ENGINEERING DESIGN MANUAL

SECTION 4– DRAINAGE

DG4.0 GENERAL

A. The design of all storm drainage facilities shall be in accordance with these guidelines and the current City of Austin Drainage Criteria Manual (COA DCM). Where conflicts between these guidelines and the COA DCM occur, these guidelines shall govern.

B. The Owner / Developer shall be responsible for complying with all Texas Pollutant Discharge Elimination System (TPDES) requirements, as well as securing any required permits.

C. Drainage easements or right-of-way shall be dedicated to the public for all designated FEMA floodplain and for upstream drainage areas in excess of 64 acres of the project site. Easements and right-of-way shall include all drainage, open or enclosed, to the limits of the one-hundred (100) year floodplain as calculated under fully developed conditions in accordance with the COA DCM. Additional easements shall be required, as necessary, to provide continuous access for purposes of maintenance.

D. Where possible, drainage shall be facilitated by means of paved sections or by use of swales to drain lots into a street without necessitating drainage easements being placed through a lot. The depth of a swale shall be that required for drainage with a minimum longitudinal slope toward a street or drainage easement of one-half of one (0.5%) percent

E. Peak runoff rates shall not be increased at any point downstream for the two (2), twenty-five (25), and one-hundred (100) year storms. The regulation of peak runoff rates to allowable levels as determined by the provisions of this policy shall be achieved by storage on-site or off-site or by participation in the construction of a regional stormwater management facility. If a regional storm water management facility or off-site storage either does not exist (or is not planned to be constructed) or does exist, but does not have adequate remaining capacity to ensure compliance with all provisions of this manual or related regulations, control of peak flow rates shall be achieved on-site prior to flows exiting the site or entering a watercourse

F. All drainage facilities shall be designed to minimize the potential for erosion at the outfall.

G. Drainage facilities and their access ways may not be located across lot lines but must instead be located adjacent to lot lines.

H. All earth structures shall be compacted to 95% minimum density. Earth slopes shall not exceed 3H:1V. The flowline of all earth structures shall include a pilot channel where a one (1) percent longitudinal slope is not achievable.

I. All proposed drainage facilities must be designed so that runoff will not gather in pools and become stagnant or foul.

J. Any drainage system design based upon aerial survey contours shall be verified with ground field data by a licensed surveyor.

K. All drainage systems within public rights-of-way or public easements shall be constructed in accordance with these guidelines and the City of Pflugerville Construction Standards Manual.

DG4.1 RUNOFF COMPUTATION

A. Runoff computations must be prepared by a licensed engineer authorized by education and experience to perform such calculations.

B. Runoff calculations are required with the preliminary plan to the extent needed to verify that the proposed easements are adequate to contain the runoff as required above.

C. Runoff calculations shall be included with all subdivision and site development construction plans. All existing and proposed hydrologic conditions including but not limited to drainage areas, time of concentration, impervious cover coefficients, twenty-five (25) year and (100) year flow values and rainfall intensities shall be illustrated on the construction plans. Runoff calculations shall be included for pre-development conditions as well as post-development conditions for the two (2) year, twenty-five (25) year and (100) year storms. If runoff for post-development conditions exceeds runoff for pre-development conditions for any of the referenced storms, detention shall be required to reduce peak runoff flows to at or below peak runoff flows for pre-development conditions. If detention is required, runoff calculations for post-development conditions with detention shall be included as well as calculations for proposed detention facilities.

D. For drainage areas less than 100 acres, the Rational Method may be used for runoff computations in accordance with the COA DCM. City of Pflugerville IDF Curve Parameters (Table 1) may be used for times of concentration of 2-hours or less. For areas larger than 100 acres or for times of concentration longer than 2-hours, a hydrograph methodology using the National Resources Conservation Service (NRCS) unit hydrograph shall be used. See Section

DG4.8B. When the runoff from two or more drainage areas is to be combined, the same methodology must be used for both areas and the methodology should be appropriate for both. The design engineer may utilize the NRCS method for areas under 100 acres if so desired.

Table 1. City of Pflugerville IDF Curve Parameters

Average Recurrence Interval	*a*	*b*	*c*
1-yr	43.66	10.43	0.7744
2-yr	45.97	9.37	0.7472
5-yr	51.35	8.44	0.7217
10-yr	60.02	8.44	0.7184
25-yr	67.90	7.88	0.6998
50-yr	75.82	7.79	0.6906
100-yr	78.75	7.05	0.6691
200-yr	79.51	6.36	0.6418
500-yr	80.44	5.57	0.6087

DG4.2 STORMWATER CONVEYANCE

A. Runoff computation for runoff conveyance shall be based on a fully developed drainage area or watershed.

B. All concrete structures shall have a minimum flowline slope of 0.4%. Earth structures shall have a minimum flowline slope of one (1%) percent.

C. All drainage facilities including street curbs, gutters, inlets and ponds shall be designed to intercept and transport runoff from the one-hundred (100) year frequency storm. Storm sewers and inlets on grade may be designed to intercept and convey runoff from the twenty-five (25) year storm provided that the runoff from the one-hundred (100) year storm does not exceed the gutter capacity.

D. All public storm sewer systems and channels are required to be profiled in the construction plans. All profiles must illustrate the twenty-five (25) year and one-hundred (100) year hydraulic grade lines.

E. Proposed hydraulic calculations including but not limited to the peak flow rate, depth of flow, hydraulic grade lines, critical depth and velocity values for the twenty-five (25) year and one-hundred (100) year storm events shall be provided in the construction plans.

DG4.3 STREETS

A. Where storm sewers are required, inlets shall be located to intercept runoff where the depth of runoff will exceed the top of curb. A minimum curb inlet length of 10-feet is required for inlets located with the City right of way.

B. Gutter and inlet capacity will be calculated in accordance with the COA DCM. Inlets shall have a throat height of five (5) inches and shall be designed so as to conform to City Construction Standards.

C. No lowering of the standard street crown height shall be allowed for the purpose of obtaining additional hydraulic capacity. Similarly, curb heights may not be raised to increase the hydraulic capacity of a street.

D. Each curb inlet must incorporate the required transition per city standard detail on the upstream and downstream ends. No driveway shall be located within the curb inlet transitions. Waivers to this requirement due to construction or other conflicts must be submitted and approved by the City Engineer.

DG4.4 STORMSEWER

A. Pipe for storm drains shall be Class III reinforced concrete pipe (RCP) and shall have a minimum cover of 18". For cover (less than 18"), or for excessive height of backfill, pipe for storm drains shall be Class IV or Class V RCP. All storm drain located within a pavement section shall be placed below any proposed base and lime stabilization. In no case shall a storm sewer have less than one (1) foot of cover over the top of the pipe.

B. Pipe for storm drains shall be constructed to the bank of the receiving drainway and shall have a minimum cover of eighteen (18) inches over the top of the pipe. Energy dissipation is required at all storm sewer outlets connecting to an earthen drainage way.

C. Storm sewer in right-of-way shall be located 5' from the street centerline to the center of the pipe on the opposite side of the street from the alignment of the wastewater line. An alternate location within the right of way may be submitted to and approved by the City Engineer.

D. Pipes shall be joined such that the soffits of the pipes are at the same elevation.

E. Manholes (inlets or junction boxes) shall be provided at all confluences greater than 45 degrees, at the junction of three or more lines, at a junction where the downstream pipe size changes. Due to equipment restraints, every point within the storm drain must be a maximum of 250 feet from an access point for drains 30 inches in diameter or smaller. For storm drains greater than 30 inches in diameter, manholes shall be placed so that there is a maximum

distance of 300 feet to an access point. Design of manholes shall conform to the current City Construction Standards. Storm inlets may be considered access points for a storm drain system.

F. Maximum velocity in the storm drain trunk line is 20 feet/second (ft/s). There is no maximum velocity for storm drain laterals.

G. Proposed vertical drop manholes shall not exceed 3-feet in elevation difference.

DG4.5 CHANNELS

A. Any proposed earthen channel must have a minimum of 3H:1V side slopes. Channels with a longitudinal slope of less than one (1) percent must incorporate a concrete pilot channel in the design of the channel.

B. Wherever possible, outfalls from storm sewers into natural drainage ways shall enter at the grade of the natural drainage channel. The outfall shall be designed to provide adequate protection against erosion with application of concrete or mortared rock rip rap, erosion blankets and tow walls.

C. Major structures such as box culverts and bridges shall be designed to carry a one-hundred (100) year frequency storm.

D. Maximum permitted velocity in a grass lined channel shall be 6 feet/second (ft/s). Velocities in excess of 6 ft/s must be mitigated by energy dissipation.

DG4.6 CULVERTS AND BRIDGES

A. Construction plans for box culverts, bridges and related structures may be adaptations of the Texas Department of Transportation (TxDOT) Standards.

B. For culverts and bridges conveying runoff in excess of 1,200 cfs, the predicted water surface elevation shall be one (1) foot lower than the low chord or the structure.

C. Culverts and pond outlet structures shall incorporate a minimum 2-feet tow wall below finished grade at the upstream and downstream portions of the structure.

DG4.7 FLOODPLAINS

A. For areas of flow with less than 64 acres of contributing area, no floodplain shall be defined; however, with regards to the drainage requirements contained in these guidelines, a concentrated flow discharge may necessitate

the dedication of a drainage easement. When considering the capacity of any facilities, the downstream conditions must be considered.

B. In all cases where a floodplain determination is required, the determination shall be based on the projected full development of all properties contributing to the point of consideration. It is the responsibility of the design engineer to coordinate with the City of Pflugerville in order to determine, based on the most accurate information available, what the fully-developed drainage area is.

C. Floodplain limits shall be determined by a backwater analysis. The direct- step method of calculating water surface profiles is required. The HEC-2 and HEC-RAS computer programs may be used for calculating the water surface profile.

D. For natural waterways of less than 64 acres, a backwater analysis is required when downstream structures will impede the flow of runoff, or where irregularities in the shape of the channel create significant energy losses.

E. When a project to modify a natural channel is proposed, the design engineer should check and adhere to any requirements of Section 404 of the Clean Water Act. If required, a permit should be obtained from the U.S. Army Corps of Engineers by the design engineer.

F. Any design within or modification of a designated FEMA floodplain must be in accordance with criteria stated in the City of Pflugerville Floodplain Ordinance.

DG4.8.A STORMWATER CONTROLS

A. All development is responsible for controlling its storm water runoff by ensuring that no increase in peak runoff will occur and there is no negative impact to upstream or downstream properties. All detention ponds shall control the increase in runoff for the two (2) year, twenty-five (25) year and one- hundred (100) year storms. In addition, all ponds must convey runoff from the one- hundred (100) year, assuming fully-developed upstream conditions.

B. All earthen ponds are required to have a minimum 4-feet embankment top width.

C. The design engineer or developer must provide an approved Texas Commission on Environmental Quality (TCEQ) Texas Water Rights permit for any proposed onsite wet-pond or modification of an existing agricultural stock tank intended to provide detention that is to be dedicated to the City of Pflugerville. If a Texas Water Permit is not warranted for the improvement,

the design engineer must submit official correspondence from TCEQ explaining a Texas Water Permit is not required.

DG4.8.B METHODOLOGY

Where detention ponds are utilized for stormwater management, a hydrograph routing methodology is required to analyze the adequacy of the proposed structure. The National Resources Conservation Service (NRCS) unit hydrograph shall be used. The times of concentration or lag times used in the analysis shall be calculated using the methodology of TR-55 or the Uplands Method described in NEH-4. The runoff curve numbers used shall be calculated based on the actual soil class in the analysis area and the actual proposed and probable impervious cover. The City of Pflugerville Atlas 14 Rainfall Depths (Table 2) shall be utilized for precipitation and shall be distributed using a HEC-HMS frequency storm or similar nested frequency storm. The HEC-1, HEC HMS, PondPak, or TR-20 computer programs are accepted programs for utilizing the NRCS hydrographs.

Table 2. City of Pflugerville Atlas 14 Rainfall Depths

	Rainfall Depth (in.) by Average Recurrence Interval								
Duration	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr
5 min	0.44	0.52	0.66	0.77	0.94	1.08	1.23	1.38	1.59
10 min	0.69	0.83	1.05	1.23	1.51	1.73	1.97	2.21	2.52
15 min	0.88	1.05	1.31	1.54	1.88	2.15	2.44	2.74	3.16
30 min	1.25	1.48	1.84	2.16	2.62	3.00	3.39	3.82	4.42
60 min	1.62	1.94	2.43	2.86	3.49	4.00	4.55	5.16	6.03
2 hr	1.93	2.38	3.04	3.65	4.55	5.32	6.16	7.12	8.52
3 hr	2.10	2.64	3.41	4.15	5.25	6.20	7.27	8.49	10.28
6 hr	2.41	3.09	4.05	4.98	6.40	7.63	9.04	10.66	13.07
12 hr	2.75	3.55	4.67	5.75	7.40	8.84	10.49	12.41	15.31
24 hr	3.14	4.03	5.31	6.53	8.38	9.98	11.82	13.97	17.22

DG4.8.C DESIGN CONSIDERATIONS

A. The minimum freeboard and embankment requirements shall be those outlined in the COA DCM.

B. Ponds which serve public facilities or which are to be maintained by public entities must meet the maintenance requirements outlined in the latest version of the COA DCM and in Section 4.8.D of these guidelines.

C. All detention facilities shall be designed to allow complete drainage within 24 hours.

DG4.8.D ADDITIONAL MAINTENANCE REQUIREMENTS

A. All existing and proposed drainage facilities within or utilized by a development must meet the following requirements for access and maintenance:

i. Any barrier-type fences must be in accordance with the City of Pflugerville Unified Development Code. A barrier type fence is required on structures with a slope steeper than 3H:1V side slopes.

ii. A 10-foot maintenance access path is required around the perimeter of public detention ponds and on one side of proposed channels. Any access strip entering a public pond shall not have a grade steeper than 15%, be constructed of concrete, and shall be designed to the horizontal geometric standards of a local street.

iii. A standard driveway approach with gate is required for any drainage access way connecting to a public roadway.

END OF SECTION