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HOUSTON PUBLIC WORKS

May 15, 2025

Infrastructure Design Manual
Section 9.1 Stormwater Design Overview and
Section 9.2 Design Requirements

To All Interested Parties:

The 2023 edition of the City of Houston Infrastructure Design Manual (IDM) was effective November 27, 2023. The manual is being updated to reflect changes to stormwater detention requirements. These updates are a result of coordination between the Mayor's office, City staff, American Council of Engineer Companies (ACEC—Houston), and other stakeholders.

As a result of Hurricane Harvey, adjustments were made to drainage requirements with excessive caution and conservatism. Those adjustments were implemented with the view that they were temporary in nature until more validation data was available. Since those adjustments, higher intensity rainfall rates have been adopted, stormwater modeling software has greatly improved, and the background work has been completed for Houston's Stormwater Master Plan. We now have 5-years of experience under the current drainage requirements and new data warrants revising the drainage criteria. Our stormwater detention requirements need a balance that encourages development and redevelopment while protecting Houston residents and properties.

Effective immediately, changes to IDM §§ 9.1—Stormwater Design Overview and 9.2—Design Requirements including Stormwater Detention:

- Establish that the jurisdiction that directly receives the storm water determines the drainage design criteria.
- Make the detention calculation user friendly by eliminating the curve detention table for non-single-family residential developments and establishes a flat detention rate.
- Provide partial detention credit for removal of existing impervious cover when redeveloping a tract.
- Recognize "Legacy Projects" that have approved master drainage plans where the detention facilities have been constructed and will allow the remainder of the project to be built out.
- Establish criteria for allowable impervious cover that results in *de minimis* impact to the City's drainage system.
- Clarify when detention requirements are not invoked.

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As stated in the cover letter of the IDM, "… the purpose of this manual is to establish the basic criteria from which engineers can design infrastructure in a manner acceptable to the Department and is not intended to address all design conditions or specialized situations." Accordingly, in line with this letter, a supplement to the City's IDM follows and is effective immediately.

Respectfully,

Signed by:
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Attachment:

Ch 9 IDM Supplement IDMS-2025-01

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IDM Ch. 9

STORMWATER DESIGN AND WATER QUALITY REQUIREMENTS

IDMS-2025-01

The following supplement modifies IDM Ch 9. Where a portion of the IDM Ch 9 is deleted by this Supplementary, the unaltered portions of the IDM shall remain in effect.

Delete existing article 9.1.02.G and replace with the following:

SECTION 1 - STORMWATER DESIGN OVERVIEW

9.1.02 POLICY

9.1.02.G The criteria in this Chapter apply to all projects located in the City limits and to expanding utility districts and new utility districts located in the City's Extraterritorial Jurisdiction (ETJ). If the criteria conflicts with Harris County, HCFCD, Fort Bend County, Montgomery County or other jurisdictions, the criteria of the jurisdiction that is directly receiving the storm water shall govern.

Delete existing Article 9.2.01.G in Design Requirements and 9.2.01.H Stormwater Detention and replace with the following:

SECTION 2 - DESIGN REQUIREMENTS

SECTION 2A - STORMWATER DESIGN REQUIREMENTS

9.2.01 DESIGN REQUIREMENTS

9.2.01.G. Design of Outfalls: Outfalls from storm sewers or Detention facilities that discharge directly into a channel or other HCFCD facility shall be designed and constructed in accordance with HCFCD criteria. If the criteria conflicts with City of Houston, the drainage criteria of the jurisdiction that is directly receiving the storm water shall govern.

9.2.01.H. Stormwater Detention.

1. The intention of Stormwater Detention is to mitigate the effect of New Development, Redevelopment, or Site Modifications on an existing drainage system. Stormwater Detention volume requirements are based on the acreage of the

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proposed Development area that may result in an increase in Impervious Surface or stormwater runoff. Stormwater Detention volumes are calculated at the minimum rates set forth in Paragraph 9.2.01.H.3.

2. Application of Detention.

   a. The use of Detention is required for all Developments within the City and for new or expanding utility districts within the City's ETJ. Detention may not be required if the City has developed Detention capacity for a drainage watershed, and/or infrastructure improvements, to serve the drainage watershed in compliance with the requirements of this chapter. Under these conditions, the City will consider a funding contribution in lieu of on-site Detention volume constructed by the owner.

   b. Drainage and storm designs are still required to collect and convey site run off for projects that are exempt from providing Detention.

   c. Stormwater Detention requirements are invoked for New Developments and Redevelopments that contain impervious areas.

   d. Stormwater Detention requirements are not invoked for the following conditions:

      (1) Where existing impervious cover exists, Detention is not required for the addition of a feature or improvement on top of the existing impervious cover. This is only in scenarios where existing impervious cover is not redeveloped (e.g. a charging station equipment without proposed pavement is added to an existing parking lot, awnings, canopies, table umbrellas, shade structures, a covered patio added to a deck, etc.).

      (2) Addition of floors to existing buildings that do not change the footprint of the building or the storm drainage pattern of the building.

      (3) Building roof repair that does not change the storm drainage pattern of the building.

      (4) Change in use of existing roof areas that do not change the storm drainage pattern of the building.

   e. Existing Impervious Cover Detention Credit for Redevelopment: Applicant must present a valid survey that is signed and sealed by a professional land surveyor licensed in the state of Texas. To claim existing impervious area, the survey shall be signed and sealed within five years of the project submittal date and shall include supporting pictures taken within the same period to validate site conditions.

      (1) Detention storage credit for Redevelopment shall apply only to Developments that are subject to Detention criteria 3.

      (2) Detention storage credit is allowed at a rate of 0.4 acre-foot/acre for Redevelopment of existing impervious cover area.

      (3) The Detention volume required including the credit shall be calculated as follows:

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$$\text{Detention Volume Required} = \left(A_p \times r_d\right) - (A_e \times 0.4 \text{ acre-ft/acre})$$

Where:

A_p = Proposed impervious area (SF)

A_e = Existing impervious area (SF) onsite to be removed with Redevelopment

r_d = Detention rate (acre-foot/acre) required by Table 9.5

(4) When a tract has existing Detention volume provided onsite prior to Redevelopment, the Detention volume determined according to article 9.2.01.H.2.e.(3) shall not be less than the existing Detention volume provided for the tract.

(5) If existing impervious cover on a Redevelopment site will remain and not be redeveloped, no additional Detention will be required for the area not being redeveloped.

(6) Credit can be applied for all impervious cover removed with Redevelopment.

f. Master Drainage Plan (Legacy Project):

(1) A master drainage plan establishes the current and future drainage plan for a Development. A master drainage plan generally consists of drainage, grading, Detention, and other applicable site plans. These site plans contain detailed calculations for impervious area, Detention, restrictors, flow rate, etc.

(2) Developments will be recognized as legacy projects where the Detention system and storm sewers have been fully constructed for the entire Development based on a master drainage plan approved after the year 2002. Legacy projects will be allowed to build out the remainder of the project under the approved drainage plan without additional requirements.

(3) Qualification: Proposed New Development or Redevelopment of tracts do not require Detention when all of the following criteria are met:

(a) Regional Detention has been provided (regardless of current Detention rates).

(b) Regional Detention has been permitted and constructed.

(c) Associated public infrastructure has been permitted and constructed.

(4) Minimum Requirements for Legacy Projects:

(a) Applicants claiming to be a legacy project shall provide documents that show the proposed design matches the original approved design.

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(b) Impervious area for proposed tracts should match the total impervious area based on the estimated amount in the original design. If this information is not available, the amount shown on the plat should be applied.

(c) If a Development results in increased impervious area from what was designed originally, Tables 9.3, 9.4, or 9.5 and other applicable criteria in this chapter shall be utilized.

g. Plat, replat, change the use of, or subdividing any tract to reduce stormwater Detention requirements will not be permitted. Original tract size on plat or replat, change the use of, subdividing, HCAD and survey will be used to determine stormwater Detention requirements. Replating subdivisions that result in increased impervious cover and differs from the regional master plan design originally approved does not reduce Detention requirements.

h. Project site that discharges directly into the Harris County, HCFCD, Fort Bend County, Montgomery County or other jurisdictions requires their review and approval prior to City's approval.

i. If the Detention criteria conflicts with Harris County, HCFCD, Fort Bend County, Montgomery County or other jurisdictions, the Detention criteria of the jurisdiction that is directly receiving the storm water shall govern.

j. City no longer allows timing analysis to avoid Detention requirements.

k. De Minimis Impact Credit:

(1) De Minimis impact projects will be considered where the increase in impervious area will have minimal impact on the City's drainage system. De Minimis Impact projects include but are not limited to adding charging stations to existing parking lots (equipment and proposed pavement), adding a deck or pool to a home, and adding additional parking area to an existing parking lot.

(2) Drainage and storm designs are still required even when Detention requirement is not applicable due to de minimis impact.

(3) De Minimis Impact credit will only apply to existing single family residential Developments or existing commercial Developments where improvements are added.

(a) For existing single family residential Developments that fall under criteria 1 (See article 9.2.01.H.3.b) and criteria 2 (See article 9.2.01.H.3.c) where improvements are added.

i. Tracts less than 15000 sq-ft in size: De minimis credit will be allowed up to 5% of the lot size area for increased impervious cover improvements. This credit is for additions that exceed the 65% impervious cover allowance for single family residential tracts. Total impervious area for the tract shall not exceed 70% of the tract area for this credit allowance.

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ii. Tracts greater than 15000 sq-ft in size: De minimis credit will be allowed up to 5% of the lot size area for increased impervious cover improvements. This credit is for additions that exceed the greater of 9750 SF or 40% impervious cover allowance for single family residential tracts. Total impervious area for the tract shall not exceed 750 square feet for this credit allowance.

iii. Repetitive submittals to claim de minimis impact credit will be accepted as long as the summation of all historical submittals requested for the tract does not exceed the maximum credit allowance.

(b) For existing Developments that fall under criteria 3 as defined in article 9.2.01.H.3.d where improvements are added.

i. Tracts 20 acres and less in size: De minimis impact credit will be given for an improvement of an existing Development up to 1% of the total tract area. Credit will only be allowed once. Repetitive submittals to claim de minimis credits will not be accepted and tract will be subject to Detention requirements.

ii. Tracts greater than 20 acres in size: A drainage study will be required to determine the total impact. The City engineer will determine whether the impact(s) can be considered a de minimis impact.

3. Calculation of Detention Volume.

a. Detention volume requirements are based on the acreage of the Development area that results in Impervious Surface or alters stormwater runoff.

b. Detention Criteria 1: For a tract containing only one Single family residential (SFR) home, follow Table 9.3.

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Table 9.3 - Detention Criteria 1

SFR Tract Size	Percentage/Total Impervious Area[i]	Detention Required (Y/N)	Detention Volume	Notes
One SFR tract ≤ 15000 SF	Total impervious area ≤ 65% of tract	N	N/A	1-3
One SFR tract ≤ 15000 SF	Total impervious area > 65% of tract	Y	0.75 ac-ft/ac rate × impervious area in excess of 65% of tract	1-3
One SFR tract >15000 SF	Total impervious area ≤ the greater of 9750 SF or 40% of tract	N	N/A	1-3
One SFR tract >15000 SF	Total impervious area > the greater of 9750 SF or 40% of tract	Y	0.75 ac-ft/ac rate × impervious area in excess of the greater of 9750 SF or 40% of tract	1-3

[i]Total impervious area = (existing + proposed) impervious area.

Notes for Table 9.3:

(1) For a tract with multiple lots, the Detention exemption shown in Table 9.3 is not applicable. Refer to Table 9.4 for Detention volume requirements.

(2) No Sheet Flow shall be permitted to an alley, neighboring properties, R.O.W. or a ditch. Without sharing storm outfall with others, a point of connection shall be through a curb via a 4-inch schedule 40 pipe or to the roadside ditch with a 12-inch schedule 40 pipe within the ROW.

(3) See article 9.2.01.H.2 Application of Detention for criteria for acceptable Detention credits.

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c. Detention Criteria 2: For tracts with SFR Developments with direct driveway access, joint access, shared access, courtyard access drive or multi-unit residential (MUR) Development, follow Table 9.4.

Table 9.4 - Detention Criteria 2

Tract Size	Percentage/Total Impervious Area[i]	Detention required (Y/N)	Detention Volume	Notes
Tract ≤ 15000 SF	Total % impervious area within tract ≤ 65% of tract	N	N/A	1-6
Tract ≤ 15000 SF	Total % impervious area within tract > 65% of tract	Y	0.75 ac-ft/ac rate × impervious area in excess of 65% of the tract	1-6
15000 SF < Tract < 1 acre	Total impervious area within tract ≤ the greater of 9750 SF or 40% of tract	N	N/A	1-6
15000 SF < Tract < 1 acre	Total impervious area within tract > the greater of 9750 SF or 40% of tract	Y	0.75 ac-ft/ac rate × impervious area in excess of the greater of 9750 SF or 40% of tract	1-6
Tract ≥ 1 acre	All proposed impervious area	Y	Refer to requirements In Table 9.5	1-6

[i]Total impervious area = (existing + proposed) impervious area also including direct driveway access, joint access, shared access, courtyard access drive or MUR Developments.

Notes for Table 9.4:

(1) When a tract of one acre or more is divided into multiple lots; Detention is required for all proposed impervious area within the lot. No residential exemption will be granted for the individual lot within this subdivision tract.

(2) No Sheet Flow shall be permitted to an alley, neighboring properties, R.O.W. or a ditch. For projects using Table 9.4, a subsurface drainage system with one shared outfall is required. A point of connection shall be through a minimum 24-inch RCP inside diameter or equivalent cross-section described in 9.2.01.C.4.a. A separate project, plan and profile shall be submitted to OCE for storm outfall approval. For SFR Developments that are 15,000 SF or less with joint access, shared access, courtyard access drive, and MUR Developments: A 4-inch schedule 40 pipe curb cut

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or 12-inch schedule 40 pipe connection to the roadside ditch is allowed only if a curb or ditch is directly fronting the Development.

(3) The Detention exemption for impervious area should be proportionate among all the lots within the tract; this also includes any direct driveway access, shared access, joint access, and courtyard access drive. A state of Texas Licensed Professional Engineer shall breakdown impervious area calculation for each lot to take the Detention exemption.

(4) A public alley created with recorded plat prior to January 1st, 2023, is exempt from Detention requirements.

(5) Proposed permanent access easement (28' PAE), private alley, public alley, or similar accessway by any other name requires Detention; no Detention exemption will be allowed.

(6) See article 9.2.01.H.2. Application of Detention for criteria for acceptable Detention credits.

d. Detention Criteria 3: For other projects not subject to 9.2.01.H.3.b or 9.2.01.H.3.c, follow Table 9.5.

Table 9.5 - Detention Criteria 3

Tract Size	Proposed Impervious area	Detention Required (Y/N)	Detention Volume	Notes
Tract ≤ 20 acre	All proposed impervious area	Y	0.8 ac-ft/ac rate × proposed impervious area of the tract	1-3
Tract > 20 acre	All proposed impervious area	Y	Follow the most current version of the HCFCD PCPM; Minimum rate is 0.75ac-ft/ac	1-3

Notes for Table 9.5:

(1) No Sheet Flow shall be permitted to an alley, neighboring properties, R.O.W or a ditch. For projects using Table 9.5, subsurface drainage system is required. A point of connection shall be through a minimum 24-inch RCP inside diameter or equivalent cross-section described in 9.2.01.C.4.a. A separate project, plan and profile shall be submitted to OCE for storm outfall approval.

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(2) Tract size greater than 20 acres: Detention calculation will be per the most current version of the HCFCD Policy, Criteria and Procedures Manual (PCPM)

(3) See article 9.2.01.H.2. Application of Detention for criteria for other acceptable Detention credits.

e. In private parking areas, and private streets, provide Detention or portion of Detention utilizing underground system or Detention pond, whenever possible. If the existing conditions do not allow for underground Detention or Detention pond, Detention through ponding in private parking areas, private transport truck only parking areas will be considered. Engineer shall provide calculations and analysis to the Office of the City Engineer for approval of design method prior to plan submittal.

f. If approved for Detention through ponding in private parking areas, the maximum depth of ponding cannot exceed 9 inches directly over the inlet and paved parking areas must provide signage stating that the area is subject to flooding during rainfall events.

If approved for Detention through ponding in private transport truck only parking, the maximum depth of flooding cannot exceed 15 inches directly above the inlet and signage must be provided stating that the area is subject to flooding during rainfall events.

g. All Detention facilities shall be located within or adjacent to the project area except for roadway projects or projects where impacts are mitigated in a regional stormwater Detention facility. Engineer shall provide calculations indicating receiving stormwater system was designed to have conveyance capacity to non-adjacent Detention facilities.

h. Low Impact Development (LID) techniques that are considered acceptable for achieving Detention are Bioretention, Infiltration Trenches, Porous Pavement, Vegetative Swales, Green Roof, Hard Roof, and Rain Barrels. See section 9.10.01 for LID design guidelines.

Review and approval of engineering calculations demonstrating the volume of Detention achieved for each LID feature will be required.

If LID techniques are considered for achieving Detention, review and approval of a maintenance and Life Cycle plan are required per this section and section 9.2.01.H of this chapter. Review and approval of engineering calculations demonstrating the volume of Detention achieved for each LID feature will be required. This plan shall be signed and sealed by a professional registered engineer and included as part of the review and approval process.

i. For any New Development or any part of an existing Development that is still undeveloped, the most recent Detention requirements would apply.

4. Calculation of Outlet Size.

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a. Detention pond discharge pipe into an existing storm sewer line or existing City of Houston ditch:

(1) If the maximum pool elevation is at or below the design hydraulic grade at the drainage system outfall, the discharge line shall be sized for the Design Rainfall with the discharge pipe flowing full. The pond will float on the drainage system to provide maximum benefit.

(2) If the maximum pool elevation is at or above the design hydraulic grade at the drainage system outfall, provide a reducer or restrictor pipe to be constructed inside the discharge line. The discharge line shall be sized for the Design Rainfall with the discharge pipe flowing full.

b. Reducer or Restrictor Pipes shall be sized as follows:

(1) Allowable Discharge Rate - Use the lowest of the discharge rates described below:

(a) Restrictor pipes will provide a combination of low level and high level controlled release from the Detention basin. The low level restrictor pipe (primary orifice) shall be sized to provide a release rate of 0.5 CFS/acre when the Detention basin water depth is 25% of capacity. The low level restrictor pipe (primary orifice) shall be located at the bottom of the basin to provide complete drainage of the pond. The high level restrictor pipe (secondary orifice) shall be sized to provide a combined release rate (from the primary orifice and secondary orifice) of 2.0 CFS/acre at full basin depth. The high level restrictor secondary orifice shall begin releasing flow when Detention basin water depth reaches 75% of capacity. The combined rate of 2.0 CFS/acre is the approximate discharge from an undeveloped tract for the 100-year storm. The basin is considered 100% full when it reaches its maximum volume during the 100-year storm.

(b) Flow discharged to the storm drain shall not exceed the proportional amount of pipe capacity allocated to the Development. The proportional amount of pipe capacity allocated to the Development shall be determined by the ratio of the area (acres) of the Development (in storm drain watershed) divided by the total Drainage Area (acres) of the storm drain multiplied by the capacity of the storm drain.

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(2) Use the following equations to calculate the required outflow orifice:

$$Q = CA\sqrt{2g}\sqrt{h}$$
$$D = Q^{1/2} / (2.25h^{1/4})$$

Where:

Q	=	outflow discharge (cfs)
C	=	coefficient of discharge
	=	0.8 for short segment of pipe
	=	0.6 for opening in plates, standpipes, or concrete walls
A	=	orifice area (square feet)
g	=	gravitational factor (32.2)
h	=	head, water surface differential (feet)
D	=	orifice diameter (feet)

(3) For rectangular weir flow calculation:

$$Q = CLH^{3/2}$$

Where:

Q	=	weir discharge (cfs)
C	=	weir coefficient
L	=	horizontal length (ft)
H	=	head on weir (ft)

The value of the weir coefficient, C, depends on the weir shape (i.e., broad crested or sharp crested) and if the weir is submerged or not. See Brater and King's Handbook of Hydraulics or other applicable references.

(4) Restrictor shall be either of the required diameter or of the equivalent cross-sectional area. The orifice diameter D shall be a minimum of 0.5 feet.

c. In addition to a pipe outlet, the Detention basin shall be provided with a gravity spillway that will protect structures from flooding should the Detention basin be overtopped.

5. Ownership and Easements.

a. Private Facilities:

(1) Pump discharges into a roadside ditch or storm sewer system must comply with the following:

(a) Submittal of pump specifications, including capacity (GPM) of the pump, on the design drawings.

(b) Provide a backup pump in the event of a pump failure.

(c) Provide emergency power from a second source or install a quick connect for a mobile generator.

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(d) Provide a stilling basin to dissipate the energy from the pump outlet prior to gravity flow into the ditch or storm sewer.

(2) The City reserves the right to prohibit the use of pump discharges where their use may aggravate flooding in the public R.O.W.

(3) Responsibility for maintenance of the Detention facility must be confirmed by letter submitted to the City as part of the design review and shall also be stated on the drawings.

(4) All private properties being served have drainage access to the pond. Dedicated easements may be required.

(5) No public properties may drain into the Detention area.

(6) A private maintenance agreement must be provided when multiple tracts are being served.

(7) All Detention facilities must completely drain out of property within 48 hours and this shall be stated on the drawings.

(8) A grading set-back of one fifth the vertical height of the cut or 2 feet minimum is required between the top of the cut of pond or swale and the property line or boundary.

(9) A grading set-back of one half the height of the slope (H/2) or 2 feet minimum is required between the toe of the slope of pond or swale and the property line or boundary.

b. Public Facilities:

(1) Facilities will only be accepted for maintenance by the City within the City limits in cases if public drainage is being provided.

(2) The City requires a maintenance work area of 20-foot width surrounding the extent of the Detention area. Public R.O.W. or permanent access easements may be included as a portion of this 20- foot width. See Table 9.6 below from the HCFCD PCPM for minimum berm widths around a Detention basin.

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Table 9.6 - Minimum Berm Width around a Detention Basin

Detention Basins That Are	The Minimum Berm Width Is
Grass-lined with a depth > 7 feet	30 feet
Grass-lined with a depth ≤ 7 feet	20 feet[1]
Grass-lined where side slopes are 8(horizontal):1(vertical) or flatter	10 feet[2]
Grass-lined with the 20-foot maintenance access on a bench	10 feet
Lined with riprap or articulated concrete blocks or partially concrete-lined	Same as grass-lined channel
Fully concrete-lined	20 feet[1]

[1]Backslope swale system not needed.
[2]Maintenance access is on the side slope.

(3) A dedication of easement shall be provided by plat or by separate instrument.

(4) Proper dedication of public access to the Detention pond must be shown on the plat or by separate instrument. This includes permanent access easements with overlapping public utility easements.

(5) Backslope drainage systems are required where the natural ground slopes towards the drainage basin. A basin that is within 30 feet of a parking lot or roadway with berms that drain away from the basin does not require a backslope swale. Comply with criteria provided in HCFCD Criteria Manual.

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END OF SECTION

END OF SUPPLEMENT

To be included in the next publication of Standard Infrastructure Design Manual:

Signed by:
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5/16/2025

City Engineer
Oluwole A. McFoy, P.E.*
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* New York

Date

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5/16/2025

Director
Randy Macchi
Houston Public Works

Date