Environmental Protection

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May 30, 2017

Joseph DiMura, P.E.
Director, Bureau of Water Compliance
New York State Department of Environmental Conservation
625 Broadway, 4th Floor
Albany, New York 12233-3506

Re: CSO Order on Consent (DEC Case No. CO2-20110512-25, modification to CO2-20000107-8)
Section IV.A.2, City-Wide Green Infrastructure Implementation, Green Infrastructure Performance Metrics Report
Section IV.A.3, City-Wide Green Infrastructure Implementation, Green Infrastructure Contingency Plan
Response to DEC Comments Dated March 16, 2017

Dear Mr. DiMura:

With this letter and the attachment, the New York City Department of Environmental Protection hereby submits responses to DEC's comment letter dated March 16, 2017.

Please contact me at (718) 595-4398 should you have any questions regarding this submittal.

Sincerely,

Angela Licata

Angela Licata
Deputy Commissioner for Sustainability

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DEC Comment #1: The GI Metrics Report indicates that the future implementation of GI assumes a much greater share of detention based GI projects than have been or will be implemented under the 1.5% application rate because the City does not have site specific information for future GI installations. As such, the Department recommends that the City conduct a sensitivity analysis that assumes a range for the future GI in terms of percent retention vs. detention practices, from 0 to 100 percent, for the remaining 8.5% application rate, and then estimate the associated CSO reductions. This approach would result in a range for the CSO reductions for the 8.5% rate.

The City recognizes that the future GI installations will be variable based on GI types and locations. However, a sensitivity analysis involving 0 to 100% implementation is hypothetical and will not guide the implementation process. Therefore, the City consulted with DEC to develop two more scenarios for additional GI implementation based on the overall 10% GI implementation rate scenario, namely, high retention and low retention scenarios, as shown in Table 1 below.

Table 1: Retention v. Detention Assumptions for Additional GI Used for Sensitivity Analyses

	High Retention Scenario		Low Retention Scenario	
	ROW and On-site Retention Area, %	On-site Detention Area, %	ROW and On-site Retention Area, %	On-site Detention Area, %
Total Citywide	**31%**	**69%**	**19%**	**81%**

Citywide results for sensitivity analyses of the high and low retention scenarios for the 10% GI implementation rate scenario (1.5% as described in the Performance Metrics (PM) Report and remaining 8.5% described in the above table), as well as the 10% scenario utilized in the PM Report, are shown in Table 2 below.

Table 2: Citywide Results for Sensitivity Analyses of Retention vs. Detention CSO Volume Reduction based on 10% GI Implementation Rate Scenario

	Presented in PM Report			High Retention Scenario		Low Retention Scenario	
	CSO Volume (MG/yr)			CSO Volume (MG/yr)		CSO Volume (MG/yr)	
	Baseline	Volume Reduction	% Reduction	Volume Reduction	% Reduction	Volume Reduction	% Reduction
Total Citywide	20,806	1,667	8.1%	1,741	8.4%	1,494	7.2%

As expected, the estimated annual CSO volume reduction increases for the high retention scenario and decreases for the low retention scenario. The overall range of CSO volume reduction changes between the high and low retention scenarios is estimated at 247 MG, or approximately 15% of the CSO volume originally estimated under the scenario utilized in the PM Report. It should be noted that the evaluations presented in the PM Report used the best

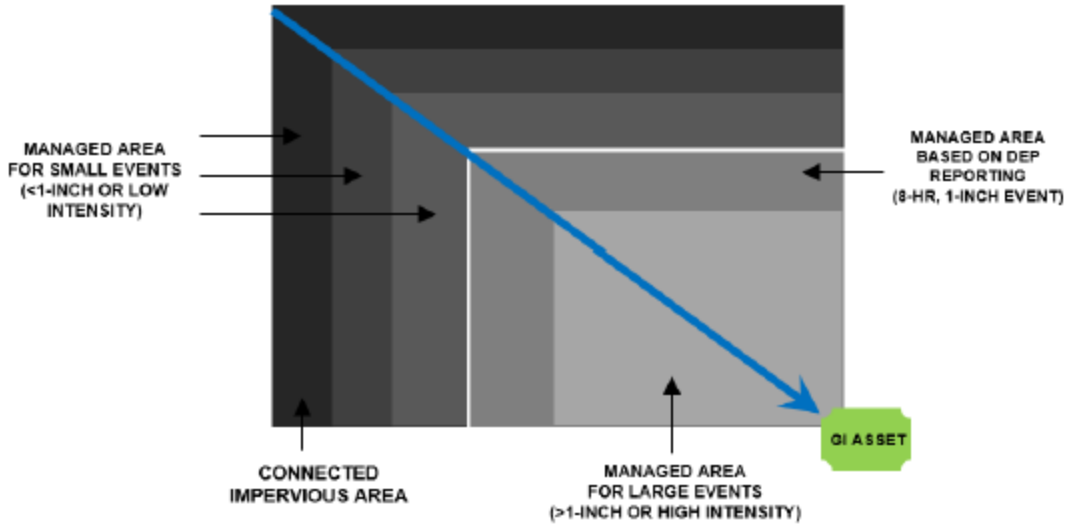
available information at the time of the report, and the City's best estimate for potential GI installations (retention v. detention) for 2030 and a target of 10% GI implementation.

DEC Comment #2: The City should continue to gather data for source control projects associated with the Stormwater Performance Standard for new development and redevelopment areas as well as other programs that could be accounted for and added to the GI goals for total CSO reduction in the future.

The City is tracking new Site Connection Proposals (SCPs) and House Connection Proposals (HCPs) submitted to the City that have been governed by the 2012 Stormwater Performance Standard and reports on these in the annual Green Infrastructure Report. The City is working internally to require all pertinent information on the SCPs that would allow the City to credit the projects toward the Program. In addition, the City continues tracking all private and public onsite and ROW GI projects using the recently developed GIS-based GI tracking tool, GreenHUB.

DEC Comment #3: [a] Section 4.4, the wording of the 4th paragraph is confusing. [b] Also in Section 4.4, last paragraph, the City indicates that the infiltration rates for future GI are based on average values for nearby constructed ROWBs. Confirm if the City also uses soil maps when estimating infiltration rates for future ROWBs.

[a] For the purposes of distributed modeling of the GI assets under the 1.5% GI modeling scenario, the actual connected impervious tributary area was used in the InfoWorks model, which was defined via a GIS analysis for each GI asset with known location based on local topography, street slopes, and relative locations of catch basins. In most cases the actual connected area is greater than the managed area reported by the City using a "static" 1-in, 8-hour precipitation event. During the dynamic continuous model simulations for the typical hydrological year (2008 JFK International Airport's NOAA rain gauge), runoff from this entire connected impervious area had the ability to reach the GI assets for a large number of precipitation events smaller than 1 inch. This concept is illustrated in Figure 1-4 of the PM Report, and is also included below. As a result, the impervious area managed "dynamically" over the typical year is always greater that the "static" value for a 1-in, 8-hr event reported by the City. For consistency with the City's annual GI reports, the "static" value was utilized to determine the managed impervious area, which was reported in the PM Report.



Schematic of Connected v. Managed Impervious Area for GI Assets

[b] The GI assets with prior boring/infiltration records have been modeled with these field confirmed infiltration rates. For the ROWBs that will be implemented to meet the 1.5% target and with no existing infiltration rates, the average values for nearby locations with field confirmed infiltration rates were used. Infiltration in urban areas can vary significantly due to compaction and backfill; additionally, there can be significant variation in underlying soil characteristics with respect to nationwide datasets on soil maps (such as SSURGO) at the local scale of a ROWB. With these uncertainties, using an average infiltration rate derived from locally available data is a defensible methodology to characterize the GI performance.

DEC Comment #4: Confirm if the City includes evapotranspiration for modeling the blue/green roofs, which would reduce the amount of stormwater that enters the sewer system.

The City included evapotranspiration for the modeling of blue/green roofs. However, blue/green roofs represent only 41 out of over 6,600 GI assets modeled in the 1.5% GI scenario. Further evaluations of the distributed green roof modeling approach are being conducted under the ongoing GI Research and Development project.

DEC Comment #5: Describe how the City will incorporate a decline in performance of the GI over time due to normal wear and tear of the practices. Although the City will be conducting routine maintenance of the GI, it would be reasonable to assume performance of the GI practices will not remain the same as when first constructed.

Long-term green infrastructure performance evaluations are ongoing in many municipalities. However, because many of these monitoring programs have been implemented only recently, actual long-term performance reports are still relatively limited. The City's GI monitoring effort began in 2010 and has one of the longest monitoring datasets available at individual GI scales and neighborhood scales. The City is currently in the process of gathering and synthesizing the data that is available, and using it to minimize the risk of reduced performance. The City's standard right-of-way bioswale (ROWB) designs have been developed to minimize clogging, such as by

now using for example, the stone gabions to increase storage and infiltration in ROWBs. Operations and Maintenance protocols, training manuals/programs, are also being developed now for this express purpose.

For the above reasons, it is not assumed that performance necessarily will deteriorate over time. In fact, in some instances, performance could increase over time, a view that is shared by some academics and other municipalities. This could occur, for example, as canopies close over soil surfaces, increasing interception and raindrop impact on soils, while establishing a dynamic root system that enhances infiltration through macropore flow and bioturbation.

The City will share lessons learned from academia and other municipalities with DEC as it is available and will integrate those lessons into design and maintenance protocols through adaptive management.

DEC Comment #6: Describe how the City will incorporate sewer infiltration associated with implementation of retention GI practices. If the City does not have any data on sewer infiltration, it would seem reasonable to gather additional field data to support modeling of long-term GI performance.

Infiltration of groundwater to the sewers does not happen when the sewers are flowing full during wet weather events, so no infiltration is expected when the CSS capacity is exceeded and CSOs are occurring. Assuming this does happen after the CSS wet weather flows subside, that flow would be conveyed to and treated at the wastewater treatment plants. Furthermore, the City does not install bioswales where the bottom of the bioswale (at 5') would be less than 4' from groundwater or bedrock. As such, groundwater infiltration is minimized.

Green Infrastructure Contingency Plan

DEC Comment #1: Table 3 provides an overview of the work DEP plans to complete to meet the 1.5% application rate, but the Department needs more detailed information on the projects that will be constructed to meet the 1.5% implementation rate. To satisfy the consent order requirements, the area wide contract/project groups need to be broken down into specific projects (can be grouped with drainage basins or sub-catchments) with their status (% complete if in construction) and location, detailed implementation schedules, and contribution to the overall 1.5% application rate.

The City provided location (waterbody), status and anticipated construction completion dates for the projects identified in the Contingency Plan to achieve the 1.5% priority area implementation rate scenario. This information is provided again, as submitted in the Contingency Plan, below as Table 3. In Table 4 below, the City has updated the status of the projects as of April 2017. However, it is not feasible to break this information down further or provide details on the projects' contribution to the 1.5% implementation rate scenario as most of these contracts are in early stages of design and require interagency coordination with multiple agencies on boring permits, site conflict screening and walkthroughs. DEP has increased staffing at partner agencies to assist and expedite the process, but each site requires individual attention and a commitment of exact dates is not possible due to the distributed nature and number of these assets. The City is

committed to providing progress toward construction completion and will report on the status of the projects identified in the Contingency Plan at DEC-DEP quarterly meetings and associated reporting as well as annual reports.

Table 3: Contingency Plan Projects Submitted in Contingency Plan

Priority Waterbodies	Area-Wide ROW Project	Current Status	Anticipated Construction Completion Date
Flushing Creek*	TI-011	60% Design	December 2019
Newtown Creek*	BB Cluster	60% Design	December 2019
Jamaica Bay*	JAM-003	Geotech	December 2019
EROW/Wallabout	NCB-014	Geotech	December 2020
EROW/Bowery Bay	BB-005	Geotech	December 2020
Westchester Creek*	HP-014	60% Design	December 2020
Westchester Creek*	HP-033	60% Design	December 2020
Flushing Creek*	TI-010	Walk-through	December 2020
Bronx River*	HP-007	Design Start July 2016	December 2020
Bronx River*	HP-004/-002	Design Start July 2016	December 2020
Jamaica Bay*	26W-005/-004	Design Start July 2016	December 2020

*Projects in priority watershed are marked with an **

Table 4: Contingency Plan Projects with Updated Status as of April 2017

Priority Waterbodies	Area-Wide ROW Project	April 2017 Status	Anticipated Construction Completion Date
Flushing Creek*	TI-011	60% Design	December 2019
Newtown Creek*	BB Cluster	60% Design	December 2019
Jamaica Bay*	JAM-003	60% Design	December 2019
EROW/Wallabout	NCB-014	60% Design	December 2020
EROW/Bowery Bay	BB-005	60% Design	December 2020
Westchester Creek*	HP-014	90% Design	December 2020
Westchester Creek*	HP-033	90% Design	December 2020
Flushing Creek*	TI-010	Geotech	December 2020
Bronx River*	HP-007	Walk-through	December 2020
Bronx River*	HP-004/-002	Walk-through	December 2020
Jamaica Bay*	26W-005/-004	Walk-through	December 2020

*Projects in priority watershed are marked with an **