

New York Interagency Engineering Council

Fall Technical Conference

October 16, 2025

Implementing Precast Porous Concrete Panels in Gravesend Bay, Brooklyn

Adriana Kocovic, PMP, ENV SP

DIRECTOR OF GREEN INFRASTRUCTURE

NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION



Session Overview

- What is Green Infrastructure and why is it being implemented in NYC?
- What are Precast Porous Concrete Panels (PPCP) and what's beneath the surface?
- How to go about planning, design, and construction of PPCP
- How is PPCP tested and maintained?
- Q & A Session



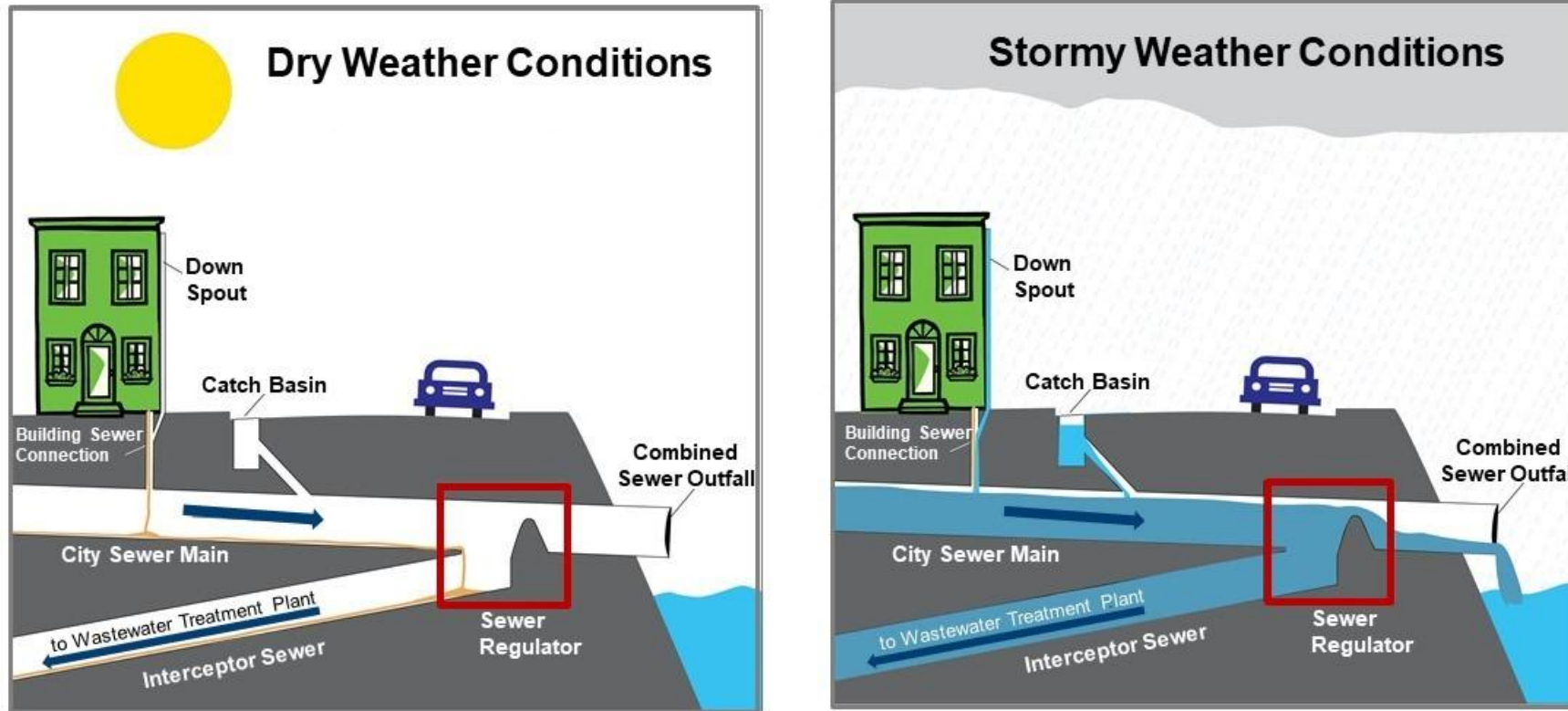
NYC DEP RIGHT OF WAY GREEN INFRASTRUCTURE

New York City Department of Environmental Protection's (DEP) Green Infrastructure (GI) Program has implemented over 16,000 GI assets citywide, preventing millions of gallons of stormwater from entering the sewer system, reducing combined sewer overflows (CSO) by 807 million gallons per year and counting. Right of way assets include rain gardens, infiltration basins, and porous pavement.

This presentation provides a review of the steps followed to design and install Precast Porous Concrete Panels (PPCP). Contract GKOH15-02 is the first of multiple areawide PPCP construction projects that NYC DEP is implementing as part of its CSO reduction GI program.

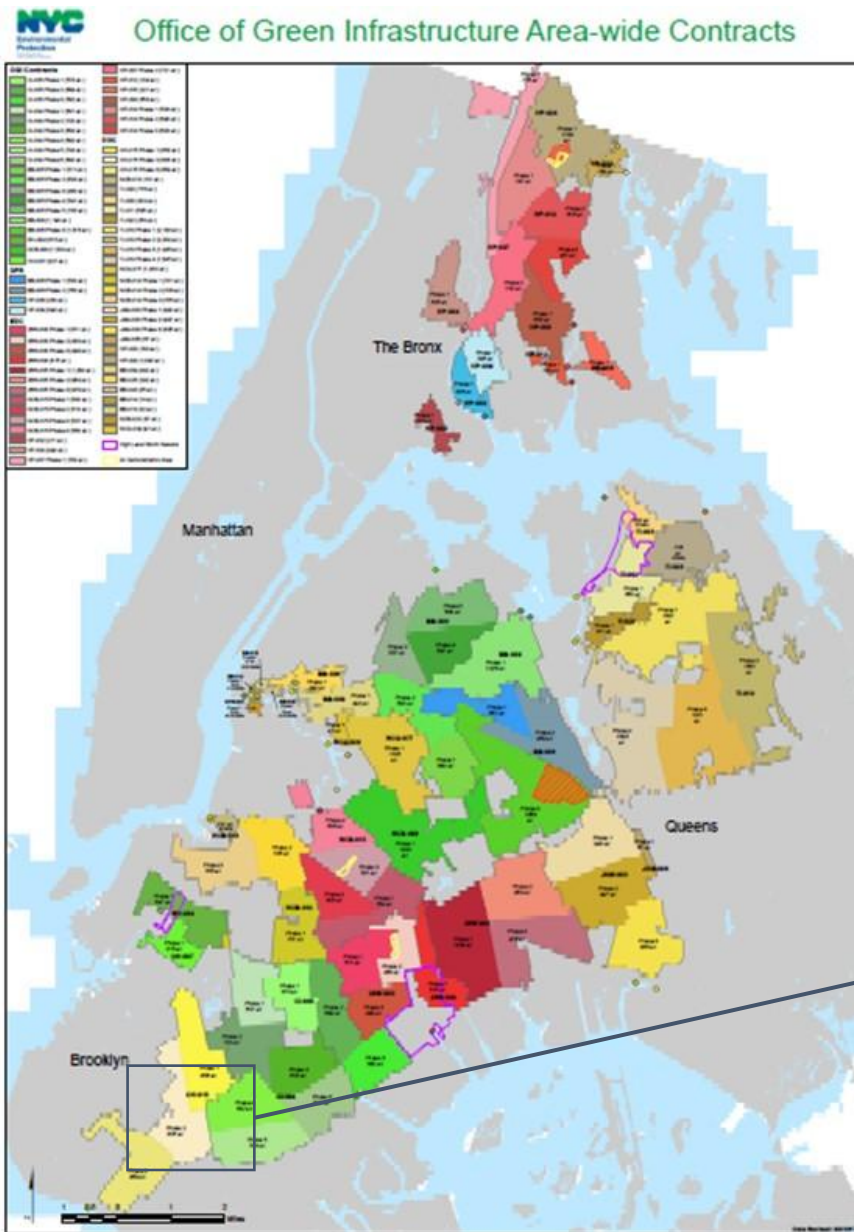
What is a Combined Sewer Overflow?

- Approximately 60% of NYC's sewer system is **combined**, which means it combines **sewage** and **stormwater flows during wet weather**.



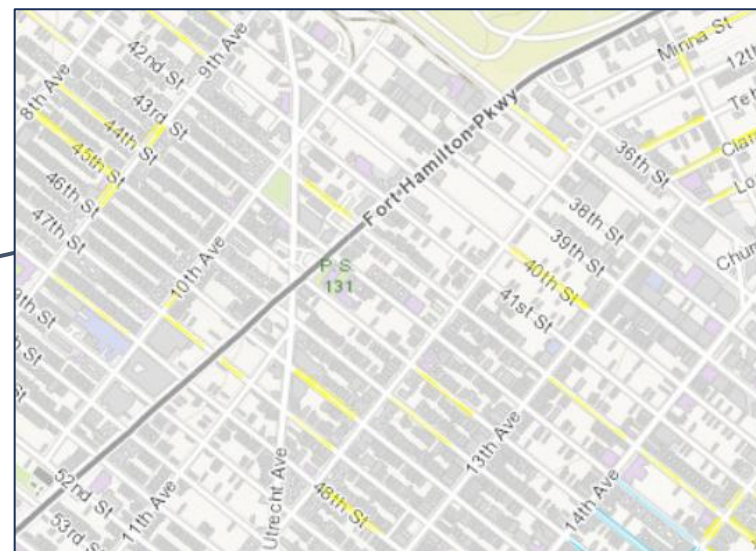
- When the sewer system is at full capacity, a diluted mixture of rain water and sewage is released into local waterways. This is called a combined sewer overflow (CSO).
- NYS DEC CSO Consent Order mandates DEP achieve 1.67 billion gallons per year of CSO reduction by 2040

Priority Areas and Areawide Approach



The Area-wide Approach allows DEP to:

- Focus resources on watersheds that provide the greatest impact in reducing CSOs (Priority Areas)
- Saturate these CSO tributary areas with as much GI as feasible
- Achieve efficiencies through standard designs, specifications and procedures
- The public can track progress online: nyc.gov/dep/gimap



Various Green Infrastructure Typologies

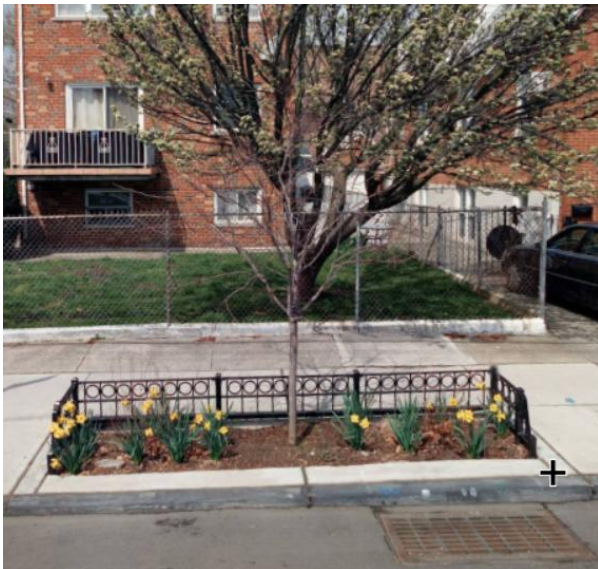
ROW Bioswales/Rain Gardens

ROW Infiltration Basins

ROW Porous Pavement

GI Animation

<https://www.youtube.com/watch?v=0N6zKBR2KbE>



WHAT IS PPCP?



PRECAST POROUS
CONCRETE PANELS

Porous Pavement



- NY Times article:
<https://www.nytimes.com/2024/09/23/nyregion/street-wars-flooding-pavement-porous.html>



Porous Pavement During Construction

PRECAST POROUS CONCRETE PANELS (PPCP)

- ❑ Typically sited in low-traffic areas (residential)
- ❑ Constructed in the parking lane
- ❑ Easier to site than sidewalk practices because of fewer surface constraints in the roadway
- ❑ A great solution for urban and crowded areas that have flooding issues and meet soil conditions and criteria.



PPCP CONSTRUCTION ELEMENTS



BIAXIAL GEOGRID



STONE
HEADERS
CHECK DAMS



STACKED
DRAINAGE CELLS

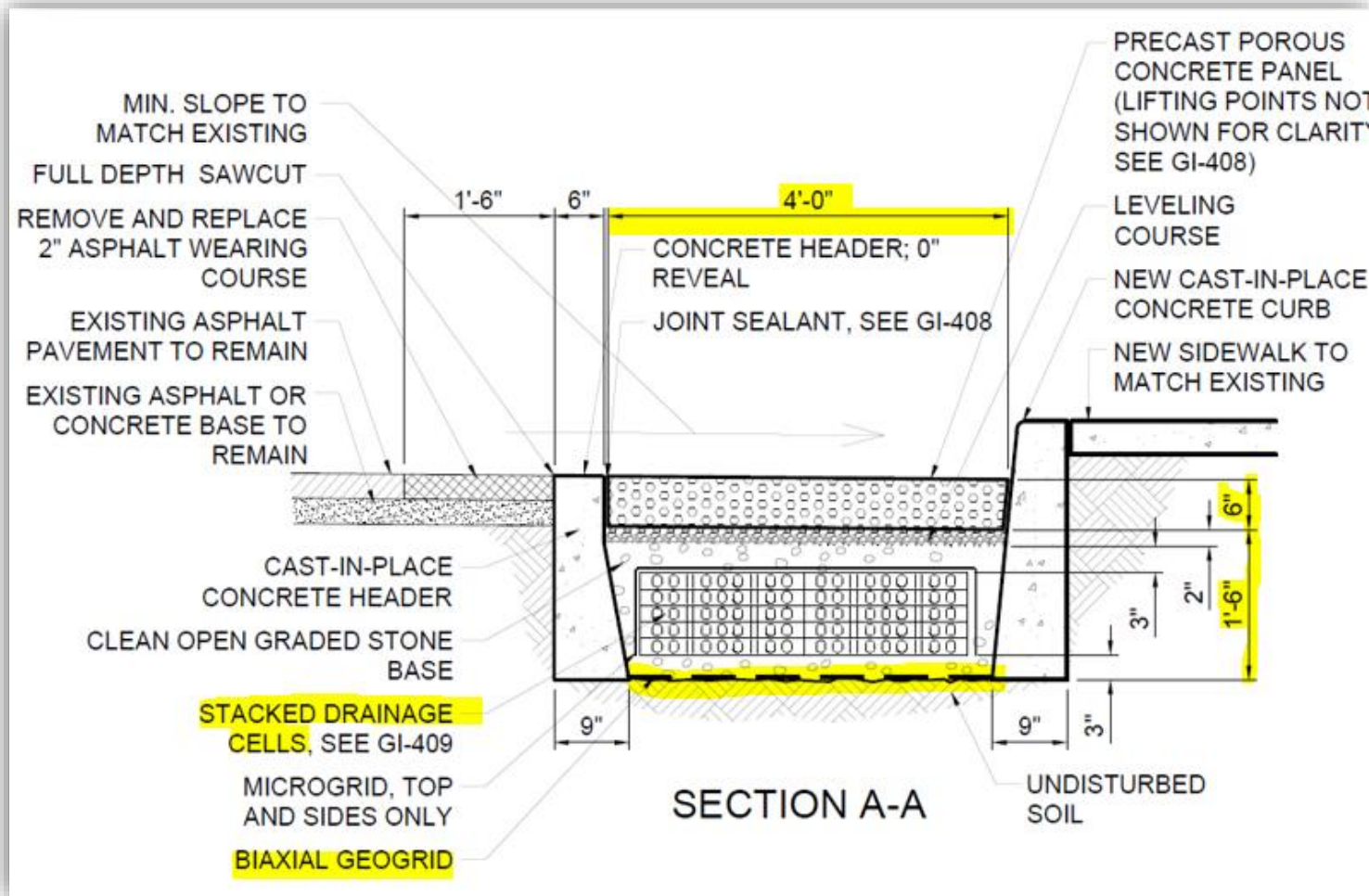


MICROGRID MESH



PRECAST POROUS
CONCRETE PANELS

PPCP DESIGN DETAIL

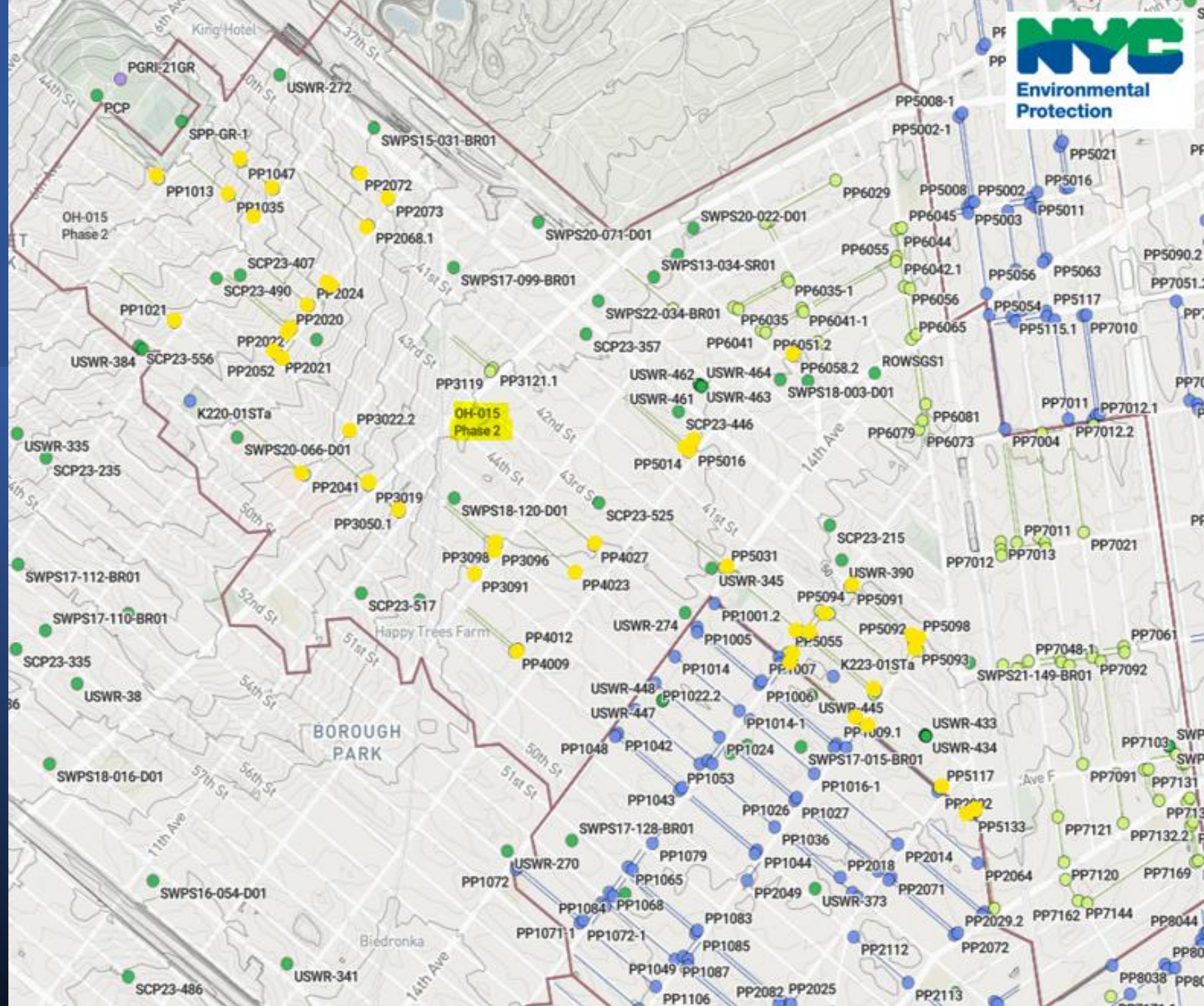


CURRENT DESIGN

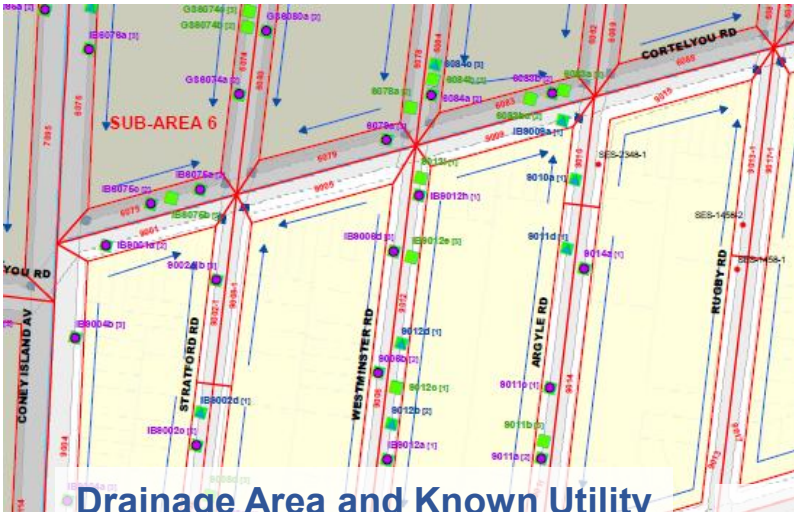
- 2'x3' and 4'x5' panel options
- 1'- 6" depth + 6" thick panel = 2'
- Full depth tapered header
- Storage cells for additional volume capture
- Biaxial grid for structural stability
- Check Dams for even distribution of stormwater throughout practice and to maximize its capacity

GKOH15-02

DEP and DDC are constructing over 7 miles of PPCP within the parking lane of roadways in the Gravesend Bay neighborhood of Brooklyn, NY



Design Process



Drainage Area and Known Utility Analysis



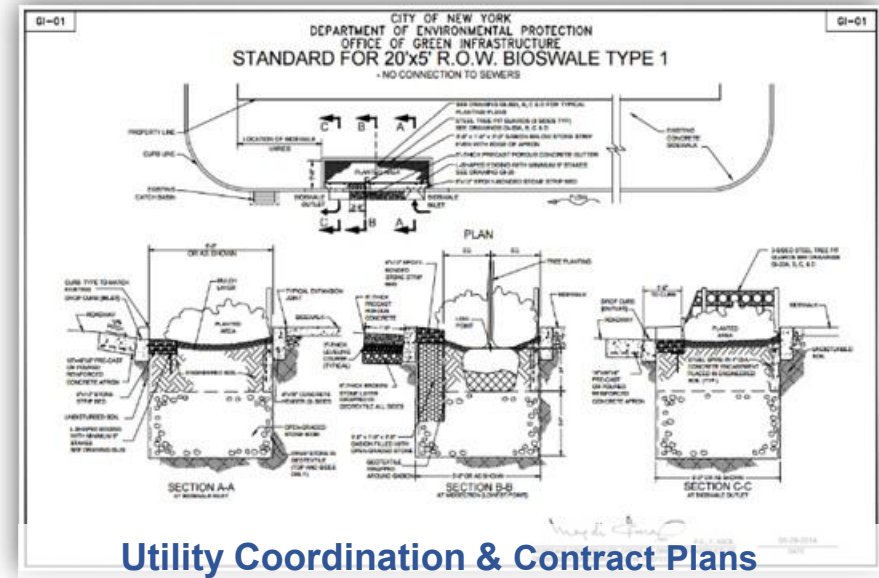
Site Walkthroughs and Mark Outs



Soil Investigations



Surveys



SITING CRITERIA



DEP Criteria:

- Average street slope no greater than 5%.
- 6' clearance from edge of sewer mains
- 3'-6" clearance from edge of water mains older than 50 years
- 2' clearance from edge of water mains 50 years or newer

DPR Criteria:

- Atypical situations must be avoided to greatest extent possible. If an atypical situation is encountered, the site must be identified for NYC Parks' review. Examples of atypical situations include missing curbs, heaved curbs, and/or the roots/root flare growing across the curb into the roadbed. See Attachment A. Atypical Curbs, for examples with photos.

DOT Criteria:

- PPCP to be sited in the parking lane
- Site PPCP at least 200' behind any bus stop
- Site PPCP at least 20' in front of any bus stop
- Site PPCP at least 15' from property line extension. For offset streets and T-intersections, the property line extension should be measured as both parallel from the offset street and perpendicular to the through street.
- Do not site on marked or unmarked crosswalk
- Avoid siting PPCP on truck routes, if possible
- Avoid siting PPCP on principal arterial roadway, if possible
- Site PPCP 25' from subway lines and railroads
- Do not site PPCP in Industrial Business Zones (IBZ)
- Do not site PPCP on block faces on the main and side streets of the following districts:
 - All manufacturing: M1, M2, M3
 - Commercial districts: C4-C8
- Do not site PPCP on existing bike lanes

GEOTECHNICAL INVESTIGATIONS

Geotechnical investigations are required prior to design to determine:

- soil characteristics
- permeability rates
- depths to the groundwater table and bedrock

Table 2 – Depth of Soil Boring and PT for Various GI Practices

Group	Type of GI Practice	Total Soil Boring Depth	Lab Sample Depths ¹	PT Depths ²
A	ROWB, ROWSGS with tree and/or typical stone reservoir depth, ROWGS, ROWIB and ROW PPCP	20 ft bgs	1-3ft bgs 3-5 ft bgs 5-7 ft bgs 7-9 ft bgs 11-13 ft bgs 18-20 ft bgs	3 ft bgs 5 ft bgs 10 ft bgs
B	ROWRG, ROWSGS with shallow stone reservoir and no tree	9 ft bgs	1-3ft bgs 3-5 ft bgs 5-7 ft bgs	3 ft bgs 6 ft bgs
D	ROW PPCP	9 ft bgs	1-3 ft bgs 3-5 ft bgs	3 ft bgs 6 ft bgs



GI-401

GI-401

PLAN

PROPERTY LINE
EXISTING CURB LINE
DISTANCE FROM EDGE OF PROPERTY LINE VARIES PER DESIGN
5'-0" MIN.
2'-0"
EXISTING CATCH BASIN
6" CAST-IN-PLACE CONCRETE HEADER FLUSH WITH EXISTING GRADE (TYP.)
OBSERVATION WELL, SEE GI-406 FOR DETAILS
5'x4', 6"-THICK PRECAST POROUS CONCRETE PANELS
EXISTING SIDEWALK
CAST-IN-PLACE CONCRETE CHECK DAM
NEW CAST-IN-PLACE CONCRETE CURB
DRAINAGE CELLS
DISTANCE FROM EDGE OF PROPERTY LINE VARIES PER DESIGN
2'-0"
4'-0"
FLOW
EXISTING ROADWAY
EXPANSION JOINT (TYP.). SEE GENERAL NOTE 7, N-01 FOR SPACING BETWEEN JOINTS
JOINT (TYP.) SEE GI-406
SEE SCHEDULE SHEET GI-409

SECTION A-A

SECTION B-B

SECTION C-C

To facilitate design, NYC DEP has developed Standard Green Infrastructure designs and specifications that are utilized for right-of-way contracts.

SPECIFICATIONS



Department of
Design and
Construction

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND
CONSTRUCTION
DIVISION OF INFRASTRUCTURE
30-30 THOMSON AVENUE
LONG ISLAND CITY, NY, 11101
TEL: 718.391.1000
WEB: www.nyc.gov/ddc

TO BE FILLED IN BY THE BIDDER:

BIDDER'S NAME:

BID SECURITY (CIRCLE ONE):

BID BOND / CERTIFIED CHECK

NUMBER OF ADDENDUMS RECEIVED
AND ATTACHED TO BID:

____ ADDENDUMS

DDC CLIENT AGENCY:

THE DEPARTMENT OF
ENVIRONMENTAL PROTECTION

PREPARED BY:

STANTEC

DATE PREPARED:

10/18/2022

VOLUME 3 OF 3

FOR FURNISHING
NECESSARY

PROJECT
SCHEDULE
SPECIFICATIONS
REVISION
SPECIFICATIONS

GREEN INFRASTRUCTURE
GRAVESEN
TRIBUTARY

TOGETHER WITH
BOROUGH
CITY OF NEW YORK

THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION

STANDARD GREEN INFRASTRUCTURE SPECIFICATIONS

August 1, 2024



Download this publication and all Specification Bulletin
updates online:

<https://www1.nyc.gov/site/ddc/resources/publications.page#infra>

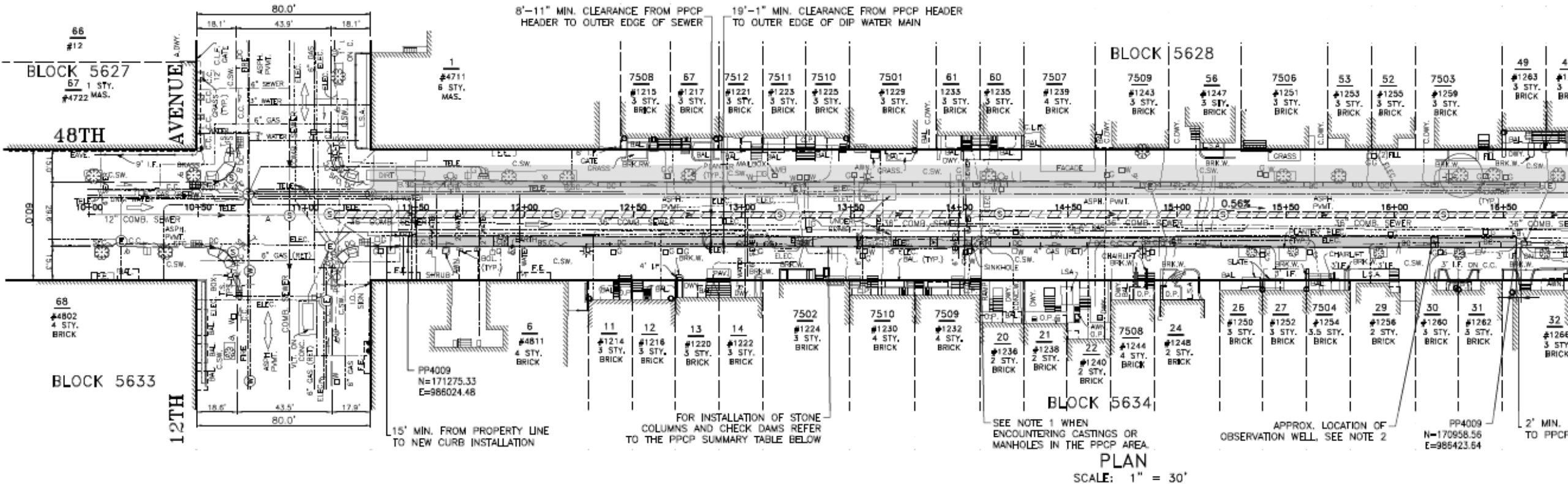


Department of
Design and
Construction



SPECIAL SPECIFICATIONS (FOR THE WORKS TO BE PAID)	23
SECTION GI-P1 – PHOTO DOCUMENTATION.....	23
SECTION GI-PPCP PRECAST POROUS CONCRETE PANEL	26
SECTION GI-PPCP-BXG — BIAXIAL GEOGRID.....	38
SECTION GI-PPCP-CC — PPCP SYSTEM CAST-IN-PLACE CONCRETE CURB	42
SECTION GI-PPCP-CCD — CAST-IN-PLACE CONCRETE CHECK DAM.....	44
SECTION GI-PPCP-CH — PPCP SYSTEM CAST-IN-PLACE CONCRETE HEADER.....	46
SECTION GI-PPCP-DC — STACKED DRAINAGE CELLS.....	48
SECTION GI-PPCP-MG — MICROGRID	53
SECTION GI-PPCP-MSFC – PPCP SYSTEM MODIFIED STEEL FACED CURB	56
SECTION GI-PPCP-PL – PPCP SYSTEM STAY-IN-PLACE PANEL.....	59
SECTION GI-PPCP-SFCC — PPCP SYSTEM STEEL FACED CAST-IN-PLACE CONCRETE CURB	61

FINAL DESIGN DRAWINGS



PRECAST POROUS CONCRETE PANEL (PPCP) SUMMARY

PP ID	UPSTREAM COORDINATE	DOWNSTREAM COORDINATE	APPROXIMATE LENGTH (LF)	PPCP WIDTH (FT)	AVERAGE ROADWAY LONGITUDINAL SLOPE, (S%)	NUMBER OF OBSERVATION WELLS	MAXIMUM DISTANCE BETWEEN CHECK DAMS (FT)	STONE COLUMN DEPTH (FT)	NUMBER OF STONE COLUMNS BETWEEN CHECK DAMS
PP4009	N=171275.33, E=986024.48	N=170958.56, E=986423.64	510	4	0.56%	2	50	N/A	N/A

BIDDING

After thorough coordination with all other city agencies and private utilities, final designs are advertised for bidding.

The city selects the low bidder and construction begins.

For GKOH15-02, the city received 14 qualified contractors bidding the job.

GKOH15-02 is an active contract; it began construction in 2023 and will be completed in 2026.

Bid date 04/27/2023
NTP 11/15/2023



CONSTRUCTION



CONSTRUCTION OF PPCP

Before starting construction, the contractor is required to get the following NYC permits:

DEP Water Use Permit and Stormwater Pollution Prevention Plan (SWPPP) approval

DOT Street Opening Permits

Parks Tree Work Permit

Safety Plan approval

Arborist and Utility Company representatives are present during construction to guide the contractor on field conditions encountered and to approve changes, if needed.



THE CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Environmental Planning & Analysis
59-17 Junction Blvd. 9th Floor, Flushing, NY 11373
Stormwaterpermits@dep.nyc.gov

Rohit T. Aggarwala
Commissioner

Issued: 10/30/2023
Expiration: 10/30/2025
Application ID: S323523
Request ID: CP-0000206

STORMWATER CONSTRUCTION PERMIT

PROJECT NAME: GREEN INFRASTRUCTURE IN THE GRAVESEND BAY CSO TRIBUTARY AREA OH-15 PHASE 2

SITE ADDRESS: Multiple streets in Borough Park, western section of Brooklyn Brooklyn New York 11218

Developer : JUDITH CORIOLAN
NYC-DDC
30-30 THOMSON AVENUE, LONG ISLAND CITY, NY 11101



Digitally signed by Douglas Gutierrez
Date: 2024.01.11 12:19:38 -05'00'

P-P PERMIT

To plant or perform work on or near trees within city right of way.
Indicated Tree Permit Work Order (P-W) must accompany this Permit at all times.

Type of tree work permitted:	☐ REMOVE TREE # TREES _____ ☒ PRUNING # TREES -50 ☐ INSTALL TREE GUARD # TREES _____	☐ ON-SITE PLANTING # TREES _____ ☒ Excavate # TREES -150 ☐ Other # TREES _____	☐ OFF-SITE PLANTING # TREES _____ ☒ PROTECT # TREES ALL ☐ Transplant # TREES _____
------------------------------	--	--	--

PERMIT NO. 41403
APPLICATION NO. PROJECT / DOB BIS NO. 1of 9
PAGES ATTACHED

DATE VALID 01/08/2024
DATE EXPIRES 06/30/2024

PERMIT APPROVED BY Ariane Trani Deputy Director PPR
BOROUGH FORESTRY MANAGER / SENIOR FORESTER

THIS PERMIT IS ISSUED TO:

NAME Hakim Ghanem / DiFazio Industries
MAILING ADDRESS 38 Kinsey Place
CITY, STATE, ZIP Staten Island, NY 10303

TELEPHONE NO. 718-720-6966
FAX NO. 718-816-5689
EMAIL hakima@difazioind.net

TO PLANT AND / OR PERFORM

TREE WORK ENTITY NAME
TREE WORK ENTITY ADDRESS

WORK LOCATION:

STREET ADDRESS
CROSS STREETS
DEPARTMENT OF BUILDINGS B1



NEW YORK CITY
Office of Permit Management
STREET OPENING PERMIT

PERMIT# B01-2023353-B21 PREVIOUS# B01-2023319-B19

ISSUED DATE: 12/19/2023
BOROUGH: BROOKLYN

PERMIT VALID FROM: 1/1/2024 TO: 2/21/2024
PERMIT TYPE: 0158 - D.D.C. CONTRACTOR MAJOR RECONSTRUCTION

FEES (NON-REFUNDABLE):
ADMINISTRATION FEE \$270.00
TOTAL : \$270.00 FEE WAIVED/CONTRACT

ROADWAY TYPE: ASPHALT
SIDEWALK TYPE: CONCRETE

PERMISSION HEREBY GRANTED TO:

NAME: DIFAZIO INDUSTRIES LLC LICENSE #: None
CONTACT NAME: GHANEM HAKIM CONTRACT #: GKOH15-02
PHONE: 7187206966 SPONSORING AGENCY: NYC DEPT OF DESIGN & CONST

ADDRESS: 38 - KINSEY PLACE STATEN ISLAND NY 10303

TO OPEN THE ROADWAY AND/OR SIDEWALK AT:

HOUSE#:
ON STREET: 44 STREET
FROM STREET: 6 AVENUE
TO STREET: 7 AVENUE

LOCATION DETAILS:

FOR PURPOSE OF: GREEN INFRASTRUCTURE IN THE GRAVESEND BAY CSO TRIBUTARY AREA OH-15, PHASE 2

RELATED AGENCY #:
FOR MAX. LENGTH OF: 300 FT
INSPECT DIST: 34
RECORDED: None
TRACKING #: 2023121900312996

COMM. BOARD: 07
SEQUENCE #: 0001

Stormwater Pollution Prevention Plan (SWPPP)

re in the Gravesend Bay CSO Tributary Area OH-15 Phase 2
Brooklyn, NY 11218, 11219, 11220
NYCDDC Project ID: GKOH15-02

Prepared For:
New York Department of Design and Construction
30-30 Thomson Avenue
Long Island City, NY 11101

DiFazio Industries LLC
38 Kinsey Place
Staten Island, NY 10303

SWPPP Prepared By:

Applemont Corporation
151 S. Mountain Road
New City, NY 10956

SWPPP Preparation Date:
September 25, 2023

ated Project Start and End Dates:
11/15/2023-12/30/2025



EXCAVATION



The total excavation depth required to install PPCP is 2'.

The area of excavation includes:

- an additional 1'- 6" wide area of street asphalt
- curb
- and one sidewalk flag.

These are re-built to match existing conditions.

For GKOH15-02 manual and pneumatic excavation have been necessary when near shallow service lines, to avoid any damage to the services and any possible hazards.

CAST-IN-PLACE CONCRETE HEADERS, CHECK DAMS AND CURBS



BIAXIAL GEOGRID



The purpose of the biaxial geogrid is to improve the structural integrity of the precast porous concrete panel subbase.

This is accomplished by providing soil base reinforcement to confine and distribute load forces.

The biaxial geogrid must be placed throughout the entire PPCP area.

After installation of biaxial geogrid, 3" of open graded stone is placed, followed by the stacked drainage cells.

CHECK DAMS

The purpose of the cast-in-place concrete check dam is to regulate the flow of water through the precast porous concrete panel system.

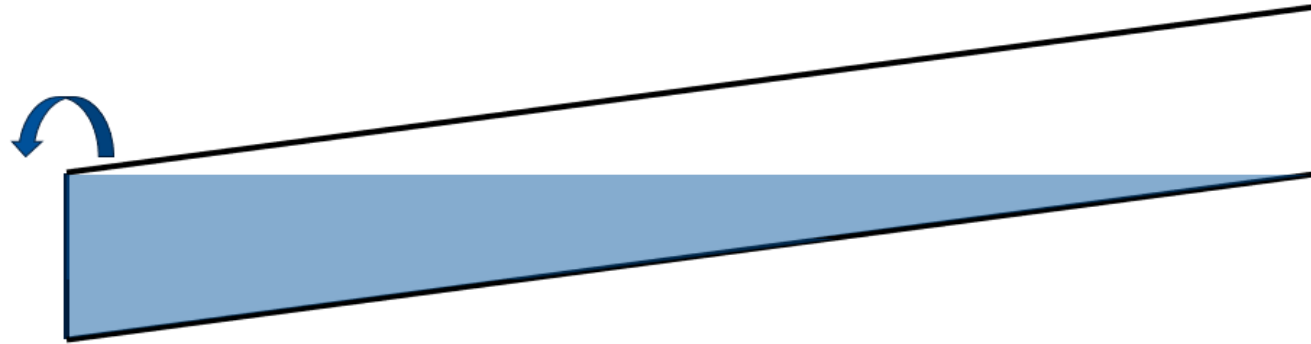
The cast-in-place concrete check dam must be constructed in accordance with specifications, Contract Drawings, and directions of the Engineer.

Each check dam must have 4 weep holes located 6" from the bottom.

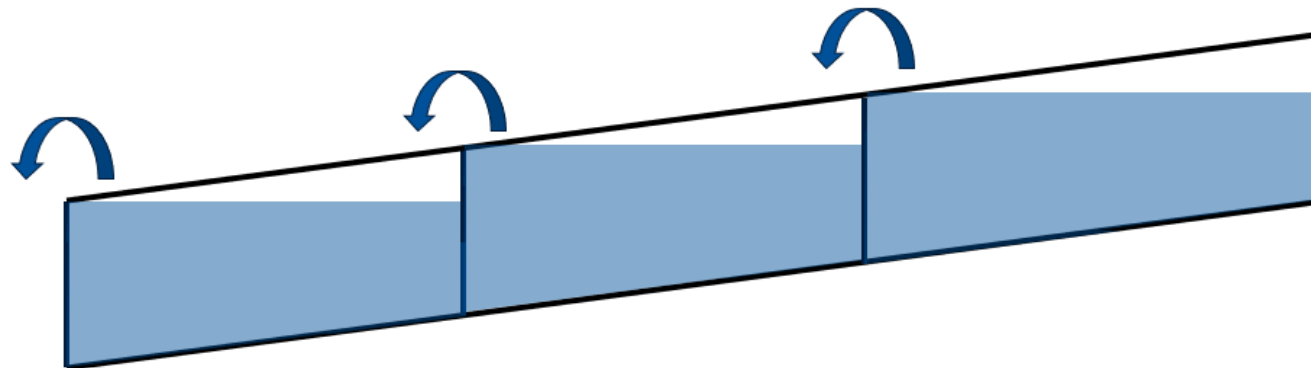


CHECK DAMS

Without Check Dams



With Check Dams



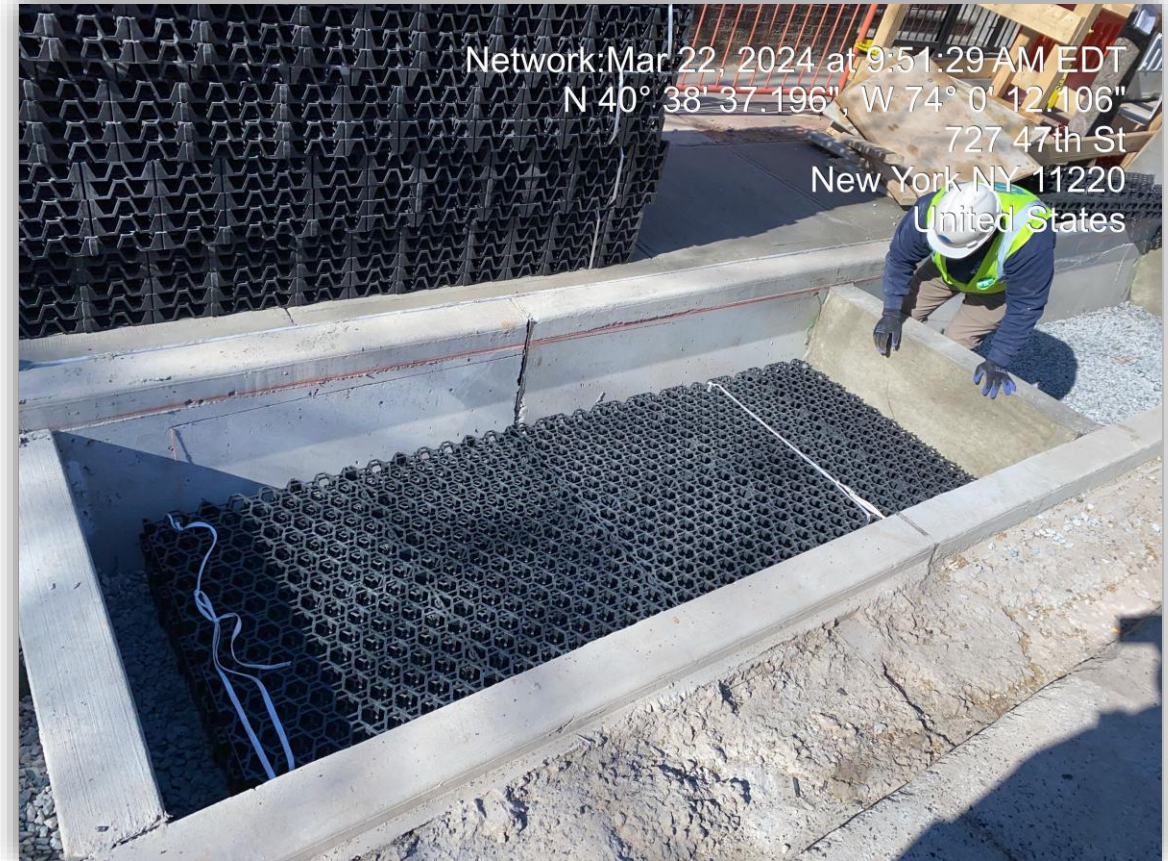
STACKED DRAINAGE CELLS

Stacked drainage cells must be installed in layers and stacked on top of each preceding layer evenly.

Clean open graded stone base is placed around the perimeter of Stacked Drainage Cells in lifts with a maximum thickness of 6".

It is not permissible to operate compaction equipment directly on Stacked Drainage Cells.

During construction, the Stacked Drainage Cells must be kept free from foreign matter.



MICROGRID



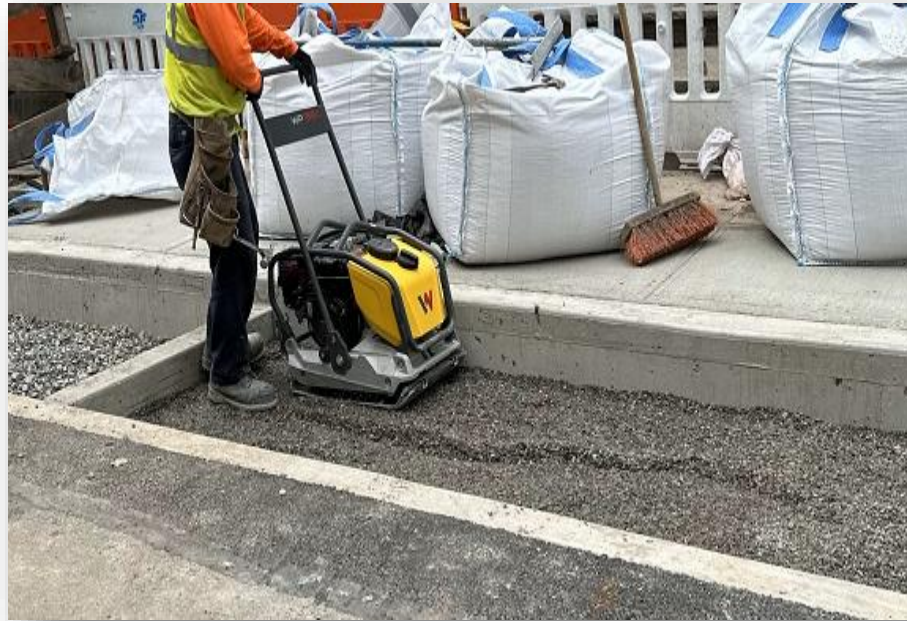
The purpose of the microgrid is to prevent the clean open graded stone base from entering the stacked drainage cells, while allowing for the free flow of water within the system.

Top and sides of the stacked drainage cells need to be wrapped with the specified microgrid.

6" of overlap microgrid is required when cells cannot be covered using a single continuous layer

The microgrid requires special care during installation to avoid any damage to the material.

CLEAN OPEN-GRADED STONE AND COMPACTION



Stone must be washed/clean before being placed.

Leveling course stone is placed and spread evenly over screed rails to achieve a thickness of two inches (2") minimum. The surface tolerance of the screed leveling course must be a maximum of a +/- one-quarter inch ($\frac{1}{4}$ ")

PRECAST POROUS CONCRETE PANELS



INSTALLATION OF PANELS

Approved lifting swivels must be used.

The swivels are inserted into permanent lifting points which are embedded in the panel surface for unloading, handling, installation, maintenance, removal, and reinstallation purposes.

All panels must be provided with lifting point protection caps to cover and protect the embedded lifting points. Spacers are also used during installation between panels, to prevent slab to slab contact, as required by the Manufacturer.





CONSTRUCTION CHALLENGES



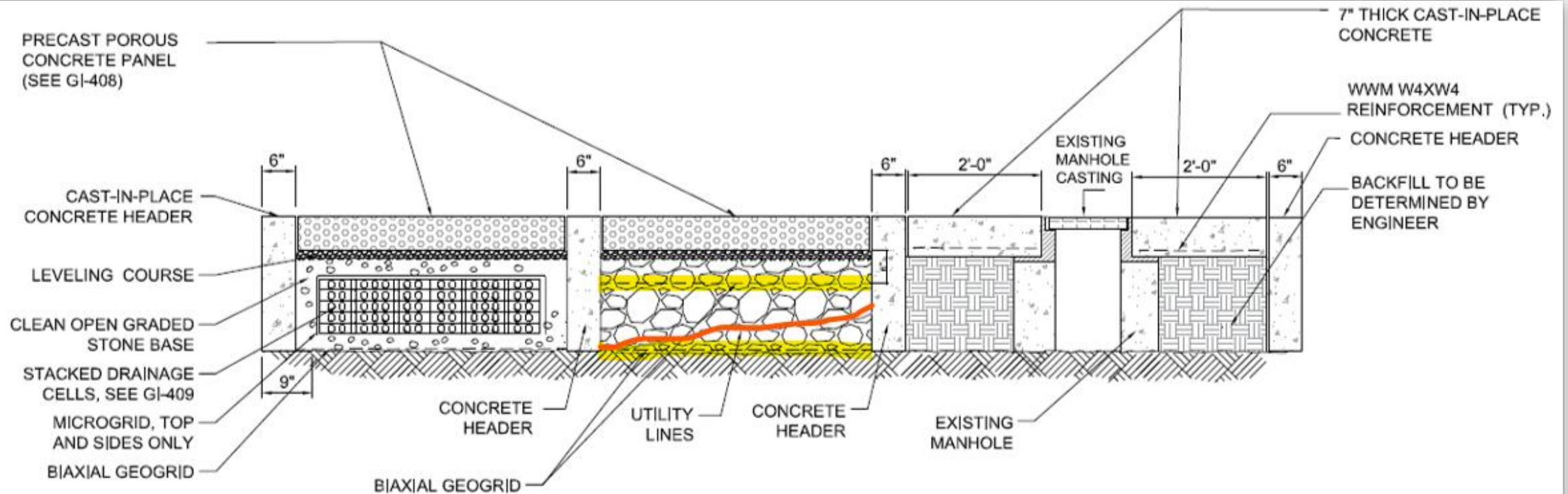
During construction in GKOH15-02, we encountered interferences with electric lines that are located less than 2' deep, which required consistent coordination with ConEdison to discuss where and how the lines could or should be moved or protected.

Some electric manholes have connected cast iron ducts that cannot be moved or lowered to achieve the 24" clearance required; in these areas the drainage cells were eliminated, and an additional Biaxial Geogrid was added at 6" below panels, following a new manhole detail created for these specific issues (Modified manhole detail).

CAST IRON DUCTS



MODIFIED MANHOLE DETAIL



MODIFIED MANHOLE DETAIL
FRONT VIEW



MOVING/LOWERING UTILITY LINES



ASPHALT FALLING INTO THE PPCP AREA



Avoid asphalt debris coming into the asset.

PPCP area must be cleaned before adding the stone.

SINKING PANELS



Because of a settling issue found in some panels, Contractor is compacting 3" of the stone base prior to placing the drainage cells, also is compacting the leveling course prior to placing the panels.

Additionally, Panels can be placed slightly higher than the corresponding level, to avoid this issue.



CUTTING OF THE PANELS



Panels can be cut to fit in the PPCP area; the correct way is to cut 1 ft from each side.

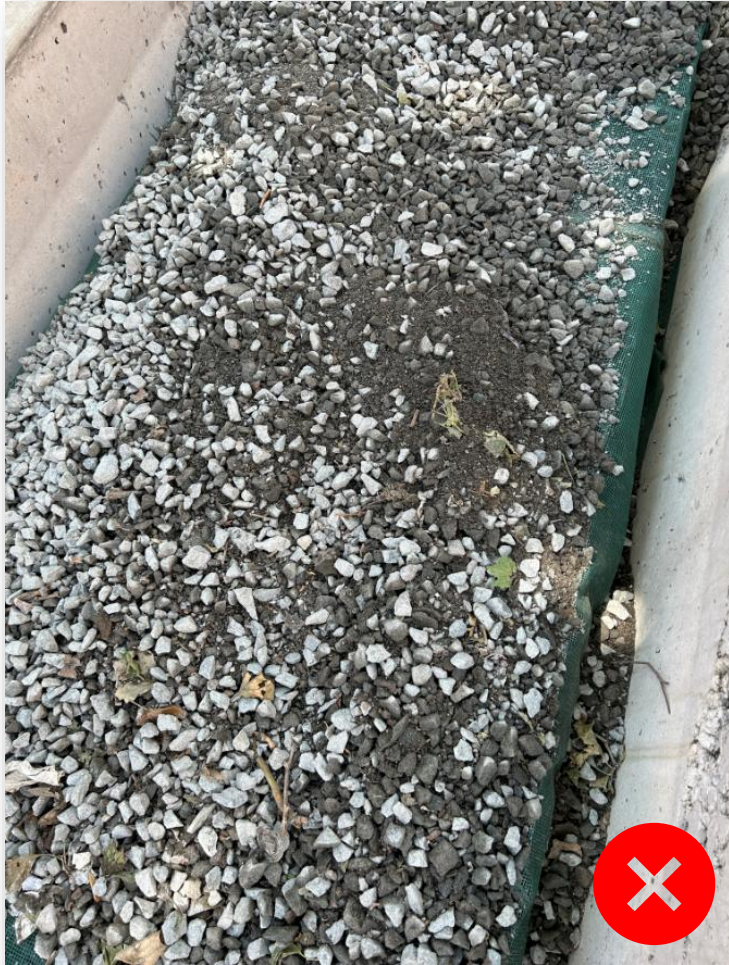
JOINTS TOO WIDE



Space between headers and panels is $\frac{3}{4}$ " maximum

Contractor must follow correct installation and verify mold dimensions so maximum width allowed is met.

DIRTY OPEN-GRADE STONE



Stones must be clean, washed and without any dirt or debris before placing them.

SLEEVE LINES ENCOUNTERED



All lines encountered must be sleeved.

For water lines, a spare sleeve is installed and a marker must be placed in the curb to know the location of the spare sleeve.



Porous Pavement Maintenance

How the maintenance works:

- Spring and Fall
- 1st pass with sweeper removes large debris and sediment
- 2nd pass with deep cleaning head
 - Uses high pressure rotary nozzles and vacuum simultaneously
- Testing per ASTM C1701 performed to ensure infiltration restored



Test Set-Up and Equipment



Designation: C1701/C1701M – 17a

Standard Test Method for Infiltration Rate of In Place Pervious Concrete¹

- Use infiltration ring and putty to create watertight seal of testing area
- Prewet test area using 8 pounds of water
- Depending on prewet time, use 8 pounds or 40 pounds of water to conduct test
- Elapsed time and measured amount of water provides variables needed for calculation



In-Field Infiltration Rate Calculation

Minimum Infiltration Rate Required

- During Construction: 150 inches/hour

$$I = \frac{KM}{(D^2 * t)}$$

where:

I = Infiltration rate, mm/h [in./h],

M = Mass of infiltrated water, kg [lb],

D = Inside diameter of infiltration ring, mm [in.],

t = time required for measured amount of water to infiltrate the concrete, s

K = 4 583 666 000 in SI units or 126 870 in [inch-pound] units.

NOTE 5—The factor K has units of (mm³·s)/(kg·h) [(in.³·s)/(lb·h)] and is needed to convert the recorded data (W , D , and t) to the infiltration rate I in mm/h [in./h].

FINAL PRODUCT





Questions?