice of associating per-day catch basin accumulations with per-day discharges may be the reasons for this apparent discrepancy. To some extent, expressing loading rates as an annual average helps to even out seasonal variations in wet weather and the associated variation in loading rates.

3.2 Inclusion of Various Factors Affecting Floatables Loading Rate

Other municipalities' studies to monitor and analyze floatables loading rates clearly demonstrated that floatables loading rates are highly variable from site to site and over time. The most comprehensive studies acknowledged that the primary factors affecting loading rates are litter-generation rates, litter-removal rates, and rainfall, while secondary factors include population, land use, street sweeping methods and frequency, storm-sewer infrastructure (such as numbers and types of catch basins), and storm-sewer maintenance activities (such as catch basin cleaning). Because litter-generation rates are dependent upon human behavior, public education and enforcement of anti-littering laws, as well as litter-basket deployment and servicing, can also affect loading rates.

The studies also indicated that the relationships between the various factors can be dynamic and difficult to characterize. The simplest methods determine loading rates solely on the basis of land use. The advantage of this approach is that land use is a readily available parameter. Baltimore's approach to land use was simplest, using only two categories for catchment land use (urban and non-urban). Los Angeles, Washington, DC, and San Francisco utilized up to seven different land use types. Although the intent of using multiple land uses was to explain more of the variation in loading rates between different sites, most studies acknowledged that land use alone is a poor predictor of loading rate.

Some municipalities attempted to account for additional factors in their calculation of loading rate. San Francisco performed a correlation analysis and determined that adding median income level to further distinguish catchment land use improved the predictive capability of its method. San Francisco and Washington, DC determined that accounting for rainfall also improved the results. San Francisco recognized that accounting for street sweeping and rainfall frequency also improved the prediction of loading rate from the catch basins because these actions directly impact the portion of litter on the streets that is captured via sweeping versus flushed into the catch basins.

The primary differences between the methods adopted to determine loading rate were the factors used to differentiate the loading rates from site to site, and over time. The simplest methods based loading rates solely on land use, while the most complex methods attempted to account for other factors, such as median income, street sweeping frequency and rainfall. DEP's approach was unique among this group because DEP based its method on measures of street litter level, rather than on land use as a surrogate for street litter level.

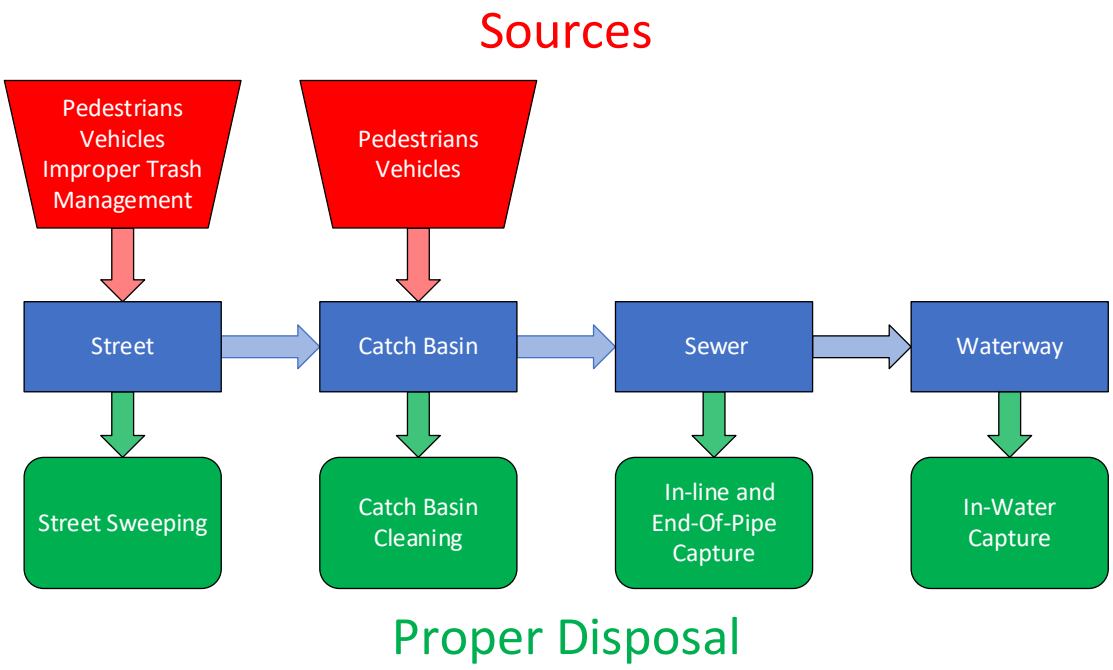
4.0 Proposed Methodology for New York City

This section presents an overview of the approach that the City proposes to use to determine the floatables loading rate from MS4 outfalls to floatables-impaired waterbodies, a justification for the proposed approach, and specifics on the methodology to implement the proposed approach. Per the Program Development Compliance Schedule in Part IV.O of the City's MS4 Permit, the City will submit a schedule for completing the floatables loading rate determination within three months after DEC approves the final work plan.

4.1 Overview of Proposed Approach

The City's proposed methodology is a hybrid approach that combines field measurements and model analysis. Using this approach, the City proposes to take field measurements of floatables discharged from catch basins representing various categories of sites that comprise the MS4 drainage areas. These data can then be used to extrapolate a floatables loading rate. In conjunction with field measurements, the City will use an updated version of DEP's existing floatables model to check the results of the field monitoring and to account for downstream in-water controls such as booms. Figure 1 below describes schematically the application of the existing floatables model to the City's MS4.

Figure 1. Schematic of MS4 Floatables Sources, Transport, Controls and Fate



4.2 Justification for Proposed Approach

As described in Section 3.0, the approaches utilized by other municipalities for determining floatables loading rates involve a range of complexities in terms of methodologies and factors affecting loading rates. The City's proposed approach, which combines the field measurement component of approaches utilized by other municipalities with the work done by DEP in the past, is suitable for determining floatables loading rates for the following reasons:

- **Considers factors beyond land use.** Other municipalities found that land use alone was not a good predictor of floatables loading rate. Where the surveyed municipalities characterized the monitored sites based on catchment land use, the City would select monitoring sites based upon important factors already understood to impact floatables discharge rates from catch basins in New York City. These factors include catchment characteristics (such as litter levels) and catch basin attributes (such as presence of a hood).
- **Utilizes institutional knowledge and already developed tools.** DEP previously studied floatables sources and effectiveness of existing floatables controls. Through a combination of field studies and modeling, DEP developed both an understanding of processes and models to estimate the impact of those processes on floatables loading rates.
- **Provides opportunities to update previous assessments.** Through targeted, focused field studies, the City can update its understanding of how floatables discharge rates are related to differences in certain factors such as street litter levels and existing floatables controls. This approach will also enable the City to observe changes in the types of items that make up street litter and floatables.
- **Isolates floatables contribution at the entry point to the MS4.** The proposed field monitoring will focus on characterizing the type and quantity of floatables entering the MS4 from the catch basins. This methodology avoids logistical difficulties and inaccuracies associated with monitoring outfalls in tidal systems, and allows characteristics of floatables to be determined for different areas.

4.3 Methodology to Implement Proposed Approach

In summary, the City's proposed methodology involves the following steps:

1. Selection of representative sites at which to conduct field monitoring
2. Field monitoring using proposed metrics to measure floatables discharge rates from catch basin sites comprising the various site categories within New York City's MS4 areas
3. Analysis of field measurements to determine unit loading rates by site category
4. Establishment of weather and other conditions suitable for calculation of floatables loadings from MS4 areas
5. Application of unit loading rates to individual catch basins, and summation of the results by MS4 outfall and by waterbody, for each waterbody designated as impaired due to floatables.

The following sections describe each of these steps in detail.

4.3.1 Selection of Representative Sites for Field Monitoring

In order to represent the full range of factors affecting floatables generation, interception, and loading for MS4 areas in New York City, the City developed 21 site categories to be included in the field monitoring program. Each site category represents a different combination of representative catch basin attributes and catchment characteristics or unique land use types.

Catchment Characteristics

Catchment characteristics include street litter level and street sweeping frequency. Street litter levels directly impact the quantity of floatable material available for discharge into catch basins, and so monitoring sites will be selected to represent each of three different street litter levels (high, medium, low), as well as "typical" levels or conditions for arterial highways,

exit ramps/turnouts, and parks. Because street sweeping frequency directly impacts the portion of street litter that is captured versus carried into catch basins during storms, the City will also select monitoring sites to represent each of three different street sweeping frequencies. Preliminary analysis suggests categories of high, medium, and low frequency may be appropriate, but these may change based on further analysis of MS4 areas. For example, categories of high, medium/low, and not applicable (N/A) may better represent conditions in the MS4. Together with rainfall conditions, street sweeping frequency and street litter level represent the secondary factors from which street litter generation can be gauged.

Catch Basin Attributes

The catch basin attribute that most directly impacts the discharge rate of floatables to storm sewers (and hence to receiving waters) is the presence of hoods. Catch basin hoods are designed to prevent sewer gases from venting through the catch basin. Because the hoods shield the catch basin's pipe outlet, they also prevent floatable items from entering the sewer system. Where present, catch basin hoods are effective at retaining floatables in catch basins; therefore, monitoring sites will be selected to represent both hooded and unhooded catch basins.

Land Use

As described above, the City will rely on the above factors known to impact the discharge rate of floatables and not general land use types (such as residential, commercial or industrial) to select catch basin sites for monitoring. However, the City will include three additional categories to represent catch basins located within unique land uses. These land use types include (1) arterial highways, (2) exit ramps/turnouts, and (3) parks. The proposed work plan includes monitoring of catch basins located in these land uses to characterize representative loading rates from catch basins in these site categories.

Catch basins along arterial highways, on exit ramps/turnouts, and within parks may not share characteristics with current standard DEP designs or maintenance practices. As a result, none of the other site category factors may be representative of these catch basins. Additionally, limited information about litter levels is available in these areas. The catch basins in these areas were not included in previous DEP floatables studies because they were not previously subject to SPDES permit requirements on floatables control. However, these catch basins are now covered by the MS4 Permit and are therefore included in this methodology.

Site Categories for Field Monitoring

Table 2 lists the 21 site categories proposed for the field monitoring program. With three different catch basin sites per category, the proposed field monitoring program will include 63 monitored sites.

Table 2. Site Categories for Monitoring MS4 Catch Basin Discharges

Site Category	Catch Basin Attributes	Street Litter Level	Street Sweeping Frequency	Site Count per Category
1	Hooded	High	High	3
2	Hooded	High	Med	3
3	Hooded	High	Low	3
4	Hooded	Med	High	3
5	Hooded	Med	Med	3
6	Hooded	Med	Low	3
7	Hooded	Low	High	3
8	Hooded	Low	Med	3

9	Hooded	Low	Low	3
10	Unhooded	High	High	3
11	Unhooded	High	Med	3
12	Unhooded	High	Low	3
13	Unhooded	Med	High	3
14	Unhooded	Med	Med	3
15	Unhooded	Med	Low	3
16	Unhooded	Low	High	3
17	Unhooded	Low	Med	3
18	Unhooded	Low	Low	3
19	Arterial Highway	Typical	N/A	3
20	Exit Ramps/Turn-outs	Typical	N/A	3
21	Parks	Typical	N/A	3
Total number of catch basin sites to monitor				**63**

The City will select specific sites for the field monitoring program based upon a combination of desktop analyses and field verification. Desktop analysis will identify candidate areas based upon information made available to DEP. Areas with high, medium, and low litter levels will be identified based on geographical assessments ("heat maps") developed using information including:

1. Recent, annual-average Street & Sidewalk Cleanliness Ratings data, which indicate the relative quantity of litter based on visual ratings conducted twice per month on about five percent of city blockfaces by the New York City Mayor's Office of Operations
2. Litter information from the Street Conditions Observation Unit (SCOUT) of the Mayor's Office of Operations
3. Catch basin cleaning frequency and similar information that DEP logs, which can be used to track the build-up of debris in DEP catch basins.

The City will identify MS4 areas with different street sweeping frequencies based on mechanical sweeper routes and schedules maintained by the New York City Department of Sanitation (DSNY), information concerning sweeping in Business Improvement Districts (BIDs) in MS4 areas, and, as applicable, information concerning sweeping programs such as Ready Willing and Able (RWA). Similarly, the City will use DEP's catch basin database to identify individual catch basins with hoods or no hoods. Finally, the City will also apply desktop analyses to identify potentially suitable catch basin locations along arterial roadways, on exit ramps/turnouts, and within parks that drain directly to waterbodies that are impaired for floatables.

In order to confirm the suitability of candidate sites for inclusion in the monitoring program, the City will visit each site to ensure that it can perform sampling safely and that site conditions match the intended category. Based on this information, the City will revise the site selection as needed.

4.3.2 Field Monitoring and Metrics

The City proposes a field monitoring program that will quantify floatables loading rates using suitable metrics. These metrics include a definition of floatables, methods of quantifying floatables in a manner allowing for scalability, and expression of rates in terms of suitable time periods. This section describes each of these metrics, as well as the general sampling procedure.

Definition of Floatables

The City's MS4 permit refers to control of "floatable and settleable trash and debris." This language is consistent with the definition of floatables that DEP adopted for prior floatables studies. As defined in DEP's 2005 Citywide Comprehensive Floatables Plan - Modified Facility Planning Report, floatables are "manmade materials, such as plastics, papers, or other products which when improperly disposed of onto streets [or] into catch basins [...] can ultimately find their way to [waterbodies] and may create nuisance conditions with regard to aesthetics, recreation, navigation, and waterbody ecology [...]." For clarity, it is noted that "floatables" include materials that are settleable as well as those that may float on the water surface or are neutrally buoyant, and acknowledged that such materials may float or sink depending on the ambient conditions to which they are subject. In this context, "floatables" does not include natural materials, vegetation, oil and grease, or sediments and small particles.

Floatables Metric

The City proposes to express floatables quantity in terms of volume. Volume is the most appropriate floatables metric for three important reasons. First, volume is an established metric associated with trash (as collected in garbage cans, dumpsters, trucks, barges, and landfills). Second, volume describes both the visual and spatial impact of floatables, and can better represent the impact on wildlife than weight. Third, unlike item count or surface area, volume is relatively simple to measure in large quantities, and is not as susceptible as weight to skewing due to complicating factors such as water content, heavy material such as glass bottles, or light material such as Styrofoam containers. As in prior studies, the City proposes to record other measures, such as weight, item counts, etc., for purposes of establishing typical relationships between metrics.

Rate Metrics for Time Period

New York City proposes expressing loading rates in terms of annual average periods. Expressing the loading rate as an annual average helps to normalize seasonal and weather-related variations. Nevertheless, year-to-year variations in loading rate will occur due to differences in the number, timing, and intensity of storm events. As a result, describing loading rates based on long-term average rainfall patterns will help to highlight the impact of operational factors (such as littering behavior, street sweeping practices, and catch basin retrofits) on year-to-year changes in loading rates.

Field Monitoring Protocols

New York City proposes field monitoring protocols to capture floatables in catch basin discharges to the MS4 using mesh strainer baskets deployed in MS4 manholes, as depicted schematically in Figure 2. Field crews will collect samples with a frequency suitable to characterizing accumulated amounts in dry periods and in wet periods. Floatables collected from each site will be separately sorted to remove sediment and vegetation, quantified at a central processing site, and recorded. This protocol is consistent with the techniques used in DEP's previous floatables study. The City will select a monitoring period that allows for a minimum of 10 storms with at least 0.2 inches of rainfall to be monitored and seasonal differences to be captured.

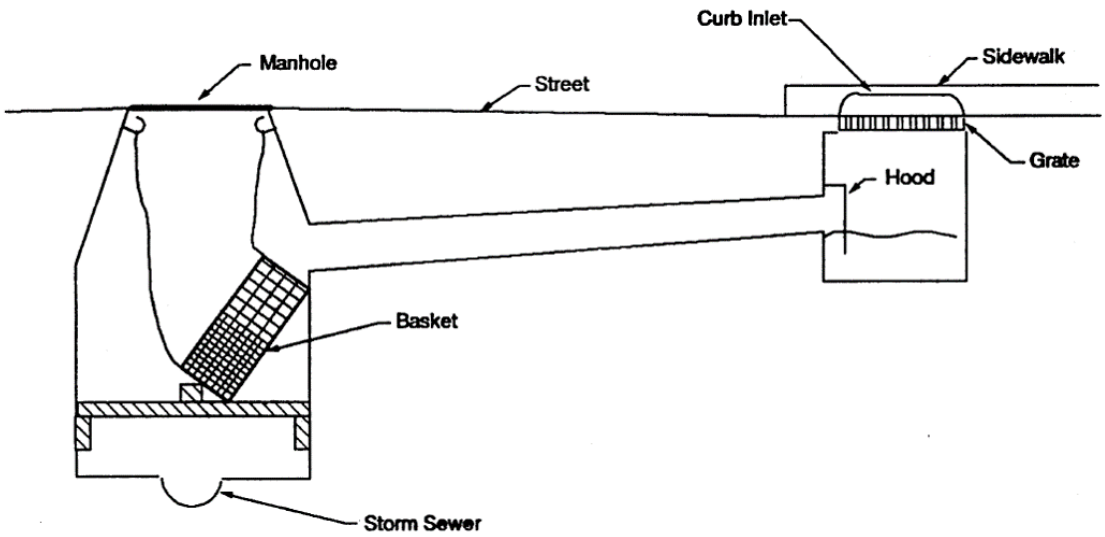


Figure 2. Sampling of Catch Basin Discharges to Sewer

4.3.3 Analysis to Determine Unit Loading Rate by Site Category

In order to develop a unit loading rate that can be scaled appropriately, the results of the field monitoring program will require analyses to normalize the size of the catchment upstream of the monitored catch basin site as well as the number of days and/or amount of rainfall during the accumulation period. The City will calculate unit loading rates for each site category.

As indicated in DEP's previous floatables studies, the length of curb (curb feet) in a catchment more closely correlates to floatables load than the area (acreage) of the catchment does. This is not surprising, because most street litter is located within 18 inches of the curb[1], and because most streets are crowned, with slopes downward to either side of the street, so that drainage is toward and along the curb to the catch basin. As a result, the City proposes using catchment curb length to normalize the measured discharge.

Similarly, the City anticipates that days of accumulation between qualifying storm events will correlate to the quantity of material discharged, and therefore proposes using days of accumulation (or inversely, frequency of qualifying storms) to normalize the measured discharge. As a result, these analyses will require information regarding rainfall during the accumulation period at each monitored catch basin site. For this purpose, the City proposes to utilize the nearest-available rain gauge from the rain gauge networks maintained by the National Weather Service, United State Geological Survey, DEP, and other reputable organizations, as well as radar rainfall information available from the National Weather Service.

The City will analyze the resulting unit (normalized) loading rates to confirm scalability and adherence to scientific principles (such as mass balance) and relationships established during prior floatables studies (such as relative capture in hooded versus unhooded catch basins).

Given an MS4 catch basin's site category's unit loading rate, catchment size (curb miles), and rainfall pattern (long-term average year), the catch basin's overall floatables load can then be calculated. The following two steps describe that process.

4.3.4 Establish Conditions for Calculation of Loading Rate

While measured loading rates reflect conditions during the field monitoring program, the expression of loading rates from particular MS4 outfalls or to floatables-impaired waterbodies will be most useful if applied using certain conditions that may be used as a baseline for comparison in the future. For this purpose, the City proposes using long-term average rainfall patterns, as determined from National Weather Service rain gauge data and as applied using the model. The

1 New York City Law requires the adjacent property owner to clean the curb area 18" into the street.

City can also use the model to specify other conditions, such as degree of catch basin hooding, street litter levels, etc., as necessary, to develop an appropriate baseline condition.

4.3.5 Calculation of Loading Rate

In order to calculate the total floatables loading rate for a specific floatables-impaired waterbody, DEP proposes the following:

1. For each catch basin in the MS4 area
   - Identify the unit loading rate corresponding to that catch basin's site category. Unit loading rate is expressed in terms of floatables volume per length of curb per days of accumulation (or per number of storms) per year.
   - Apply the unit loading rate for that catch basin to calculate the annual floatables load, in terms of volume, by multiplying the unit loading rate by:
     - The length of curb in the catch basin's catchment.
     - The number of days of accumulation (or number of storms) in the baseline year.
2. Sum the calculated loading rates for each catch basin to determine the total loading rate for the MS4 outfall. This will be a total volume per year.

To calculate the total floatables loading rate from MS4 areas to a particular waterbody, the above procedure would be repeated for each MS4 outfall discharging to the waterbody, and the sum of these would then represent the total MS4 loading rate to the waterbody.

After developing the unit loading rates as described in the preceding section, DEP will analyze available information on both existing and historical conditions regarding New York City's floatables controls. The current level of floatables control in MS4 areas reflects changes implemented in various New York City programs, such as the catch basin hooding program (completed in 2010 but ongoing per SPDES permit requirements), the recently launched annual catch basin inspection program (required by City local law through the end of fiscal year 2019), and extensive public education and media campaigns. The City will evaluate the impact of these programs on floatables loading rates for MS4 areas before making a recommendation of a particular baseline loading rate year, against which to track and monitor floatables loadings in future years.

5.0 References

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Appendix 9.1 A

Response to Public Comments

The MS4 Permit requires the City of New York to develop a work plan to determine the loading rate of floatable and settleable trash and debris discharged from the MS4 to waterbodies listed as impaired for floatables. On August 1, 2017, the City submitted a draft work plan to NYSDEC for review. The City also posted the draft work plan on the DEP website on August 1, 2017 and presented it publicly at a Trash Free NYC Waters Meeting on October 4, 2017. The public was encouraged to review the draft work plan and submit comments by October 16, 2017.

The City prepared the following responses to the comments received at the public meeting and in writing via electronic mail. For convenience and clarity, the City has combined and grouped similar comments. The City also received some comments or questions that, while related to the topic of trash and debris, were not relevant to the work plan. These comments are not included in this document.

Comment: *Construction sites can be sources of trash and debris that enter the MS4. Will the City include loads from construction sites in the MS4 Floatables loading rate?*

Response: Trash and debris from construction sites is regulated by the New York City Construction Code. Additionally, construction activities that disturb an acre or more of soil are required to obtain coverage under the New York State Department of Conservation State Pollution Discharge Elimination System General Permit for Stormwater Discharges from Construction Activities (GP-0-15-002). The General Permit requires construction activities to use pollution prevention measures to control trash and debris. The construction and post-construction provisions of the Stormwater Management Program further address stormwater runoff from constructions sites within the MS4 area.

The City responds to a variety of public complaints related to construction activities including excessive debris; dumping concrete, cement, sand, or construction material in a catch basin; or dumpsters overflowing with construction debris. To make a complaint of this nature, the public can:

- Visit 311 Online;
- Call 311 or (212) NEW-YORK, (212) 639-9675, from outside New York City; or
- Text 311-692;

The proposed methodology for determining the floatables loading rate is to sample trash and debris from representative catch basins within the MS4 area. To do this, the methodology divides catch basins in the MS4 into categories based on the characteristics of catch basin attributes, street litter level, and street sweeping frequency, as well as unique land use type. The City will select a sample of catch basins from each category to monitor. While some selected catch basins may be near construction sites, the City does not plan to use proximity to construction sites as a factor in selecting sample locations. If a selected catch basin is near a construction site, and debris happens to enter the catch basin, the City may observe that in the collected samples.

Comment: *Highways can be a major source of trash and debris. Places where drivers can pull over or slow down are particularly full of litter. Will the City sample at turnouts, exit ramps and other places where drivers can pull over/stop/slow down?*

Response: The City recognizes that trash and debris loads coming from catch basins along highways may be different from the loads coming from other parts of the MS4. To account for this, the City had already included a category of catch basins on arterial highways in the work plan. The City agrees with this comment that highway turnouts and exit ramps may have different trash and debris loads from other sections of arterial highways. In response, the City has amended the work plan to include an additional category of catch basins to be sampled. This new category will sample catch basins located on arterial highway turnouts and exit ramps.

Comment: *Will the City select locations impacted by tourists or events (e.g.,. marathons, New Year's Eve, sporting events, etc.) which generate trash and debris?*

Response: As proposed, the methodology accounts for sites that have the potential for high trash and debris by using street litter levels as a characteristic for defining categories and selecting catch basins. As a result, it will include locations that may have more trash and debris due to proximity to tourist destinations.

As stated in the NYC Administrative Code and Chapter 14 of the Rules of the City of New York, sponsors and participating vendors of block parties, street fairs, and other similar events are required to arrange garbage collection and ensure appropriate separation of recyclable materials. Additionally, many special events and tourist locations are in Manhattan, outside the MS4 area. Therefore, locations impacted by special events such as marathons, parades, and sporting events, will not be selected for sampling. However, because the City plans to sample each location for at least 7 months, the data would include loads from special events if one does occur at a sampling location during that period.

Comment: *Will the City look at catch basins on NYCHA properties?*

Response: No. The intent of the study is to determine the loading rate from the MS4. The MS4 Permit does not cover NYCHA properties since NYCHA is not a Mayoral Agency. Therefore, catch basins on NYCHA property are not included in the proposed methodology.

Comment: *Will the City look at catch basins on streets not owned by New York City DOT?*

Response: The intent of the study is to determine the loading rate from the MS4. Streets not owned by NYC are not part of the MS4 and therefore not included in the proposed methodology.

Comment: *Will the City sample even when it does not rain?*

Response: Yes. The methodology proposes to sample catch basins weekly, even if it has not rained. However, the City will stop taking samples once it starts snowing.

Comment: *Why is the City not taking measurements at outfalls?*

Response: Taking measurements at MS4 outfalls presents various challenges that make sampling at the catch basin level the preferred option. First, many booms would need to be built in order to obtain a representative sample size, and construction and operation of booms are expensive. Second, the tide influences many MS4 outfalls, whereby trash and debris captured in a boom or net at the end of the outfall can move back into the sewer system during high tides, making it more difficult to get accurate field measurements. Third, the area draining to a single MS4 outfall can be large and diverse. By taking measurements at the outfall rather than at the catch basin level, we would lose the ability to make connections between the loads and other factors such as street sweeping frequency or catch basin design. Fourth, as emphasized by EPA and NOAA through the Trash Free Waters initiative, addressing marine litter issues at the source is more effective than at the end of the pipe at outfalls.

Comment: *In some MS4 areas, stormwater runoff reaches waterways by overland flow without entering the sewer system, for example from areas bordering waterbodies, areas where catch basins are not functioning for some reason, or areas where streets end at waterways. Many of these areas also tend to be litter hot spots. The proposed methodology would not capture trash and debris generated in MS4 areas and reaching waterways by overland flow.*

Response: While the areas bordering waterbodies can be sources of trash and debris, it is important to note that areas draining to waterbodies by overland flow are only considered part of the MS4 area if City-owned or operated. The pollution prevention and good housekeeping provisions of the Stormwater Management Program address trash and debris management at these City facilities and operations. Additionally, to keep catch basins in good working order, DEP regularly inspects catch basins throughout the City. If needed based on inspection, DEP cleans or repairs the catch basins.

Street ends, while also having the potential to contribute trash and debris to waterbodies through runoff or wind impacts, are a relatively small portion of the areas draining to waterbodies compared to the other sources. It is also challenging to establish a practical and scientific sampling plan for estimating the contribution from street ends. The proposed methodology meets the MS4 Permit requirement to quantify the trash and debris discharging from the MS4.

Comment: *Will the City do a count of the types of trash and specific brands? Will the City use this information to identify prime offenders?*

Response: While the City proposes to report the loading rate as a volume, the City also intends to track other measures such as weight and item counts of types of trash. While tracking specific brands is not part of this study, the City is conducting multiple media campaigns to focus on public behavior and encourage proper disposal of trash.

Comment: *Could the City look at some catch basins with stenciling to see if there are any differences in loading rates between painted and not painted catch basins in the same category?*

Response: The City plans to explore the impact of catch basin stenciling through a separate, smaller sampling initiative. These catch basins will likely not be the same ones sampled as part of the loading rate study because, in order to assess effectively the impact of stenciling, all other defining characteristics of the catch basins (i.e., street litter level, street cleaning frequency, catch basin hoods) would need to be the same.

Comment: *Why isn't the City using median household income as a factor in determining the loading rate?*

Response: New York City is fortunate to have a record of street cleanliness levels dating back to the 1970s. Because of this record, we do not need to use proxies such as land use or median household income to represent litter conditions on the street. However, the City may look at a variety of data to see if there are any additional correlations between street cleanliness and neighborhood characteristics.

Comment: *Has the City already selected specific sampling locations?*

Response: The City has not chosen sampling locations yet and will not do so until NYSDEC approves the final work plan, which will be submitted with the SWMP Plan on August 1, 2018. Since the intent of this study is to determine the loading rate of trash and debris from the MS4, the City will only select sampling locations in MS4 areas. The methodology will divide catch basins in the MS4 into categories based on the shared characteristics of catch basin attributes, street litter level, and street sweeping frequency. The City will then select a sample of catch basins from each category to monitor.

Comment: *Will the City also look at bacteria from the MS4?*

Response: This work plan seeks to determine only the loading rate of trash and debris from the MS4. However, other provisions of the Stormwater Management Program will address bacterial loads from the MS4. For example, the Illicit Discharge Detection and Elimination (IDDE) Program will monitor waterbodies for elevated levels for fecal coliform and seek to track down and eliminate sources. The Monitoring and Assessment Program will also test stormwater runoff in the MS4 for fecal coliform and enterococcus.

Comment: *The cleanliness of a street can vary over the course of a given day. It could be relatively clean on a Friday morning immediately following street cleaning and then relatively dirty later that evening after restaurants and bars close. How will the methodology capture that variation?*

Response: Street litter level is a key factor affecting the loading rate of trash and debris from a particular catch basin. As such, the City is proposing to use litter level as a characteristic for selecting catch basins for monitoring. The litter level of a particular street will be determined using information from the Street & Sidewalk Cleanliness Ratings program, the SCOUT program, and the DEP catch basin cleaning program. Because these programs collect information about litter levels at different times and in different ways, the City feels that the data sets give an accurate picture of the average condition of a street. Additionally, because the City will sample at the catch basin, the data will capture any trash and debris that was carried from the street to a catch basin during a rain event.

Comment: *Parks and greenways can also be major sources of trash and debris. During the recreational season, park users leave behind trash and debris. City staff may also contribute to the problems by mowing over this litter or by leaving behind supplies. How is the City tackling trash and debris in parks?*

Response: The City recognizes that the load of trash and debris coming from catch basins in parks may be different from the loads coming from other parts of the MS4. To account for this potential variation, the City intends to include park catch basins in the loading rate calculation and the sampling plan. In addition, the pollution prevention and good housekeeping provisions of the Stormwater Management Program include training City staff on pollution prevention and good housekeeping at City facilities and operations.

Comment: *Ships and other marine activity can also be sources of trash and debris in waterways. Will the City quantify the loading rate from these sources?*

Response: This methodology aims to quantify the trash and debris discharging from the MS4. As such, it does not include marine-based sources, as trash and debris from these sources do not come from the MS4.

Appendix 10.1

MS4 Monitoring Program

New York City Municipal Separate Storm Sewer System (MS4) Monitoring Program

Revised September 30, 2020

Prepared in accordance with
SPDES Permit Number NY-0287890
Part IV.J

Appendix 10.1
Table of Contents

1.0 Introduction

Pursuant to the State Pollutant Discharge Elimination System (SPDES) Municipal Separate Storm Sewer System (MS4) Permit (No. NY-0287890), the City must develop a monitoring and assessment program designed to satisfy Part IV.J, Monitoring and Assessment of Controls. This appendix details the MS4 Monitoring Program to be conducted to achieve the Permit requirements described in Part IV.J.2, including:

i. Assess compliance with the requirements of the MS4 Permit

ii. Measure the effectiveness of the Stormwater Management Program (SWMP)

iii. Characterize and assess the quality of stormwater discharges at representative MS4 outfalls

iv. Identify sources of specific pollutants

v. Detect and eliminate illicit discharges, including illegal connections, to the MS4

vi. Evaluate long-term trends in quality.

Appendix 10.1: MS4 Monitoring Program describes the monitoring strategy and work plan to characterize and assess the quality of stormwater discharges at representative MS4 outfalls, identify sources of specific pollutants, and evaluate long-term trends in receiving water quality after considering the impact of non-MS4 sources and planned controls for those sources.

Additional strategies currently being implemented or proposed by the New York City Department of Environmental Protection (DEP) to detect and eliminate illicit discharges and illegal connections to the MS4 and measure the effectiveness of the SWMP are described in Chapter 5: Illicit Discharge Detection and Elimination—IDDE and Chapter 12: Recordkeeping and Reporting of the SWMP Plan.

2.0 Program Overview

The MS4 Monitoring Program relies on a multi-pronged, phased approach to assess the pollutant contribution from stormwater and its influence on New York Harbor water quality, as well as existing water quality data collection programs. Two sets of stormwater outfalls will be targeted as part of the MS4 Monitoring Program:

Phase 1 –Land Use-Based Outfall Monitoring, which will focus on six predominant land use types within New York City (mixed, high-density residential, low-density residential, industrial, open space, and highway).

Phase 2—Targeted Outfall Monitoring, which will target specific MS4 outfalls based on discharge volume, pollutant loading, historic changes, and significance to other water quality programs such as DEP's Long-Term Control Plan (LTCP) program.

Ambient water quality monitoring will be performed concurrently with the Phase 2 monitoring to aid in the assessment of the influence of these stormwater loads on water quality and the role that stormwater plays as a potential pollutant source. Flow metering of targeted outfalls will also be performed.

Sampling for the two sets of outfalls will be staggered such that Phase 1 sampling will occur first, to provide more information on parameter variability. Phase 1 data will then be analyzed to aid development of Phase 2 sampling, which will be implemented after Phase 1 analysis is complete, and the Phase 2 monitoring strategy and work plan is finalized and contracts are procured. In addition to the two sets of outfalls, the receiving water sampling that is performed concurrently and complementary to the Phase 2 monitoring will aid in assessing the influence of stormwater loads in receiving waters.

3.0 Program Implementation

A central strategy to the monitoring program for MS4 Permit compliance is the continued reliance on the substantial, existing DEP programs. The Harbor Survey, Sentinel Monitoring, Field Sampling Analysis Program (FSAP), and other ongoing monitoring programs will continue to provide valuable information. *This appendix pertains only to the additional metering and sampling to be completed to satisfy Part IV.J.2 requirements of the MS4 Permit.* The data collected under this monitoring program will supplement the ongoing programs, and will be specifically targeted to characterize the water quality, pollutant loadings, and receiving water response associated with the City's MS4 discharges.

3.1 Identification of Pollutants to Monitor

The MS4 Monitoring Program includes sampling for a variety of pollutants identified by existing data sources and reports, as well as the MS4 Permit. However, stormwater from the City's MS4 is not the only load contributor of pollutants to the receiving waters of the New York Harbor. Other contributors include combined sewer overflows (CSOs); wastewater treatment plants (WWTPs); stormwater outfalls not subject to the City's MS4 Permit; coastal inflows from the Long Island Sound and the New York Bight; inflows from the Hudson, Raritan, and Bronx Rivers, as well as lesser natural inflows; and industrial users. Floatables loading rates are addressed in Chapter 9: Control of Floatable and Settleable Trash and Debris of the SWMP and are not discussed in this appendix.

A pollutant is selected for monitoring as part of the MS4 Monitoring Program if it meets one or more of the following criteria:

- Is listed as a pollutant of concern (POC) in Appendix 2—Impaired Water Segments and Pollutants of Concern of the MS4 Permit
- Is listed as a cause for impairment in receiving waterbodies on the Clean Water Act (CWA) Section 303(d) list
- Is identified as being present at representative MS4 outfalls/manholes in the DEP Supplemental Discharge Characterization Report that was prepared for the WWTP SPDES Permits
- Is a POC commonly associated with land uses within an outfall's drainage area
- Has a history of association with the City's MS4 discharges based on existing monitoring programs

3.2 Phased Monitoring Strategy (Phases 1 and 2)

DEP is proposing a multi-phased approach for the MS4 Monitoring Program to assess different MS4 outfalls and drainage areas, and to adapt monitoring approaches based on ongoing data collection, assessments and reviews. Phase 1—Land-Based Outfall Monitoring and Phase 2—Targeted Outfall Monitoring are described in more detail below.

3.2.1 Phase 1—Land Use-Based Outfall Monitoring

Phase 1 outfalls are targeted based on upstream land uses to identify potential sources of specific pollutants, and to characterize and assess the quality of stormwater discharges at representative MS4 outfalls as required by the MS4 Permit (Part IV.J.2). The collected data will be used to determine whether there is any correlation between land use type and pollutant loadings.

Per United States Environmental Protection Agency (USEPA) stormwater sampling guidance document (https://nepis.epa.gov/Exe/ZyPDF.cgi/20012RVG.PDF?Dockey=20012RVG.PDF), consideration of land use patterns within a municipality should be a major factor in selecting outfalls to monitor. The Phase 1 monitoring strategy and work plan targets eight outfalls to be representative of six land use types within New York City:

- Mixed
- High-Density Residential
- Low-Density Residential
- Industrial
- Open Space
- Highway

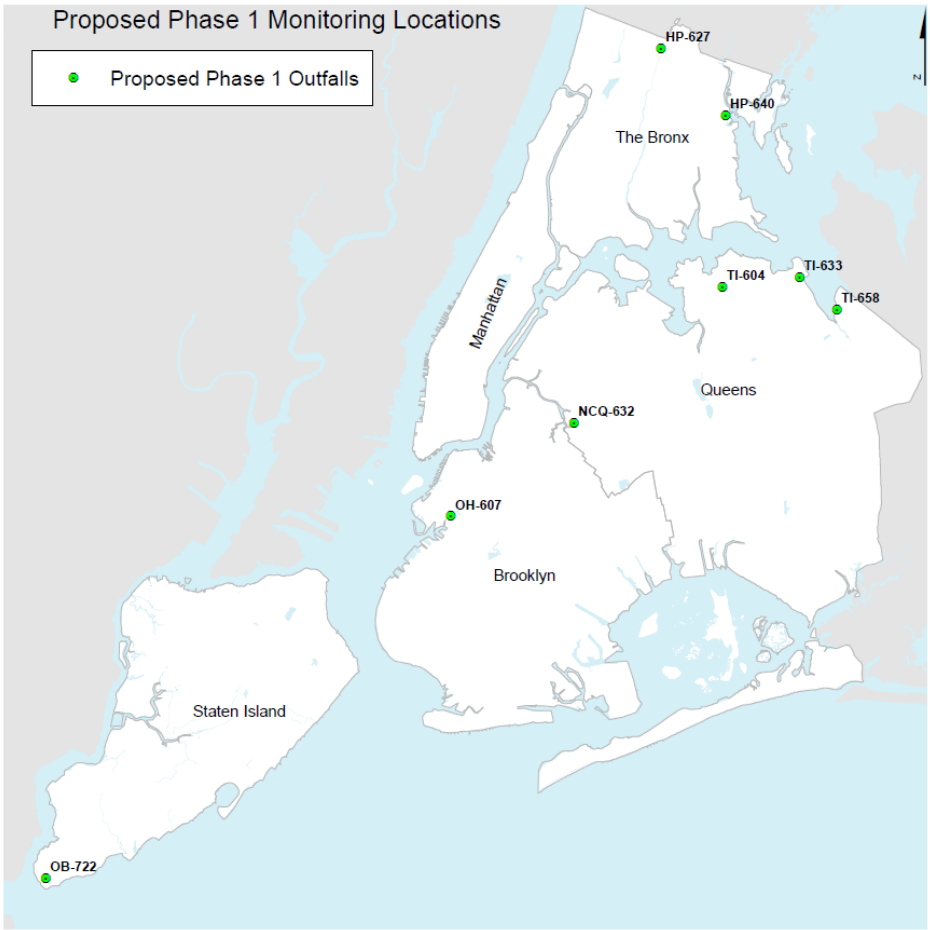
The selected outfalls are listed in *Table 1* and their locations are shown on *Figure 1*. Note that each land use type is represented by a single location except for low-density residential and industrial land uses, which are each represented by two locations. The two locations for low-density residential and industrial land uses were selected to aid in the evaluation of similar land uses across boroughs or watersheds. Mixed land use refers to multiple land use types that individually represent less than half of the drainage area to the monitoring location but together comprise a significant portion of the drainage area. For example, multi-family residential, commercial and office buildings, and public facilities and institutions comprise 83 percent of the total drainage area to the HP-640 sampling location in Table 1.

Final monitoring locations for each Phase 1 outfall were determined based on reconnaissance field visits, and monitoring (metering and sampling) will generally occur within the farthest downstream outfall pipe or manhole that is not influenced by tides, has no constant dry weather flows, and is safe and accessible to sampling field crews.

Table 1—Phase 1 Outfalls to be Monitored

Targeted Outfall ID	Sampling Location		Outfall Size	Borough	Receiving Waterbody	Land Use Represented
	Latitude	Longitude				
HP-627	40.8957	-73.8632	36" diameter	Bronx	Bronx River	Open Space
HP-640	40.8641	-73.8229	48" diameter	Bronx	Hutchinson River	Mixed
NCQ-632	40.7179	-73.9182	54" diameter	Queens	Newtown Creek	Industrial
OB-722	40.5010	-74.2480	Double barrel 7'3" x 3'6"	Staten Island	Raritan Bay	Low-Density Residential
OH-607	40.6735	-73.9953	12" diameter	Brooklyn	Gowanus Canal	Industrial
TI-604	40.7823	-73.8252	24" diameter	Queens	Flushing Creek	Highway
TI-633	40.7871	-73.7766	54" diameter	Queens	Little Neck Bay	High-Density Residential
TI-658	40.7714	-73.7535	40" diameter	Queens	Little Neck Bay	Low-Density Residential

Figure 1—Phase 1 Outfalls to be Monitored



3.2.2 Phase 2—Targeted Outfall Monitoring

Phase 2 monitoring will be implemented to satisfy stipulations in the MS4 Permit that require assessing compliance, measuring effectiveness of controls, and evaluating long-term trends. As described above, Phase 2 monitoring will be planned and implemented after evaluation of Phase 1 data so that information collected during the first phase can be used to refine the locations and water quality parameters to be selected for Phase 2. Outfall selection will also be supported by water quality analyses completed as part of DEP's development of LTCPs.

Selection of Phase 2 outfalls will generally be based on the following criteria (as well as consideration of Phase 1 results and other information):

- Drain to impaired waterbodies, including potential Priority MS4 Waterbodies
- Drain the largest upstream area, convey the greatest stormwater volume, and have greater impact on receiving water quality (largest pollutant load)
- Discharge to sensitive areas such as recreational beaches
- Drain areas where source controls such as education and outreach, green infrastructure, stormwater control measures (SCMs), and other SWMP-related programs are expected to be implemented.

In addition to the two sets of outfalls (Phases 1 and 2) to be monitored, receiving or ambient water quality sampling that is performed concurrently and complementary to Phase 2 monitoring will aid in assessing the influence of stormwater loads and long-term trends in receiving waters, as described below.

3.3 Sampling

Phase 1 monitoring will be initiated by 2020, and sampling will be performed on a quarterly basis during qualifying rain events. After two years of sampling, the collected Phase 1 data will be evaluated to allow for a more informed determination of the benefits of continuing, modifying, or ceasing the quarterly monitoring. As part of this evaluation, land-use-based monitoring may be suspended if either the relevant findings are definitive, or it is clear that the benefits of further sampling during Phase 1 are limited due to a high degree of variability.

During both Phase 1 and Phase 2 monitoring, sampling will occur quarterly based on precipitation forecasts. At the start of the scheduled quarter, weather forecasts and precipitation totals will be monitored. Once 48 hours of relatively dry weather (no rain in excess of 0.1 inch in the outfall catchment area) occurs, crews will be deployed to sample when there is an 80 percent probability of a rain event that will result in 0.2 inch of rain or greater occurring within the next day. (An average rain event for NYC is 0.4 inch; therefore, the acceptable range for an event, plus or minus 50 percent, is 0.2–0.6 inch. Any rainfall event outside the average storm volume and duration for NYC will be excluded from the evaluation.) Once samples are collected, the storm total should be obtained from the nearest or most appropriate rain gauge.

3.4 Flow Metering

Flow metering will be conducted so that stormwater discharge rates may be correlated with rainfall and combined with water quality pollutant data to estimate loadings. Both Phase 1 and Phase 2 outfalls will be metered during a portion of the duration for which they will be sampled, with the deployments focusing on summer months, when water quality impacts to uses are greatest. Each meter deployment will cover six consecutive weeks at a given location, with the goal of at least one Phase 1 sampling event occurring during meter deployment. This period may be extended if insufficient precipitation occurs during that period to develop valid precipitation-response relationships.

3.5 Precipitation Monitoring

Rain data will be collected from the certified National Weather Service (NWS) rain gauges routinely used by NYC for both Phase 1 and Phase 2 monitoring. Data from these gauges are highly reliable, and all stormwater outfalls are sufficiently close to at least one of these gauges. Therefore, rain data from these gauges may be considered representative of the tributary catchment. In addition, temporary rain gauges will be deployed synoptically during flow metering to supplement the assigned NWS gauge and to provide a measure of spatial variability.

3.6 Ambient Water Quality Monitoring to Characterize Water Quality Condition

Ambient water quality will be monitored on a periodic basis in association with the Phase 2—Targeted Outfall Monitoring to evaluate the role that stormwater plays as a potential pollutant source, and in support of evaluations of long-term trends in receiving water quality. Ambient water quality monitoring will be performed at the nearest ongoing Harbor Survey or Sentinel Monitoring station location as practicable for historical comparisons. Slight spatial adjustments may be necessary depending on the sample results. The timing of receiving water monitoring will be connected to the outfall monitoring, tides, and precipitation in order to collect samples most reflective of the receiving water response to MS4 discharges.

4.0 Water Quality Methods and Test Procedures

Table 2 lists the water quality parameters and sampling methodologies (sample type and holding time) for the monitoring program. Field or in-situ parameters will be analyzed in the field. The remaining parameters will be collected and analyzed at a laboratory certified by the New York State (NYS) Environmental Laboratory Approval Program (ELAP). The goal is to collect data during rainfall events that are average in volume and/or duration for NYC. Once samples are collected, the storm volume and duration should be obtained from the nearest or most appropriate rain gauge. Storms that are outside the target (plus or minus 50 percent) will be excluded from the evaluation.

Table 2—Water Quality Parameters; and Sampling Methodologies

Parameter	Sample Type		Holding Time
	Outfall Sampling	Receiving Water Sampling	
Temperature	In-Situ	In-Situ	Analyze Immediately
Salinity	In-Situ	In-Situ	Analyze Immediately
Dissolved Oxygen	In-Situ	In-Situ	Analyze Immediately
pH	In-Situ	In-Situ	Analyze Immediately
Fecal Coliform	Grab	Grab	6 hours
Enterococcus	Grab	Grab	6 hours
Total Dissolved Solids (TDS)	Composite	Grab	7 days
Total Suspended Solids (TSS)	Composite	Grab	7 days
Total Phosphorus	Composite	Grab	28 days
Dissolved Phosphorus	Composite	Grab	28 days
Total Nitrogen	Composite	Grab	28 days
Total Ammonia (as N)	Composite	Grab	28 days
Total Kjeldahl Nitrogen (TKN)	Composite	Grab	28 days
Total Cadmium	Composite	Grab	180 days
Total Chromium	Composite	Grab	180 days
Total Copper	Composite	Grab	180 days
Total Lead	Composite	Grab	180 days
Total Nickel	Composite	Grab	180 days
Total Arsenic	Composite	Grab	180 days
Total Mercury	Composite	Grab	28 days
Total Zinc	Composite	Grab	180 days
Oil and Grease: Total Recoverable n-Hexane Extractable Material (HEM)	Grab	Grab	28 days

4.1 Sampling Procedures for Laboratory Analysis

Sampling locations will be identified using latitude/longitude coordinates with a Global Positioning System (GPS) device. When sampling is conducted from a boat, where necessary, the boat will not be anchored during sampling, but care will be taken to monitor latitude and longitude throughout the sampling process, and the boat location will be adjusted as necessary.

Landside Outfall Sampling. Using a stainless steel dip bucket, aliquots of water will be collected approximately every 30 minutes during a 2-hour continuous period of a qualifying rain event (5 grabs to make a single composite for laboratory analysis). If the actual storm duration did not allow the collection of five samples within a period of two hours (0-minutes; 30-minutes; 60-minutes; 90-minutes and 120-minutes) immediately after the start of overland runoff, the samples collected would be discarded. The aliquot volume to be collected will depend on the total volume needed for laboratory analyses of all the composited parameters. For example, if the laboratory requires a total of 5 liters of sample water, each aliquot collected should be at least 1 liter. Additional volume per aliquot is recommended in case of accidental spillage. All aliquots must be of the same volume for the sample to be representative of the sampling period. The compositing container (e.g., a clean, glass carbuoy) will be kept on ice during the sampling period to keep the composited sample cool. Once the last aliquot is collected, the composite sample will be gently agitated and poured into the designated sample bottles. Sample identification, date, and time will be recorded on the field datasheet. Time of sample should be the time of the last aliquot collected.

Receiving Water Sampling. Receiving water sampling will conform to the Harbor Survey's Ambient Water Quality Monitoring Quality Assurance Project Plan (2014) as approved by USEPA and insofar as the sampling parameters coincide. Receiving water samples will be collected using a pump sampler at the desired depth. Sample water will be directly poured from the sampler tubing into the designated sample bottles.

4.2 Sample Preservation and Transfer Procedure

All samples for laboratory analysis will be preserved per laboratory methods and transferred to a contract laboratory for analysis. Analysis will be performed by a certified NYS ELAP Laboratory for analytes and laboratory parameters will be reported. All sample bottles used for laboratory analysis will be new and provided by the sampling contractor or the contracted laboratory, including equipment blanks.

4.3 Sample Handling and Custody

Samples that are collected will be transferred to a contract laboratory under standard chain-of-custody (COC) protocols and within required holding times. COC documentation tracks the progress of samples from their collection in the field through laboratory analysis. The forms will be completed by field personnel and will accompany the samples to the laboratory. Each time the samples change hands, the COC form will be signed by the person relinquishing the samples, and then by the person receiving them.

Collected samples will be immediately stored on wet ice in a cooler. The temperature of the first sample taken by each sampling crew will be measured upon delivery of samples to the contractor laboratory and will be recorded on COC forms. Note that the last samples taken, depending on the temperature of the sampling waters, may not have time to reach the cooling temperature of approximately 4°C or lower before delivery to the laboratory. Data will be evaluated for conformance based on holding time, sample collection temperature, and laboratory receiving temperature.

4.4 Test Procedures

It is the intent of the long-term MS4 Monitoring Program to utilize the same analytical methods followed by the Harbor Survey and other existing monitoring programs. *Table 3* summarizes the sample analysis methods preferred for this monitoring program. However, should it be necessary to employ an alternative method, DEP will be contacted and this appendix will be revised to document method changes and any resulting quality control (QC) changes required by DEP.

Table 3—Preferred Laboratory Analytical Methods

Parameter	Analysis Method*	Reporting Limit**	Preservation**
Fecal Coliform	USEPA 1978 p124	1, 2, 4, 10 CFU/100 mL	4°C
Enterococcus	USEPA 1600	1, 2, 4, 10 CFU/100 mL	4°C
Total Dissolved Solids (TDS)	USEPA 160.1	20 mg/L	4°C
Total Suspended Solids (TSS)	SM 2540 D	1 mg/L	6°C
Total Phosphorus	SM 4500-P B,E	0.05 mg/L	H_2SO_4, pH<2, 6°C
Dissolved Phosphorus	USGS I-4650-03	0.02501 mg/l	4°C
Total Nitrogen	USGS I-4650-03	0.088 mg/l	4°C
Total Ammonia (as N)	USEPA 350.1	0.0408 mg/L	H_2SO_4, pH<2, 6°C
Total Kjeldahl Nitrogen (TKN)	USEPA 351.2	0.30 mg/L	H_2SO_4, pH<2, 6°C
Total Cadmium	USEPA 200.7	0.0020 mg/L	HNO_3, pH<2, 4°C
Total Chromium	USEPA 200.7	0.0050 mg/L	HNO_3, pH<2, 4°C
Total Copper	USEPA 200.7	0.010 mg/L	HNO_3, pH<2, 4°C
Total Lead	USEPA 200.7	0.0050 mg/L	HNO_3, pH<2, 4°C
Total Nickel	USEPA 200.7	0.0050 mg/L	HNO_3, pH<2, 4°C
Total Arsenic	USEPA 200.7	0.010 mg/L	HNO_3, pH<2, 4°C
Total Mercury	USEPA 200.8	0.10 µg/L	HNO_3, pH<2, 4°C
Total Zinc	USEPA 200.7	0.050 mg/L	HNO_3, pH<2, 4°C
Oil and Grease: Total Recoverable n-Hexane Extractable Material (HEM)	USEPA 1664	5 mg/L	HCl, pH<2, 4°C

* USEPA: US Environmental Protection Agency; USGS: US Geological Survey; SM: Standard Methods

** CFU = colony forming unit; C = Celsius; mL = milliliters; mg/L = milligrams per liter; µg/L = micrograms per liter; H_2SO_4 = sulfuric acid; HNO_3 = nitric acid; HCl = hydrochloric acid.

4.5 Data Management

Primary data will be recorded on data sheets or in laboratory notebooks, and will be retained according to the participating laboratory's procedures. The sampling contractor will maintain copies of primary data and summary data reports for at least seven years in an organized and easily retrievable manner. Other project documentation, such as sample COC records and instrument maintenance and calibration information, will be kept on file at each laboratory within their normal documentation systems.

Data records for this project will be kept using basic laboratory practices, such as writing corrections in ink, using a single-line to cross out incorrect information, and labeling documents with sample identification, date, and signature of analyst. Data records will be stored in each laboratory's normal data files using either data sheets or laboratory notebooks.

Data will be compiled for analysis using Microsoft Excel. Excel functions will be applied to calculate basic mathematical values (e.g., monthly or seasonal averages, geometric means, data ranges) for each analytical parameter from each sampling site.

4.6 Adjustments

The MS4 Monitoring Program strategy and work plan described above is based on a good faith effort to determine the best locations, the most appropriate parameters, and reasonable sampling volumes to meet the stated goals of the long-term MS4 Monitoring Program. However, it is likely that data collection will reveal opportunities for improvement.

Therefore, an evaluation of the MS4 Monitoring Program will be performed. The data will be evaluated in the context of the goals of the SWMP and SWMP-related programs. Where data collected is ambiguous or otherwise uninformative, consideration will be given to changing sampling frequency or replacing one sampling location with another anticipated to yield more meaningful results. Data that have failed quality assurance (QA) or quality control (QC) criteria may also trigger adjustments and additional data reviews.

Any adjustment to the MS4 Monitoring Program will first be proposed to New York State Department of Environmental Conservation (NYSDEC) in writing for review and approval, and no change will be implemented without prior NYSDEC approval.

5.0 Flow Metering Methods and Test Procedures

Precipitation monitoring and flow metering will be conducted so that stormwater overflow rates may be correlated with rainfall and combined with water quality pollutant data to estimate loadings. Stormwater outfalls are not expected to discharge continuously. Therefore, meter setup will be designed to measure flow from as close to a dry condition as possible, to capture the fullest extent of a flow event. Eight stormwater outfalls will be metered during the Phase 1 sampling period (two years), with the deployments focusing on summer months, when water quality impacts to uses are greatest. Each deployment will cover six consecutive weeks at a given location. Eight locations at six weeks each results in 48 meter-weeks of deployment. Phase 2 will follow a similar methodology; the number of locations will be established during the Phase 1 data review.

5.1 Precipitation

Hourly rain data will be collected from the certified NWS rain gauges routinely used by NYC (*Table 4*). In addition, a temporary rain gauge will be deployed synoptically with the flow meters to supplement the assigned NWS gauge and to provide a measure of spatial variability. A minimum of one recording tipping bucket rainfall gauge will be installed at a central location within the tributary catchment area. The rain gauge will be capable of recording rainfall data in 15-minute increments.

Table 4—NWS Rain Gauge

Station Name (Call Sign)	City	Latitude	Longitude	Start Date of Precipitation Data
Newark Liberty International Airport (KEWR)	Newark, NJ	40°41'N	74°10'W	1929
John F Kennedy International Airport (KJFK)	Jamaica, NY	40°38'N	73°46'W	1948
La Guardia Airport (KLGA)	Flushing, NY	40°47'N	73°53'W	1935
Central Park (KNYC)	New York, NY	40°47'N	73°58'W	1869

Hourly data will be aggregated into discrete events to assist in developing relationships between rainfall, runoff/overflow volume, pollutant loads, and timing. Precipitation events will be defined by a minimum inter-event time (MIT) determined with NYSDEC's concurrence. For comparison, New York City's LTCP program uses a 12-hour MIT for calculating wet weather capture at its WWTPs to ensure that the collection system has completely returned to a dry weather condition between storms, but a 4-hour MIT for calculating return-period statistics to be consistent with the National Oceanic and Atmospheric Administration (NOAA) and others.

5.2 Flow Metering

Flow data will be collected at stormwater outfalls for a period of six weeks at each outfall being sampled. The monitoring will rely on a specialty company with expert knowledge in the science of flow measurements that will install, maintain, and remove the equipment.

All meters will be tested for flow and/or level accuracy and stability before installation and will be calibrated on installation for velocity and/or level. Meters will be located along free-flowing portions of storm sewers using redundant level sensors (typically one pressure and one ultrasonic meter). The precise location of the sensors will be determined during an initial site reconnaissance with the flow monitoring company to ensure that logistical and practical considerations unique to each site are addressed (e.g., access, proximity to changes in flow patterns, depth of flow initially observed, sediment deposition). Each site will be visited periodically for maintenance, including a visual inspection of all meter and sensor components, a review of the previous period's data to search for anomalies in the meter performance, physical calibration of velocity and/or level, and replacement of any questionable equipment.

5.3 Flow Data

Sensors will measure depth of flow and velocity, and data from each sensor will be downloaded electronically using telemetry to a central data collection center approximately every four hours. In addition, receiving water tidal stage will be retrieved from appropriate NOAA gauges to adjust data for backwater effects on tide gates and resulting calculated discharge volumes. All data will be reviewed two or three times per week by a dedicated data analyst who will report any anomalies and dispatch a field crew for a maintenance visit.

Data reduction and review will be performed on all data obtained for each flow monitoring location. In addition to the preliminary data review noted above, a final quality assurance/quality control (QA/QC) review of the data will include checking the validity of each data point, checking flow balance, comparison of observed flow to expected flow (pipe rating curve), and similar tests. Questionable data will be flagged or discarded as appropriate to their final use.

The depth and velocity measurements will be used to calculate flow in a manner suitable for the particular deployment. For example, different pipe cross-sections may rely on different metering approaches. Generally, flow area will be calculated based on depth, and volumetric flow will be calculated based on area-velocity. Other approaches may be necessary in instances such as weir overflow or orifice flow, where calculations may be based on height of flow over some critical elevation or through use of scatter graphs and other graphical techniques. In all cases, flow will be adjusted for tidal or high water influences.

6.0 Quality Assurance and Quality Control

To ensure adequate data quality, numerous institutional controls will be implemented throughout the sample collection, transport, and laboratory analysis process. The QA/QC program includes QA (process-oriented) procedures related to documentation, COC, decontamination procedures, as well as QC (product-oriented) procedures such as duplicate sampling and replicate laboratory analyses.

Primary data records (forms, notebooks, or electronically generated data) will be checked for completeness and accuracy. All data that are electronically entered into the Excel study records will be checked by someone other than the person entering the data. An Excel file will be used to compile data into a single file. The entry of data into this single file will be checked again for correctness to eliminate the possibility of typographical errors.

6.1 Quality Objectives and Criteria

Most laboratory methods are prescriptive regarding calibration procedures, numbers of duplicates and spikes, and other procedures necessary to document data quality. Reliance on NYS ELAP-certified laboratories ensures that these minimum requirements are being met. Field sampling procedures will be dictated by the requirements prescribed in the laboratory methods. The primary criteria to be used will be precision, accuracy, sensitivity, completeness, comparability, and representativeness, as discussed below.

Precision

Precision is a measure of how much repeated measurements deviate from one another, and assesses the variability associated with sample collection, handling, and storage in the field, as well as variability associated with the analytical processes. Precision will be evaluated by collecting and analyzing a duplicate sample, with the original and duplicate values being compared on a relative percent difference (RPD) basis. At a minimum, one sample from each sampling event and sampling group will be collected in duplicate. As an additional assessment of analytical precision, every 20th sample, or at least one sample per batch, will be split in the laboratory for duplicate analysis.

Accuracy

Accuracy is a measure of how close a given result is to the true value. It will be assessed by analyzing a second source QC sample of known concentration with each batch of samples for methods where applicable. Those QC samples can be in the form of laboratory-fortified blanks or matrix spikes, depending on the analytical method, and the percent recovery of the known concentration will be reported with the data associated with that spike.

Sensitivity

Sensitivity of the methods will be assessed using predetermined method detection limits (calculated annually as necessary) and reporting limits or levels. Detection limits and similar terms are used to describe the minimum threshold concentration that can be reliably detected for a given method.

Completeness

Even with rigorous QA/QC measures in place, no sample collection program is perfect. Samples are lost or damaged, holding times may be violated, or COCs may be illegible. In addition, QC samples are analyzed after the collection effort is done, and the result may render a set of analyses invalid retroactively. Completeness is a measure of the amount of valid data obtained relative to the amount of data planned, and it should be expected that at least 90 percent of data collected will be valid, usable data, meeting all quality objectives.

Comparability

Comparability is a measure of the confidence with which one data set (or method) can be considered equivalent to another, and is assessed using performance test (PT) samples as part of annual laboratory and method certification for each laboratory participating in the analysis of program samples. Comparability is thus built into the program by using only USEPA-approved methods and relying on NYS ELAP-certified laboratories.

Representativeness

Representativeness is a measure of the degree to which data represent the environmental condition at the sampling point. Representativeness is established by adhering to sampling and sample handling procedures, equipment maintenance, calibration, and use procedures, and by uniform implementation of all program-related standard operating procedures (SOPs). In addition, equipment blanks using laboratory de-ionized water will be generated each day that samples are collected and for each sampler to use during that event (includes all sampling groups within each sampling event). At least one equipment blank will be collected during each sampling event to be analyzed with each parameter of interest.

6.2 Instruments and Equipment

Many of the quality objectives and criteria can be met only through the use of well-maintained, clean equipment. The rigorous care of field and laboratory equipment is a vital element of monitoring and related QA/QC programs so that accurate, precise, repeatable measurements can be made.

Testing, Inspection, and Maintenance

Field equipment will be maintained and operated according to the specific equipment manuals. Routine preventive maintenance will be performed at the frequency recommended by equipment manuals to minimize the occurrence of field and laboratory instrument failure and other system malfunctions. All maintenance performed will be documented in the appropriate instrument operating and maintenance record books.

Calibration and Frequency

Laboratory equipment used in this project will be maintained, calibrated, and operated according to NYS ELAP requirements and applicable project SOPs. Calibrations for laboratory equipment and instrumentation will be performed prior to sample analysis. Field equipment, including meters, will be calibrated according to the specific equipment manuals. Calibrations for field equipment will be performed prior to each day of use for sample analysis. Instruments will be recalibrated after any maintenance activity is conducted. All calibration activities will be recorded on the field data sheets or in field calibration log books.

Decontamination

Field equipment will be cleaned with mild detergent, rinsed with de-ionized water, and inspected for cleanliness and usability before each use in the field.

Operator Training

A clear understanding of project objectives and data quality criteria is necessary for project personnel to successfully participate in this project. Field personnel are trained in routine field water sampling and in-situ testing techniques. Lab personnel are trained in quality laboratory techniques and in the analyte tests that they will perform. Each laboratory that performs testing for this project will be certified by the NYS ELAP for applicable parameters.

Inspection/Acceptance for Supplies and Consumables

Supplies will be inspected to ensure they will meet the needs of the project. Any specialized replacement equipment will be tested prior to use.

7.0 Assessment and Reporting

The Phase 1 monitoring report will be prepared two years (i.e., eight quarterly sampling cycles) after the Phase 1 monitoring has commenced. The report, which will include assessments and recommended adjustments, as appropriate, will be submitted along with comparisons to historical data where available. Values will be compared to nationwide sources and to directly applicable New York State standards. Data that fail QA/QC criteria will be documented as part of the data packet, along with an evaluation of the cause and severity of the QA/QC contravention.

The Phase 2 monitoring report will be developed similar to Phase 1 assessment and reporting procedures, unless Phase 1 results suggest alternative procedures for assessing and reporting monitoring data and results during the future phase. Therefore, it is currently anticipated that the final results for both Phase 1 and Phase 2 monitoring will include the following information for each monitoring location:

- An assessment of potential sources of discharge of stormwater POCs
- Identification of potential additional reduction measures
- Figures showing metering locations and configuration of sensors, with photos of installed flow monitors provided in the Sewer System Characterization Report
- A summary of daily flow information for a selected time period, including minimum rate, peak rate, total daily flow, total rain, peak hourly rain, and peak 15-minute rainfall, if applicable
- Detailed flow reports of the flow rate data in 15-minute time increments, including depth of flow, velocity of flow, incremental flow rate, cumulative flow rate, and recorded rainfall
- Flow hydrographs comprised of a plot of the recorded flow rates for a selected time period along with a bar graph of associated rainfall for each flow monitoring location
- QA/QC data demonstrating the validity of the results and flags on questionable data, including the preliminary and final QA/QC data checks
- Calibration and maintenance procedures, available upon request
- Data in an electronic format, available upon request.

8.0 Schedule

Part IV.O, Program Development Compliance Schedule, of the MS4 Permit identifies the deliverables and related submittal schedule that the City must meet for Permit compliance. The Effective Date of Permit (EDP) is August 1, 2015, and the Permit remains effective through July 31, 2020. The milestones relevant to the Monitoring Program are:

- Stormwater Management Program Plan Draft (Part III.A), due EDP plus three years (August 1, 2018)
- Monitoring and Assessment of Controls (Part IV.J.3), certification of implementation due EDP plus five years (August 1, 2020; i.e., the beginning of the next five-year Permit cycle).

The Phase 1 outfall sampling and metering will be initiated prior to August 1, 2020. Subsequent to the two-year collection period, data will be evaluated before the Phase 2 monitoring strategy and work plan is finalized and contracts are procured for implementation.

9.0 References

APHA/AWWA/WEF. 2017. "Method SM 2540 D: Total Suspended Solids Dried at 103-105o," Standard Methods for the Examination of Water and Wastewater, 23rd Edition.

APHA/AWWA/WEF. 2017. "Method SM 4500-P E: Phosphorus by Ascorbic Acid," Standard Methods for the Examination of Water and Wastewater, 23rd Edition.

USEPA. 1978. "Microbiological Methods for Monitoring the Environment Water and Wastes," p. 124.

USEPA. 1993a. "Method 350.1: Determination of Ammonia Nitrogen by Semi-Automated Colorimetry," Revision 2.0.

USEPA. 1993b. "Method 351.2: Determination of Total Kjeldahl Nitrogen by Semi-Automated Colorimetry," Revision 2.0.

USEPA. 1994. "Method 200.8: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry," Revision 5.4.

USEPA. 1999."Total Dissolved Solids (TDS): USEPA Method 160.1 (Gravimetric, Dried at 180 degrees C)."

USEPA. 2001. "Method 200.7 Trace Elements in Water, Solids, and Biosolids by Inductively Coupled Plasma-Atomic Emission Spectrometry," Revision 5.0.

USEPA. 2006. "Method 1600: Enterococci in Water by Membrane Filtration Using membrane-Enterococcus Indoxyl-B-D-Glucoside Agar (mEI)."

USEPA. 2010. "Method 1664: n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry," Revision B.

USGS. 2003. "Method I-4650-03: Nitrogen and phosphorus, total whole water (mg/L as N or P)," Water-Resources Investigations Report 03–4174.

Appendix 12.1

CIT System Framework Certification

Environmental Protection

Vincent Sapienza
Commissioner

Angela Licata
Deputy Commissioner
Sustainability

Pinar Balci
Assistant Commissioner
Environmental Planning & Analysis

59-17 Junction Blvd.
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August 1, 2018

Selvin Trevor Southwell, P.E.
Deputy Regional Water Engineer, Division of Water
New York State Department Of Environmental Conservation
47-40 21st Street
Long Island City, NY 11101

Dear Mr. Southwell:

In accordance with Part IV.J.1 of the New York City Municipal Separate Storm Sewer System (MS4) Permit (SPDES Number NY-0287890), the New York City Department of Environmental Protection (DEP) has developed a consolidated information tracking system framework (CITS Framework). The CITS Framework, developed by DEP, is a data directory that will ultimately be the basis for the consolidated information tracking system (CITS) – a database that includes a portal that will be used by the City to input data required by the MS4 permit's annual reporting requirements. The DEP Office of Information Technology is using the CITS Framework as a guide for developing the CITS.

The CITS Framework is the description of the CITS requirements for system design and data collection. It is organized into two main sections: (1) technical and design requirements for the software system (e.g., user creation, system configurations, and user notifications) that includes features that allow the CITS to grow and adapt to future changing needs, and (2) substantive data tracking and reporting requirements that include the information required to be reported by the MS4 permit. The CITS Framework includes the following information required by the MS4 permit that follows the Stormwater Management Program (SWMP) Plan chapter format:

- Annual reporting requirements
- Framework requirements
- SWMP provision requirements
- Wireframe user interface screen mock ups
- Import schema
- Web service specifications
- Summary data
- Data elements

This certification fulfils the permit requirement in Part IV.J.1 of the MS4 Permit.

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief' true, accurate, and complete. I am aware that there are significant penalties for submitting false information.

Sincerely,

Pinar Balci, Ph.D.
Assistant Commissioner
Bureau of Environmental
Planning & Analysis

cc (via email):
Marcella Eckels, DEP Bureau of Legal Affairs
Robert Elburn, DEC Regional Water Engineer, Region 2