HOUSTON DISTRICT HYDRAULIC SECTION

Minimum Information Required on the Drainage Plans to Obtain Hydraulic Approval:

When a Drainage Permit is required from the Houston District, the most stringent criteria from either the Houston District Hydraulic Section or another permitting agency will govern. The typical acceptable peak flow calculations, allowable discharge calculations, and detention calculation methods are explained below and supplemental material is provided online on the TxDOT Houston District website.

TxDOT allowable discharge shall be obtained from the as-built plans. The as-built plans shall be requested through the following e-mail address: **Hou_planrequest@txdot.gov**. Please provide a vicinity map and explanation as to the location of the project and name of the TxDOT highway.

The following steps are recommended for a typical land development project less than 5 acres within Houston District. Please consult with the Hydraulic Section for larger and significantly more complicated projects in advance of detail design:

1. Prepare the existing condition drainage area map with directional flow arrows based on a recent signed, sealed and dated site survey and topography map, and site investigation. Delineate the proposed development project sub-areas with directional flow arrows as needed to indicate the direction of sheet flow, including any applicable off-site drainage areas. For small sites, there may be only one sub-area which is the subject site itself. Calculate the Time of concentration (Tc). Use the NRCS method equation as outlined in the most current TxDOT Hydraulic Design Manual (HDM) to calculate the "Existing" time of concentration (Tc). The Minimum time of concentration for TxDOT methodology is 10-minues; however, to use this minimum time for existing conditions the supporting calculations must be provided. Use the calculated Existing Tc to determine the existing 10-yr and 100-yr Intensity. To obtain Intensity Duration Frequency (IDF) values refer to the TxDOT updated IDF spreadsheet. For runoff coefficients (C-value) refer to TxDOT HDM. Use the Rational Method equation as outlined in the HDM to calculate the existing peak flows.
2. For developed condition, the minimum Tc = 10 minutes. Detailed Tc calculations are required if a longer Tc is used. Refer to the TxDOT updated IDF spread sheet for Intensity Duration Frequency (IDF) values. Refer to the Runoff Coefficient table for C values. A weighted "C" based on proposed pervious and impervious cover, or "C" value of 0.85 (Commercial) may be used for developed site conditions. Use the rational method to calculate the 10-yr and 100-yr developed condition peak flows.
3. Obtain the TxDOT "Allowable" discharge from the as-built plans. In lieu of as-built plan, consult with Houston District Hydraulic Section prior to plan submittal. In some cases, the engineer will use the Rational Method and may assume a 2- year design frequency for the intensity, with C=0.65 and

the area equal to the frontage of the project site multiplied by 150 ft. development strip. {e.g.: Amount of frontage in feet x 150 feet / 43,560= _____ Acre)}.

Two acceptable methods to calculate the required detention volume are presented as Method 1 and Method 2 and are available on the Houston District Hydraulic Section Link. Both methods require peak inflow, peak outflow, and the total Excess Volume of Runoff (V) for the storm event being analyzed. To calculate the depth (V) for the detention calculations in either methods, the ATLAS 14, 24-hour precipitation estimates are required. The ATLAS 14 precipitation for the 10-yr and 100-yr storm events may be obtained from visiting website: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx

For the detention pond system peak outflow, use either the existing 100-yr portion of the runoff to the right of way (ROW), or the "Allowable" discharge, whichever is greater. The area used in the detention calculations is the detention service area or the accumulated drainage area routed through the pond.

4. Design the restrictor size using the orifice equation with an appropriate differential "Head" (H). Allowable discharge (Q) used in the orifice calculation is determined per item 3 of this guideline. The following equation may be used to size the diameter (D) of the orifice: D= (Q^0.5)/[2.25 x (H^0.25)]. The engineer will use the difference in elevations between outfall pipe Soffit and the design 100-yr WSE. Consult with Hydraulic section for "H" less than 2'.

   NOTE: The design engineer may choose to perform the detention system routing analysis to size a complex outfall structure. Please consult with the Hydraulic Section prior to detail analysis or plan submittal.

5. The plan set to be submitted, shall include but not be limited to the following information:
   a. Cover sheet
   b. General construction notes
   c. Existing SITE survey map (signed & sealed)
   d. Existing condition drainage area map (as explained above)
   e. Proposed drainage area map (Internal drainage system design may use the City / MUD or the County criteria). Show the extreme event sheet flow direction with arrows.
   f. Proposed grading plan with inlets flow arrows.
   g. Proposed drainage plan including all pertaining peak flow, restrictor, and detention calculations. Cross sections and details of the detention area (underground, above ground, parking area, etc.) with elevations is required. Restrictor details at the outfall location to TxDOT is required. The restrictor pipe shall be located inside the private property and not in the TxDOT ROW.
   h. Standard construction details. Structures in TxDOT R.O.W. shall use TxDOT standard details and specifications.
   i. SWPPP plan and standard details.
   j. Off-site sheet flow path arrows and design consideration if applicable.

k. The table shown below with all applicable information:

DRAINAGE SUMMARY TABLE (APLICABLE TO PROJECTS WITH DRAINAGE TO TxDOT)

Please copy and paste the completed table onto the drainage sheet

TxDOT Tracking number (TR #)	
Highway	
TxDOT frontage	FT
TxDOT Area (the strip of site within 150-ft frontage)	AC
Total tract area based on submitted survey map	AC
Proposed disturbed area	AC
Project contributing drainage area to TxDOT	AC
Off-site contributing drainage area (if applicable)	AC
Increased impervious area	AC
10-yr required detention volume	AC-FT
10-yr proposed detention volume	AC-FT
10-yr design W.S.E.	FT
10-yr Pre-developed peak flow	CFS
10-yr Post-developed peak flow (Before detention/restrictor)	CFS
10-yr Proposed discharge to TxDOT R.O.W. (With detention/restrictor)	CFS
100-yr required detention volume	AC-FT
100-yr proposed detention volume	AC-FT
100-yr design W.S.E.	FT
100-yr Pre-developed peak flow	CFS
100-yr Post-developed peak flow (Before detention/restrictor)	CFS
100-yr Proposed discharge to TxDOT (With detention/restrictor)	CFS
TxDOT as-built or calculated allowable discharge	CFS
Primary tie-in/outfall structure size	Inch
Primary restrictor size	Inch
Primary restrictor maximum discharge	CFS
Secondary outfall device size (If applicable)	CFS
Secondary outfall discharge (If applicable)	CFS
Maximum combined pumped discharge (If applicable)	GPM (CFS)
% Pumped discharge volume (If applicable)	AC-FT
Effective gravity discharge elevation (If applicable)	FT
B.F.E. per effective FIRM (If applicable)	FT
Proposed fill below B.F.E. (If applicable)	AC-FT
Proposed cut below B.F.E. (If applicable)	AC-FT