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TRAILS AT CROWFOOT
FINAL DRAINAGE REPORT

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CVL PROJECT NO. 8130283701

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*This report for the Final design of **Trails at Crowfoot** was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage and Enviromental Criteria Manual. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by other.*

_____
Signature

_____
Colorado P.E. License No.

_____
Seal and Date

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The following narrative and supporting calculations provide the drainage design associated with the *Trails at Crowfoot Final Drainage Report*. The report primarily addresses drainage concepts related to Pond and storm system infrastructure sizing.

I. INTRODUCTION

1. Location

The Trails at Crowfoot Development is located within the Town of Parker, Douglas County, Colorado. The boundary of the development spans several sections, all of which are located within Township 7 South, Range 66 west of the 5th principal meridian.

More specifically, the southwest quarter, and majority of the north half, of Section 4, the south half, and majority of the north half, of Section 5, the east half of Section 6, a small portion along the east edge of Section 8, the north half, and the north half of the southwest quarter, of Section 9.

On a broader scale, the site is bounded by Rueter-Hess Reservoir to the northwest, Stroh Road to the north, Lemon Gulch Way to the south and east, and Cherry Creek to the east. More easily put, a majority of the site itself is bounded by the city limits of Parker.

2. Proposed Development

The proposed site spans roughly 400 acres along the southwest edge of the Parker city limits. The topography of the site generally slopes from southwest to northeast and west to east for the Lemon Gulch Basin, with many ravines, valleys, rolling hills, and channels conveying stormwater runoff to the northeast, where it will ultimately converge with Cherry Creek. The site itself is situated on five, previously studied, regional sub catchment basins, Oak Gulch, West Stroh, North Crowfoot Valley, Scott Gulch, and Lemon Gulch. Oak Gulch and Lemon Gulch drainage basins encompass the majority of the site.

Little exists in terms of drainage or utility infrastructure in the area. Drainage wise, there are several CMP culvert crossings along North Crowfoot Valley Road to the east, Lemon Gulch Way to the west, and Stroh Road to the North. Utility wise, raw water and potable water lines run down Stroh Road along the northern boundary of the site. Water mains cross the western half of the site, of which they generally follow a connection road between Lemon Gulch Way and Stroh Road.

Existing vegetation on site is comprised of native grasses, shrubs, trees, and weedy species indigenous to the area.

The site in its current state contains Soil Groups B, C, and D with the following breakdown: 49.8% B, 38% C, and 12.2% D. [Ref 3]

3. Previous Studies

The regional sub catchment basins within the area have been analyzed by the Urban Drainage and Flood Control District (UDFCD). The foundation of the conceptual report was based upon, and compared against, the following Outfall Systems Planning (OSP) and Master Drainage studies:

1. Oak Gulch and Stroh Ranch Area Outfall Systems Planning – Final Design Report by Knight Piesold Consulting
2. Master Drainage Plan for Anthology by Harris Kocher Smith (HKS)
3. Scott Gulch and Lemon Gulch Watershed Outfall systems Planning – Final Design Report by CH2M Hill
4. Cherry Creek Corridor – Reservoir to Scott Road Major Drainageway Planning – Final Design Report by URS
5. Conceptual Drainage Report for Hess Ranch Development by Manhard Consulting

The previous OSPs provide CUHP/SWMM analyses regarding the regional sub catchment flows, recommendations for erosion mitigation, regional detention pond system sizing, and design alternatives, with cost breakdowns, for the various channels in the area.

The HKS master drainage report provides a master drainage plan, for what was at the time, the latest proposed land use plan within the area. It makes use of previous UDFCD studies to compile a master drainage plan for all of Anthology.

4. Proposed Development

The entire Trails at Crowfoot development consists of approximately 890 single family residential lots. The site also comprise of school, multi-family development, parks and mixed use. The intent of this Final drainage report is to size storm infrastructure for Trails at Crowfoot Development. The report addresses land use and the relevant percentage imperviousness for the site. Ponds and major drainage infrastructure were designed using the CUHP/SWMM methodology. The rational method presented in the Urban Drainage [Ref:1] and Town of Parker criteria [Ref: 2] was used for the interior street capacity and storm sewer design.

II. HISTORIC DRAINAGE

1. Major Basin and Sub Basin Description

The Trails at Crowfoot Development site encompasses a fraction of five much larger major basins: Oak Gulch, West Stroh, North Crowfoot Valley, Scott Gulch, and Lemon Gulch. The Trails at Crowfoot Development is mostly in the Lemon Gulch Basin and OS-2 basin with a portion in the Scott Gulch Basin. The sub basins in this section are taken from the Hess Ranch Conceptual Design [Ref. 4].

1. Scott Gulch

Scott Gulch is located along the southernmost point of the development boundary and is adjacent to the Lemon Gulch and OS-2 drainage basins. The latest development plan indicates that Scott Gulch will primarily consist of single family residential and open space **Note:** *A detention/water quality pond will be required for that portion of Basin 406 situated onsite. Coordination with the adjacent landowner will be required to discuss routing of historic release flows.*

2. Lemon Gulch

As a part of the Scott Gulch and Lemon Gulch OSP, Lemon Gulch makes up a large portion of the Trails at Crowfoot Development site. Lemon Gulch is centrally located within the development and is substantially larger than the other major basins that are contributed by the development area. The latest development plan indicates that Lemon Gulch will consist of single family residential and mixed use property, park space, open space, roadways, and a commercial development. A regional pond will capture runoff from the Trails development and release directly to Lemon Gulch.

2. Floodplain

According to the *Federal Emergency Management Agencies (FEMA) Flood Emergency Rate Map (FIRM)* [Ref. 5], proposed development area lies within "Zone X" which is described as an area determined to be outside the 500 year floodplain limits or shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile.

There are no existing major irrigation facilities such as ditches and canals on the property or within 100-feet of the property.

Floodplain development permit will be required for all work within the Lemon Gulch Floodplain. It is anticipated that any work within Lemon Gulch will have no impact on the conveyance or flood capacity of Lemon Gulch.

III. DESIGN CRITERIA

1. List of References

This Final drainage report is in accordance with the *Storm Drainage and Environmental Criteria Manual* [Ref. 2] and *Urban Storm Drainage Criteria Manual, VOL 1, 2 &3* [Ref. 1 - UDFCD].

Along with these criteria manuals, this report also adheres to the general guidelines set forth by the *Hess Ranch Conceptual Drainage Report* [Ref. 5].

2. Hydrologic Criteria

For Trails at Crowfoot, the Rational Method was used to establish the peak flow rate at design points throughout the development. Per the SDECM [Ref. 2], rainfall intensity is determined using the one-hour rainfall depth, P_1, in the USDCM [Ref. 1] Equation RA-3 as shown below:

$$I = \frac{28.5\,P_1}{(10 + T_c)^{0.786}} \qquad \text{(RA-3)}$$

The 2-year storm event was determined to have a 0.99-inch 1-hour rainfall depth, and the 100-year storm event was determined to have a 2.60-inch 1-hour rainfall depth.

3. Hydraulic Criteria

The *"Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3"* (USDCM) [Ref. 1] and the *"Storm Drainage and Environmental Criteria Manual"* (SDECM) [Ref. 2] are the design guidelines for the design and analyses provided in this report. Inlets, street, and pipes are designed in this report, which utilizes the 2-year and 100-year design storm events respectively as the basis of the minor and major storm events. Urban Drainage and Flood Control District's UD-Inlet.xls software is employed to evaluate the streets and inlets capacity. UDFCD's UD-Sewer software is utilized for the hydraulic analysis of the storm sewer network. The hydraulic grade line from the UD-Sewer analysis is included in summary printout in the appendix and show on the construction drawings.

This report assumes on-grade inlets will be sized to intercept the 2-year design peak flow, and sump inlets will be sized to intercept up-to the 100-year design peak flow. The site inlets and street capacities are evaluated with UD-Inlet.xls in this report.

Major drainage infrastructure was designed using peak flows calculated from the CUHP/SWMM methodology. The software versions available from UDFCD used for the analysis are CUHP v.2.0.0 and SWMM 5.1. The sub-basins delineated for the rational method were aggregated into larger basins based on their pipe outfall to the drainage channel and Pond. Peak flows and volume from the CUHP/SWMM analysis are used for the design of Ponds, channel, and all culvert designs. The CUHP/SWMM summary results are included in the appendix.

The 5-year and 100- year storm events were analyzed for the channel design. The channel is a composite section utilizing a stable slope of 0.2% with sculpted concrete drop structures. The channel provides greater than the required 1.5' of freeboard. The channel design parameters assume a non-cohesive soil. The HEC-RAS analysis demonstrates the channel is stable and only requires protection at the locations of drop structures. HEC-RAS 5.0.3 was used for the analysis. The HEC-RAS analysis is included in the appendix.

The 6'x6' RCB culvert and large 48" RCP conveyance element associated with the channel utilize the CUHP/SWMM 100-year peak flow for design. The UD-Culvert spreadsheets are located in the appendix.

IV. DRAINAGE PLAN

1. General Concept

Trails at Crowfoot is delineated into 87 sub-basins and 6 off-site basins. Sub-basins with designations "A", "B" and "C" drain to Pond A. Sub-basins D1, D2, D6, D7, D8, D10 & D12 drain to Pond B. Sub-basins with designation "E" (E13 & E17 excluded) and sub-basins F6 and F8 drains to Pond D. Sub-basins D3, D4, D5, D9, D11 and designation "F" (F6 & F8 excluded) drain to Pond C.

2. Specific Details

The Crowfoot Gulch is a composite channel design. A channel slope of 0.002 ft/ft with drop structures was used to achieve a stabilized design. For the 100-year flow of 268 cfs, the channel cross section operates with a mean velocity of 3.5 fps and Froude number of 0.48. The bank full portion of the channel is sized for 70% of the 2-year flow. For 70% of the 2-year flow of 39 cfs, the bankfull section operates with a mean velocity of 2.4 fps and Froude number of 0.45. A HEC-RAS analysis for the 5 and 100-year peak flows demonstrates the drop structures provide adequate erosion control for the channel. The composite channel calculation and HEC-RAS analysis is included in the appendix.

Pond A is a Town of Parker maintenance eligible regional facility with a drainage area of 151 acres. The weighted average imperviousness for the area is 40.7%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges into Lemon Gulch. The overflow for Pond A is sized for the peak inflow of 269 cfs and discharges directly into Lemon Gulch.

The table on the following page summarizes the Pond A design. Calculations for the design of Pond A are included in the appendix. The Pond A detailed design is shown in the construction drawings.

Pond A complies with CRS 37-92-602(8). The compliance worksheet is included in the appendix.

POND A	
Description	
Drainage Area (FT)	151.23
Percent Imperviousness (%)	40.74
WQCV (AC-FT)	2.29
EURV Volume (including WQVC) (AC-FT)	6.11
EURV Water Surface (FT)	5995.27
100-YR Volume (including EURV) (AC-FT)	11.18
100-yar water surface elevation (FT)	5997.18
Emergency Spillway Crest Elevation (FT)	5997.18
100-year Peak Inflow (CFS)	268.86
100-year Peak Outflow (CFS)	177.21

Pond B is a sub-regional facility with a drainage area of 23 acres. The weighted average imperviousness for the area is 47.4%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges into a pipe provided by the downstream development. Which ultimately discharges into Scott Gulch. The overflow for Pond B conveys the peak inflow of 105 cfs and discharges southeast into the future Bayou Gulch Road.

The table below summarizes the Pond B design. Calculations for the design of Pond B are included in the appendix. The Pond B detailed design is shown in the construction drawings.

Pond B complies with CRS 37-92-602(8). The compliance worksheet is included in the appendix.

POND B	
Description	
Drainage Area (FT)	23.2
Percent Imperviousness (%)	47.36
WQCV (AC-FT)	0.39
EURV Volume (including WQVC) (AC-FT)	1.10
EURV Water Surface (FT)	6092.92
100-YR Volume (including EURV) (AC-FT)	2.18
100-yar water surface elevation (FT)	6094.48
Emergency Spillway Crest Elevation (FT)	6094.48
100-year Peak Inflow (CFS)	105.30
100-year Peak Outflow (CFS)	30.56

Pond C is a maintenance eligible regional facility with a drainage area of 97.8 acres. The weighted average imperviousness for the area is 45.9%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was

utilized to determine the 100-year volume. The outlet discharges to Cherry Creek and will comply with Cherry Creek Reservoir Control Regulations.

Pond C complies with CRS 37-92-602(8). The compliance worksheet is included in the appendix.

POND C	
Description	
Drainage Area (FT)	97.79
Percent Imperviousness (%)	45.93
WQCV (AC-FT)	1.60
EURV Volume (including WQVC) (AC-FT)	4.49
EURV Water Surface (FT)	5973.31
100-YR Volume (including EURV) (AC-FT)	8.68
100-yar water surface elevation (FT)	5978.27
Emergency Spillway Crest Elevation (FT)	5978.27
100-year Peak Inflow (CFS)	314.00
100-year Peak Outflow (CFS)	106.71

Pond D is a maintenance eligible regional facility with a drainage area of 53 acres. The weighted average imperviousness for the area is 55.15%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges to Cherry Creek and will comply with Cherry Creek Reservoir Control Regulations.

Pond D complies with CRS 37-92-602(8). The compliance worksheet is included in the appendix.

POND D	
Description	
Drainage Area (FT)	52.76
Percent Imperviousness (%)	55.15
WQCV (AC-FT)	0.97
EURV Volume (including WQVC) (AC-FT)	2.954
EURV Water Surface (FT)	5991.65
100-YR Volume (including EURV) (AC-FT)	4.96
100-yar water surface elevation (FT)	5993.55
Emergency Spillway Crest Elevation (FT)	5993.55
100-year Peak Inflow (CFS)	184.40
100-year Peak Outflow (CFS)	58.28

Sub-basins are described in detail as follows:

Sub-basin A1 primarily consists of the lots along Red Cosmos Terr. Surface runoff generally drains to the curb and gutter, which continues northerly to the on-grade inlet at Design Point 1A where it is piped to DP 1. 100-year storm street flows to sump inlet DP 1B. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A2 primarily consists of the lots along Rose Mallow Street. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A3 primarily consists of the lots along Rose Mallow Street. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1C where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1C will overland to Crowfoot Gulch.

Sub-basin A4 primarily consists of the lots along Wild Lupine Street and Shasta Daisy Street. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1D where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1D will overland to Crowfoot Gulch.

Sub-basin A5 primarily consists of the lots along Shasta Daisy Street and Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A6 primarily consists of the lots along Scarlet Sage Ln. Surface runoff generally drains to the curb and gutter, which continues westerly to the on-grade inlet at Design Point 1F where it is piped to sump inlet at DP 1N. 100-year storm street flows to sump inlet at DP 1N. Emergency flow from DP 1N will overland to Crowfoot Gulch via swale.

Sub-basin A7 primarily consists of the lots along Shasta Daisy Street and Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to on-grade inlet at design point 1G where it is piped to sump inlet at design point 1E. 100-year storm street flows to sump inlet at DP 1E. Emergency flow from DP 1E will overland to Crowfoot Gulch via swale.

Sub-basin A8 primarily consists of the lots along Wild Lupine Street. Surface runoff generally drains to the curb and gutter to the sump inlet at DP 1H. Emergency flow from DP 1H will overland to Crowfoot Gulch via swale.

Sub-basin A9 is located along Bayou Gulch Rd. Surface runoff generally drains to the curb and gutter to DP 1I where it runs westerly to Design Point IJ. Emergency flow from DP 1J will overland to Crowfoot Gulch.

Sub-basin A10 is located along Bayou Gulch Rd. Surface runoff generally drains to the curb and gutter to sump inlet at DP 1J. Emergency flow from DP 1J will overland to Crowfoot Gulch.

Sub-basin A11 primarily consists of the lots along Trefoil ln. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1K. 100 Year flow from 1K will overland to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A12 primarily consists of the lots along Scarlet Sage Street and Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1L. 100 Year flow from 1L will street flow to sump inlet at Design Point 1N where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1N will overland to Crowfoot Gulch.

Sub-basin A13 primarily consists of the lots along Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1M. 100 Year flow from 1M will street flow to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A14 primarily consists of the lots along Wild Lupine Street. Surface runoff generally drains to the curb and gutter to the sump inlet at DP 1N. Emergency flow from DP 1N will overland to Crowfoot Gulch via swale.

Sub-basin A15 is located along Bayou Gulch Rd. Surface runoff generally drains to the curb and gutter to on-grade Inlet at DP 1O. Emergency flow from DP 1O will overland to Crowfoot Gulch.

Sub-basin A16 is located along N. Pinery Parkway. Surface runoff generally drains to the curb and gutter, which continues northerly to the on-grade inlet at Design Point 1P where it is piped to DP 1. 100-year storm street flows to sump inlet at DP 1B. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A17 primarily consists of the lots along Red Cosmos Terr and Rose Mallow Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1Q. 100 Year flow from 1Q will street to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A18 primarily consists of the lots along Rose Mallow Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1R. 100 Year flow from 1R will street to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A19 primarily consists of the lots along Scarlet Sage Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1S. 100 Year flow from 1S will street to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A20 primarily consists of the lots along Scarlet Sage Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1T. 100 Year flow from 1T will

street to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A21 primarily consists of the lots along Scarlet Sage lane. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1U. 100 Year flow from 1U will street flow to sump inlet at Design Point 1N where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1N will overland to Crowfoot Gulch.

Note:
1) 0% slope indicates sump inlet.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q_2	Q_{100}	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
A1	4.11	43.77	3.84	17.73	Local	2.00
A2	1.84	52.16	2.22	9.10	Local	0.00
A3	3.23	48.80	3.16	13.54	Local	0.00
A4	4.07	34.03	2.78	15.39	Local	0.00
A5	2.04	49.08	2.27	9.70	Local	0.00
A6	4.96	35.28	3.58	19.32	Local	1.50
A7	4.33	51.70	5.01	20.65	Local	4.00
A8	2.86	52.68	3.45	14.07	Local	0.00
A9	3.44	50.33	3.75	15.73	Arterial	2.00
A10	0.72	61.44	1.12	4.14	Arterial	0.00
A11	2.39	53.79	2.92	11.75	Local	2.00
A12	2.96	48.02	3.22	13.95	Local	1.50
A13	7.08	46.42	6.77	29.97	Local	5.00
A14	1.43	54.86	1.94	7.68	Local	0.00
A15	7.15	26.55	3.58	23.96	Arterial	0.00
A16	0.75	76.70	1.39	4.52	Local	2.00
A17	3.76	52.91	4.19	17.02	Local	2.00
A18	2.54	52.87	2.95	11.99	Local	2.00
A19	2.09	51.95	2.51	10.32	Local	4.00
A20	2.04	49.09	2.28	9.72	Local	2.00
A21	3.02	52.59	3.69	15.04	Local	1.50

Sub-basin B1 is located south west of the project along Rose Mallow Ave. Surface runoff generally overland flows to on-grade inlet at DP 2A. Emergency flow from 2A will street flow to sump inlet to DP to 2K.

Sub-basin B2 is located along Shasta Daisy Terrace. Surface runoff street flows to on-grade inlet at DP 2B. 100 Year flow from 2B will street flow to on-grade inlet at Design Point 2A Emergency flow from 2A will street flow to sump inlet to DP 2K.

Sub-basin B3 is located along Shasta Daisy Street and Dames Rocket Ave. Surface runoff generally drains to the curb and gutter to on-grade inlet at DP 2C. 100-year flow from 2C runs

northerly to N. Pinery Parkway to sump inlet at DP 2J. Emergency flow from DP 2J will overland to Crowfoot Gulch.

Sub-basin B4 primarily consists of the lots located along Shasta Daisy Street. Surface runoff generally drains to on grade inlet at Design Point 2D. 100 year and Emergency flow from DP 2D will street flow to sump inlet to DP 2J.

Sub-basin B5 primarily consists of the lots located along Rose Mallow Ave and Birds Foot Ave. Surface runoff generally drains to on grade inlet at Design Point 2E. Emergency flow from DP 2E will street flow to sump inlet to DP 2K.

Sub-basin B6 primarily consists of the lots located along Rose Mallow Ave and Birds Foot Ave. Surface runoff generally drains to on grade inlet at Design Point 2F. Emergency flow from DP 2F will street flow to sump inlet to DP 2K.

Sub-basin B7 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to Design Point 2G. Flow from DP 2G will street flow to local sump inlet at Design Point 2I. Emergency flow from DP 2I will street flow to sump inlet to DP 2J.

Sub-basin B8 primarily consists of the lots located along N Pinery Parkway and Birds Foot Trail. Surface runoff generally drains to local sump inlet at Design Point 2H. Emergency flow from DP 2H will street flow to sump inlet to DP 2J.

Sub-basin B9 primarily consists of the lots located along Birds Foot Trail. Surface runoff generally drains to local sump inlet at Design Point 2I. Emergency flow from DP 2I will overland to sump inlet to DP 2J.

Sub-basin B10 is located along N Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 2J. Emergency flow from 2J will overland to Crowfoot Gulch.

Sub-basin B11 is located along N Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 2K. Emergency flow from 2K will overland to Crowfoot Gulch.

Sub-basin B12 is located along Shasta Daisy Street. Surface runoff generally drains to the curb and gutter to on-grade inlet at DP 2D. 100-year flow from 2D runs northerly to N. Pinery Parkway to sump inlet at DP 2J. Emergency flow from DP 2J will overland to Crowfoot Gulch.

Sub-basin B13 primarily consists of the lots located along Shasta Daisy Street and Birds Foot Trail. Surface runoff generally drains to on grade inlet at Design Point 2M. Emergency flow from DP 2M will street flow to sump inlet to DP 2K.

Sub-basin B14 primarily consists of the lots located along hasta Daisy Street and Birds Foot Ave. Surface runoff generally drains to on grade inlet at Design Point 2N. Emergency flow from DP 2E will street flow to sump inlet to DP 2K.

Sub-basin B15 is located along Street Dames Rocket Street. Surface runoff generally drains to the curb and gutter to on-grade inlet at DP 2O. 100-year flow from 2O runs northerly to N. Pinery Parkway to sump inlet at DP 2J. Emergency flow from DP 2J will overland to Crowfoot Gulch.

Note:
1) 0% slope indicates sump inlet.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q_2	Q_{100}	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
B1	21.00	23.33	8.48	62.92	Local	7.00
B2	3.13	51.76	3.82	15.75	Local	3.00
B3	4.92	50.31	5.58	23.45	Local	3.00
B4	1.50	91.11	4.10	12.16	Local	5.00
B5	3.19	53.20	3.88	15.72	Local	6.00
B6	3.19	53.20	3.88	15.72	Local	6.00
B7	5.76	49.66	5.79	24.54	Local	6.00
B8	4.93	46.94	4.95	21.81	Res. Blvd	0.00
B9	2.81	49.17	2.94	12.55	Local	0.00
B10	0.65	76.70	1.28	4.14	Res. Blvd	0.00
B11	0.84	76.70	1.59	5.15	Res. Blvd	0.00
B12	2.53	88.00	5.86	17.68	Local	3.00
B13	3.19	53.20	3.88	15.72	Local	2.00
B14	3.19	53.20	3.88	15.72	Local	2.00
B15	2.01	53.11	2.50	10.13	Local	1.00

Sub-basin C1 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to sump inlet at Design Point 3A. Emergency flow from DP 3A overland flow to Crowfoot Gulch via swale.

Sub-basin D1 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to sump inlet at Design Point 4A. Emergency flow from DP 4A will overland Pond B.

Sub-basin D2 primarily consists of the lots located along Rose Mallow Ave and Shasta Dais Terrace. Surface runoff generally drains to Design Point 4B. Flow from DP 4B street flows to sump inlet at Design Point 4J. Emergency flow from DP 4J will overland to Pond B.

Sub-basin D3 primarily consists of the lots located along Rose Mallow Trail. Surface runoff generally drains to Design Point 4C. Flow from DP 4C street flows to sump inlet at Design Point 4E. Emergency flow from DP 4E will street flow on N Pinery Parkway to Pond B.

Sub-basin D4 primarily consists of the lots located along Rose Mallow Trail. Surface runoff generally drains to Design Point 4D. Flow from DP 4D street flows to sump inlet at Design Point 4E. Emergency flow from DP 4E will street flow on N Pinery Parkway to Pond D.

Sub-basin D5 primarily consists of the lots located along Bayou Gulch Rd and N Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 4E. Emergency flow from DP 4E will street flow on N Pinery Parkway to Pond C.

Sub-basin D6 is located along Bayou Gulch Rd. Surface runoff generally drains to sump inlet at Design Point 4F. Emergency flow from DP 4F will overland flow to Pond B.

Sub-basin D7 is located along Shasta Daisy Street. Surface runoff generally drains to on-grade inlet at Design Point 4G. Emergency flow from DP 4G will street flow to Pond B.

Sub-basin D8 primarily consists of the lots located along Shasta Daisy Street. Surface runoff generally drains to Design Point 4H. Flow from DP 4H street flows to sump inlet at Design Point 4F. Emergency flow from DP 4F will overland to Pond B.

Sub-basin D9 primarily consists of the lots located along N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 4I. Emergency flow from DP 4I street flow to Pond C via N Pinery Parkway.

Sub-basin D10 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to sump inlet at Design Point 4J. Emergency flow from DP 4J will overland to Pond B.

Sub-basin D11 is located along N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 4K. Emergency flow from DP 4K will street flow on N. Pinery Parkway.

Sub-basin D12 is located along Bayou Gulch. Surface runoff generally drains to on-grade inlet at Design Point 4L. Emergency flow from DP 4L will overland to Pond B.

Note:
1) 0% slope indicates sump inlet.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q_2	Q_{100}	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
C1	7.47	43.49	6.21	28.78	Local	0.00
D1	5.94	42.41	5.34	25.23	Local	0.00
D2	5.33	46.14	5.58	24.83	Local	5.00
D3	3.66	43.82	3.28	15.11	Local	5.00
D4	2.91	42.33	2.45	11.57	Local	3.00
D5	9.10	61.93	11.25	41.49	Arterial	0.00
D6	2.57	42.99	2.30	10.74	Arterial	6.00
D7	2.58	42.09	2.48	11.76	Local	4.00
D8	0.85	51.73	1.06	4.38	Local	5.00
D9	4.62	45.07	4.34	19.61	Arterial	0.00
D10	4.80	50.52	5.60	23.45	Local	0.00
D11	3.29	84.30	6.19	19.00	Arterial	0.00
D12	1.13	84.30	2.13	6.53	Arterial	1.50

Sub-basin E1 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5A. Emergency flow from DP 5A street flow to Pond C via Street R.

Sub-basin E2 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to sump inlet at Design Point 5B. A swale formed between the sidewalk and the backyard portions of Basin E2 directs flow to Pond C. Emergency flow from DP 5B overland flows to Pond C.

Sub-basin E3 primarily consists of lots located along Alpine Phlox Lane and Beebalm Trail. Surface runoff generally drains to on-grade inlet at Design Point 5C. 100 Year and Emergency flow from DP 5C street flows to sump inlet at Design Point 5E.

Sub-basin E4 primarily consists of lots located along Beebalm Ave and Crownvetch Circle. Surface runoff generally drains to Design Point 5D where it street flows southerly sump inlet at Design Point 5E. Emergency flow from DP 5E overland flows to Pond C.

Sub-basin E5 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to sump inlet at Design Point 5E. Emergency flow from DP 5E overland flows to Pond C.

Sub-basin E6 primarily consists of lots located along Alpine Phlox Lane. Surface runoff generally drains to on-grade inlet at Design Point 5F. 100 Year flow street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E7 primarily consists of lots located along Crownvetch Circle and Copper Mallow Trail. Surface runoff generally drains to sump inlet to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E8 primarily consists of lots located along Beebalm Ave and Scarlet Sage Ave. Surface runoff generally drains to on-grade inlet at Design Point 5H. 100 Year discharge street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E9 primarily consists of lots located along Beebalm Ave and Field Mint Terrace. Surface runoff generally drains to on-grade inlet at Design Point 5I. 100 Year discharge street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E10 primarily consists of lots located along Beebalm Ave and Beebalm way. Surface runoff generally drains to Design Point 5J. Flow from 5J street flows to sump inlet at Design Point 5B. Emergency flow from DP 5B overland flows to Pond C.

Sub-basin E11 primarily consists of open space along Scarlet Sage Ave. Surface runoff generally drains to Design Point 5K. Flow from 5K street flows to on-grade inlet at Design

Point 5P. 100 year flows from 5P will street flow to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E12 primarily consists of open space along Scarlet Sage Ave. Surface runoff generally drains to Design Point 5L. Flow from 5L street flows to on-grade inlet at Design Point 5P. 100 year flows from 5P will street flow to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E13 primarily consists of open space along N. Pinery Parkway. Surface runoff generally drains to Design Point 5M. Flow from 5M street flows to on-grade inlet at Design Point 5Q. 100 year flows from 5Q will street flow to Design Point 6H via pipe and swale through basin F8. Emergency flow from DP 6H overland flows to Pond D.

Sub-basin E14 primarily consists of lots located along Alpine Phlox Street and Scarlet Sage Ave. Surface runoff generally drains to sump inlet at Design Point 5N. Emergency flow from DP 5N will street flow on Street E.

Sub-basin E15 primarily consists of lots located along Alpine Phlox Street and Copper Mallow Trail. Surface runoff generally drains to on-grade inlet at DP 5O. Flow from 5O street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E16 is located along Scarlet Sage Ave. Surface runoff generally drains to on-grade inlet at Design Point 5P. Flow from 5P street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E17 is located along N. Pinery Parkway and Scarlet Sage Ave. Surface runoff generally drains to on-grade inlet at Design Point 5Q. Flow from 5Q street flows to sump inlet at Design Point 6H. Emergency flow from DP 6H overland flows to Pond D.

Sub-basin E18 primarily consists of open space along CrownVetch Circle. Surface runoff generally drains to on-grade inlet at Design Point 5R. 100 year flows from 5R will street flow to sump inlet at DP 5E. Emergency flow from DP 5E overland flows to Pond C.

Sub-basin E19 primarily consists of lots located along Scarlet Sage Ave and Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5S. 100 Year flow street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E20 primarily consists of lots located along Beebalm Ave and Field Mint Terrace. Surface runoff generally drains to sump inlet to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E21 primarily consists of lots located along Scarlet Sage Ave and Coppermallow Trail. Surface runoff generally drains to on-grade inlet at Design Point 5U. 100 Year discharge street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E22 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5V. Emergency flow from DP 5V street flow to Pond C via Beebalm Ave.

Sub-basin E23 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5W. Emergency flow from DP 5W street flow to Pond C via Beebalm Ave.

Sub-basin E24 primarily consists of open space along Scarlet Sage Ave. Surface runoff generally drains to Design Point 5X. Flow from 5X street flows to on-grade inlet at Design Point 5L. 100 year flows from 5X will street flow to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E25 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to on grade inlet at DP 5Y. 100-year street flows from 5Y to sump inlet at Design Point 5N. Emergency flow from DP 5N will street flow on Street E.

Sub-basin E26 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to on grade inlet at DP 5Z. 100-year street flows from 5Z to sump inlet at Design Point 5N. Emergency flow from DP 5N will street flow on Street E.

Note:
1) 0% slope indicates sump inlet.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q_2	Q_{100}	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
E1	4.04	52.65	4.95	20.19	Local	2.70
E2	5.27	52.02	4.71	19.36	Local	0.00
E3	4.77	52.31	5.64	23.07	Local	3.00
E4	3.20	52.07	3.78	14.69	Local	4.00
E5	2.76	53.77	3.09	12.43	Local	0.00
E6	2.63	53.59	3.06	12.34	Local	1.00
E7	2.77	51.99	3.21	13.17	Local	0.00
E8	2.68	53.33	3.13	12.64	Local	2.00
E9	4.84	39.52	3.92	19.46	Local	2.00
E10	0.70	56.03	0.85	3.31	Local	1.00
E11	3.99	30.00	2.48	14.96	Local	1.00
E12	3.28	30.00	2.04	12.33	Local	6.00
E13	4.45	30.00	2.76	16.67	Local	1.00
E14	5.58	56.35	7.00	27.28	Local	0.00
E15	1.89	51.97	2.08	8.55	Local	2.00
E16	1.57	73.60	2.68	8.89	Local	6.00
E17	1.55	73.60	2.64	8.76	Local	1.00
E18	2.72	52.96	3.45	14.00	Local	1.50
E19	2.91	53.40	3.58	14.46	Local	1.20
E20	2.75	53.49	3.12	12.57	Local	2.00
E21	2.05	54.72	2.56	10.18	Local	2.00
E22	4.41	53.09	5.39	21.86	Local	2.70
E23	4.11	51.69	4.81	19.86	Local	2.70
E24	4.23	30.00	2.63	15.87	Local	2.00
E25	3.62	52.58	4.65	18.92	Local	2.00
E26	2.88	59.79	4.24	15.89	Local	2.00

Sub-basin F1 is located along Alpine Phlox Street and N. Pinery Parkway. Surface runoff generally drains to on-grade inlet at Design Point 6A. 100 Year discharge from 6A street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F2 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6B. 100 Year discharge from 6B street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F3 is located along Scarlet Sage Ave and Sky Pilot Ave. Surface runoff generally drains to on-grade inlet at Design Point 6C. 100 Year discharge from 6C street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F4 primarily consists of lots located along Sky Pilot Ave. Surface runoff generally drains to Design Point 6D. 2 Year discharge from 6D street flows Design Point 6C. 100 Year

discharge from 6D street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F5 primarily consists of lots located along N. Pinery Parkway. Surface runoff generally drains to on-grade inlet at Design Point 6E. 100 Year discharge from 6E street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F6 primarily consists of lots located along Beebalm Way. Surface runoff generally drains to sump inlet at Design Point 6F. Emergency flow from DP 6F overland flows to Pond C.

Sub-basin F7 is located along N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 6G. Emergency flow from DP 6G overland flows to Pond D.

Sub-basin F8 primarily consists of lots located along Beebalm Way. Surface runoff generally drains to sump inlet at Design Point 6H. Emergency flow from DP 6H overland flows to Pond C.

Sub-basin F9 is located along street E and N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F10 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6J. 100 Year discharge from 6J street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F11 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6K. 100 Year discharge from 6K street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F12 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6L. 100 Year discharge from 6L street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F13 primarily consists of lots located along Sky Pilot Lane. Surface runoff generally drains to Design Point 6M. 2 Year discharge from 6M street flows Design Point 6C. 100 Year discharge from 6M street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Note:
1) 0% slope indicates sump inlet.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q_2	Q_{100}	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
F1	1.71	90.64	4.59	13.55	Local	2.50
F2	1.77	93.50	4.96	14.53	Local	2.50
F3	3.60	19.77	1.47	12.47	Local	1.00
F4	3.79	53.06	4.56	18.47	Local	4.00
F5	4.58	46.86	4.46	19.66	Res. Blvd	4.00
F6	4.93	38.37	3.70	18.75	Local	0.00
F7	4.51	18.05	1.68	15.41	Res. Blvd	0.00
F8	7.93	34.99	5.57	30.18	Local	0.00
F9	1.28	66.27	1.75	6.18	Res. Blvd	0.00
F10	1.93	92.20	5.30	15.64	Local	2.50
F11	1.50	91.79	4.07	12.03	Local	2.50
F12	1.22	93.17	3.39	9.95	Local	2.50
F13	3.58	52.91	4.36	17.70	Local	4.00

Sub-basin OS10 is located in the South west of the site. Surface runoff will overland flow to DP 34. Flow from DP 34 is conveyed to the Crowfoot Gulch via DP A.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q_2	Q_{100}	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
OS 10	5.37	2.00	0.30	16.40	N/A	5.00

Sub-basin OS 1 is located south west of the site. Surface runoff overland flows to Design Point A. Flow from DP A and is conveyed via pipe into the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 1 is 19 cfs.

Sub-basin OS 2 is located south west of the site. . Surface runoff overland flows to the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 2 is 9.06 cfs.

Sub-basin OS 8 is located south west of the site. . Surface runoff overland flows to the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 8 is 8.04 cfs.

Sub-basin OS 3 is located south west of the site. Surface runoff overland flows to the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 3 is 5.77 cfs.

Sub-basins OS 9 and OS11 are undeveloped and drain to their historic drainage pathways.

OS 9's surface runoff is conveyed to an existing culvert under Crowfoot Road.

OS 11 is located in the South west of the site. Surface runoff overland flows to the defunct irrigation ditch which acts as a berm. Flow that overtops this berm will fill the irrigation ditch. In the event the irrigation ditch becomes full and overtops, the runoff will flow to existing culvert downstream.

V. ENVIRONMENTAL PROTECTION CRITERIA

1. Erosion and Sediment Control Concept

Where possible native open space area will be maintained around the perimeter of the site and along/within the natural drainage ways. As planning areas develop, BMP erosion control plans shall be developed to control erosion and sediment at the construction site.

VI. CONCLUSIONS

1. Compliance with Standards

This Final Drainage Report for Trails at Crowfoot is prepared in general conformance with the *"Storm Drainage and Environmental Criteria Manual"* [Ref. 2] and the *"Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3"* [Ref. 1].

2. Summary of Concept

The report addresses drainage concepts related to pond and storm system infrastructure sizing. The site drains to three major basins. Surface flow is intercepted by on-grade and sump inlets and are piped to three separate ponds. The three ponds will capture and detain developed runoff before exiting the site, respective to the drainage basin.

VI. REFERENCES

1. **Urban Storm Drainage Criteria Manual, Volumes 1,2,3**, Urban Drainage and Flood Control District, prepared by Urban Drainage and Flood Control District, Latest Revisions.
2. **Storm Drainage and Environmental Criteria Manual,** Town of Parker, February 2014.

3. **Web Soil Survey**, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, United States Department of Agriculture – Natural Resources Conservation Service.

4. **First Creek Major Drainageway Plan Conceptual Design Report**, Moser and Associates Engineering, August 2010.

5. **Hess Ranch Conceptual Drainage Report**, Manhard Consulting, June 23, 2015.

6. **FIRM, Flood Insurance Rate Map**, Douglas County, Colorado, map number 08035CO181G, 08035CO182G, 08035CO183G, and 08035CO184G Federal Emergency Management Agency, March 16, 2016.

7. **Scott and Lemon Gulch Watersheds**, Outfall systems Planning**,** CH2MHILL, July 2006.

Checklist of Drainage Report Requirements

Project Name: _____

____ **Conceptual** ____ **Preliminary** ____ **Final**

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[ ]		COVER SHEET with title, date, applicant, preparer	X	X	X
[ ]		TABLE OF CONTENTS	X	X	X
[ ]		PE Certification and Seal		X	X
GENERAL LOCATION & DESCRIPTION					
[ ]	1	Township, range, section, quarter section	X	X	X
[ ]	2	Local streets within and adjacent to the subdivision	X	X	X
[ ]	3	Major drainageway and facilities	X	X	X
[ ]	4	Names of surrounding subdivisions	X	X	X
[ ]	5	Area in acres (verify with plat if available)	X	X	X
[ ]	6	Existing ground cover (trees, scrubs, etc.)	X	X	X
[ ]	7	Existing soil conditions	X	X	X
[ ]	8	Proposed land use	X	X	X
DRAINAGE BASINS AND SUB-BASINS					
		Major Basin Description			
[ ]	9	Reference major drainageway planning study	X	X	X
[ ]	10	Reference flood hazard delineation report	X	X	X
[ ]	11	Reference FEMA flood insurance study	X	X	X
[ ]	12	Identify presence of regulatory floodplains/floodways at site. Discuss any proposed disturbance to floodplain.	X	X	X
[ ]	13	Supporting and labeled FEMA flood insurance map included (if applicable)		X	X
[ ]	14	Will a FEMA LOMR be required?		X	X
[ ]	15	Reference previous drainage studies affecting the site	X	X	X
[ ]	16	Coordination with surrounding subdivision plans	X	X	X
[ ]	17	Basin drainage characteristics - existing and planned land uses affecting the site	X	X	X
		Site Sub-Basin Description			
[ ]	18.19	Discussion of historic drainage pattern of the property	X	X	X
[ ]	19	Discussion of off-site drainage flow patterns onto the site	X	X	X
[ ]	20	Supporting off-site delineation map included		X	X
[ ]	21	Identify presence or absence of any major drainageways on the site with total tributary area >130 acres	X	X	X
[ ]	22	Discussion of development of off-site basins and impact on site	X	X	X
DRAINAGE DESIGN CRITERIA					
		Regulations			
[ ]	23	Discussion of compliance with the Town's floodplain ordinance	X	X	X
		Discussion of compliance with Town's Stream Preservation Standards			
[ ]	24	Stream Buffers in project area	X	X	X
[ ]	25	Permitted uses planned, if any	X	X	X
[ ]	26	Discussion of Minor or Major Modification requested	X	X	X
[ ]	27	Discussion of compliance with UD&FCD maintenance eligibility review	X	X	X
		Development Criteria Reference and Constraints			
[ ]	28	Discussion of previous drainage studies for the site	X	X	X

Checklist of Drainage Report Requirements

Project Name: _____

____ **Conceptual** ____ **Preliminary** ____ **Final**

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[ ]	29	Complies with previous study/Does not comply (Discussion on changes from the previous study)	X	X	X
[ ]	30	Discussion of coordination with adjacent drainage studies	X	X	X
[ ]	31	Discussion of site drainage constraints (such as streets, utilities, existing structures, etc.)	X	X	X
		Hydrology Criteria			
[ ]	32	Identify design rainfall event, frequency, and duration	X	X	X
[ ]	33	Identify runoff calculation method used	X	X	X
[ ]	34	Identify calculation method for detention storage requirement	X	X	X
[ ]	35	Identify calculation method for detention discharge	X	X	X
[ ]	36	Discussion and justification of criteria or methods not referenced by SDECM	X	X	X
		Hydraulic Criteria			
[ ]	37	Identify street capacity references		X	X
[ ]	38	Identify other capacity references		X	X
[ ]	39	Identify detention pond outlet design method		X	X
[ ]	40	Identify check/ drop structure criteria used		X	X
[ ]	41	Discussion of drainage facility design criteria not referenced by SDECM		X	X
		Variance from Criteria			
[ ]	42	Identify provision by section number for which a variance is requested	X	X	X
[ ]	43	Provide justification and discussion for each variance requested	X	X	X
DRAINAGE FACILITY DESIGN					
		General Concept			
[ ]	44	Discussion of concept and proposed drainage patterns of the site	X	X	X
[ ]	45	Discussion of off-site runoff impacting the site	X	X	X
[ ]	46	Discussion of runoff impacting downstream properties		X	X
[ ]	47	Discussion of tables, charts, figures, drawing, etc. presented in the appendix	X	X	X
[ ]	48	Discussion of proposed drainage patterns	X	X	X
		Specific Details			
[ ]	49	Discussion of drainage problems of the site	X	X	X
[ ]	50	Underdrains allowed in ROW only with Public Works Director approval		X	X
[ ]	51	Discussion of specific solutions at design points	X	X	X
		Discussion of detention storage required for full-spectrum detention			
[ ]	52	Supporting labeled calculations for adequate storage volume requirement	X	X	X
[ ]	53	Supporting labeled calculations that detention pond will accommodate volume required	X	X	X
[ ]	54	Supporting labeled calculations for water surface elevations		X	X
[ ]	55	Supporting labeled calculations for minimum of one foot freeboard requirement		X	X
		Discussion of outlet requirements			
[ ]	56	Water quality requirements are met - per SDECM Section 8.3		X	X
[ ]	57	Supporting labeled calculations for water quality orifice plate geometry and perforation sizing.			X
[ ]	58	Supporting labeled calculations for detention pond outlet staged release structure		X	X
[ ]	59	Supporting labeled calculations for detention pond outlet pipe capacity		X	X
[ ]	60	Supporting labeled calculations for sewer pipe outfall, design of riprap (match with grades, and downstream flowpath)			X
[ ]	61	Supporting labeled calculations for emergency overflow conditions		X	X
		Discussion of storm sewer configuration			

Checklist of Drainage Report Requirements

Project Name: _____

____ **Conceptual** ____ **Preliminary** ____ **Final**

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[ ]	62	Supporting labeled calculations for storm sewer capacity, type of flow, calculated pipe losses, and hydraulic grade line calculations		X	X
[ ]	63	Supporting labeled calculations for storm sewer inlet type and sizing calculations		X	X
[ ]	64	Supporting labeled calculations for storm sewer outlet conditions			X
[ ]	65	Supporting labeled calculations for conduit outlet protection design			X
		Discussion on channel design and soil erodibility within channel			
[ ]	66	Supporting labeled calculations for type of flow and velocity of flow		X	X
[ ]	67	Discussion on proposed channel lining/bank protection		X	X
[ ]	68	Supporting labeled calculations for freeboard requirement		X	X
[ ]	69	Supporting labeled calculations for water surface elevations		X	X
[ ]	70	Supporting labeled calculations for backwater analysis		X	X
[ ]	71	Supporting labeled calculations for sizing calculation for check structures			X
[ ]	72	Supporting labeled calculations for sizing calculation for drop structures			X
[ ]	73	Discussion of easements and tracts dedicated for drainage & maintenance purposes	X	X	X
[ ]	74	Discussion of maintenance and access aspects of the design		X	X
		Stormwater Utility Eligible Facilities			
[ ]	75	Identify stormwater facilities proposed for acceptance into the Stormwater Utility		X	X
ENVIRONMENTAL PROTECTION CRITERIA					
		General			
[ ]	76	Identify wetland areas, jurisdictional status, and other "Waters of the U.S."	X	X	X
[ ]	77	Identify potential impacts to T & E species and presence of Habitat Protection Areas and Stream Restoration Areas	X	X	X
[ ]	78	Discuss compliance with State and Federal environmental permitting regulations	X	X	X
		Construction BMP Plan			
[ ]	79	Discussion of Construction BMP Requirements (per SDECM Section 8.2)	X	X	X
		Permanent BMP Plan			
[ ]	80	Discussion of Permanent BMP requirements (per SDECM Section 8.3)	X	X	X
[ ]	81	Supporting labeled calculations for WQCV requirements		X	X
[ ]	82	Supporting labeled calculations for storage volume requirements		X	X
[ ]	83	Supporting labeled calculations for outlet structure design		X	X
[ ]	84	Discussion of landscaping considerations for PBMP		X	X
[ ]	85	Discussion of maintenance and access aspects of the design		X	X
CONCLUSIONS					
		Compliance with Standards			
[ ]	86	Town Ordinances	X	X	X
[ ]	87	Town SDECM	X	X	X
[ ]	88	Major drainageway plans (UDFCD Outfall Systems Plan)	X	X	X
[ ]	89	Town floodplain regulations	X	X	X
[ ]	90	Stream Preservation Standards	X	X	X
		Drainage Concept			
[ ]	91	Effectiveness of design to control storm runoff	X	X	X
[ ]	92	Discussion of maintenance responsibility for public and private drainage facilities		X	X
[ ]	93	Discuss impact of proposed development on the Major Drainageway Planning Studies recommendations		X	X

Checklist of Drainage Report Requirements

Project Name: _____

____ **Conceptual** ____ **Preliminary** ____ **Final**

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
		Sediment and Erosion Control Concept			
[ ]	94	Effectiveness of erosion control plan		X	X
[ ]	95	Suitability of site soils for development		X	X
[ ]	96	Certification statement and PE seal and signature		X	X
REFERENCES					
[ ]	97	List all drainage reports and technical information used	X	X	X
[ ]	98	List all computer software used in analysis	X	X	X
APPENDICES					
		Hydrologic Computations (Historic)			
[ ]	99	Historic basin delineation, onsite and offsite	X	X	X
[ ]	100	Runoff coefficient determination, including composite "C" calculation	X	X	X
[ ]	101	Rational Method analysis for each basin, initial and major storm	X	X	X
[ ]	102	Rational method analysis for each design point (i.e., routed cumulative flow), initial and major storm	X	X	X
[ ]	103	Schematic figure illustrating routing for basins and design points	X	X	X
[ ]	104	CUHP/UDSWM input and output data	X	X	X
[ ]	105	Schematic figure illustrating routing of CUHP basins and UDSWM elements	X	X	X
		Hydrologic Computations (Developed)			
[ ]	106	Developed basin delineation, onsite and offsite	X	X	X
[ ]	107	Runoff coefficient determination, including composite "C" calculation	X	X	X
[ ]	108	Rational Method analysis for each basin, initial and major storm	X	X	X
[ ]	109	Rational method analysis for each design point (i.e., routed cumulative flow), initial and major storm	X	X	X
[ ]	110	Schematic figure illustrating routing for basins and design points	X	X	X
[ ]	111	CUHP/UDSWM input and output data	X	X	X
[ ]	112	Schematic figure illustrating routing of CUHP basins and UDSWM elements	X	X	X
		Hydraulic Computations (Extended Detention Basin)			
[ ]	113	Volume of storage required (WQCV, EURV and 100-year event)	X	X	X
[ ]	114	Volume of designed detention pond (maximum volume)	X	X	X
[ ]	115	Does maximum water surface elevation allow for one foot minimum freeboard requirement (may require profile of pond)		X	X
[ ]	116	Inflow(s) energy dissipater (see hydraulic computations for storm sewer)		X	X
[ ]	117	Forebay - volume and drain pipe/weir		X	X
		Hydraulic Computation (EDB Outlet Structure)			
[ ]	118	Calculation of Historic release rates based on UDFCD Volume 2, Storage Chapter	X	X	X
[ ]	119	Calculation of allowable 100-year release rate based on UDFCD Volume 2, Storage Chapter	X	X	X
[ ]	120	Water quality orifice plate geometry		X	X
[ ]	121	Water quality trash rack/screen geometry and open area			X
[ ]	122	Orifice or weir sizing for 100-year release rate			X
[ ]	123	Orifice or weir placement for 100-year water surface elevation		X	X
[ ]	124	Trash Rack (overflow) sizing calculation			X
[ ]	125	Calculations for emergency overflow		X	X
[ ]	126	Capacity, velocity, and Froude number calculations for outlet structure storm sewer pipe		X	X
[ ]	127	Calculations for outlet protection for outlet structure pipe			X

Checklist of Drainage Report Requirements

Project Name: _____

____ **Conceptual** ____ **Preliminary** ____ **Final**

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[ ]	128	Invert locations, slope, diameter (18-inch minimum), material (RCP only) and pipe classification for outlet structure storm sewer pipe			X
[ ]	129	Does the invert out of the outlet structure storm sewer pipe match grade and have a logical downstream flowpath		X	X
[ ]	130	Profile of outlet structure and outlet storm sewer pipe (may be included with profile of pond)			X
[ ]	131	Design procedure form included			X
		Hydraulic Computation (Storm Sewer Configuration)			
[ ]	132	Minimum pipe size 18-inch (RCP only) for lateral and main line		X	X
[ ]	133	Capacity calculations		X	X
[ ]	134	Pipe loss calculations		X	X
[ ]	135	Initial and Major Storm hydraulic grade line calculations (minor storm cannot surcharge storm sewer system)		X	X
[ ]	136	Inlet (or entrance condition) sizing and capacity calculations			X
[ ]	137	Velocity and Froude number calculation at pipe outlet		X	X
[ ]	138	Outlet protection design calculations			X
[ ]	139	Discharge of a storm sewer onto streets is prohibited		X	X
		Hydraulic Computation (Culverts)			
[ ]	140	Calculations for flow through structure		X	X
[ ]	141	Calculations for controlling condition (entrance or outlet)		X	X
[ ]	142	Capacity calculations (minimum 24-inch CMP or RCP within ROW or 18-inch minimum RCP or CMP for swales at driveways, trails and sidewalks)		X	X
[ ]	143	Velocity calculations (minimum of 3 fps during initial storm is recommended)		X	X
[ ]	144	Water surface or overtopping elevations calculated and compared to allowable overtopping (see SDECM Table 2.7)		X	X
		Hydraulic Computation (Bridges)			
[ ]	145	See UDFCD Volume 2, Hydraulic Structures Chapter		X	X
		Hydraulic Computation (Open Channels)			
[ ]	146	Calculation of developed flow through the channel		X	X
[ ]	147	Investigation of erodibility of soils in channel is required		X	X
[ ]	148	Calculations to document 100-year discharge flow parameters		X	X
[ ]	149	Backwater calculations		X	X
[ ]	150	Check structure design calculations		X	X
[ ]	151	Drop structure design calculations		X	X
[ ]	152	Riprap design calculations		X	X
[ ]	153	Calculations for all other proposed channel lining			
		Hydraulic Computation (Streets)			
[ ]	154	Street classification			X
[ ]	155	Street capacity major and initial storm (see SDECM Section 2.5)			X
		Permanent BMP Calculations			
[ ]	156	Calculations for WQCV requirements		X	X
[ ]	157	Calculations for storage volume requirements		X	X
[ ]	158	Supporting labeled calculations for outlet structure design		X	X
[ ]	159	All other design calculations necessary for design of Permanent BMP		X	X
HISTORIC CONDITIONS DRAINAGE DRAWING					
[ ]	160	24"x 36" drawing - scale of 1"=100' to 1"=400'	X	X	X

Checklist of Drainage Report Requirements

Project Name: _____

____ **Conceptual** ____ **Preliminary** ____ **Final**

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[ ]	161	General location or vicinity map	X	X	X
[ ]	162	North arrow and scale	X	X	X
[ ]	163	Legend to define map symbols	X	X	X
[ ]	164	Title block in lower right hand corner	X	X	X
[ ]	165	Existing contours at appropriate contour interval	X	X	X
[ ]	166	Delineation of onsite basins and offsite basins impacting site	X	X	X
[ ]	167	Drainage flow paths and design points for accumulated flow	X	X	X
[ ]	168	Table showing routing and accumulation of flow at design points for initial and major event	X	X	X
[ ]	169	Existing drainage facilities	X	X	X
[ ]	170	Existing 100-year floodplains	X	X	X
[ ]	171	Stream Buffer areas	X	X	X
DRAINAGE DRAWING CONTENTS					
[ ]	172	24"x 36" drawing - scale of 1"=20' to 1"=200'	X	X	X
[ ]	173	General location or vicinity map	X	X	X
[ ]	174	North arrow and scale	X	X	X
[ ]	175	Legend to define map symbols	X	X	X
[ ]	176	Title block in lower right hand corner	X	X	X
[ ]	177	Existing contours at minimum 2 foot contour interval (dashed-shaded) extending minimum of 100' beyond property lines	X	X	X
[ ]	178	Proposed contours at minimum 2 foot contour interval (solid) extending minimum of 100' beyond property lines	X	X	X
[ ]	179	All property and lots lines shown	X	X	X
[ ]	180	All easements and tracts shown and labeled with purpose	X	X	X
[ ]	181	Streets shown (with ROW width, flowline, sidewalk, etc. for PDR and FDR)	X	X	X
[ ]	182	Existing drainage facilities shown with structures, ditches, drainageways, gutter flow, culverts, etc.	X	X	X
[ ]	183	Existing drainage facilities labeled with material, size, shape, slope, and location	X	X	X
[ ]	184	Stream Buffer areas	X	X	X
[ ]	185	Overall drainage area boundary shown (including any off-site basins)	X	X	X
[ ]	186	Drainage area sub-boundary shown	X	X	X
[ ]	187	Basin and sub-basin descriptor (which includes identification, area, runoff coefficients or flows)	X	X	X
[ ]	188	Directional flow arrows	X	X	X
[ ]	189	Table showing routing and accumulation of flow at design points for major & initial event	X	X	X
[ ]	190	Proposed type of street flow (detail if necessary)		X	X
[ ]	191	Drainage ditches, swales, gutter, and cross pans shown (Generally shown for CDR)	X	X	X
[ ]	192	Proposed storm sewer shown including size and type of pipe, inlets, manholes, outfall, riprap, etc. shown (Generally shown for CDR)	X	X	X
[ ]	193	Existing storm sewer shown including size and type of pipe, inlets, manholes, outfall, riprap, etc. labeled (if any)		X	X
[ ]	194	Proposed open drainage channels shown including drop and check structures, riprap, channel lining, side slope, channel slope, etc. shown (Generally shown for CDR)	X	X	X
[ ]	195	Existing open drainage channels shown including drop and check structures, riprap, channel lining, side slope, channel slope, etc.		X	X
[ ]	196	Detention pond with extent of pond delineated	X	X	X
[ ]	197	Shaded area of 100-year water surface shown for detention pond		X	X
[ ]	198	Table of volumes and release rates for water quality/detention facilities	X	X	X

Checklist of Drainage Report Requirements

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Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[ ]	199	Detail information on EDB outlet structure			X
[ ]	200	Profile of EDB outlet structure showing water surface elevations, outlet pipe, water quality orifice plate, and discharge orifices			X
[ ]	201	Detail of water quality orifice plate showing size of perforations, number of rows, and spacing			X
[ ]	202	Detail information on Permanent BMPs			X
[ ]	203	Profile of Permanent BMP outlet structure showing water surface elevations, outlet pipe, water quality orifice plate, and discharge orifices			X
[ ]	204	Location and elevation (if known) for all existing and proposed utilities by of affecting the drainage design	X	X	X
[ ]	205	Routing of off-site flows thru the development (around detention basins, not through)	X	X	X
[ ]	206	Definition of flow path leaving the development through downstream properties to a major drainageway (if applicable)	X	X	X
[ ]	207	Location of all FEMA floodplains affecting the site (both existing and proposed)	X	X	X

Appendix

I. Vicinity Map

II. Hydrologic Computations

A. Land use assumptions
B. Minor and major storm runoff computations for historic and developed runoff conditions
C. Pond Calculation

III. Hydraulic Computations

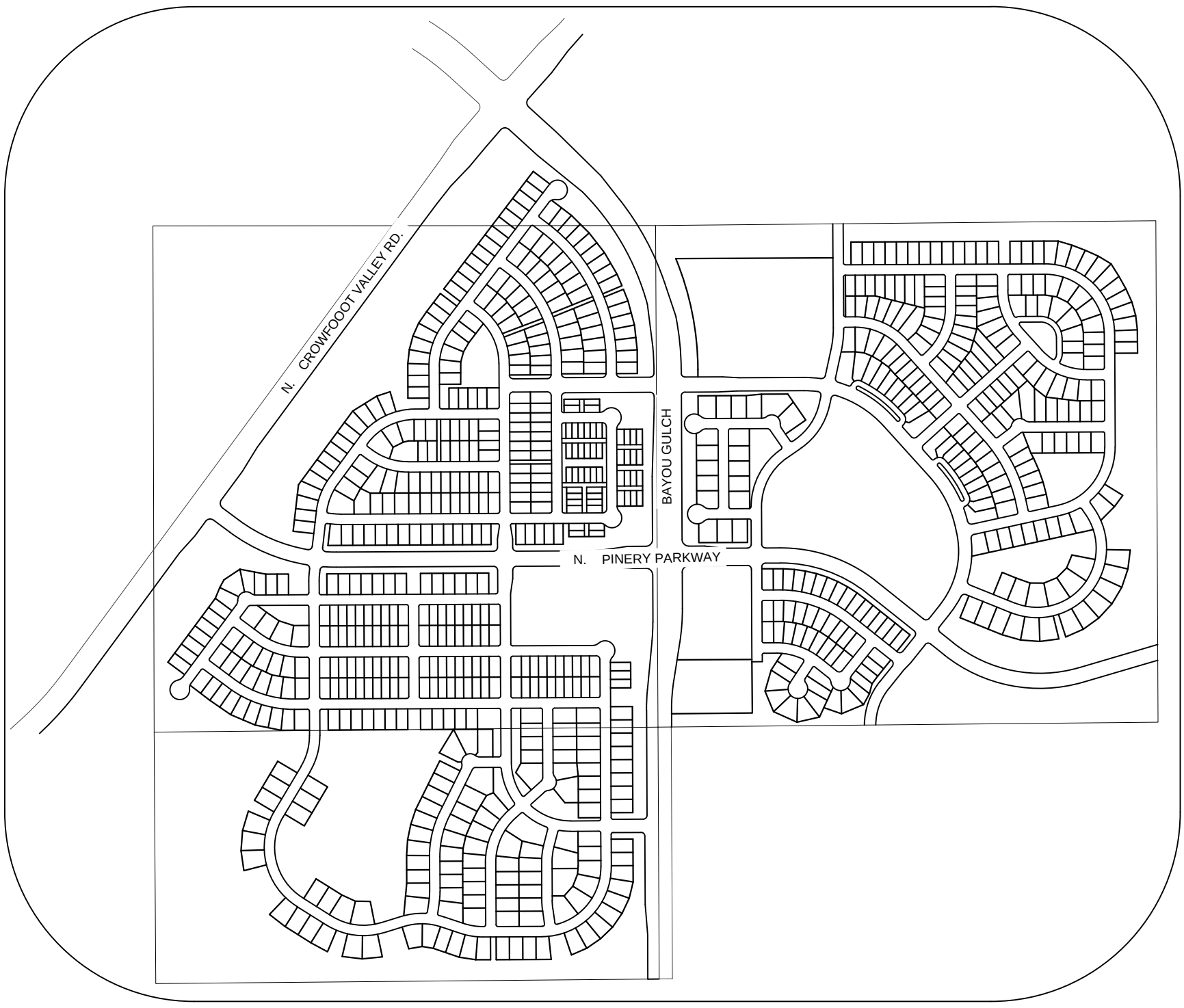
A. CUHP & SWMM
B. UD Inlet
C. UD Sewer
D. UD Channel
E. UD Culvert
F. HECRAS

IV. Copies of graphs, tables, and nomographs

A. FIRM
B. Soils Report
C. 1-Hour Rainfall Data
D. Excerpts from Adjacent Studies

V. Sub-basin Exhibit

I. Vicinity Map



VICINITY MAP

N.T.S.

II. Hydrologic Computations

A. Land use assumptions
   1. Imperviousness & Composite C Calculations
   2. SF-1-Time of Concentrations
B. Minor and major storm runoff computations for historic and developed runoff conditions
   1. SF-2 2-Year Sub-Basin Rational Method Calculations
   2. SF-2 100-Year Sub-Basin Ration Method Calculations
C. Pond Calculation

COMPOSITE BASIN COEFFICIENTS

Subdivision: Trails at Crowfoot

Soil Type B/C/D

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/17/2017

Soil Type B **49.80%**

Land Use	Imp.	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.42	0.67
School	55%	0.49	0.51	0.72
Business	95%	0.85	0.88	0.92
Residential (Multi Family)	75%	0.67	0.70	0.82
Streets	100%	0.89	0.93	0.94
Paved	90%	0.80	0.84	0.90
Parks	10%	0.09	0.09	0.50
Open Space / Lawns	2%	0.02	0.02	0.46
Mixed Use	30%	0.27	0.28	0.60

Soil Type C/D **50.20%**

Land Use	Imp.	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.44	0.71
School	55%	0.49	0.53	0.76
Business	95%	0.85	0.88	0.96
Residential (Multi Family)	75%	0.67	0.70	0.85
Streets	100%	0.89	0.92	0.96
Paved	90%	0.80	0.83	0.91
Parks	10%	0.09	0.14	0.55
Open Space / Lawns	2%	0.02	0.07	0.52
Mixed Use	30%	0.27	0.31	0.64

Composite Runoff Co-eff

Land Use	Imp.	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69
School	55%	0.49	0.52	0.74
Business	95%	0.85	0.88	0.94
Residential (Multi Family)	75%	0.67	0.70	0.84
Streets	100%	0.89	0.92	0.95
Paved	90%	0.80	0.83	0.91
Parks	10%	0.09	0.12	0.53
Open Space / Lawns	2%	0.02	0.05	0.49
Mixed Use	30%	0.27	0.30	0.62

R.O.W. Imperviousness Average Imperviousness Calculation for R.O.W. (Bayou Gulch Road)

Total Area **120.00 Sq.ft** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	% C_2	% C_5	% C_{100}
Lawns, Sandy Soil (2-7%)	2	0.02	0.05	0.49	16	0.3	0.00	0.01	0.07
Walks	90	0.80	0.83	0.91	32	24.0	0.21	0.22	0.24
Street	100	0.89	0.92	0.95	72	60.0	0.53	0.55	0.57
TOTAL					**120.00**	**84.3**	**0.75**	**0.78**	**0.88**

R.O.W. Imperviousness Average Imperviousness Calculation for R.O.W. (N Pinery Parkway)

Total Area **80.00 Sq.ft** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	% C_2	% C_5	% C_{100}
Lawns, Sandy Soil (2-7%)	2	0.02	0.05	0.49	16	0.4	0.00	0.01	0.10
Walks	90	0.80	0.83	0.91	30	33.8	0.30	0.31	0.34
Street	100	0.89	0.92	0.95	34	42.5	0.38	0.39	0.40
TOTAL					**80.00**	**76.7**	**0.68**	**0.72**	**0.84**

R.O.W. Imperviousness Average Imperviousness Calculation for R.O.W. (Residential Local)

Total Area **65.00 Sq.ft** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	% C_2	% C_5	% C_{100}
Lawns, Sandy Soil (2-7%)	2	0.02	0.05	0.49	16	0.5	0.00	0.01	0.12
Walks	90	0.80	0.83	0.91	15	20.8	0.18	0.19	0.21
Street	100	0.89	0.92	0.95	34	52.3	0.47	0.48	0.50
TOTAL					**65.00**	**73.6**	**0.66**	**0.69**	**0.83**

A1

Total Area **4.11 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.22	24.3	0.22	0.23	0.37
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.02	19.1	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.87	0.4	0.00	0.01	0.10
TOTAL					**4.11**	**43.8**	**0.39**	**0.42**	**0.69**

A2

Total Area **1.84 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.38	33.7	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.46	18.4	0.16	0.17	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**1.84**	**52.2**	**0.46**	**0.49**	**0.72**

A3

Total Area **3.23 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	31.8	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.74	16.9	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.21	0.1	0.00	0.00	0.03
TOTAL					**3.23**	**48.8**	**0.43**	**0.46**	**0.71**

A4

Total Area **4.07 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.50	16.6	0.15	0.16	0.25
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	16.6	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	1.65	0.8	0.01	0.02	0.20
TOTAL					**4.07**	**34.0**	**0.30**	**0.33**	**0.64**

A5

Total Area **2.04 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.25	27.5	0.24	0.26	0.42
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.59	21.3	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.20	0.2	0.00	0.00	0.05
TOTAL					**2.04**	**49.1**	**0.44**	**0.47**	**0.71**

A6

Total Area **4.96 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.44	22.1	0.20	0.21	0.34
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.84	12.5	0.11	0.12	0.14
Open Space / Lawns	2%	0.02	0.05	0.49	1.68	0.7	0.01	0.02	0.17
TOTAL					**4.96**	**35.3**	**0.31**	**0.34**	**0.65**

A7

Total Area **4.33 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.63	27.3	0.24	0.26	0.42
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.43	24.2	0.22	0.23	0.27
Open Space / Lawns	2%	0.02	0.05	0.49	0.27	0.1	0.00	0.00	0.03
TOTAL					**4.33**	**51.7**	**0.46**	**0.49**	**0.72**

A8

Total Area **2.86 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.09	32.9	0.29	0.31	0.50
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.77	19.8	0.18	0.18	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**2.86**	**52.7**	**0.47**	**0.50**	**0.73**

A9

Total Area **3.44 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	2.02	49.5	0.44	0.46	0.51
Open Space / Lawns	2%	0.02	0.05	0.49	1.42	0.8	0.01	0.02	0.20
TOTAL					**3.44**	**50.3**	**0.45**	**0.48**	**0.72**

A10

Total Area **0.72 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	0.52	60.9	0.54	0.57	0.63
Open Space / Lawns	2%	0.02	0.05	0.49	0.20	0.6	0.01	0.01	0.14
TOTAL					**0.72**	**61.4**	**0.55**	**0.58**	**0.77**

A11

Total Area **2.39 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.66	31.2	0.28	0.30	0.48
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.74	22.6	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**2.39**	**53.8**	**0.48**	**0.51**	**0.73**

A12

Total Area **2.96 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.01	30.5	0.27	0.29	0.47
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.70	17.3	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.26	0.2	0.00	0.00	0.04
TOTAL					**2.96**	**48.0**	**0.43**	**0.46**	**0.70**

A13

Total Area **7.08 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	2.45	26.0	0.23	0.24	0.29
ROW	74%	0.66	0.69	0.83	1.89	19.7	0.18	0.18	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	2.74	0.8	0.01	0.02	0.19
TOTAL					**7.08**	**46.4**	**0.41**	**0.44**	**0.70**

A14

Total Area **1.43 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.07	33.7	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	0.36	21.1	0.19	0.20	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**1.43**	**54.9**	**0.49**	**0.52**	**0.74**

A15

Total Area **7.15 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	2.45	25.2	0.22	0.24	0.28
Open Space / Lawns	2%	0.02	0.05	0.49	4.70	1.3	0.01	0.03	0.32
TOTAL					**7.15**	**26.5**	**0.24**	**0.27**	**0.61**

A16

Total Area **0.75 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.75	76.7	0.68	0.72	0.84
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**0.75**	**76.7**	**0.68**	**0.72**	**0.84**

A17

Total Area **3.76 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.82	33.8	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.94	19.1	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.76**	**52.9**	**0.47**	**0.50**	**0.73**

A18

Total Area **2.54 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.84	32.6	0.29	0.31	0.50
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.70	20.2	0.18	0.19	0.23
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**2.54**	**52.9**	**0.47**	**0.50**	**0.73**

A19

Total Area **2.09 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.58	34.1	0.30	0.33	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.51	17.9	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**2.09**	**51.9**	**0.46**	**0.49**	**0.72**

A20

Total Area **2.04 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.15	25.3	0.22	0.24	0.39
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.65	23.5	0.21	0.22	0.26
Open Space / Lawns	2%	0.02	0.05	0.49	0.24	0.2	0.00	0.01	0.06
TOTAL					**2.04**	**49.1**	**0.44**	**0.47**	**0.71**

A21

Total Area **3.02 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.22	33.0	0.29	0.32	0.51
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.80	19.5	0.17	0.18	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.02**	**52.6**	**0.47**	**0.50**	**0.73**

B1

Total Area **21.00 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	5.62	12.0	0.11	0.12	0.18
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	2.88	10.1	0.09	0.09	0.11
Open Space / Lawns	2%	0.02	0.05	0.49	12.50	1.2	0.01	0.03	0.29
TOTAL					**21.00**	**23.3**	**0.21**	**0.24**	**0.59**

B2

Total Area **3.13 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.39	34.4	0.31	0.33	0.53
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.74	17.4	0.15	0.16	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.13**	**51.8**	**0.46**	**0.49**	**0.72**

B3

Total Area **4.92 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.93	26.8	0.24	0.26	0.41
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.56	23.3	0.21	0.22	0.26
Open Space / Lawns	2%	0.02	0.05	0.49	0.43	0.2	0.00	0.00	0.04
TOTAL					**4.92**	**50.3**	**0.45**	**0.48**	**0.72**

B4

Total Area **1.50 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.18	74.8	0.67	0.69	0.74
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.32	16.3	0.14	0.15	0.18
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**1.50**	**91.1**	**0.81**	**0.84**	**0.92**

B5

Total Area **3.19 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.19**	**53.2**	**0.47**	**0.50**	**0.73**

B6

Total Area **3.19 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.19**	**53.2**	**0.47**	**0.50**	**0.73**

B7

Total Area **5.76 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	3.57	27.9	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.69	21.6	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.50	0.2	0.00	0.00	0.04
TOTAL					**5.76**	**49.7**	**0.44**	**0.47**	**0.71**

B8

Total Area **4.93 acres** Composite Calculations

Land Use	.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.13	19.4	0.17	0.19	0.30
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.74	27.1	0.24	0.25	0.30
Open Space / Lawns	2%	0.02	0.05	0.49	1.06	0.4	0.00	0.01	0.11
TOTAL					**4.93**	**46.9**	**0.42**	**0.45**	**0.70**

B9

Total Area **2.81 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.00	32.0	0.28	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.65	17.0	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.16	0.1	0.00	0.00	0.03
TOTAL					**2.81**	**49.2**	**0.44**	**0.47**	**0.71**

B10

Total Area **0.65 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.65	76.7	0.68	0.72	0.84
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**0.65**	**76.7**	**0.68**	**0.72**	**0.84**

B11

Total Area **0.84 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.84	76.7	0.68	0.72	0.84
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**0.84**	**76.7**	**0.68**	**0.72**	**0.84**

B12

Total Area **2.53 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.56	58.7	0.52	0.54	0.58
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.97	29.3	0.26	0.27	0.32
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**2.53**	**88.0**	**0.79**	**0.82**	**0.90**

B13

Total Area **3.19 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.19**	**53.2**	**0.47**	**0.50**	**0.73**

B14

Total Area **3.19 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.19**	**53.2**	**0.47**	**0.50**	**0.73**

B15

Total Area **2.01 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.44	32.2	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.57	20.9	0.19	0.19	0.23
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**2.01**	**53.1**	**0.47**	**0.50**	**0.73**

C1

Total Area **7.47 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	4.41	26.6	0.24	0.25	0.41
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.68	16.6	0.15	0.15	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	1.38	0.4	0.00	0.01	0.09
TOTAL					**7.47**	**43.5**	**0.39**	**0.42**	**0.68**

D1

Total Area **5.94 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	4.20	31.8	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.83	10.3	0.09	0.10	0.12
Open Space / Lawns	2%	0.02	0.05	0.49	0.91	0.3	0.00	0.01	0.08
TOTAL					**5.94**	**42.4**	**0.38**	**0.41**	**0.68**

D2

Total Area **5.33 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	3.34	28.2	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.28	17.7	0.16	0.16	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.71	0.3	0.00	0.01	0.07
TOTAL					**5.33**	**46.1**	**0.41**	**0.44**	**0.70**

D3

Total Area **3.66 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	2.05	25.2	0.22	0.24	0.39
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.90	18.2	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.70	0.4	0.00	0.01	0.09
TOTAL					**3.66**	**43.8**	**0.39**	**0.42**	**0.69**

D4

Total Area **2.91 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.83	28.3	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.54	13.7	0.12	0.13	0.15
Open Space / Lawns	2%	0.02	0.05	0.49	0.54	0.4	0.00	0.01	0.09
TOTAL					**2.91**	**42.3**	**0.38**	**0.41**	**0.68**

D5

Total Area **9.10 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	4.05	42.3	0.38	0.39	0.42
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	2.05	19.0	0.17	0.18	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	3.00	0.7	0.01	0.01	0.16
TOTAL					**9.10**	**61.9**	**0.55**	**0.58**	**0.78**

D6

Total Area **2.57 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	1.28	42.0	0.37	0.39	0.44
Open Space / Lawns	2%	0.02	0.05	0.49	1.29	1.0	0.01	0.02	0.25
TOTAL					**2.57**	**43.0**	**0.38**	**0.41**	**0.68**

D7

Total Area **2.58 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	1.29	22.5	0.20	0.22	0.35
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.67	19.1	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.62	0.5	0.00	0.01	0.12
TOTAL					**2.58**	**42.1**	**0.37**	**0.40**	**0.68**

D8

Total Area **0.85 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.65	34.4	0.31	0.33	0.53
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.20	17.3	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**0.85**	**51.7**	**0.46**	**0.49**	**0.72**

D9

Total Area **4.62 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.73	11.9	0.11	0.11	0.13
ROW	84%	0.75	0.78	0.88	1.77	32.3	0.29	0.30	0.34
Open Space / Lawns	2%	0.02	0.05	0.49	2.12	0.9	0.01	0.02	0.22
TOTAL					**4.62**	**45.1**	**0.40**	**0.43**	**0.69**

D10

Total Area **4.80 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	3.87	36.3	0.32	0.35	0.56
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.93	14.2	0.13	0.13	0.16
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**4.80**	**50.5**	**0.45**	**0.48**	**0.72**

D11

Total Area **3.29 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	3.29	84.3	0.75	0.78	0.88
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**3.29**	**84.3**	**0.75**	**0.78**	**0.88**

D12

Total Area **1.13 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	1.13	84.3	0.75	0.78	0.88
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					**1.13**	**84.3**	**0.75**	**0.78**	**0.88**

OS1

Total Area **56.02 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	56.02	2.0	0.02	0.05	0.49
TOTAL					**56.02**	**2.0**	**0.02**	**0.05**	**0.49**

OS2

Total Area **10.95 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	10.95	2.0	0.02	0.05	0.49
TOTAL					**10.95**	**2.0**	**0.02**	**0.05**	**0.49**

OS3

Total Area **5.32 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	5.32	2.0	0.02	0.05	0.49
TOTAL					**5.32**	**2.0**	**0.02**	**0.05**	**0.49**

OS4

Total Area **2.22 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	2.22	2.0	0.02	0.05	0.49
TOTAL					**2.22**	**2.0**	**0.02**	**0.05**	**0.49**

OS5

Total Area **19.19 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Future Landuse (OSP)	36%	0.31	0.36	0.67	19.19	36.1	0.31	0.36	0.67
TOTAL					**19.19**	**36.1**	**0.31**	**0.36**	**0.67**

OS6

Total Area **17.33 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Future Landuse (OSP)	34%	0.31	0.36	0.67	17.33	34.0	0.31	0.36	0.67
TOTAL					**17.33**	**34.0**	**0.31**	**0.36**	**0.67**

OS7

Total Area **29.69 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Open Space / Lawns	2%	0.02	0.05	0.49	29.69	2.0	0.02	0.05	0.49
TOTAL					**29.69**	**2.0**	**0.02**	**0.05**	**0.49**

OS8

Total Area **5.02 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Open Space / Lawns	2%	0.02	0.05	0.49	5.02	2.0	0.02	0.05	0.49
TOTAL					**5.02**	**2.0**	**0.02**	**0.05**	**0.49**

OS10

Total Area **5.37 acres** Composite Calculations

Land Use	Imp.	C_2	C_5	C_{100}	Area	Imp%	C_2	C_5	C_{100}
Open Space / Lawns	2%	0.02	0.05	0.49	5.37	2.0	0.02	0.05	0.49
TOTAL					**5.37**	**2.0**	**0.02**	**0.05**	**0.49**

II-B. MINOR AND MAJOR STORM RUNOFF COMPUTATIONS FOR DEVELOPED RUNOFF CONDITIONS

1. SF-2 2-Year Sub-Basin Rational Method Calculations
2. SF-2 100-Year Sub-Basin Rational Method Calculations
3. Pond Calculation

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
A1	4.11	0.42	50	1.0	8.7	1050	4.0	4.0	4.4	13.0	1100.0	16.1	13.0
A2	1.84	0.49	50	1.0	7.7	750	4.4	4.1	3.0	10.7	800.0	14.4	10.7
A3	3.23	0.46	50	1.0	8.1	900	1.2	2.2	6.8	14.9	950.0	15.3	14.9
A4	4.07	0.33	50	1.0	9.8	880	2.0	2.8	5.2	15.0	930.0	15.2	15.0
A5	2.04	0.47	50	1.0	8.1	700	3.4	3.7	3.2	11.2	750.0	14.2	11.2
A6	4.96	0.34	50	1.0	9.6	1178	4.5	4.2	4.7	14.3	1228.0	16.8	14.3
A7	4.33	0.49	50	1.0	7.8	1000	4.5	4.2	3.9	11.7	1050.0	15.8	11.7
A8	2.86	0.50	50	1.0	7.6	540	1.9	2.7	3.4	11.0	590.0	13.3	11.0
A9	3.44	0.48	50	1.0	7.9	1300	5.2	4.6	4.8	12.7	1350.0	17.5	12.7
A10	0.72	0.58	50	1.0	6.6	427	3.5	3.7	1.9	8.5	477.0	12.7	8.5
A11	2.39	0.51	50	1.0	7.5	950	4.5	4.2	3.7	11.3	1000.0	15.6	11.3
A12	2.96	0.46	50	1.0	8.2	700	3.4	3.7	3.2	11.3	750.0	14.2	11.3
A13	7.08	0.44	50	1.0	8.4	890	1.7	2.5	5.9	14.2	940.0	15.2	14.2
A14	1.43	0.52	50	1.0	7.4	430	4.4	4.2	1.7	9.1	480.0	12.7	9.1
A15	7.15	0.27	50	1.0	10.6	1669	4.7	4.3	6.5	17.1	1719.0	19.6	17.1
A16	0.75	0.72	50	1.0	4.9	1100	3.8	3.9	4.7	9.6	1150.0	16.4	9.6
A17	3.76	0.50	50	1.0	7.6	1250	3.4	3.6	5.7	13.4	1300.0	17.2	13.4
A18	2.54	0.50	50	1.0	7.6	980	3.4	3.6	4.5	12.1	1030.0	15.7	12.1
A19	2.09	0.49	50	1.0	7.7	650	3.2	3.6	3.0	10.8	700.0	13.9	10.8
A20	2.04	0.47	50	1.0	8.1	830	4.8	4.4	3.2	11.2	880.0	14.9	11.2
A21	3.02	0.50	50	1.0	7.7	650	3.2	3.6	3.0	10.7	700.0	13.9	10.7

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
B1	21.00	0.24	50	1.0	11.0	1925	3.0	3.5	9.3	20.3	1975.0	21.0	20.3
B2	3.13	0.49	50	1.0	7.8	650	4.8	4.3	2.5	10.3	700.0	13.9	10.3
B3	4.92	0.48	50	1.0	7.9	770	3.4	3.6	3.5	11.4	820.0	14.6	11.4
B4	1.50	0.84	50	1.0	3.2	300	3.0	3.5	1.4	4.7	350.0	11.9	5.0
B5	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B6	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B7	5.76	0.47	50	1.0	8.0	1280	2.7	3.2	6.6	14.6	1330.0	17.4	14.6
B8	4.93	0.45	50	1.0	8.3	1100	3.9	3.9	4.6	12.9	1150.0	16.4	12.9
B9	2.81	0.47	50	1.0	8.0	850	2.0	2.8	5.0	13.1	900.0	15.0	13.1
B10	0.65	0.72	50	1.0	4.9	630	2.5	3.2	3.3	8.2	680.0	13.8	8.2
B11	0.84	0.72	50	1.0	4.9	750	2.3	3.0	4.2	9.1	800.0	14.4	9.1
B12	2.53	0.82	50	1.0	3.6	670	1.9	2.8	4.1	7.7	720.0	14.0	7.7
B13	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B14	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B15	2.01	0.50	50	1.0	7.6	530	2.5	3.1	2.9	10.4	580.0	13.2	10.4
C1	7.47	0.42	50	1.0	8.7	2100	5.0	4.5	7.8	16.5	2150.0	21.9	16.5

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
D1	5.94	0.41	50	1.0	8.8	1150	4.9	4.4	4.4	13.2	1200.0	16.7	13.2
D2	5.33	0.44	50	1.0	8.4	800	5.3	4.6	2.9	11.3	850.0	14.7	11.3
D3	3.66	0.42	50	1.0	8.7	730	1.1	2.0	6.1	14.7	780.0	14.3	14.3
D4	2.91	0.41	50	1.0	8.8	890	1.0	2.0	7.4	16.2	940.0	15.2	15.2
D5	9.10	0.58	50	1.0	6.6	1570	2.4	3.0	8.6	15.2	1620.0	19.0	15.2
D6	2.57	0.41	50	1.0	8.7	950	2.4	3.1	5.1	13.9	1000.0	15.6	13.9
D7	2.58	0.40	50	1.0	8.9	620	5.0	4.5	2.3	11.2	670.0	13.7	11.2
D8	0.85	0.49	50	1.0	7.8	250	1.2	2.2	1.9	9.7	300.0	11.7	9.7
D9	4.62	0.43	50	1.0	8.5	700	1.3	2.2	5.3	13.8	750.0	14.2	13.8
D10	4.80	0.48	50	1.0	7.9	680	3.8	3.9	2.9	10.8	730.0	14.1	10.8
D11	3.29	0.78	50	1.0	4.0	1375	2.3	3.0	7.7	11.8	1425.0	17.9	11.8
D12	1.13	0.78	50	1.0	4.0	1376	2.3	3.0	7.7	11.8	1426.0	17.9	11.8
E1	4.04	0.50	50	1.0	7.6	870	5.9	4.8	3.0	10.7	920.0	15.1	10.7
E2	5.27	0.49	50	1.0	7.7	1800	0.5	1.4	21.2	28.9	1850.0	20.3	20.3
E3	4.77	0.50	50	1.0	7.7	750	2.9	3.4	3.7	11.4	800.0	14.4	11.4
E4	3.20	0.49	50	1.0	7.7	710	2.8	3.3	3.5	11.3	760.0	14.2	11.3
E5	2.76	0.51	50	1.0	7.5	1050	2.1	2.8	6.2	13.7	1100.0	16.1	13.7
E6	2.63	0.51	50	1.0	7.5	1020	3.0	3.5	4.9	12.4	1070.0	15.9	12.4
E7	2.77	0.49	50	1.0	7.7	870	3.1	3.5	4.1	11.8	920.0	15.1	11.8
E8	2.68	0.51	50	1.0	7.6	870	2.4	3.1	4.7	12.3	920.0	15.1	12.3
E9	4.84	0.38	50	1.0	9.2	709	1.3	2.2	5.4	14.5	759.0	14.2	14.2
E10	0.70	0.53	50	1.0	7.3	710	1.3	2.2	5.4	12.7	760.0	14.2	12.7
E11	3.99	0.30	50	1.0	10.2	711	1.3	2.2	5.4	15.7	761.0	14.2	14.2
E12	3.28	0.30	50	1.0	10.2	900	3.7	3.8	4.0	14.2	950.0	15.3	14.2
E13	4.45	0.30	50	1.0	10.2	713	1.3	2.2	5.4	15.7	763.0	14.2	14.2
E14	5.58	0.53	50	1.0	7.2	1080	3.7	3.8	4.7	11.9	1130.0	16.3	11.9
E15	1.89	0.49	50	1.0	7.7	715	1.3	2.2	5.4	13.2	765.0	14.3	13.2
E16	1.57	0.69	50	1.0	5.2	716	1.3	2.2	5.4	10.7	766.0	14.3	10.7
E17	1.55	0.69	50	1.0	5.2	717	1.3	2.2	5.5	10.7	767.0	14.3	10.7
E18	2.72	0.50	50	1.0	7.6	530	3.8	3.8	2.3	9.9	580.0	13.2	9.9
E19	2.91	0.51	50	1.0	7.6	770	3.9	3.9	3.3	10.9	820.0	14.6	10.9
E20	2.75	0.51	50	1.0	7.6	1080	2.5	3.2	5.7	13.2	1130.0	16.3	13.2
E21	2.05	0.52	50	1.0	7.4	721	2.6	3.2	3.7	11.1	771.0	14.3	11.1
E22	4.41	0.50	50	1.0	7.6	950	5.7	4.7	3.3	10.9	1000.0	15.6	10.9
E23	4.11	0.49	50	1.0	7.8	920	4.5	4.2	3.7	11.4	970.0	15.4	11.4
E24	4.23	0.30	50	1.0	10.2	900	3.7	3.8	4.0	14.2	950.0	15.3	14.2
E25	3.62	0.50	50	1.0	7.7	560	6.3	5.0	1.9	9.5	610.0	13.4	9.5
E26	2.88	0.56	50	1.0	6.8	580	3.8	3.8	2.5	9.3	630.0	13.5	9.3

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
F1	1.71	0.84	50	1.0	3.3	400	3.0	3.5	1.9	5.2	450.0	12.5	5.2
F2	1.77	0.87	50	1.0	3.0	510	4.3	4.1	2.0	5.0	560.0	13.1	5.0
F3	3.60	0.20	50	1.0	11.4	717	1.3	2.2	5.5	16.9	767.0	14.3	14.3
F4	3.79	0.50	50	1.0	7.6	850	3.8	3.8	3.7	11.3	900.0	15.0	11.3
F5	4.58	0.45	50	1.0	8.3	719	1.3	2.2	5.5	13.8	769.0	14.3	13.8
F6	4.93	0.37	50	1.0	9.3	1234	2.6	3.2	6.5	15.8	1284.0	17.1	15.8
F7	4.51	0.19	50	1.0	11.6	721	1.2	2.2	5.5	17.1	771.0	14.3	14.3
F8	7.93	0.34	50	1.0	9.7	1070	2.8	3.3	5.3	15.0	1120.0	16.2	15.0
F9	1.28	0.62	50	1.0	6.1	1708	3.2	3.6	8.0	14.0	1758.0	19.8	14.0
F10	1.93	0.85	50	1.0	3.1	520	4.4	4.2	2.1	5.2	570.0	13.2	5.2
F11	1.50	0.85	50	1.0	3.2	520	4.0	4.0	2.2	5.3	570.0	13.2	5.3
F12	1.22	0.86	50	1.0	3.0	510	4.3	4.1	2.0	5.1	560.0	13.1	5.1
F13	3.58	0.50	50	1.0	7.6	850	4.7	4.3	3.3	10.9	900.0	15.0	10.9
OS1	56.02	0.05	300	3.1	22.7	2240	5.5	4.7	8.0	30.6	2540.0	24.1	24.1
OS2	10.95	0.05	300	1.2	30.8	1334	1.2	2.2	10.1	40.9	1634.0	19.1	19.1
OS3	5.32	0.05	300	2.9	23.2	1037	2.9	3.3	5.2	28.4	1337.0	17.4	17.4
OS4	2.22	0.05	300	3.5	21.7	730	3.5	3.7	3.3	24.9	1030.0	15.7	15.7
OS10	5.37	0.05	300	4.2	20.4	305	4.2	4.1	1.2	21.6	605.0	13.4	13.4

NOTES:

T_i = (1.8*(1.1 - C_5)*(L)^0.5)/(S^0.33)

T_t=L/60V (Velocity From Fig. 3-2)

Tc Check = 10+L/180

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 2 Yr
2-Year P1 = 0.99 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
A1	1A	A1	4.11	0.39	13.0	1.60	2.4	3.8	1 @ 10' Type R On-Grade Inlet	3.8	0.0	13.0	1.60	2.4	3.8									
A1, 16	1P	A16	0.75	0.68	9.6	0.51	2.7	1.4	1 @ 5' Type R On-Grade Inlet	0.0	0.0	13.1	2.11	2.4	5.1			3.8	1.00	18.00	30.0	5.35	0.1	Piped to 1P
A11	1K	A11	2.39	0.48	11.3	1.15	2.6	2.9	1 @ 10' Type R On-Grade Inlet	2.9	0.0	11.3	1.15	2.6	2.9			5.1	1.00	18.00	420.0	5.85	1.2	Piped to DP 1
A11, 17	1Q	A17	3.76	0.47	13.4	1.77	2.4	4.2	1 @ 10' Type R On-Grade Inlet	4.2	0.0	13.4	2.91	2.4	6.9			2.9	1.00	18.00	30.0	5.04	0.1	Piped to 1Q
A1,11,16,17	1											14.3	5.03	2.3	11.5			6.9	1.00	18.00	30.0	6.31	0.1	Piped to DP 1
A18	1R	A18	2.54	0.47	12.1	1.19	2.5	3.0	1 @ 10' Type R On-Grade Inlet	3.0	0.0	12.1	1.19	2.5	3.0			11.5	1.00	24.00	340.0	7.20	0.8	Piped to DP 2
A2, 18	1B	A2	1.84	0.46	10.7	0.85	2.6	2.2	1 @ 15' Type R Sump Inlet	2.2	0.0	12.3	2.04	2.5	5.0			3.0	1.00	1.50	40.0	5.07	0.1	Piped to 1B
A1,2,11,16,17,18	2											15.1	7.07	2.2	15.8			5.0	1.00	30.00	40.0	5.65	0.1	Piped to DP 2
A1,2,3,11,16,17,18	1C	A3	3.23	0.43	14.9	1.40	2.3	3.2	1 @ 15' Type R Sump Inlet	3.2	0.0	15.2	8.47	2.2	18.9			15.8	1.00	30.00	30.0	7.77	0.1	Piped to 1C
A13	1M	A13	7.08	0.41	14.2	2.94	2.3	6.8	1 @ 15' Type R On-Grade Inlet	6.8	0.0	14.2	2.94	2.3	6.8			18.9	1.00	42.00	500.0	7.94	1.0	Piped to West Channel
A7	1G	A7	4.33	0.46	11.7	1.99	2.5	5.0	1 @ 10' Type R On-Grade Inlet	5.0	0.0	11.7	1.99	2.5	5.0			6.8	1.00	18.00	250.0	6.28	0.7	Piped to DP 3
A7, 20	1T	A20	2.04	0.44	11.2	0.89	2.6	2.3	1 @ 10' Type R On-Grade Inlet	2.3	0.0	11.8	2.88	2.5	7.2			5.0	1.00	18.00	40.0	5.85	0.1	Piped to 1T
A7,13,20	3											14.9	5.82	2.3	13.1			7.2	1.00	18.00	25.0	6.31	0.1	Piped to DP 3
A19	1S	A19	2.09	0.46	10.8	0.97	2.6	2.5	1 @ 10' Type R On-Grade Inlet	2.5	0.0	10.8	0.97	2.6	2.5			13.1	1.00	24.00	572.0	7.45	1.3	Piped to DP 4
A5, 19	1E	A5	2.04	0.44	11.2	0.89	2.6	2.3	2 @ 15' Type R Sump Inlet	2.3	0.0	11.5	1.85	2.5	4.7			2.5	1.00	18.00	225.0	5.00	0.8	Piped to 1E
A5,7,13,19,20	4											16.2	7.67	2.2	16.6			4.7	1.00	30.00	50.0	5.52	0.2	Piped to 1D
A4,5,7,13,19,20	1D	A4	4.07	0.30	15.0	1.24	2.3	2.8	1 @ 10' Type R Sump Inlet	2.8	0.0	16.3	8.91	2.2	19.3			16.6	1.00	30.00	50.0	7.87	0.1	Piped to 1D
A4,5,7,8,13,19,20	1H	A8	2.86	0.47	11.0	1.34	2.6	3.5	1 @ 10' Type R Sump Inlet	3.5	0.0	16.3	10.25	2.2	22.1			19.3	1.00	42.00	40.0	8.02	0.1	Piped to 1H
A12	1L	A12	2.96	0.43	11.3	1.26	2.5	3.2	1 @ 10' Type R On-Grade Inlet	3.2	0.0	11.3	1.26	2.5	3.2			22.1	1.00	42.00	140.0	8.37	0.3	Piped to West Channel
A12, 21	1U	A21	3.02	0.47	10.7	1.41	2.6	3.7	1 @ 10' Type R On-Grade Inlet	3.7	0.0	11.8	2.68	2.5	6.7			3.2	1.00	18.00	130.0	5.18	0.4	Piped to 1U
A6,12, 21	1F	A6	4.96	0.31	14.3	1.56	2.3	3.6	1 @ 10' Type R On-Grade Inlet	3.6	0.0	14.3	4.24	2.3	9.7			6.7	1.00	18.00	90.0	6.28	0.2	Piped to 1F
A6,12,14,21	1N	A14	1.43	0.49	9.1	0.70	2.8	1.9	2 @ 10' Type R Sump Inlet	1.9	0.0	14.7	4.94	2.3	11.2			9.7	1.00	18.00	160.0	6.72	0.4	Piped to 1N
A15	1O	A15	7.15	0.24	17.1	1.70	2.1	3.6	1 @ 10' Type R Sump Inlet	4.9	0.0	17.1	1.70	2.1	3.6			11.2	1.00	36.00	150.0	6.99	0.4	Piped to West Channel
A9	1I	A9	3.44	0.45	12.7	1.54	2.4	3.7				12.7	1.54	2.4	3.7			3.6	1.00	24.00	100.0	5.23	0.3	Piped to 1J
A9,10,15	1J	A10	0.72	0.55	8.5	0.39	2.8	1.1	1 @ 10' Type R Sump Inlet	4.5	0.0	14.199 17.4	1.94 3.64	2.3 2.1	4.5 7.6	4.0	3.7				370.0	4.00	1.5	Street Flow to 1J
																		7.6	1.00	24.00	10.0	6.47	0.0	Piped to West Channel

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 2 Yr
2-Year P1 = 0.99 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
OS10	O10	OS10	5.37	0.02	13.4	0.11	2.4	0.3				13.4	0.11	2.4	0.3									
OS10, C1	3A	C1	7.47	0.39	16.5	2.89	2.1	6.2	1 @ 15' Type R Sump Inlet	2.5	0.0	16.5	3.00	2.1	6.4	2.0	0.3				30.0	2.83	0.2	Street Flow to 3A
B15	2O	B15	2.01	0.47	10.4	0.95	2.6	2.5	1 @ 10' Type R On-Grade Inlet	2.5	0.0	10.4	0.95	2.6	2.5			6.4	1.00	18.00	285.0	6.00	0.8	Piped to DP 19
B3	2C	B3	4.92	0.45	11.4	2.20	2.5	5.6	1 @ 15' Type R On-Grade Inlet	5.6	0.0	11.4	2.20	2.5	5.6			2.5	1.00	18.00	225.0	6.00	0.6	Piped to 2A
B3,12	2L	B12	2.53	0.79	7.7	1.98	3.0	5.9	1 @ 15' Type R On-Grade Inlet	5.9	0.0	12.1	4.19	2.5	10.4			5.6	1.00	18.00	225.0	6.00	0.6	Piped to 2L
B3,4,12	2D	B4	1.50	0.81	5.0	1.22	3.4	4.1	1 @ 10' Type R On-Grade Inlet	4.1	0.0	12.6	5.41	2.4	13.1			10.4	1.00	18.00	225.0	6.75	0.6	Piped to 2D
B2	2B	B2	3.13	0.46	10.3	1.44	2.7	3.8	1 @ 10' Type R On-Grade Inlet	3.8	0.0	11.1	2.39	2.6	6.1			13.1	1.00	24.00	1037.0	7.45	2.3	Piped to DP 10
B1, B2	2A	B1	21.00	0.21	20.3	4.38	1.9	8.5	2 @ 10' Type R On-Grade Inlet	8.5	0.0	20.3	6.78	1.9	13.1			6.1	2.00	18.00	1290.0	6.97	3.1	Piped to 2A
B14	2N	B14	3.19	0.47	11.1	1.51	2.6	3.9	1 @ 10' Type R On-Grade Inlet	3.9	0.0	11.1	1.51	2.6	3.9			13.1	2.00	30.00	245.0	9.11	0.4	Piped to DP 5
B5, 14	2E	B5	3.19	0.47	11.1	1.51	2.6	3.9	2 @ 15' Type R On-Grade Inlet	8.5	0.0	11.1	1.51	2.6	3.9			3.9	1.00	18.00	500.0	6.96	1.2	Piped to DP 6
B5,14	6											12.2	3.02	2.5	7.4			3.9	2.00	36.00	50.0	6.50	0.1	Piped to DP 6
B1,2,3,4,5,12,14,15	5											20.7	9.79	1.9	18.7			7.4	1.00	18.00	80.0	6.42	0.2	Piped to DP 6
B1,2,3,4,5,12,14,15, OS10, C1	19											21.2	12.79	1.9	24.2			18.7	2.00	36.00	300.0	10.00	0.5	Piped to DP 19
B13	2M	B13	3.19	0.47	11.1	1.51	2.6	3.9	1 @ 10' Type R On-Grade Inlet	3.9	0.0	11.1	1.51	2.6	3.9			24.2	2.00	36.00	385.0	10.00	0.6	Piped to DP 2J
B6, 13	2F	B6	3.19	0.47	11.1	1.51	2.6	3.9	2 @ 15' Type R On-Grade Inlet	3.9	0.0	11.1	1.51	2.6	3.9			3.9	1.00	18.00	510.0	6.96	1.2	Piped to DP 7
B6,13	7											12.4	3.02	2.5	7.4			3.9	2.00	36.00	40.0	6.50	0.1	Piped to DP 7
B6,13	8											12.5	3.02	2.4	7.4			7.4	1.00	18.00	80.0	8.33	0.2	Piped to DP 8
B7	2G	B7	5.76	0.44	14.6	2.55	2.3	5.8	1 @ 15' Type R On-Grade Inlet	5.8	0.0	14.6	2.55	2.3	5.8			7.4	2.00	36.00	200.0	10.78	0.3	Piped to DP 9
B9	2I	B9	2.81	0.44	13.1	1.23	2.4	2.9	2 @ 15' Type R Sump Inlet	2.9	0.0	13.1	1.23	2.4	2.9			5.8	1.00	18.00	200.0	6.00	0.6	Piped to DP 9
B8	2H	B8	4.93	0.42	12.9	2.06	2.4	5.0	2 @ 10' Type R Sump Inlet	5.0	0.0	12.9	2.06	2.4	5.0			2.9	0.50	36.00	50.0	4.60	0.2	Piped to DP 9
B6,7,8,9,13	9											15.2	8.85	2.2	19.8			5.0	0.50	30.00	50.0	6.50	0.1	Piped to DP 9
B6,7,8,9,13,3,4,12	10											15.2	14.26	2.2	31.8			19.8	1.00	48.00	40.0	9.25	0.1	Piped to DP 10
B1,2,5,14,15, OS10, C1 B6,7,8,9,10,13	2J	B10	0.65	0.68	8.2	0.44	2.9	1.3	2 @ 10' Type R Sump Inlet	1.3	0.0	21.8	13.24	1.9	24.6			31.8	1.00	48.00	580.0	9.92	1.0	Piped to West Channel
B1,2,5,14,15, OS10, C1 B6,7,8,9,10,13	2K	B11	0.84	0.68	9.1	0.57	2.8	1.6	1 @ 5' Type R Sump Inlet	1.6	0.0	21.9	13.81	1.9	25.6			24.6	1.00	54.00	30.0	9.90	0.1	Piped to 2K
																		25.6	1.00	54.00	50.0	10.00	0.1	Piped to West Channel

STANDARD FORM SF-3
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(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 2 Yr
2-Year P1 = 0.99 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
D2	4B	D2	5.33	0.41	11.3	2.19	2.5	5.6	1 @ 10' Type R On-Grade Inlet	5.6	0.0	11.3	2.19	2.5	5.6									
D2, D10	4J	D10	4.80	0.45	10.8	2.16	2.6	5.6	2 @ 10' Type R Sump Inlet	5.6	0.0	12.4	4.35	2.5	10.7			5.6	1.00	18.00	375.0	6.00	1.0	Piped to 4J
D7	4G	D7	2.58	0.37	11.2	0.97	2.6	2.5	2 @ 10' Type R On-Grade Inlet	3.0	0.0	11.2	0.97	2.6	2.5			10.7	1.00	36.00	20.0	6.70	0.0	Piped to DP 11
D2,7,10	11											13.1	5.31	2.4	12.7			2.5	1.50	18.00	630.0	5.30	2.0	Piped to DP 11
D1,2,7,10	4A	D1	5.94	0.38	13.2	2.24	2.4	5.3	1 @ 15' Type R Sump Inlet	5.9	0.0	13.2	7.55	2.4	18.0			12.7	1.50	36.00	20.0	6.80	0.0	Piped to 4A
D8	4H	D8	0.85	0.46	9.7	0.39	2.7	1.1				9.7	0.39	2.7	1.1			18.0	1.50	36.00	30.0	7.00	0.1	Piped to Pond B
D12	4L	D12	1.13	0.75	11.8	0.85	2.5	2.1	2 @ 10' Type R On-Grade Inlet	2.9	0.0	13.3	1.24	2.4	2.9	5.00	1.1				980.0	4.47	3.7	Street Flow to 4F
D6,8,12	4F	D6	2.57	0.38	13.9	0.99	2.3	2.3	2 @ 10' Type R On-Grade Inlet	3.0	0.0	13.9	2.23	2.3	5.2			2.9	1.50	18.00	100.0	5.10	0.3	Piped to 4F
																		5.2	0.50	30.00	200.0	6.90	0.5	Piped to Pond B
D3	4C	D3	3.66	0.39	14.3	1.43	2.3	3.3				14.3	1.43	2.3	3.3									
D3,4	4D	D4	2.91	0.38	15.2	1.10	2.2	2.4				15.2	2.52	2.2	5.6	5.0	3.3				40.0	4.47	0.1	Street Flow to 4D
D3,4,5	4E	D5	9.10	0.55	15.2	5.04	2.2	11.3	2 @ 10' Type R Sump Inlet	13.6	0.0	23.2	7.56	1.8	13.6	3.0	5.6				1668.0	3.46	8.0	Street Flow to 4E
D9	4I	D9	4.62	0.40	13.8	1.86	2.3	4.3	1 @ 10' Type R Sump Inlet	4.3	0.0	13.8	1.86	2.3	4.3			13.6	1.00	36.00	30.0	7.80	0.1	Piped to DP 2
D3,4,5,9	12											23.3	9.42	1.8	16.9			4.3	1.00	24.00	30.0	5.20	0.1	Piped to DP 2
D11	4K	D11	3.29	0.75	11.8	2.47	2.5	6.2	1 @ 10' Type R Sump Inlet	6.2	0.0	11.8	2.47	2.5	6.2			16.9	2.00	36.00	204.0	8.10	0.4	Piped to DP 13
D3,4,5,9,11	13											23.7	11.89	1.8	21.1			6.2	1.00	24.00	30.0	5.20	0.1	Piped to DP 13
																		21.1	2.00	36.00	550.0	14.00	0.7	Piped to 16

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Subdivision Trails at Crowfoot

Design Storm 2 Yr
2-Year P1 = 0.99 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
E23	5W	E23	4.11	0.46	11.4	1.90	2.5	4.8	1 @ 10' Type R On-Grade Inlet	4.8	0.6	11.4	1.90	2.5	4.8									
E22, 23	5V	E22	4.41	0.47	10.9	2.09	2.6	5.4	1 @ 15' Type R On-Grade Inlet	5.4	0.6	12.1	3.98	2.5	9.8			4.8	1.00	18.00	250.0	5.80	0.7	Piped to 5V
E1,22,23	5A	E1	4.04	0.47	10.7	1.90	2.6	4.9	2 @ 15' Type R On-Grade Inlet	4.9	0.6	12.6	5.88	2.4	14.3			9.8	1.00	18.00	200.0	6.70	0.5	Piped to 5A
E1,3, 22,23	5C	E3	4.77	0.47	11.4	2.22	2.5	5.6	1 @ 15' Type R On-Grade Inlet	5.6	0.0	13.9	8.09	2.3	18.8			14.3	1.00	24.00	570.0	7.50	1.3	Piped to 5C
E1,3,4, 22,23	5D	E4	3.20	0.46	11.3	1.48	2.6	3.8	1 @ 10' Type R On-Grade Inlet	3.8	0.6	14.5	9.57	2.3	21.9			18.8	1.00	24.00	270.0	8.05	0.6	Piped to 5D
E1,3,4,5,18,22,23	5E	E5	2.76	0.48	13.7	1.32	2.3	3.1	2 @ 15' Type R Sump Inlet	3.1	0.0	16.4	10.89	2.2	23.5			21.9	1.00	24.00	956.0	8.16	2.0	Piped to 5E
E26	5Z	E26	2.88	0.53	9.3	1.54	2.7	4.2	1 @ 10' Type R On-Grade Inlet	4.2	0.0	9.3	1.54	2.7	4.2			23.5	0.50	48.00	30.0	5.30	0.1	Piped to Pond C
E25, 26	5Y	E25	3.62	0.47	9.5	1.70	2.7	4.6	1 @ 10' Type R On-Grade Inlet	4.6	0.0	10.0	3.24	2.7	8.7			4.2	1.00	18.00	220.0	5.60	0.7	Piped to 5Y
E14,25,26	5N	E14	5.58	0.50	11.9	2.81	2.5	7.0	2 @ 10' Type R Sump Inlet	7.0	0.0	11.9	6.05	2.5	15.1			8.7	1.00	18.00	220.0	6.60	0.6	Piped to 5N
E24	5X	E24	4.23	0.27	14.2	1.14	2.3	2.6				14.2	1.14	2.3	2.6			15.1	0.50	42.00	970.0	14.70	1.1	Piped to 5P
E12,24	5L	E12	3.28	0.27	14.2	0.89	2.3	2.0	1 @ 10' Type R On-Grade Inlet	4.6	0.0	14.7	2.03	2.3	4.6	6.0	2.6				150.0	4.90	0.5	Overland to 5L
E11	5K	E11	3.99	0.27	14.2	1.08	2.3	2.5				14.2	1.08	2.3	2.5			4.6	1.00	18.00	50.0	5.70	0.1	Piped to 5P
E11,12,14,16,24,25,26	5P	E16	1.57	0.66	10.7	1.03	2.6	2.7	1 @ 15' Type R On-Grade Inlet	4.8	0.0	14.3 14.9	2.11 10.18	2.3 2.3	4.8 23.0	1.0	2.5				10.0	2.00	0.1	Overland to 5P
E6	5F	E6	2.63	0.48	12.4	1.25	2.4	3.1	1 @ 10' Type R On-Grade Inlet	3.1	0.0	12.4	1.25	2.4	3.1			23.0	1.00	24.00	329.0	8.10	0.7	Piped to 5S
E6,11,12,14,16,24,25,26,19	5S	E19	2.91	0.47	10.9	1.38	2.6	3.6	1 @ 15' Type R On-Grade Inlet	3.6	0.0	15.5	12.82	2.2	28.3			3.1	1.00	18.00	50.0	5.10	0.2	Piped to 5S
E21	5U	E21	2.05	0.49	11.1	1.00	2.6	2.6	1 @ 10' Type R On-Grade Inlet	2.6	0.0	11.1	1.00	2.6	2.6			28.3	1.00	30.00	288.0	9.00	0.5	Piped to 5H
E6,8,11,12,14,16,21,24,25,26,19	5H	E8	2.68	0.47	12.3	1.27	2.5	3.1	1 @ 15' Type R On-Grade Inlet	3.1	0.0	16.1	15.09	2.2	32.8			2.6	1.00	18.00	50.0	4.90	0.2	Piped to 5H
E9	5I	E9	4.84	0.35	14.2	1.70	2.3	3.9	1 @ 15' Type R On-Grade Inlet	3.9	0.0	14.2	1.70	2.3	3.9			32.8	1.00	30.00	660.0	9.26	1.2	Piped to DP 14
E6,8,11,12,14,16,21,24,9,19 E25,26	14											17.3	16.79	2.1	35.3			3.9	1.00	18.00	30.0	5.50	0.1	Piped to DP 14
E20	5T	E20	2.75	0.48	13.2	1.31	2.4	3.1				13.2	1.31	2.4	3.1			35.3	1.00	30.00	280.0	9.40	0.5	Piped to DP 15
E7,20	5G	E7	2.77	0.46	11.8	1.28	2.5	3.2	2 @ 15' Type R Sump Inlet	6.2	0.0	13.3	2.59	2.4	6.2	2.0	3.1				10.0	2.83	0.1	Street Flow to 5G
E6,7,8,11,12,14,16,21,24,9,19 E20,25,26	15											17.7	19.38	2.1	40.1			6.2	0.50	48.00	30.0	6.60	0.1	Piped to DP 15
E15	5O	E15	1.89	0.46	13.2	0.87	2.4	2.1	1 @ 10' Type R On-Grade Inlet	2.1	0.0	13.2	0.87	2.4	2.1			40.1	0.50	60.00	280.0	5.30	0.9	Piped to Pond C
E15,18	5R	E18	2.72	0.47	9.9	1.28	2.7	3.4	1 @ 10' Type R On-Grade Inlet	3.4	0.0	14.9	2.16	2.3	4.9			2.1	1.00	18.00	500.0	4.90	1.7	Piped to 5R
E10	5J	E10	0.70	0.50	12.7	0.35	2.4	0.8				12.7	0.35	2.4	0.8			4.9	1.00	18.00	30.0	5.23	0.1	Piped to 5B
E2,10,15,18	5B	E2	5.27	0.46	20.3	2.44	1.9	4.7	1 @ 15' Type R Sump Inlet	5.4	0.0	20.3	4.94	1.9	9.6	1.0	0.8				300.0	2.00	2.5	Street Flow to 5B
																		9.6	0.60	90.00	30.0	5.30	0.1	Piped to Pond C

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Subdivision Trails at Crowfoot

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Project No. 254103
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Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
F12	6L	F12	1.22	0.83	5.1	1.01	3.3	3.4	1 @ 10' Type R On-Grade Inlet	3.4	0.0	5.1	1.01	3.3	3.4			3.4	1.00	18.00	50.0	5.30	0.2	Piped to 6B
F2	6B	F2	1.77	0.84	5.0	1.48	3.4	5.0	1 @ 10' Type R On-Grade Inlet	5.0	0.0	5.2	2.49	3.3	8.3			8.3	1.00	18.00	130.0	6.90	0.3	Piped to 6K
F2,11,12	6K	F11	1.50	0.82	5.3	1.23	3.3	4.1	1 @ 10' Type R On-Grade Inlet	4.1	0.0	5.5	3.73	3.3	12.2			8.3	1.00	18.00	100.0	6.90	0.2	Piped to 6J
F2,10,11,12	6J	F10	1.93	0.82	5.2	1.59	3.3	5.3	1 @ 15' Type R On-Grade Inlet	5.3	0.0	5.8	5.32	3.2	17.2			12.2	1.00	24.00	100.0	7.30	0.2	Piped to 6A
F1,2,10,11,12	6A	F1	1.71	0.81	5.2	1.38	3.3	4.6	2 @ 15' Type R On-Grade Inlet	4.6	0.0	6.0	6.70	3.2	21.4			21.4	1.00	24.00	100.0	8.20	0.2	Piped to DP 16
D3,4,5,9,11 F1,2,10,11,12	16											24.4	18.60	1.7	32.5			32.5	1.00	30.00	1025.0	9.20	1.9	Piped to 6E
F4	6D	F4	3.79	0.47	11.3	1.79	2.6	4.6	1 @ 10' Type R On-Grade Inlet	4.6	0.0	11.3	1.79	2.6	4.6			4.6	1.00	18.00	50.0	5.80	0.1	Piped to 6M
F4,13	6M	F13	3.58	0.47	10.9	1.68	2.6	4.4	1 @ 10' Type R On-Grade Inlet	4.4	0.0	11.4	3.47	2.5	8.8			8.8	1.00	18.00	50.0	6.70	0.1	Piped to 6C
F3,4,13	6C	F3	3.60	0.18	14.3	0.64	2.3	1.5	1 @ 10' Type R On-Grade Inlet	1.5	0.0	14.3	4.11	2.3	9.5			9.5	1.00	18.00	200.0	6.70	0.5	Piped to DP 17
D3,4,5,9,11 F1,2,5,10,11,12	6E	F5	4.58	0.42	13.8	1.91	2.3	4.5	1 @ 15' Type R On-Grade Inlet	4.5	0.0	26.2	20.50	1.7	34.4			34.4	1.00	30.00	100.0	9.33	0.2	Piped to DP 17
D3,4,5,9,11 F1,2,3,4,5,10,11,12,13	17											26.4	24.61	1.7	41.2			41.2	1.00	30.00	1200.0	9.50	2.1	Piped to Pond D
D3,4,5,9,11 F1,2,3,4,5,9,10,11,12,13	6I	F9	1.28	0.59	14.0	0.76	2.3	1.8	2 @ 15' Type R Sump Inlet	1.8	0.0	14.0	0.76	2.3	1.8			1.8	0.50	48.00	200.0	6.50	0.5	Piped to 6G
D3,4,5,9,11 F1,2,3,4,5,7,9,10,11,12,13	6G	F7	4.51	0.16	14.3	0.73	2.3	1.7	1 @ 10' Type R Sump Inlet	1.7	0.0	14.6	1.49	2.3	3.4			3.4	0.50	48.00	200.0	6.50	0.5	Piped to Pond D
E13	5M	E13	4.45	0.27	14.2	1.20	2.3	2.8	1 @ 10' Type R On-Grade Inlet	2.8	0.0	14.2	1.20	2.3	2.8			2.8	1.00	18.00	70.0	5.10	0.2	Piped to 5Q
E17	5Q	E17	1.55	0.66	10.7	1.01	2.6	2.6	1 @ 10' Type R On-Grade Inlet	2.6	0.0	14.5	2.21	2.3	5.1			5.1	0.50	30.00	780.0	6.50	2.0	Piped/Overland Flow to 6H
F8	6H	F8	7.93	0.31	15.0	2.48	2.2	5.6	1 @ 10' Type R Sump Inlet	4.5	0.0	16.5	4.69	2.1	10.1			10.1	0.50	36.00	30.0	9.10	0.1	Piped to 6F
F6	6F	F6	4.93	0.34	15.8	1.69	2.2	3.7	1 @ 10' Type R Sump Inlet	3.7	0.0	16.5	6.38	2.1	13.7			13.7	0.50	42.00	102.0	9.10	0.2	Piped to Channel

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Subdivision Trails at Crowfoot

Design Storm 100 Yr
100-Year P1 = 2.6 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
A1	1A	A1	4.11	0.69	13.0	2.82	6.3	17.7				13.0	2.82	6.3	17.7									
A1, 16	1P	A16	0.75	0.84	9.6	0.63	7.1	4.5				13.3	3.45	6.2	21.5	2.0	17.7				40.0	2.83	0.2	Street Flow to 1P
A11	1K	A11	2.39	0.73	11.3	1.75	6.7	11.7				11.3	1.75	6.7	11.7	2.0	21.5				400.0	2.83	2.4	Street Flow to DP 1
A11, 17	1Q	A17	3.76	0.73	13.4	2.73	6.2	17.0				13.4	4.49	6.2	27.9	2.0	11.7				40.0	2.83	0.2	Street Flow to 1Q
A1,11,16,17	1											15.6	7.93	5.8	45.9	2.0	27.9				40.0	2.83	0.2	Street Flow to DP 1
A18	1R	A18	2.54	0.73	12.1	1.85	6.5	12.0				12.1	1.85	6.5	12.0	2.0	45.9				340.0	2.83	2.0	Street Flow to 1B
A2, 18	1B	A2	1.84	0.72	10.7	1.33	6.8	9.1	1 @ 15' Type R Sump Inlet	42.1	18.5	17.6 17.6	7.72 11.11	5.5 5.5	42.1 60.6	2.0	12.0				40.0	2.83	0.2	Street Flow to 1B
A1,2,11,16,17,18	2											17.7	7.72	5.4	42.0			42.1	1.00	30.00	40.0	9.47	0.1	Piped to DP 2
A1,2,3,11,16,17,18	1C	A3	3.23	0.71	14.9	2.29	5.9	13.5	1 @ 15' Type R Sump Inlet	32.0	0.0	17.7	13.40	5.4	73.0			42.0	1.00	30.00	30.0	9.40	0.1	Piped to 1C
A13	1M	A13	7.08	0.70	14.2	4.95	6.1	30.0				14.2	4.95	6.1	30.0			73.0	1.00	42.00	500.0	11.37	0.7	Piped to West Channel
A13,20	1T	A20	2.04	0.71	11.2	1.45	6.7	9.7				15.1	6.40	5.9	37.6	5.0	30.0				250.0	4.47	0.9	Street Flow to 1T
A7,13,20	1G	A7	4.33	0.72	11.7	3.13	6.6	20.6				15.4	9.53	5.8	55.6	5.0	37.6				60.0	4.47	0.2	Street Flow to 1G
A7,13,20	3	*(Not Relavent in 100 Year Storm)*														5.0	55.6				520.0	4.47	1.9	Street Flow to 1E
A19	1S	A19	2.09	0.72	10.8	1.51	6.8	10.3				10.8	1.51	6.8	10.3									
A5,7,13,19,20	1E	A5	2.04	0.71	11.2	1.45	6.7	9.7	1 @ 15' Type R Sump Inlet	42.1	26.7	17.3 17.3	7.65 12.48	5.5 5.5	42.1 68.7	1.5	10.3				225.0	2.45	1.5	Street Flow to 1E
A5,7,13,19,20	4											17.4	7.65	5.5	42.0			42.1	1.00	30.00	50.0	9.47	0.1	Piped to DP 4
A4,5,7,13,19,20	1D	A4	4.07	0.64	15.0	2.60	5.9	15.4	1 @ 15' Type R Sump Inlet	42.1	0.0	17.4	15.09	5.5	82.9			42.0	1.00	30.00	50.0	9.40	0.1	Piped to 1D
A4,5,7,8,13,19,20	1H	A8	2.86	0.73	11.0	2.08	6.8	14.1	1 @ 10' Type R Sump Inlet	14.1	0.0	17.5	17.17	5.5	94.1			82.9	1.00	42.00	40.0	11.67	0.1	Piped to 1H
A12	1L	A12	2.96	0.70	11.3	2.09	6.7	13.9				11.3	2.09	6.7	13.9			94.1	1.00	42.00	140.0	11.88	0.2	Piped to West Channel
A12, 21	1U	A21	3.02	0.73	10.7	2.20	6.9	15.0				12.2	4.28	6.5	27.7	1.5	13.9				130.0	2.45	0.9	Street Flow to 1U
A6,12, 21	1F	A6	4.96	0.65	14.3	3.20	6.0	19.3				14.3	7.48	6.0	45.2	1.5	27.7				90.0	2.45	0.6	Street Flow to 1F
A6,12,14,21	1N	A14	1.43	0.74	9.1	1.05	7.3	7.7	2 @ 10' Type R Sump Inlet	49.8	0.0	15.4	8.54	5.8	49.8	1.5	45.2				160.0	2.45	1.1	Street Flow to 1N
A15	1O	A15	7.15	0.61	17.1	4.33	5.5	24.0	1 @ 10' Type R Sump Inlet	24.0	0.0	17.1	4.33	5.5	24.0			49.8	1.00	36.00	150.0	10.33	0.2	Piped to West Channel
A9	1I	A9	3.44	0.72	12.7	2.47	6.4	15.7				12.7	2.47	6.4	15.7			24.0	1.00	24.00	100.0	8.12	0.2	Piped to 1J
A9,10,15	1J	A10	0.72	0.77	8.5	0.55	7.5	4.1	1 @ 10' Type R Sump Inlet	18.3	0.0	14.199 17.3	3.02 7.35	6.1 5.5	18.3 40.5	4.0	15.7				370.0	4.00	1.5	Street Flow to 1J
																		40.5	1.00	24.00	10.0	9.49	0.0	Piped to West Channel

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(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 100 Yr
100-Year P1 = 2.6 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
OS10	O10	OS10	5.37	0.49	13.4	2.63	6.2	16.4				13.4	2.63	6.2	16.4									
C1	3A	C1	7.47	0.68	16.5	5.11	5.6	28.8	1 @ 15' Type R Sump Inlet	28.8	0.0	16.5	7.74	5.6	43.6	2.0	16.4				30.0	2.83	0.2	Street Flow to 3A
B15	2O	B15	2.01	0.73	10.4	1.47	6.9	10.1				10.4	1.47	6.9	10.1			43.6	1.00	30.00	285.0	7.00	0.7	Piped to DP 19
B3	2C	B3	4.92	0.72	11.4	3.52	6.7	23.4				11.4	4.99	6.7	33.2	5.0	10.1				225.0	4.47	0.8	Street Flow to 2L
B3,12	2L	B12	2.53	0.90	7.7	2.28	7.8	17.7				12.3	7.27	6.5	46.9	5.0	33.2				225.0	4.47	0.8	Street Flow to 2C
B3,4,12	2D	B4	1.50	0.92	5.0	1.38	8.8	12.2				13.1	8.65	6.3	54.3	5.0	46.9				225.0	4.47	0.8	Street Flow to 2D
B2	2B	B2	3.13	0.72	10.3	2.26	7.0	15.7				10.3	2.26	7.0	15.7	3.5	54.3				1605.0	3.74	7.1	Street Flow to 2J
B1, B2	2A	B1	21.00	0.59	20.3	12.38	5.1	62.9	2 @ 15' Type R On-Grade Inlet	48.0	26.5	20.3 20.3	9.44 14.65	5.1 5.1	48.0 74.4	4.0	15.7				1230.0	4.00	5.1	Street Flow to 2A
B14	2N	B14	3.19	0.73	11.1	2.33	6.8	15.7				11.1	2.33	6.8	15.7			48.0	2.00	30.00	245.0	13.15	0.3	Piped to DP 5
B5, 14	*50% of carryover flow from 2A ~ 26.5/2 = 13.25 CFS* 2E	B5	3.19	0.73	11.1	2.33	6.8	15.7	2 @ 15' Type R On-Grade Inlet	34.8	6.8	14.0 14.0 20.6	5.71 4.65 15.15	6.1 6.1 5.0	34.8 28.4 76.4	2.0	15.7				500.0	2.83	2.9	Street Flow to 2E
B5,14	6	*(Not Relavent in 100 Year Storm)*																76.4	2.00	36.00	50.0	14.80	0.1	Piped to DP 5
B1,5,14,15	5											20.6	15.15	5.0	76.2									
B1,2,5,14,15,C1,OS10	19											21.6	22.89	4.9	112.3			76.2	2.00	36.00	900.0	14.78	1.0	Piped to DP 19
B13	2M	B13	3.19	0.73	11.1	2.33	6.8	15.7				11.1	2.33	6.8	15.7			112.3	2.00	42.00	385.0	14.78	0.4	Piped to DP 2J
B6, 13	*50% of carryover flow from 2A ~ 6.8/2 = 3.4 CFS* 2F	B6	3.19	0.73	11.1	2.33	6.8	15.7	2 @ 15' Type R On-Grade Inlet	29.1	2.7	14.0 14.0 14.0	4.77 4.65 4.77	6.1 6.1 6.1	29.1 28.4 29.1	2.0	15.7				500.0	2.83	2.9	Street Flow to 2F
B6	7	*(Not Relavent in 100 Year Storm)*																29.1	2.00	36.00	40.0	9.50	0.1	Piped to DP 7
B6,13	8											14.1	4.77	6.1	29.0									
B7	2G	B7	5.76	0.71	14.6	4.11	6.0	24.5				14.6	4.11	6.0	24.5			29.0	2.00	36.00	200.0	15.08	0.2	Piped to DP 9
B9	2I	B9	2.81	0.71	13.1	2.00	6.3	12.6	2 @ 15' Type R Sump Inlet	35.7	0.0	15.3	6.10	5.8	35.7	6.0	24.5				200.0	4.90	0.7	Street Flow to 2I
B8	*50% of carryover flow from 2F ~ 2.7/2 = 1.35 CFS* 2H	B8	4.93	0.70	12.9	3.45	6.3	21.8	2 @ 10' Type R Sump Inlet	23.2	0.0	12.9 12.9	3.67 3.45	6.3 6.3	23.2 21.8			35.7	0.50	36.00	50.0	7.31	0.1	Piped to DP 9
B6,7,8,9	9											15.4	14.54	5.8	84.8			23.2	0.50	30.00	50.0	6.55	0.1	Piped to DP 9
B6,7,8,9,13	10											15.5	14.54	5.8	84.6			84.8	1.00	48.00	40.0	13.00	0.1	Piped to DP 10
B3,4,12 B1,2,5,14,15,C1,OS10,B10	2J	B10	0.65	0.84	8.2	0.55	7.6	4.1	2 @ 10' Type R Sump Inlet	46.7	0.0	20.3 22.1	9.19 32.08	5.1 4.9	46.7 155.7			84.6	1.00	48.00	10.0	12.98	0.0	Piped to West Channel
B3,4,12 B1,2,5,14,15,C1,OS10,B10	18											22.1	32.08	4.8	155.6			155.7	1.00	54.00	30.0	14.03	0.0	Piped to 18
B3,4,12,11 B1,2,5,14,15,C1,OS10,B10	2K	B11	0.84	0.84	9.1	0.71	7.3	5.2	1 @ 5' Type R Sump Inlet	5.2	0.0	22.1	32.79	4.8	159.0			155.6	1.00	54.00	30.0	14.03	0.0	Piped to 2K
																		159.0	1.00	54.00	50.0	14.00	0.1	Piped to West Channel

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Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
D2	4B	D2	5.33	0.70	11.3	3.71	6.7	24.8				11.3	3.71	6.7	24.8									
D2, D10	4J	D10	4.80	0.72	10.8	3.44	6.8	23.5	2 @ 10' Type R Sump Inlet	45.7	0.0	12.6	7.15	6.4	45.7	6.00	24.8				375.0	4.90	1.3	Street Flow to 4J
D7	4G	D7	2.58	0.68	11.2	1.75	6.7	11.8	2 @ 10' Type R On-Grade Inlet	11.8	0.0	11.2	1.75	6.7	11.8			45.7	1.00	36.00	20.0	10.14	0.0	Piped to DP 11
D2,7,10	11											12.6	8.90	6.4	56.8			11.8	1.50	18.00	630.0	8.25	1.3	Piped to DP 11
D1,2,7,10	4A	D1	5.94	0.68	13.2	4.03	6.3	25.2	1 @ 10' Type R Sump Inlet	25.2	0.0	13.2	12.93	6.3	80.9			56.8	1.50	36.00	20.0	12.37	0.0	Piped to 4A
D8	4H	D8	0.85	0.72	9.7	0.61	7.1	4.4				9.7	0.61	7.1	4.4			80.9	1.50	36.00	30.0	13.13	0.0	Piped to Pond B
D12	4L	D12	1.13	0.88	11.8	0.99	6.6	6.5	2 @ 10' Type R On-Grade Inlet	2.9	0.0	13.3	1.61	6.2	10.0	5.00	4.4				980.0	4.47	3.7	Street Flow to 4F
D6,8,12	4F	D6	2.57	0.68	13.9	1.75	6.1	10.7	2 @ 15' Type R On-Grade Inlet	14.5	0.0	13.9	2.37	6.1	14.5			10.0	1.50	18.00	100.0	7.96	0.2	Piped to 4F
												13.9	3.97	6.1	24.3			24.3	0.50	30.00	200.0	6.64	0.5	Piped to Pond B
D3	4C	D3	3.66	0.69	14.3	2.51	6.0	15.1				14.3	2.51	6.0	15.1									
D3,4	4D	D4	2.91	0.68	15.2	1.97	5.9	11.6				15.2	4.48	5.9	26.3	5.0	15.1				40.0	4.47	0.1	Street Flow to 4D
D3,4,5	4E	D5	9.10	0.78	15.2	7.07	5.9	41.5	2 @ 10' Type R Sump Inlet	54.5	0.0	23.2	11.56	4.7	54.5	3.0	26.3				1668.0	3.46	8.0	Street Flow to 4E
D9	4I	D9	4.62	0.69	13.8	3.20	6.1	19.6	1 @ 10' Type R Sump Inlet	19.6	0.0	13.8	3.20	6.1	19.6			54.5	1.00	36.00	30.0	10.52	0.0	Piped to DP 2
D3,4,5,9	12											23.3	14.76	4.7	69.5			19.6	1.00	24.00	30.0	8.07	0.1	Piped to DP 2
D11	4K	D11	3.29	0.88	11.8	2.89	6.6	19.0	1 @ 10' Type R Sump Inlet	19.0	0.0	11.8	2.89	6.6	19.0			69.5	2.00	36.00	204.0	14.54	0.2	Piped to DP 3
D3,4,5,9,11	13											23.5	17.64	4.7	82.7			19.0	1.00	24.00	30.0	8.02	0.1	Piped to DP 3
																		82.7	2.00	36.00	2650.0	9.00	4.9	Piped to Pond D

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Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
E23	5W	E23	4.11	0.72	11.4	2.98	6.7	19.9				11.4	2.98	6.7	19.9									
																2.7	19.9				250.0	3.29	1.3	Street Flow to 5V
E22, 23	5V	E22	4.41	0.73	10.9	3.22	6.8	21.9				12.7	6.20	6.4	39.5									
																2.7	39.5				200.0	3.29	1.0	Street Flow to 5A
E1,22,23	5A	E1	4.04	0.73	10.7	2.94	6.9	20.2				13.7	9.15	6.2	56.3									
																2.7	56.3				570.0	3.29	2.9	Street Flow to 5C
E1,3, 22,23	5C	E3	4.77	0.72	11.4	3.45	6.7	23.1				16.6	12.60	5.6	70.9									
																2.7	70.9				270.0	3.29	1.4	Street Flow to 5D
E1,3,4, 22,23	5D	E4	3.20	0.69	11.3	2.19	6.7	14.7				18.0	14.79	5.4	80.0									
																1.0	80.0				956.0	2.00	8.0	Street Flow to 5E
E18	5R	E18	2.72	0.73	9.9	1.98	7.1	14.0				9.9	1.98	7.1	14.0									
																1.0	14.0				30.0	2.00	0.3	Street Flow to 5E
E1,3,4,5,18,22,23	5E	E5	2.76	0.73	13.7	2.02	6.2	12.4	2 @ 15' Type R Sump Inlet	83.4	0.0	25.9	18.79	4.4	83.4									
																		83.4	0.50	48.00	30.0	9.00	0.1	Piped to Pond C
E26	5Z	E26	2.88	0.76	9.3	2.20	7.2	15.9				9.3	2.20	7.2	15.9									
																3.5	15.9				220.0	3.74	1.0	Street Flow to 5Y
E25, 26	5Y	E25	3.62	0.73	9.5	2.64	7.2	18.9				10.3	4.84	6.9	33.6									
																3.5	33.6				220.0	3.74	1.0	Street Flow to 5N
E14,25,26	5N	E14	5.58	0.75	11.9	4.16	6.6	27.3	2 @ 15' Type R Sump Inlet	59.0	0.0	11.9	9.00	6.6	59.0									
																		59.0	0.50	42.00	2400.0	8.22	4.9	Piped to DP 14
E24	5X	E24	4.23	0.62	14.2	2.62	6.1	15.9				14.2	2.62	6.1	15.9									
																6.0	15.9				150.0	4.90	0.5	Street Flow to 5L
E12,24	5L	E12	3.28	0.62	14.2	2.04	6.1	12.3				14.7	4.66	6.0	27.7									
																6.0	27.7				50.0	4.90	0.2	Street Flow to 5P
E11	5K	E11	3.99	0.62	14.2	2.47	6.0	15.0				14.2	2.47	6.0	15.0									
																1.0	15.0				10.0	2.00	0.1	Overland to 5P
E11,12,14,16,24,25,26	5P	E16	1.57	0.83	10.7	1.30	6.8	8.9				14.9	8.43	5.9	49.9									
																1.0	49.9				340.0	2.00	2.8	Street Flow to 5S
E6	5F	E6	2.63	0.73	12.4	1.92	6.4	12.3				12.4	1.92	6.4	12.3									
																1.0	12.3				50.0	2.00	0.4	Street Flow to 5S
E6,11,12,14,16,24,25,26,19	5S	E19	2.91	0.73	10.9	2.12	6.8	14.5				17.7	12.47	5.4	67.9									
																1.0	67.9				288.0	2.00	2.4	Street Flow to 5H
E21	5U	E21	2.05	0.74	11.1	1.51	6.7	10.2				11.1	1.51	6.7	10.2									
																1.0	10.2				50.0	2.00	0.4	Street Flow to 5H
E6,8,11,12,14,16,21,24,25,26,19	5H	E8	2.68	0.73	12.3	1.95	6.5	12.6				20.1	15.94	5.1	81.3									
																1.0	81.3				660.0	2.00	5.5	Street Flow to DP 14
E9	5I	E9	4.84	0.66	14.2	3.22	6.1	19.5				14.2	3.22	6.1	19.5									
																1.0	19.5				30.0	2.00	0.3	Street Flow to DP 14
E10	5J	E10	0.70	0.74	12.7	0.52	6.4	3.3				12.7	0.52	6.4	3.3									
																1.0	3.3				300.0	2.00	2.5	Street Flow to DP 14
E6,8,10,11,12,14,16,21,24,9,19 E25,26	14											25.6	28.68	4.5	128.2									
																1.0	128.2				230.0	2.00	1.9	Street Flow to 5G
E15	5O	E15	1.89	0.72	13.2	1.37	6.3	8.6				13.2	1.37	6.3	8.6									
																1.0	8.6				500.0	2.00	4.2	Street Flow to 5G
E20	5T	E20	2.75	0.73	13.2	2.01	6.2	12.6				13.2	2.01	6.2	12.6									
									2 @ 15' Type R			17.3	5.38	5.5	29.6	2.0	12.6				10.0	2.83	0.1	Street Flow to 5G
E7,15,20	5G	E7	2.77	0.72	11.8	2.01	6.6	13.2	Sump Inlet	86.1	21.4	27.5	34.06	4.3	146.1									
																		146.1	0.50	48.00	30.0	9.11	0.1	Piped to Pond C
E1,3-10,11,12,14-16,18-26	15											27.6	34.06	4.3	145.9									
						21.4 CFS from 5G						20.3	4.21	5.1	21.4			145.9	0.50	60.00	280.0	10.66	0.4	Piped to Pond C
E1-12,14-16,18-26	5B	E2	5.27	0.72	20.3	3.81	5.1	19.4	1 @ 15' Type R Sump Inlet	40.8	0.0	20.3	8.03	5.1	40.8									
																		40.8	0.60	60.00	30.0	11.70	0.0	Piped to Pond C

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 100 Yr
100-Year P1 = 2.6 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
F12	6L	F12	1.22	0.93	5.1	1.13	8.8	9.9				5.1	1.13	8.8	9.9									
																1.0	9.9				50.0	2.00	0.4	Street Flow to 6B
F2	6B	F2	1.77	0.93	5.0	1.65	8.8	14.5				5.5	2.78	8.6	23.9									
																1.0	23.9				130.0	2.00	1.1	Street Flow to 6K
F2,11,12	6K	F11	1.50	0.92	5.3	1.39	8.7	12.0				6.6	4.17	8.2	34.0									
																1.0	34.0				100.0	2.00	0.8	Street Flow to 6J
F2,10,11,12	6J	F10	1.93	0.93	5.2	1.79	8.7	15.6				7.4	5.96	7.9	46.8									
																1.0	46.8				100.0	2.00	0.8	Street Flow to 6A
F1,2,10,11,12	6A	F1	1.71	0.91	5.2	1.55	8.7	13.5				8.2	7.51	7.6	56.9									
																1.0	56.9				80.0	2.00	0.7	Street Flow to DP 16
F1,2,10,11,12	16											8.9	7.51	7.4	55.3									
																1.0	55.3				1025.0	2.00	8.5	Street Flow to 6E
F4	6D	F4	3.79	0.73	11.3	2.76	6.7	18.5				11.3	2.76	6.7	18.5									
																1.0	18.5				50.0	2.00	0.4	Street Flow to 6M
F4,13	6M	F13	3.58	0.73	10.9	2.60	6.8	17.7				11.7	5.36	6.6	35.4									
																1.0	35.4				50.0	2.00	0.4	Street Flow to 6C
F3,4,13	6C	F3	3.60	0.57	14.3	2.06	6.0	12.5				14.3	7.42	6.0	44.9									
																1.0	44.9				200.0	2.00	1.7	Street Flow to DP 17
F1,2,5,10,11,12	6E	F5	4.58	0.70	13.8	3.20	6.1	19.7				17.4	10.72	5.5	58.8									
																1.0	58.8				100.0	2.00	0.8	Street Flow to DP 17
F1,2,3,4,5,10,11,12,13	17											18.3	18.14	5.4	97.2									
									4 @ 15' Type R			18.3	3.49	5.4	18.7	5.0	97.2				952.0	4.47	3.5	Street Flow to 6Ia
F1,2,3,4,5,10,11,12,13	6Ia								On-Grade Inlets	78.5	18.7	18.3	14.65	5.4	78.5	3.0	18.72				270.0	3.46	1.3	Street Flow to 6I & 6G
						9.35 CFS from 6Ia			1 @ 10' Type R									78.5	0.50	48.00	100.0	9.10	0.2	Piped to Pond D
F7	6G	F7	4.51	0.57	14.3	2.55	6.0	15.4	Sump Inlet	22.2	0.0	19.6	4.30	5.2	22.2									
						9.35 CFS from 6Ia			1 @ 10' Type R									22.2	0.50	36.00	50.0	9.10	0.1	Piped to 6I
F1,2,3,4,5,9,10,11,12,13	6I	F9	1.28	0.79	14.0	1.02	6.1	6.2	Sump Inlet	15.5	0.0	19.7	7.06	5.2	36.4									
																		36.4	0.50	36.00	100.0	9.10	0.2	Piped to Pond D
E13	5M	E13	4.45	0.62	14.2	2.76	6.0	16.7				14.2	2.76	6.0	16.7									
																1.0	16.7				70.0	2.00	0.6	Street Flow to 5Q
E17	5Q	E17	1.55	0.83	10.7	1.28	6.8	8.8				14.8	4.04	5.9	24.0									
									1 @ 15' Type R			16.8	9.15	5.6	51.1			24.0	0.50	30.00	780.0	6.60	2.0	Piped/Overland Flow to 6H
F8	6H	F8	7.93	0.64	15.0	5.11	5.9	30.2	Sump Inlet	42.1	9.0	16.8	7.53	5.6	42.1									
						9CFS from 6H			1 @ 10' Type R									42.1	0.50	36.00	30.0	7.60	0.1	Piped to 6F
F6	6F	F6	4.93	0.66	15.8	3.25	5.8	18.7	Sump Inlet	27.8	0.0	16.9	12.40	5.6	69.2									
																		69.2	0.50	42.00	102.0	8.40	0.2	Piped to Pond C

POND RELEASE RATES

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 5/9/2017

POND A

Area (a)	151.23	acres			
Slope	3.4	%			
L^2 / Area	5.03				
Unit Discharge @ 3% Slope for Type B Soil	1.24	/acre	Unit Discharge @ 3% Slope for Type C/D Soil	1.35	/acre
Unit Discharge @ 4% Slope for Type B Soil	1.31	/acre	Unit Discharge @ 4% Slope for Type C/D Soil	1.42	/acre
Interpolated Unit Discharge	1.25	/acre	Interpolated Unit Discharge	1.36	/acre
Total Interpolated Unit Discharge	1.30				
Release Rate	177.21	CFS			

POND B

Area (a)	22.49	acres			
Slope	5.7	%			
L^2 / Area	2.34				
Unit Discharge > 4% Slope for Type B Soil	1.45	/acre	Unit Discharge > 4% Slope for Type C/D Soil	1.57	/acre
Total Interpolated Unit Discharge	1.51				
Release Rate	30.56	CFS			

POND C:

Area (a)	97.79	acres			
Slope	2.8	%			
L^2 / Area	2.53				
Unit Discharge @ 2% Slope for Type B Soil	1.16	/acre	Unit Discharge @ 2% Slope for Type C/D Soil	1.26	/acre
Unit Discharge @ 3% Slope for Type B Soil	1.24	/acre	Unit Discharge @ 3% Slope for Type C/D Soil	1.35	/acre
Interpolated Unit Discharge	1.22	/acre	Interpolated Unit Discharge	1.33	/acre
Total Interpolated Unit Discharge	1.28				
Release Rate	107.73	CFS			

POND D:

Area (a)	53.04	acres			
Slope	2.8	%			
L^2 / Area	4.29				
Unit Discharge @ 2% Slope for Type B Soil	1.16	/acre	Unit Discharge @ 2% Slope for Type C/D Soil	1.26	/acre
Unit Discharge @ 3% Slope for Type B Soil	1.24	/acre	Unit Discharge @ 3% Slope for Type C/D Soil	1.35	/acre
Interpolated Unit Discharge	1.22	/acre	Interpolated Unit Discharge	1.33	/acre
Total Interpolated Unit Discharge	1.28				
Release Rate	58.42	CFS			

POND A	
Description	
Drainage Area (FT)	151.23
Percent Imperviousness (%)	40.74
WQCV (AC-FT)	2.29
EURV Volume (including WQVC) (AC-FT)	6.11
EURV Water Surface (FT)	5995.27
100-YR Volume (including EURV) (AC-FT)	11.18
100-yar water surface elevation (FT)	5997.18
Emergency Spillway Crest Elevation (FT)	5997.18
100-year Peak Inflow (CFS)	268.86
100-year Peak Outflow (CFS)	177.21
POND B	
Description	
Drainage Area (FT)	23.2
Percent Imperviousness (%)	47.36
WQCV (AC-FT)	0.39
EURV Volume (including WQVC) (AC-FT)	1.10
EURV Water Surface (FT)	6092.92
100-YR Volume (including EURV) (AC-FT)	2.18
100-yar water surface elevation (FT)	6094.48
Emergency Spillway Crest Elevation (FT)	6094.48
100-year Peak Inflow (CFS)	105.30
100-year Peak Outflow (CFS)	30.56
POND C	
Description	
Drainage Area (FT)	97.79
Percent Imperviousness (%)	45.93
WQCV (AC-FT)	1.60
EURV Volume (including WQVC) (AC-FT)	4.49
EURV Water Surface (FT)	5973.31
100-YR Volume (including EURV) (AC-FT)	8.68
100-yar water surface elevation (FT)	5978.27
Emergency Spillway Crest Elevation (FT)	5978.27
100-year Peak Inflow (CFS)	314.00
100-year Peak Outflow (CFS)	106.71
POND D	
Description	
Drainage Area (FT)	52.76
Percent Imperviousness (%)	55.15
WQCV (AC-FT)	0.97
EURV Volume (including WQVC) (AC-FT)	2.954
EURV Water Surface (FT)	5991.65
100-YR Volume (including EURV) (AC-FT)	4.96
100-yar water surface elevation (FT)	5993.55
Emergency Spillway Crest Elevation (FT)	5993.55
100-year Peak Inflow (CFS)	184.40
100-year Peak Outflow (CFS)	58.28

RIPRAP RUNDOWN

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

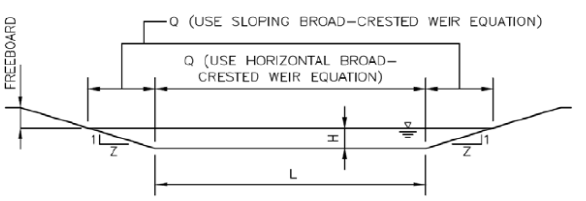
Overflow Riprap Pond A

Inputs:

Q Overflow =	269.0	CFS
H=	0.82	FT
Z =	2.5	
C =	3.0	
L =	107.9	FT

Output:

Q Horizontal =	265.3	CFS
Q Sloping =	3.7	CFS
Q Total =	269.0	CFS
RipRap =	Type M	
D50 =	12	INCH
Riprap Thickness =	24.0	INCH



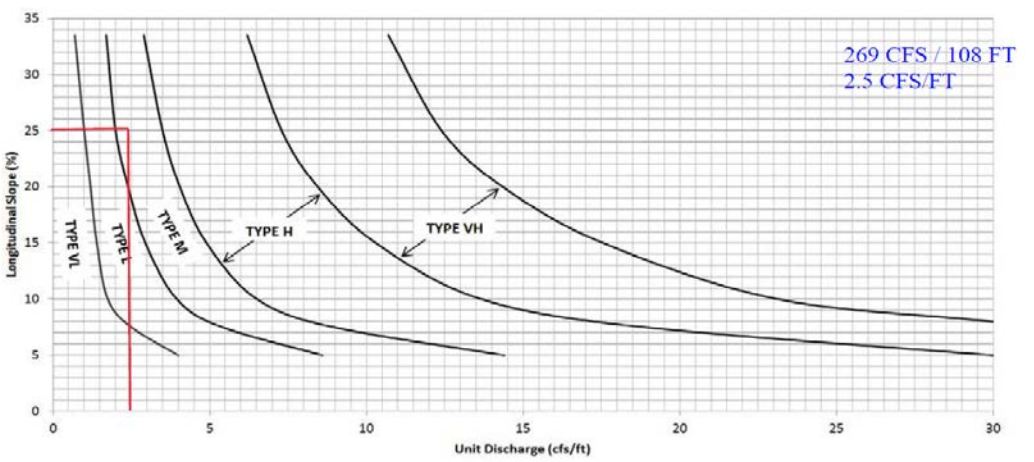
Horizontal Broad-Crested Weir:

$$Q = C_{BCW} L H^{1.5}$$

Sloping Broad-Crested Weir:

$$Q = \left(\frac{2}{5}\right) C_{BCW} Z H^{2.5}$$

Figure 12-20. Sloping broad-crest weir



Overflow Riprap Pond B

Inputs:

Q Overflow =	105.3	CFS
H=	0.43	FT
Z =	2.5	
C =	3.0	
L =	81.1	FT

Output:

Q Horizontal =	104.6	CFS
Q Sloping =	0.7	CFS
Q Total =	105.3	CFS
RipRap =	Type L	
D50 =	9	INCH
Riprap Thickness =	18.0	INCH

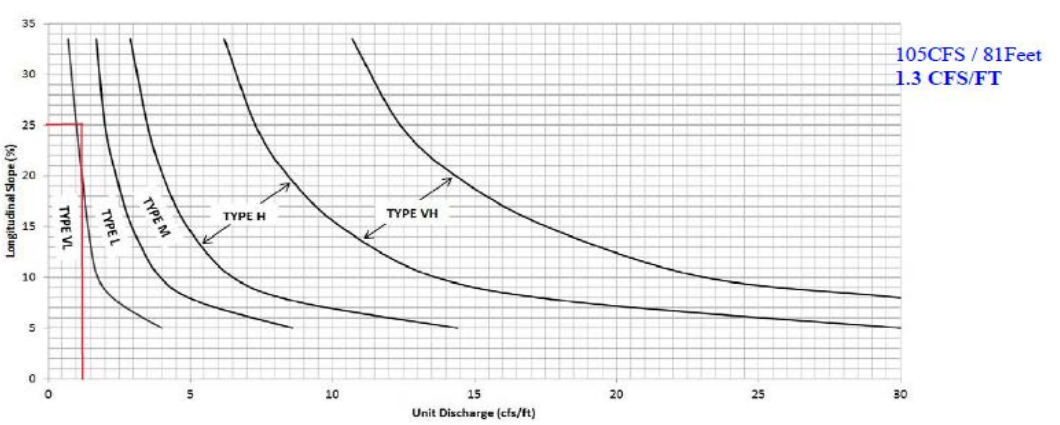


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

RIPRAP RUNDOWN

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Overflow Riprap Pond A

Overflow Riprap Pond C

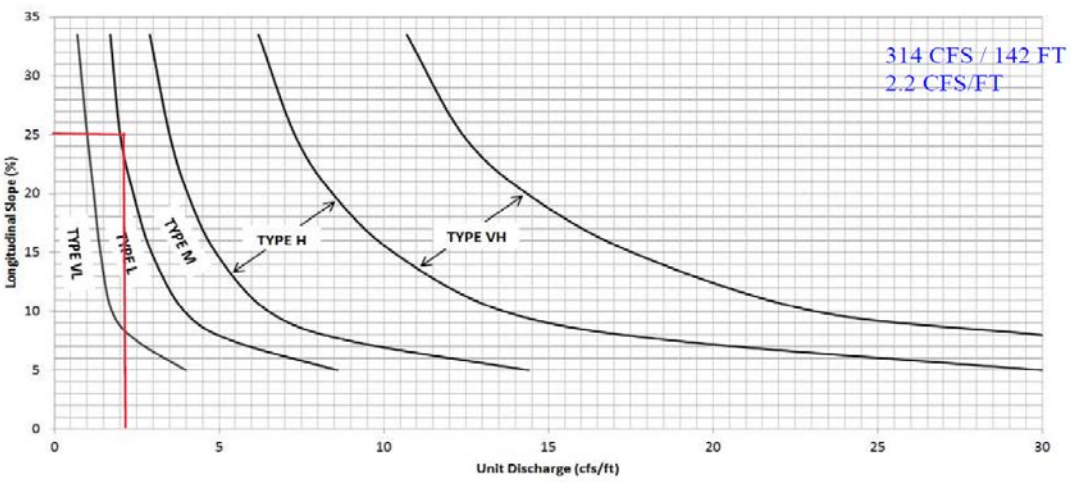
Inputs:

Q Overflow =	314.0	CFS
H=	0.73	FT
Z =	2.5	
C =	3.0	
L =	142.1	FT

Output:

Q Horizontal =	311.3	CFS
Q Sloping =	2.7	CFS
Q Total =	314.0	CFS

RipRap =	Type M	
D50 =	12	INCH
Riprap Thickness =	24.0	INCH



Overflow Riprap Pond D

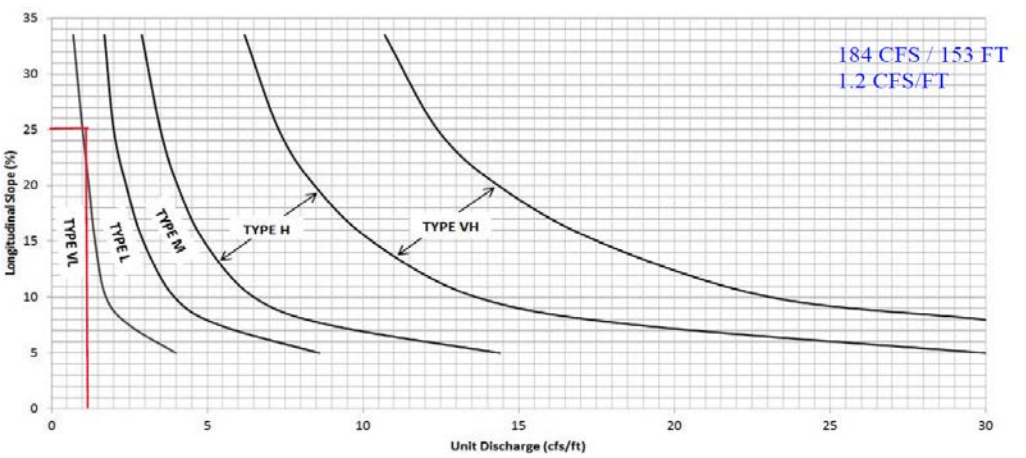
Inputs:

Q Overflow =	184.4	CFS
H=	0.40	FT
Z =	2.5	
C =	3.0	
L =	153.2	FT

Output:

Q Horizontal =	183.8	CFS
Q Sloping =	0.6	CFS
Q Total =	184.4	CFS

RipRap =	Type L	
D50 =	9	INCH
Riprap Thickness =	18.0	INCH



POND A

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Pond A

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
11.18	6.11	2.29	177.2

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1⁄3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
5991	5780.00	0	0	0	0	0	0
5992	36261	56,518	18,839	1	18,839	18,839	0.43
5993	69342	155,747	51,916	1	51,916	70,755	1.62
5994	83939	229,573	76,524	1	76,524	147,279	3.38
5995	97157	271,402	90,467	1	90,467	237,747	5.46
5996	112127	313,658	104,553	1	104,553	342,300	7.86
5997	129346	361,902	120,634	1	120,634	462,934	10.63
5998	139612	403,339	134,446	1	134,446	597,380	13.71
5999	149656	433,815	144,605	1	144,605	741,985	17.03

WQ ELEV	5993.38	FT	**WQ VOLUME**	2.29	AC-FT
EURV ELEV	5995.27	FT	**EURV VOLUME**	6.11	AC-FT
100YEAR ELEV	5997.18	FT	**100YEAR VOLUME**	11.18	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Pond A

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT^3)	(FT)
2.29	299.26	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1⁄3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
5991	542.00	0	0	0	0	0	0
5991.5	726	1,895	632	0.5	316	316	0.01

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Pond A**

Facility Location & Jurisdiction: **Trails at Crowfoot**

User Input: Watershed Characteristics

Watershed Slope =	0.031	ft/ft
Watershed Length =	5730	ft
Watershed Area =	151.23	acres
Watershed Imperviousness =	40.7%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent

Location for 1-hr Rainfall Depths (use dropdown):

Parker - Town Hall

WQCV Treatment Method =

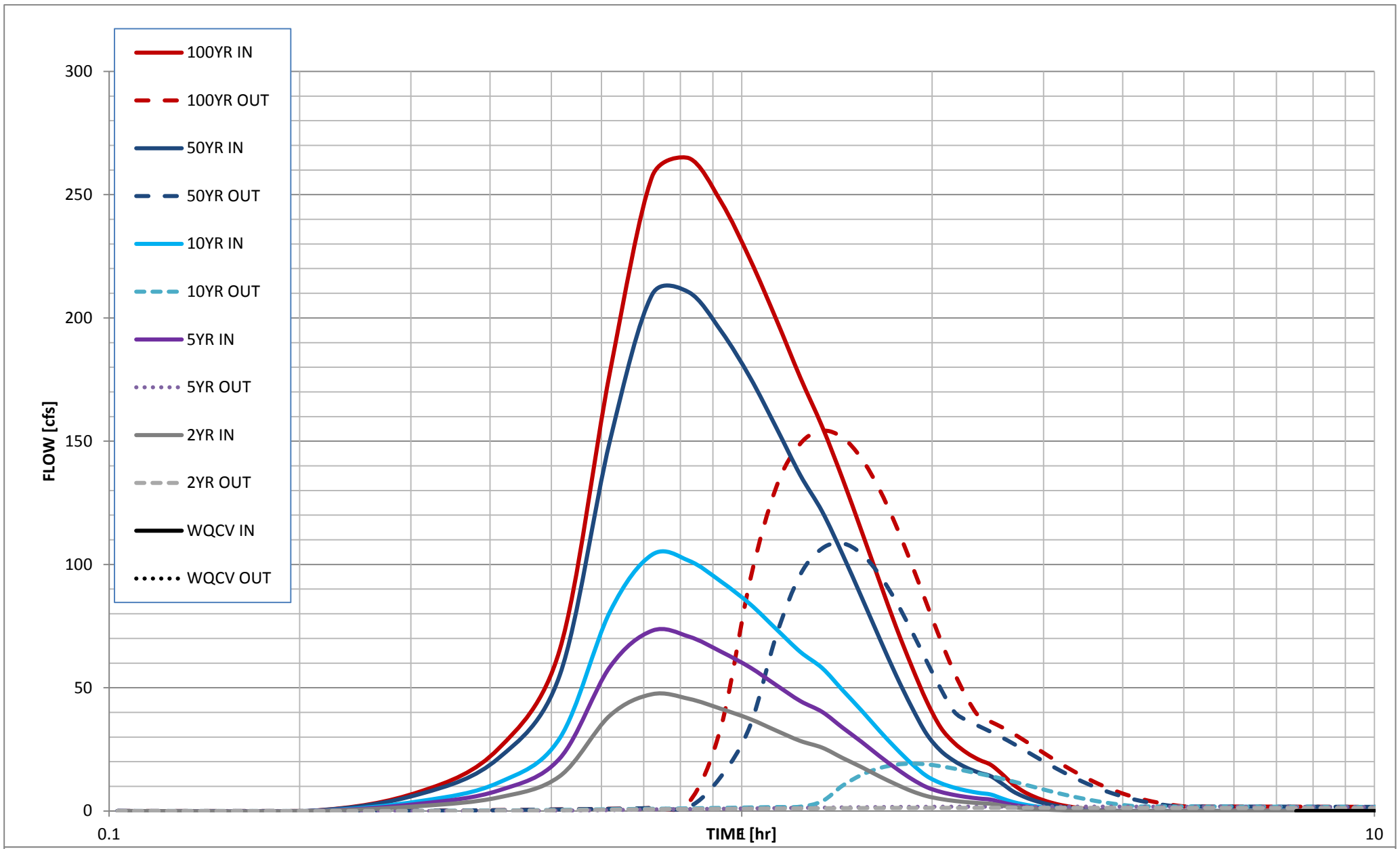
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	5,780	0.00	0.00
1.00	36,261	1.00	0.64
2.00	69,342	2.00	0.92
3.00	83,939	3.00	1.31
4.00	97,157	4.00	1.84
5.00	112,127	5.00	38.60
6.00	129,346	6.00	164.06
7.00	139,612	7.00	211.81
8.00	149,656	8.00	250.61
9.00	159,643	9.00	284.17

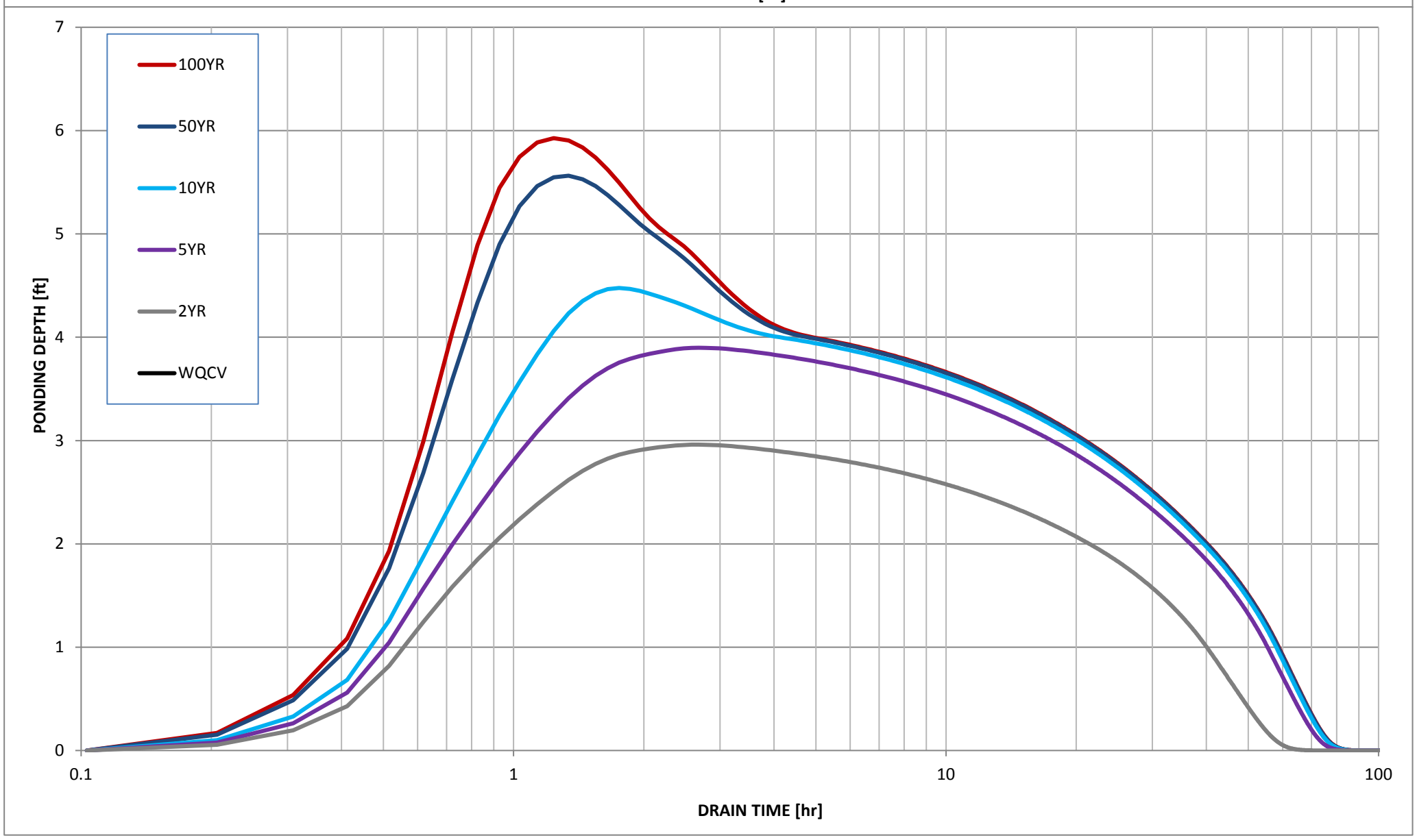
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	0.82	1.10	1.34	1.98	2.29	in
Calculated Runoff Volume =		3.609	5.631	8.075	16.698	21.301	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =		3.609	5.622	8.069	16.689	21.300	acre-ft
Time to Drain 97% of Inflow Volume =		50.4	**63.2**	63.5	58.4	56.0	hours
Time to Drain 99% of Inflow Volume =		55.2	68.8	69.8	66.6	**65.2**	hours
Maximum Ponding Depth =		2.96	3.90	4.48	5.56	5.93	ft
Maximum Ponded Area =		1.91	2.20	2.39	2.79	**2.94**	acres
Maximum Volume Stored =		3.364	5.289	6.609	9.427	10.461	acre-ft

Stormwater Detention and Infiltration Design Data Sheet

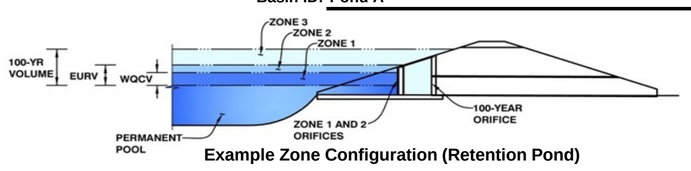




DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Trails at Crowfoot

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	151.23	acres		
Watershed Length =	5,730	ft		
Watershed Slope =	0.031	ft/ft		
Watershed Imperviousness =	40.74%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	49.8%	percent		
Percentage Hydrologic Soil Groups C/D =	50.2%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Parker - Parker Town Court			
Water Quality Capture Volume (WQCV) =	2.291	acre-feet	Optional User Input 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	6.105	acre-feet		
2-yr Runoff Volume (P1 = 0.96 in.) =	4.410	acre-feet		inches
5-yr Runoff Volume (P1 = 1.4 in.) =	8.565	acre-feet		inches
10-yr Runoff Volume (P1 = 1.65 in.) =	11.601	acre-feet		inches
25-yr Runoff Volume (P1 = 1.98 in.) =	16.615	acre-feet		inches
50-yr Runoff Volume (P1 = 2.3 in.) =	20.678	acre-feet		inches
100-yr Runoff Volume (P1 = 2.61 in.) =	25.264	acre-feet		inches
500-yr Runoff Volume (P1 = 3.25 in.) =	33.989	acre-feet		inches
Approximate 2-yr Detention Volume =	4.163	acre-feet		
Approximate 5-yr Detention Volume =	7.087	acre-feet		
Approximate 10-yr Detention Volume =	7.810	acre-feet		
Approximate 25-yr Detention Volume =	8.905	acre-feet		
Approximate 50-yr Detention Volume =	10.767	acre-feet		
Approximate 100-yr Detention Volume =	13.496	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	2.291	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.814	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	7.391	acre-feet
Total Detention Basin Volume =	13.496	acre-feet
Initial Surcharge Volume (ISV) =	299	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool									

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond A**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 40.8 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.408
C) Contributing Watershed Area	Area = 151.230 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 2.291 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

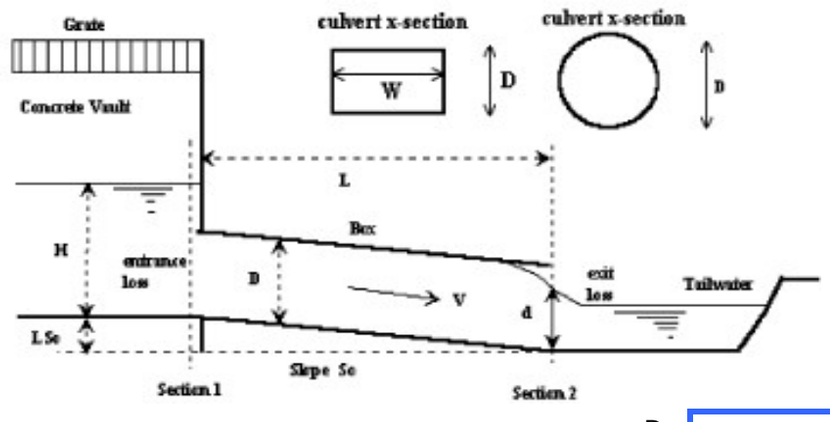
Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond A**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.069 ac-ft
B) Actual Forebay Volume	V_F = 0.069 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 24.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 269.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 5.38 cfs
E) Forebay Discharge Design	Choose One ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 11.7 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One ○ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond A (Q_{100} = 177.2)
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =		inches
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Beveled Edge	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =	4.00	ft.
	Barrel Width (Span) in Feet	Width (Span) =	4.00	ft.
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Bevel w/ 90 Deg. Headwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	5989.33	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Slope =	0.0218	ft vert. / ft horiz.
	Culvert Length in Feet	L =	124	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.61
Sum of All Loss Coefficients	K_s =	1.81
Orifice Inlet Condition Coefficient	C_d =	1.03
Minimum Energy Condition Coefficient	KE_{low} =	0.0026

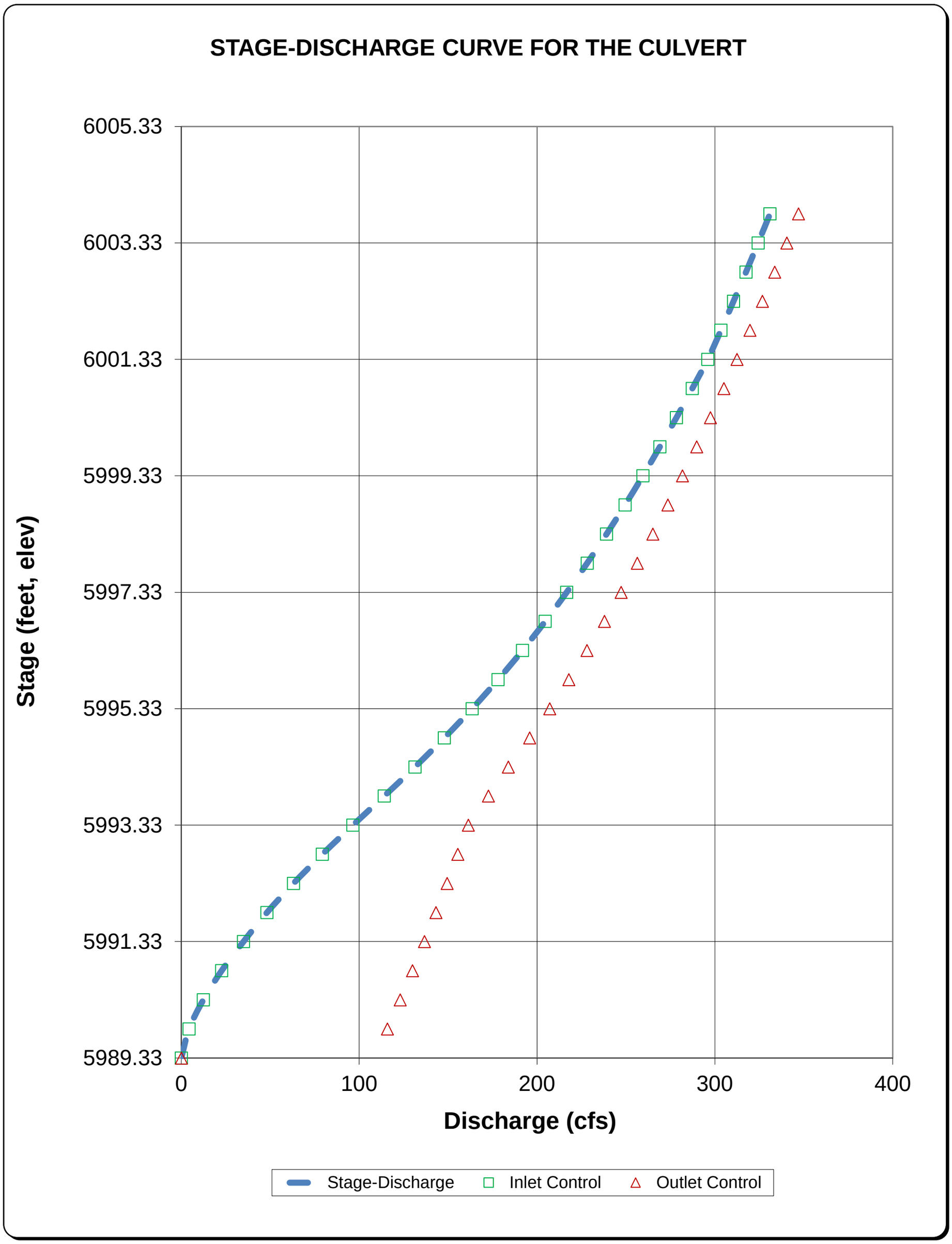
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
5989.33	5987.96	0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
5989.83	5987.96	4.40	115.85	**4.40**	Min. Energy. Eqn.	INLET
5990.33	5987.96	12.40	123.06	**12.40**	Min. Energy. Eqn.	INLET
5990.83	5987.96	22.70	130.00	**22.70**	Min. Energy. Eqn.	INLET
5991.33	5987.96	35.00	136.69	**35.00**	Min. Energy. Eqn.	INLET
5991.83	5987.96	48.20	143.15	**48.20**	Regression Eqn.	INLET
5992.33	5987.96	63.10	149.40	**63.10**	Regression Eqn.	INLET
5992.83	5987.96	79.30	155.47	**79.30**	Regression Eqn.	INLET
5993.33	5987.96	96.50	161.36	**96.50**	Regression Eqn.	INLET
5993.83	5987.96	114.10	172.68	**114.10**	Regression Eqn.	INLET
5994.33	5987.96	131.40	183.79	**131.40**	Regression Eqn.	INLET
5994.83	5987.96	147.90	195.80	**147.90**	Regression Eqn.	INLET
5995.33	5987.96	163.50	207.12	**163.50**	Regression Eqn.	INLET
5995.83	5987.96	178.10	217.85	**178.10**	Regression Eqn.	INLET
5996.33	5987.96	191.80	228.07	**191.80**	Regression Eqn.	INLET
5996.83	5987.96	204.60	237.86	**204.60**	Regression Eqn.	INLET
5997.33	5987.96	216.70	247.26	**216.70**	Regression Eqn.	INLET
5997.83	5987.96	228.20	256.32	**228.20**	Regression Eqn.	INLET
5998.33	5987.96	239.10	265.07	**239.10**	Regression Eqn.	INLET
5998.83	5987.96	249.50	273.53	**249.50**	Regression Eqn.	INLET
5999.33	5987.96	259.50	281.74	**259.50**	Regression Eqn.	INLET
5999.83	5987.96	269.10	289.72	**269.10**	Regression Eqn.	INLET
6000.33	5987.96	278.40	297.50	**278.40**	Regression Eqn.	INLET
6000.83	5987.96	287.30	305.06	**287.30**	Regression Eqn.	INLET
6001.33	5987.96	296.00	312.45	**296.00**	Regression Eqn.	INLET
6001.83	5987.96	303.40	319.66	**303.40**	Orifice Eqn.	INLET
6002.33	5987.96	310.50	326.72	**310.50**	Orifice Eqn.	INLET
6002.83	5987.96	317.50	333.63	**317.50**	Orifice Eqn.	INLET
6003.33	5987.96	324.30	340.40	**324.30**	Orifice Eqn.	INLET
6003.83	5987.96	331.00	347.02	**331.00**	Orifice Eqn.	INLET

Processing Time: 00.67 Seconds

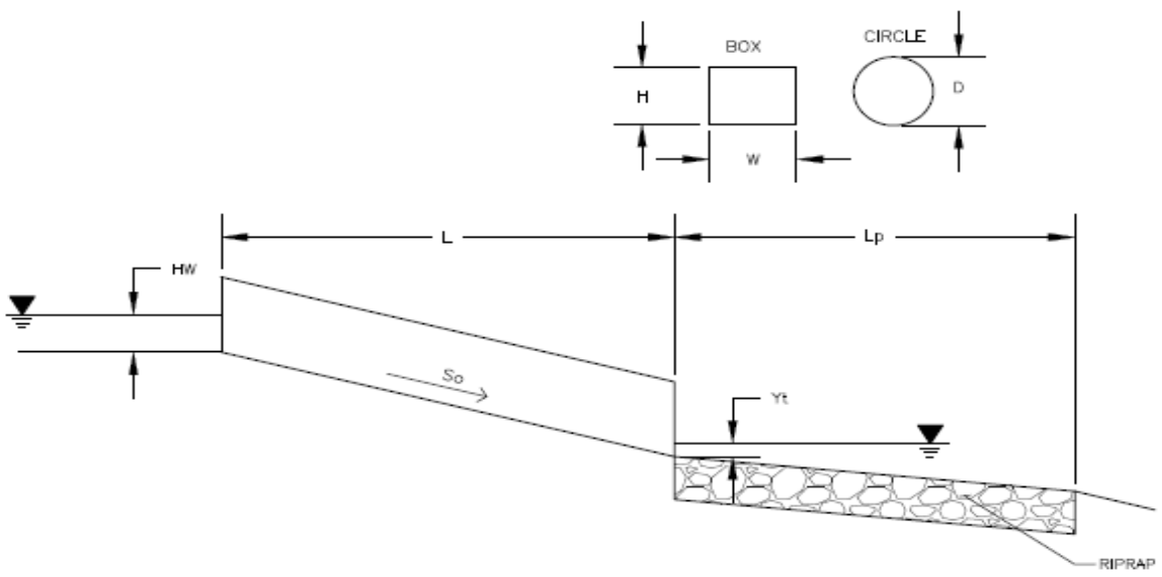
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond A (Q100 = 177.2)



Determination of Culvert Headwater and Outlet Protection

Project: TRAILS AT CROWFOOT
Basin ID: POND A OUTFALL (Q100 =177.21)



Soil Type:
Choose One:
○ Sandy
◉ Non-Sandy

Supercritical Flow! Using Ha to calculate protection type.

Design Information (Input):

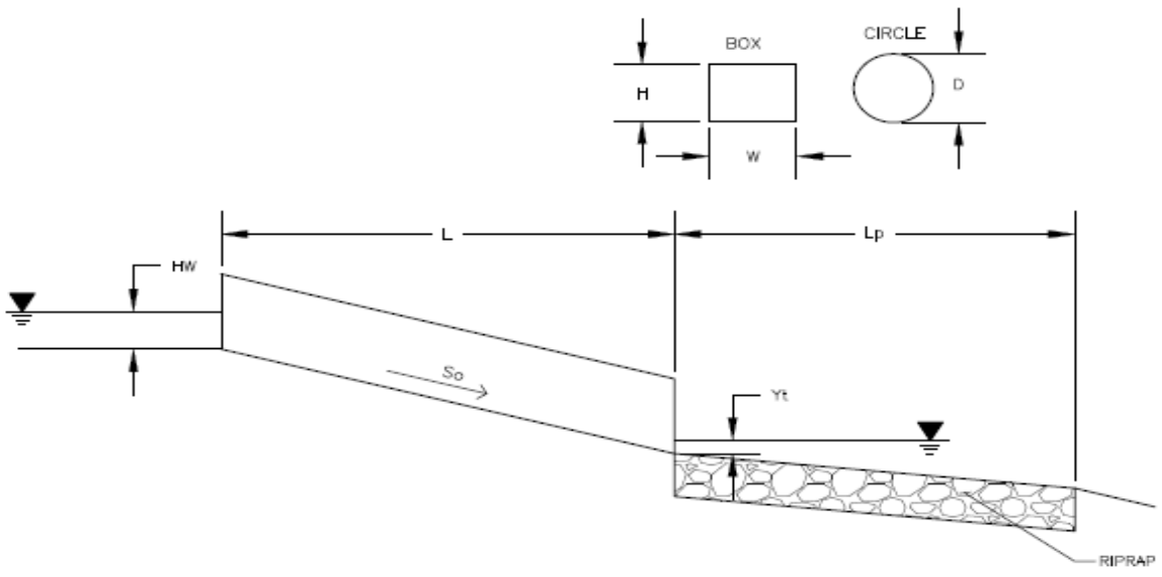
Design Discharge	Q =	177.21	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =		inches
Inlet Edge Type (Choose from pull-down list)			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =	4	ft
Barrel Width (Span) in Feet	Width (Span) =	4	ft
Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Bevel w/ 90 Deg. Headwall	
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	5989.33	ft
Outlet Elevation **OR** Slope	So =	0.218	ft/ft
Culvert Length	L =	123	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.60	ft
Flow Area at Max Channel Velocity	A_t =	25.32	ft^2
Culvert Cross Sectional Area Available	A =	16.00	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.60	
Sum of All Losses Coefficients	k_s =	1.80	ft
Culvert Normal Depth	Y_n =	1.06	ft
Culvert Critical Depth	Y_c =	3.94	ft
Tailwater Depth for Design	d =	3.97	ft
Adjusted Diameter **OR** Adjusted Rise	H_a =	2.53	ft
Expansion Factor	1/(2*tan(Θ)) =	3.91	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/WH^1.5 =	5.54	$ft^{0.5}/s$
Froude Number	Fr =	7.17	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/H =	0.63	
Inlet Control Headwater	HW_I =	6.08	ft
Outlet Control Headwater	HW_O =	-19.41	
Design Headwater Elevation	**HW =**	**5,995.41**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/H =**	**1.52**	**HW/H > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	7	in
Nominal Riprap Size	d_{50} =	9	in
UDFCD Riprap Type	**Type =**	**L**	
Length of Protection	**L_p =**	**40**	**ft**
Width of Protection	**T =**	**15**	**ft**

Determination of Culvert Headwater and Outlet Protection

Project: TRAILS AT CROWFOOT
Basin ID: POND A OUTFALL (Q100 =5892 CFS)



Soil Type:
Choose One:
○ Sandy
◉ Non-Sandy

Design Information (Input):

Design Discharge	Q =	5892	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =		inches
Inlet Edge Type (Choose from pull-down list)			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =	4	ft
Barrel Width (Span) in Feet	Width (Span) =	4	ft
Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Bevel w/ 90 Deg. Headwall	
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	5989.33	ft
Outlet Elevation **OR** Slope	So =	0.218	ft/ft
Culvert Length	L =	123	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.60	ft
Flow Area at Max Channel Velocity	A_t =	841.71	ft^2
Culvert Cross Sectional Area Available	A =	16.00	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.60	
Sum of All Losses Coefficients	k_s =	1.80	ft
Culvert Normal Depth	Y_n =	18.56	ft
Culvert Critical Depth	Y_c =	4.00	ft
Tailwater Depth for Design	d =	4.00	ft
Adjusted Diameter **OR** Adjusted Rise	H_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	1.00	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/WH^1.5 =	184.13	$ft^{0.5}/s$
Froude Number	Fr =	-	**Pressure flow!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/H =	0.40	
Inlet Control Headwater	HW_I =	3,792.98	ft
Outlet Control Headwater	HW_O =	3,773.74	
Design Headwater Elevation	**HW =**	**9,782.31**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/H =**	**948.25**	**HW/H > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	309	in
Nominal Riprap Size	d_{50} =	-	in
UDFCD Riprap Type	**Type =**	**Very Big**	
Length of Protection	**L_p =**	**217**	**ft**
Width of Protection	**T =**	**221**	**ft**

POND GRATE SIZING

Subdivision: Filing No 1

Project Name: Trails at Crowfoot
Project No. 283701
Calculated By: AYK

Pond A Stage-Discharge-Volume-Drain Time Table (Grate)

	STAGE		WEIR / ORIFICE RELEASE RATES												VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	WQ Weir 1	EURV Orifice 1	EURV Weir 1	EURV Orifice 2	EURV Weir 2	100-yr Orifice	100-yr Lower Horizontal Weir	100-yr Upper Horizontal Weir	100-yr Inclined Weir	100-yr Total Weir	Release	Stage			Stage	Cumulative
	ft	ft	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs			cfs	CF	CF	(Ac-Ft)	hours	hours
Opening 1	5991.00	0	-	0.00										0.00	0.00	0.00	0.00	0.00	0.00
	5991.25	0.25	0.28	0.23										0.23	2331.75	2331.75	0.05	2.83	2.83
	5991.50	0.50	0.43	0.85										0.43	4267.01	6598.76	0.15	2.73	5.56
	5991.75	0.75	0.55	1.68										0.55	6183.15	12781.91	0.29	3.15	8.70
	5992.00	1.00	0.64	2.69										0.64	8094.01	20875.92	0.48	3.52	12.23
	5992.25	1.25	0.72	3.85										0.72	10081.35	30957.27	0.71	3.89	16.12
	5992.50	1.50	0.79	5.13										0.79	12151.93	43109.20	0.99	4.26	20.38
	5992.75	1.75	0.86	6.53										0.86	14221.63	57330.82	1.32	4.60	24.99
	5993.00	2.00	0.92	8.04										0.92	16290.78	73621.61	1.69	4.92	29.91
	5993.25	2.25	0.98	9.66										0.98	17789.71	91411.31	2.10	5.06	34.97
Opening 2 / WQCV	5993.50	2.50	1.03	11.36	-	-								1.03	18702.11	110113.43	2.53	5.03	40.00
	5993.75	2.75	1.08	13.68	0.11	0.03								1.12	19614.51	129727.94	2.98	4.88	44.88
	5994.00	3.00	1.13	15.59	0.18	0.17								1.31	20526.90	150254.84	3.45	4.37	49.25
	5994.25	3.25	1.18	17.58	0.24	0.37								1.42	21396.48	171651.33	3.94	4.19	53.44
Opening 3	5994.50	3.50	1.23	19.64	0.28	0.61	-	-						1.51	22222.66	193873.99	4.45	4.10	57.54
	5994.75	3.75	1.27	21.79	0.32	0.89	0.11	0.03						1.62	23048.83	216922.81	4.98	3.95	61.48
	5995.00	4.00	1.31	24.00	0.35	1.21	0.18	0.17						1.84	23875.00	240797.81	5.53	3.61	65.09
	5995.25	4.25	1.35	26.28	0.38	1.55	0.24	0.37						1.97	24755.59	265553.40	6.10	3.48	68.58
T.O.S / EURV	5995.50	4.50	1.39	28.64	0.41	1.93	0.28	0.61						2.09	25691.27	291244.67	6.69	3.42	72.00
	5995.75	4.75	-	-	-	-	-	-	66.98	13.50	-	0.03	13.53	13.53	26626.94	317871.61	7.30	0.55	72.55
	5996.00	5.00	-	-	-	-	-	-	94.72	38.18	-	0.41	38.60	38.60	27562.61	345434.22	7.93	0.20	72.75
	5996.25	5.25	-	-	-	-	-	-	116.01	70.15	-	1.48	71.63	71.63	28568.15	374002.38	8.59	0.11	72.86
Top of Grate	5996.50	5.50	-	-	-	-	-	-	133.96	108.00	0.00	3.44	111.44	111.44	29644.40	403646.78	9.27	0.07	72.93
	5996.75	5.75	-	-	-	-	-	-	149.77	150.93	13.50	6.44	170.88	149.77	30720.65	434367.43	9.97	0.06	72.99
	5997.00	6.00	-	-	-	-	-	-	164.06	198.41	38.18	10.64	247.23	164.06	31796.89	466164.32	10.70	0.05	73.04
100-YR	5997.25	6.25	-	-	-	-	-	-	177.21	250.02	70.15	16.16	336.33	177.21	32656.79	498821.11	11.45	0.05	73.09
	5997.50	6.50	-	-	-	-	-	-	189.45	305.47	108.00	23.11	328.58	189.45	33298.42	532119.53	12.22	0.05	73.14
	5997.75	6.75	-	-	-	-	-	-	200.94	364.50	150.93	31.60	547.03	200.94	33940.06	566059.58	12.99	0.05	73.19
	5998.00	7.00	-	-	-	-	-	-	211.81	426.91	198.41	41.73	667.04	211.81	34581.69	600641.28	13.79	0.05	73.23
	5998.25	7.25	-	-	-	-	-	-	222.14	492.52	250.02	53.59	796.13	222.14	35216.41	635857.68	14.60	0.04	73.28
	5998.50	7.50	-	-	-	-	-	-	232.02	561.18	305.47	67.27	933.93	232.02	35844.17	671701.85	15.42	0.04	73.32
	5998.75	7.75	-	-	-	-	-	-	241.50	632.77	364.50	82.86	1080.14	241.50	36471.92	708173.78	16.26	0.04	73.36
	5999.00	8.00	-	-	-	-	-	-	250.61	707.17	426.91	100.44	1234.53	250.61	37099.68	745273.46	17.11	0.04	73.40
	5999.25	8.25	-	-	-	-	-	-	259.41	784.28	492.52	120.09	1396.89	259.41	37725.66	782999.12	17.98	0.04	73.44
	5999.50	8.50	-	-	-	-	-	-	267.92	864.00	561.18	141.88	1567.06	267.92	38349.86	821348.98	18.86	0.04	73.48
	5999.75	8.75	-	-	-	-	-	-	276.16	946.25	632.77	165.88	1744.91	276.16	38974.05	860323.03	19.75	0.04	73.52
	6000.00	9.00	-	-	-	-	-	-	284.17	1030.96	707.17	192.17	1930.31	284.17	39598.25	899921.28	20.66	0.04	73.56

(Note: This sheet sizes WQ & EURV Orifice & 100 Year Grate inflows to the Pond Outlet)

Pond Inv:	5991.00		**Opening 1 Center =**	5991.07
$WQCV_{ELEV}$ =	5993.38		**Opening 2 Center =**	5993.63
$EURV_{ELEV}$ =	5995.27		**Opening 3 Center =**	5994.63
$T.O.S_{ELEV}$ =	5995.50			
$T.O.G_{ELEV}$ =	5996.50			
100 yr_{ELEV} =	5997.05			

WQCV Orifice

Area	0.14	SF
Orifice Length	1.00	LF
Orifice Height	0.14	LF

(1.0'Wx 0.14'H Opening 1 at invert 5391', orifice center at 5991.07')

EURV- Orifice

Area	0.06237	SF
Orifice Length	0.2500	LF
Orifice Height	0.2500	LF

(0.25'Wx 0.25'H Opening at invert 5993.5', orifice center at 5993.63')
(0.25'Wx 0.25'H Opening at invert 5994.5', orifice center at 5994.63')

100-yr Grate

Area	27.82	SF	
Weir Length	36.00	LF	(2 x 6.71
Weir Width	8.00	LF	(2 x 4')

Orfice Clogging factor = 50 %

Min Required Opening Area for Grate 144.00 SF

36'W x 4.0'L Grate, Grate Inv @ 5995.50)
(Use 6 @ 3'W x 4'L Grates)

NOTE:
1) 100-year outlet sized with Orifice Sheet
2) The outlet grates release more than the allowable release rate.
3) The orifices on the Orifice Design Sheet control the release rate.

DETENTION POND ORIFICE SIZING

Subdivision: Filing No 1

Project Name: Trails at Crowfoot
Project No. 283701
Calculated By: AYK

Pond A Stage-Discharge-Volume-Drain Time Table (Orifce)

	STAGE		ORIFICE RELEASE RATES					VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 1	EURV Orifice 2	100-yr Orifice	Release	Stage			Stage	Cumulative
	ft	ft	cfs	Cfs	cfs	cfs	cfs	CF	CF	(Ac-Ft)	hours	hours
	5991.00	0	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
	5991.25	0.25	0.23	0.00			0.23	2331.75	2331.75	0.05	2.83	2.83
	5991.50	0.50	0.43	0.00			0.43	4267.01	6598.76	0.15	2.73	5.56
	5991.75	0.75	0.55	0.00			0.55	6183.15	12781.91	0.29	3.15	8.70
	5992.00	1.00	0.64	0.00			0.64	8094.01	20875.92	0.48	3.52	12.23
	5992.25	1.25	0.72	0.00			0.72	10081.35	30957.27	0.71	3.89	16.12
	5992.50	1.50	0.79	0.00			0.79	12151.93	43109.20	0.99	4.26	20.38
	5992.75	1.75	0.86	0.00			0.86	14221.63	57330.82	1.32	4.60	24.99
	5993.00	2.00	0.92	0.00			0.92	16290.78	73621.61	1.69	4.92	29.91
	5993.25	2.25	0.98	0.00			0.98	17789.71	91411.31	2.10	5.06	34.97
WQCV	5993.50	2.50	1.03	0.00			1.03	18702.11	110113.43	2.53	5.03	40.00
	5993.75	2.75	1.08	0.03			1.12	19614.51	129727.94	2.98	4.88	44.88
	5994.00	3.00	1.13	0.17			1.31	20526.90	150254.84	3.45	4.37	49.25
	5994.25	3.25	1.18	0.24			1.42	21396.48	171651.33	3.94	4.19	53.44
	5994.50	3.50	1.23	0.28	-		1.51	22222.66	193873.99	4.45	4.10	57.54
	5994.75	3.75	1.27	0.32	0.11		1.69	23048.83	216922.81	4.98	3.78	61.31
	5995.00	4.00	1.31	0.35	0.18		1.85	23875.00	240797.81	5.53	3.59	64.90
	5995.25	4.25	1.35	0.38	0.24		1.97	24755.59	265553.40	6.10	3.48	68.39
T.O.S. / EURV	5995.50	4.50	1.39	0.41	0.28		2.09	25691.27	291244.67	6.69	3.42	71.81
	5995.75	4.75	0.00	0.00	0.00	154.49	154.49	26626.94	317871.61	7.30	0.05	71.86
	5996.00	5.00	0.00	0.00	0.00	158.50	158.50	27562.61	345434.22	7.93	0.05	71.90
	5996.25	5.25	0.00	0.00	0.00	162.42	162.42	28568.15	374002.38	8.59	0.05	71.95
	5996.50	5.50	0.00	0.00	0.00	166.24	166.24	29644.40	403646.78	9.27	0.05	72.00
	5996.75	5.75	0.00	0.00	0.00	169.97	169.97	30720.65	434367.43	9.97	0.05	72.05
	5997.00	6.00	-	-	-	173.63	173.63	31796.89	466164.32	10.70	0.05	72.10
100-YR	5997.25	6.25	-	-	-	177.21	177.21	32656.79	498821.11	11.45	0.05	72.15
	5997.50	6.50	-	-	-	180.72	180.72	33298.42	532119.53	12.22	0.05	72.21
	5997.75	6.75	-	-	-	184.16	184.16	33940.06	566059.58	12.99	0.05	72.26
	5998.00	7.00	-	-	-	187.54	187.54	34581.69	600641.28	13.79	0.05	72.31
	5998.25	7.25	-	-	-	190.86	190.86	35216.41	635857.68	14.60	0.05	72.36
	5998.50	7.50	-	-	-	194.12	194.12	35844.17	671701.85	15.42	0.05	72.41
	5998.75	7.75	-	-	-	197.33	197.33	36471.92	708173.78	16.26	0.05	72.46
	5999.00	8.00	-	-	-	200.49	200.49	37099.68	745273.46	17.11	0.05	72.51
	5999.25	8.25	-	-	-	203.60	203.60	37725.66	782999.12	17.98	0.05	72.57
	5999.50	8.50	-	-	-	206.66	206.66	38349.86	821348.98	18.86	0.05	72.62
	5999.75	8.75	-	-	-	209.68	209.68	38974.05	860323.03	19.75	0.05	72.67
	6000.00	9.00	-	-	-	212.65	212.65	39598.25	899921.28	20.66	0.05	72.72

(Note: This sheet sizes WQCV , EURV & 100 Year Orifices from Pond Outlet)

Pond Inv:	5991.00	**WQCV Orifice 1 Center =**	5991.07
$WQCV_{ELEV}$ =	5993.38	**WQCV Orifice 1 Center =**	5993.63
$EURV_{ELEV}$ =	5995.27	**EURV Orifice Center =**	5994.63
$T.O.S_{ELEV}$ =	5996.75		
100 yr $_{ELEV}$ =	5997.05		

WQCV Orifice

Area	0.14	SF
Orifice Length	1.00	LF
Orifice Height	0.14	LF

(1.0'Wx 0.14'H Opening 1 at invert 5391', orifice center at 5391.07')

EURV- Orifice

Area	0.06237	SF
Orifice Length	0.2500	LF
Orifice Height	0.2500	LF

(0.25'Wx 0.25'H Opening at invert 5393.5', orifice center at 5393.63')
(0.25'Wx 0.25'H Opening at invert 5394.5', orifice center at 5394.63')

100-yr Orifice

Area	14.72	SF	
Opening Width =	4.00	LF	(4'W x 3.31'H Outlet Culverts)
Opening Height =	3.68	LF	(Remaining Area to be Covered by Restrictor Plate)

(4'W x 3.68'H Opening in 4'Wx4'H RCBC to be achieved
with Restrictor Plate)

POND B

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Pond B

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
2.18	1.10	0.39	30.6

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
6089	88.00	0	0	0	0	0	0
6090	3892	4,565	1,522	1	1,522	1,522	0.03
6091	12287	23,094	7,698	1	7,698	9,220	0.21
6092	21470	49,999	16,666	1	16,666	25,886	0.59
6093	26933	72,450	24,150	1	24,150	50,036	1.15
6094	31290	87,253	29,084	1	29,084	79,120	1.82
6095	35405	99,979	33,326	1	33,326	112,447	2.58
6096	39867	112,842	37,614	1	37,614	150,061	3.44
6097	45397	127,806	42,602	1	42,602	192,663	4.42

WQ ELEV	6091.45	FT	**WQ** VOLUME	0.39	AC-FT
EURV ELEV	6092.92	FT	**EURV** VOLUME	1.10	AC-FT
100YEAR ELEV	6094.48	FT	**100**YEAR VOLUME	2.18	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Pond B

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT^3)	(FT)
0.39	50.31	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
6089	96.00	0	0	0	0	0	0
6089.5	182	410	137	1	68	68	0.00

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Pond B**

Facility Location & Jurisdiction: **Trails at Crowfoot**

User Input: Watershed Characteristics

Watershed Slope =	0.057	ft/ft
Watershed Length =	1513	ft
Watershed Area =	23.20	acres
Watershed Imperviousness =	47.4%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent

Location for 1-hr Rainfall Depths (use dropdown):

Parker - Town Hall

WQCV Treatment Method =

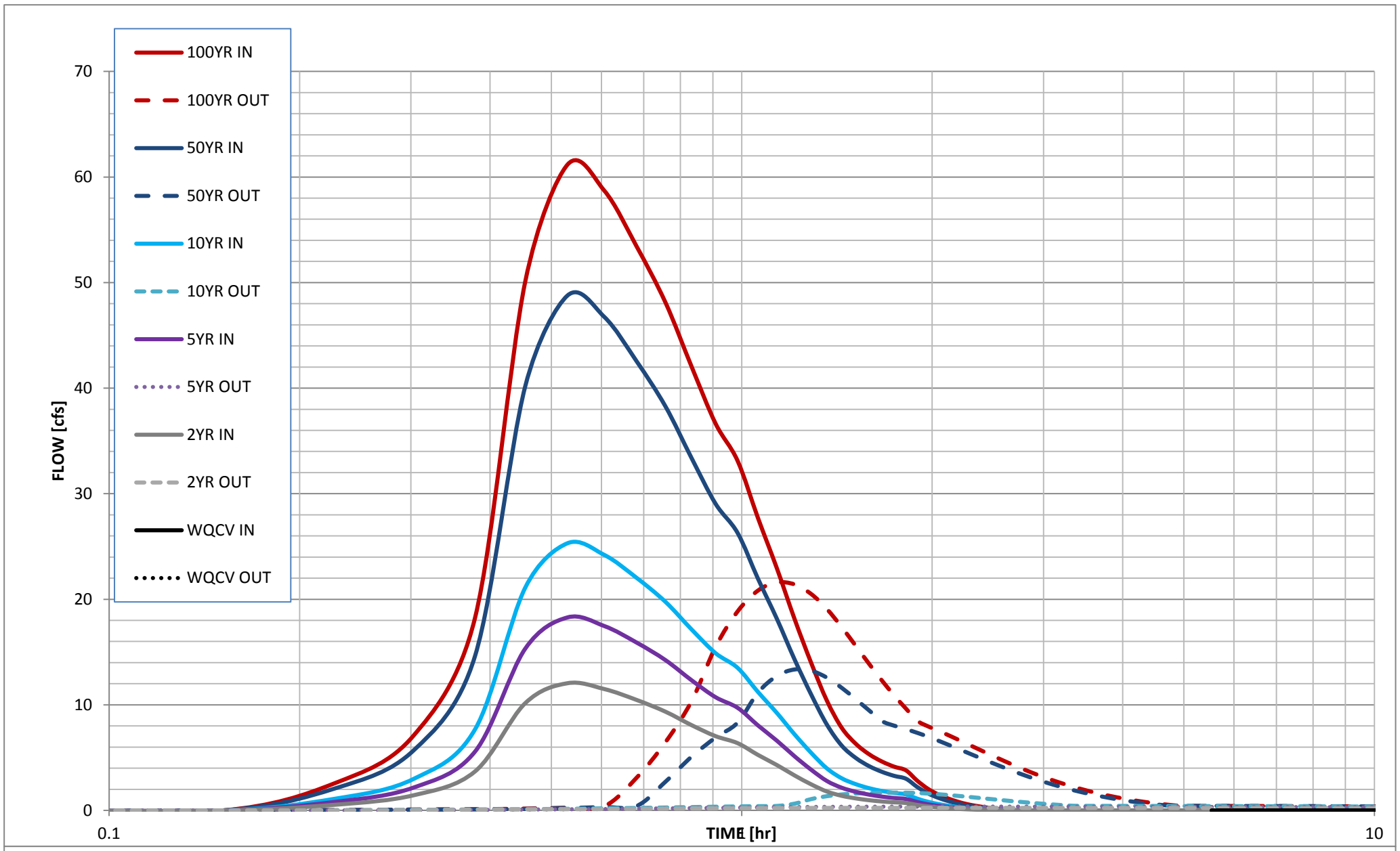
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	88	0.00	0.00
1.00	3,892	1.00	0.09
2.00	12,287	2.00	0.13
3.00	21,470	3.00	0.24
4.00	26,933	4.00	0.43
5.00	31,290	5.00	8.30
6.00	35,405	6.00	31.22
7.00	39,867	7.00	33.72
8.00	45,397	8.00	36.05

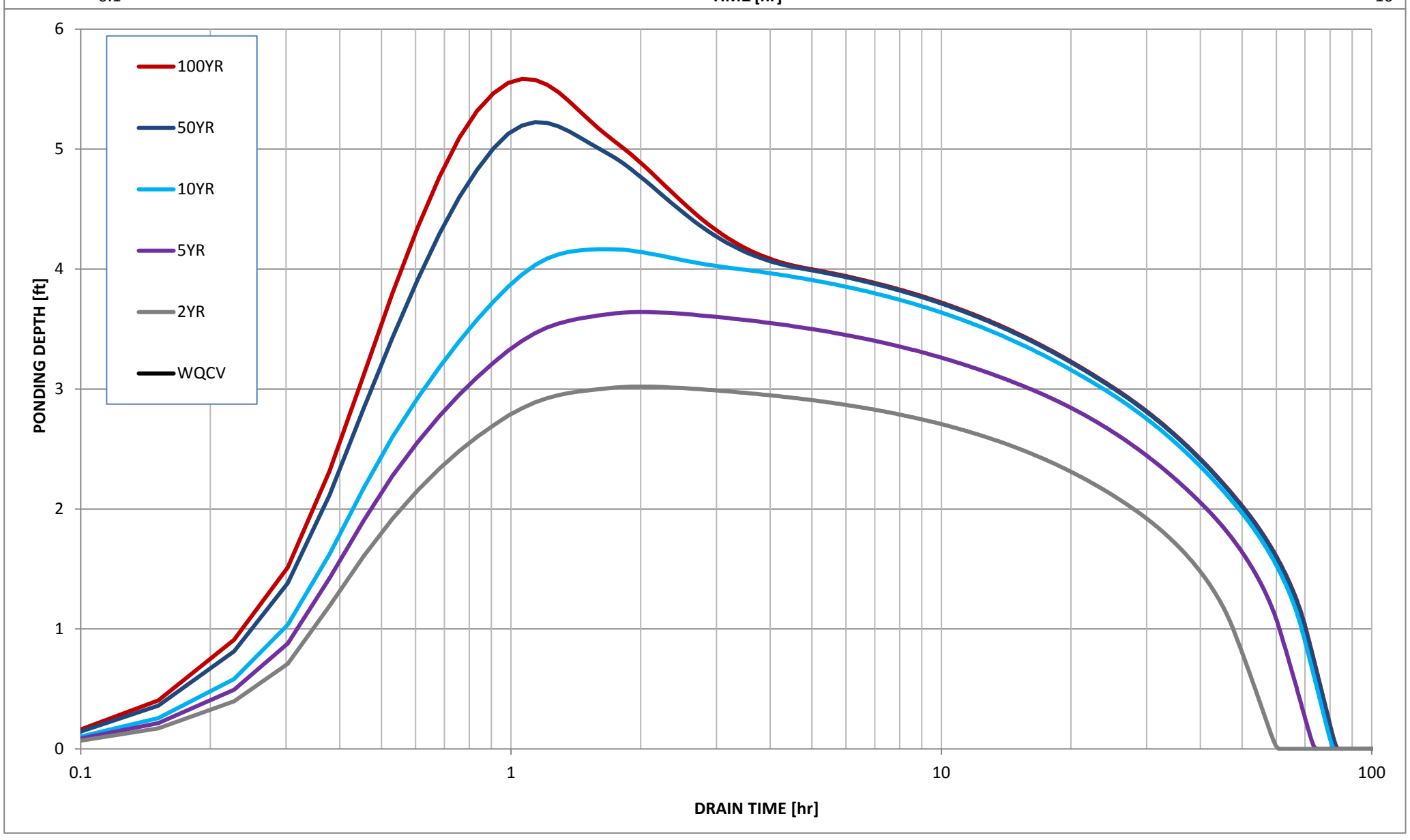
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	0.82	1.10	1.34	1.98	2.29	in
Calculated Runoff Volume =		0.660	1.007	1.399	2.719	3.421	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =		0.660	1.006	1.398	2.718	3.420	acre-ft
Time to Drain 97% of Inflow Volume =		51.8	**63.3**	69.2	65.8	63.5	hours
Time to Drain 99% of Inflow Volume =		55.3	67.6	74.2	73.0	**72.0**	hours
Maximum Ponding Depth =		3.02	3.64	4.17	5.22	5.59	ft
Maximum Ponded Area =		0.49	0.57	0.63	0.74	**0.77**	acres
Maximum Volume Stored =		0.625	0.956	1.274	2.001	2.274	acre-ft

Stormwater Detention and Infiltration Design Data Sheet

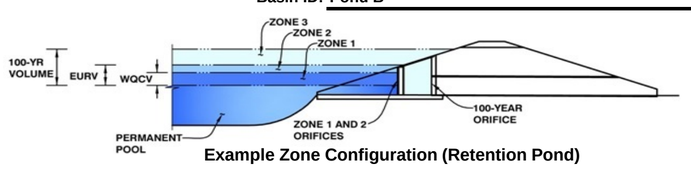




DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Trails at Crowfoot

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	23.20	acres		
Watershed Length =	1,513	ft		
Watershed Slope =	0.057	ft/ft		
Watershed Imperviousness =	47.36%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	49.8%	percent		
Percentage Hydrologic Soil Groups C/D =	50.2%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Parker - Parker Town Court			
Water Quality Capture Volume (WQCV) =	0.385	acre-feet	Optional User Input 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	1.102	acre-feet		
2-yr Runoff Volume (P1 = 0.96 in.) =	0.802	acre-feet		inches
5-yr Runoff Volume (P1 = 1.4 in.) =	1.472	acre-feet		inches
10-yr Runoff Volume (P1 = 1.65 in.) =	1.944	acre-feet		inches
25-yr Runoff Volume (P1 = 1.98 in.) =	2.705	acre-feet		inches
50-yr Runoff Volume (P1 = 2.3 in.) =	3.336	acre-feet		inches
100-yr Runoff Volume (P1 = 2.61 in.) =	4.038	acre-feet		inches
500-yr Runoff Volume (P1 = 3.25 in.) =	5.381	acre-feet		inches
Approximate 2-yr Detention Volume =	0.758	acre-feet		
Approximate 5-yr Detention Volume =	1.249	acre-feet		
Approximate 10-yr Detention Volume =	1.371	acre-feet		
Approximate 25-yr Detention Volume =	1.546	acre-feet		
Approximate 50-yr Detention Volume =	1.833	acre-feet		
Approximate 100-yr Detention Volume =	2.250	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.385	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.717	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.148	acre-feet
Total Detention Basin Volume =	2.250	acre-feet
Initial Surcharge Volume (ISV) =	50	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool									

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond B (Forebay 1)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 47.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.474
C) Contributing Watershed Area	Area = 23.200 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.385 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond B (Forebay 1)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.012 ac-ft
B) Actual Forebay Volume	V_F = 0.012 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 80.90 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.62 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ● Wall with Rect. Notch; ○ Wall with V-Notch Weir — (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 8.2 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One: ○ Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond B (Forebay 2)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 47.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.474
C) Contributing Watershed Area	Area = 4.500 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.075 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

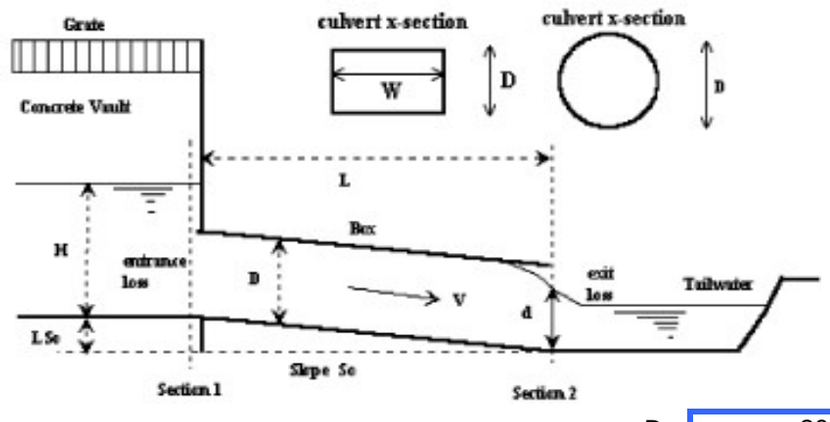
Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond B (Forebay 2)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV)	V_{FMIN} = 0.002 ac-ft
B) Actual Forebay Volume	V_F = 0.002 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 24.30 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.49 cfs
E) Forebay Discharge Design	Choose One ○ Berm With Pipe ● Wall with Rect. Notch ○ Wall with V-Notch Weir **(flow too small for berm w/ pipe)**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 4.2 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One ● Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One ○ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond B (Q_{100} = 30.56 CFS)
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	30	inches
	Inlet Edge Type (choose from pull-down list)		Square End with Headwall	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 30-78 deg. Flared Wingwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	6087.075	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	6086.66	ft. elev.
	Culvert Length in Feet	L =	82.18	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.50
Friction Loss Coefficient	K_f =	0.75
Sum of All Loss Coefficients	K_s =	2.25
Orifice Inlet Condition Coefficient	C_d =	0.85
Minimum Energy Condition Coefficient	KE_{low} =	0.0152

Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
6089.00	6090.20	14.90	0.00	**0.00**	Regression Eqn.	N/A
6089.50	6090.20	21.40	0.00	**0.00**	Regression Eqn.	N/A
6090.00	6090.20	27.50	0.00	**0.00**	Regression Eqn.	N/A
6090.50	6090.20	32.70	14.38	**14.38**	Regression Eqn.	OUTLET
6091.00	6090.20	37.20	23.48	**23.48**	Regression Eqn.	OUTLET
6091.50	6090.20	41.10	29.92	**29.92**	Regression Eqn.	OUTLET
6092.00	6090.20	44.60	35.21	**35.21**	Regression Eqn.	OUTLET
6092.50	6090.20	47.90	39.80	**39.80**	Regression Eqn.	OUTLET
6093.00	6090.20	50.90	43.91	**43.91**	Regression Eqn.	OUTLET
6093.50	6090.20	53.80	47.67	**47.67**	Regression Eqn.	OUTLET
6094.00	6090.20	56.50	51.15	**51.15**	Regression Eqn.	OUTLET
6094.50	6090.20	59.10	54.42	**54.42**	Regression Eqn.	OUTLET
6095.00	6090.20	61.50	57.49	**57.49**	Orifice Eqn.	OUTLET
6095.50	6090.20	63.80	60.42	**60.42**	Orifice Eqn.	OUTLET
6096.00	6090.20	66.00	63.21	**63.21**	Orifice Eqn.	OUTLET
6096.50	6090.20	68.10	65.87	**65.87**	Orifice Eqn.	OUTLET
6097.00	6090.20	70.10	68.44	**68.44**	Orifice Eqn.	OUTLET
6097.50	6090.20	72.10	70.90	**70.90**	Orifice Eqn.	OUTLET
6098.00	6090.20	74.10	73.29	**73.29**	Orifice Eqn.	OUTLET
6098.50	6090.20	76.00	75.61	**75.61**	Orifice Eqn.	OUTLET
6099.00	6090.20	77.80	77.85	**77.80**	Orifice Eqn.	INLET
6099.50	6090.20	79.60	80.03	**79.60**	Orifice Eqn.	INLET
6100.00	6090.20	81.40	82.15	**81.40**	Orifice Eqn.	INLET
6100.50	6090.20	83.10	84.22	**83.10**	Orifice Eqn.	INLET
6101.00	6090.20	84.80	86.25	**84.80**	Orifice Eqn.	INLET
6101.50	6090.20	86.40	88.22	**86.40**	Orifice Eqn.	INLET
6102.00	6090.20	88.10	90.15	**88.10**	Orifice Eqn.	INLET
6102.50	6090.20	89.70	92.03	**89.70**	Orifice Eqn.	INLET
6103.00	6090.20	91.20	93.89	**91.20**	Orifice Eqn.	INLET
6103.50	6090.20	92.80	95.71	**92.80**	Orifice Eqn.	INLET

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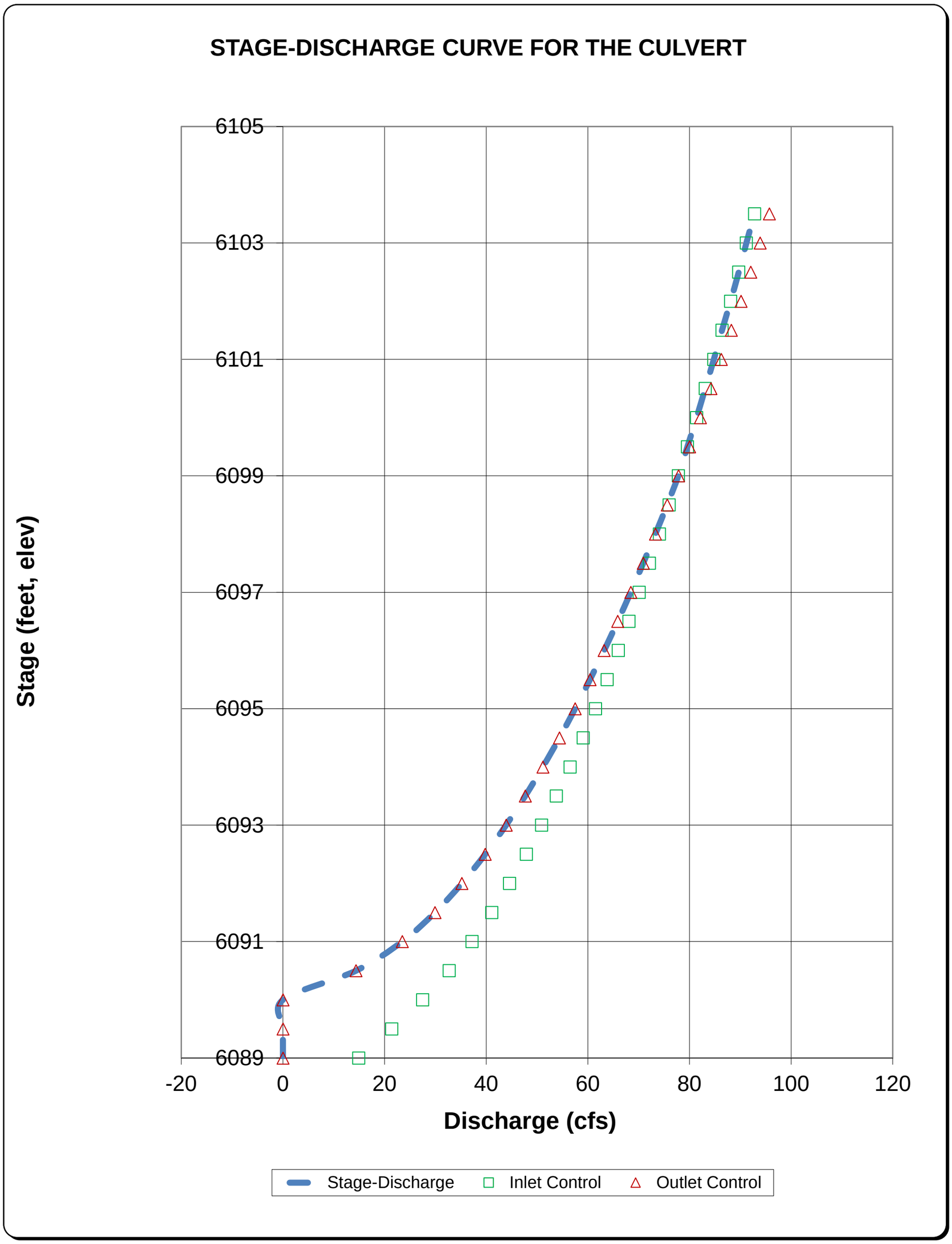
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond B (Q100 = 30.56 CFS)



Pond B Stage-Discharge-Volume-Drain Time Table (Grate)

	STAGE		WEIR / ORIFICE RELEASE RATES									VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 2	EURV Orifice	100-yr Orifice	100-yr Lower Horizontal Weir	100-yr Upper Horizontal Weir	100-yr Inclined Weir	100-yr Total Weir	Release	Stage			Stage	Cumulative
	ft	ft	cfs	cfs	cfs	cfs	cfs	cfs			cfs	CF	CF	(Ac-Ft)	hours	hours
Opening 1	6089.00	0	-								-	0.00	0.00	0.00	0.00	0.00
	6089.25	0.25	0.04								0.04	119.11	119.11	0.00	0.84	0.84
	6089.50	0.50	0.06								0.06	372.24	491.36	0.01	1.68	2.52
	6089.75	0.75	0.08								0.08	612.52	1103.88	0.03	2.18	4.70
	6090.00	1.00	0.09								0.09	851.35	1955.23	0.04	2.59	7.30
	6090.25	1.25	0.10								0.10	1225.95	3181.18	0.07	3.31	10.61
	6090.50	1.50	0.11								0.11	1753.48	4934.66	0.11	4.30	14.90
	6090.75	1.75	0.12								0.12	2279.68	7214.34	0.17	5.15	20.06
	6091.00	2.00	0.13								0.13	2805.31	10019.65	0.23	5.91	25.97
	6091.25	2.25	0.14								0.14	3354.62	13374.28	0.31	6.65	32.62
Opening 2 / WQCV	6091.50	2.50	0.15	-							0.15	3929.16	17303.44	0.40	7.38	40.00
	6091.75	2.75	0.16	0.05							0.20	4503.55	21806.99	0.50	6.13	46.13
	6092.00	3.00	0.16	0.08							0.24	5077.83	26884.81	0.62	5.87	52.00
Opening 3	6092.25	3.25	0.17	0.10	-						0.27	5537.34	32422.15	0.74	5.74	57.75
	6092.50	3.50	0.18	0.12	0.05						0.29	5878.83	38300.98	0.88	5.60	63.35
	6092.75	3.75	0.18	0.13	0.08						0.39	6220.31	44521.30	1.02	4.42	67.77
T.O.S / EURV	6093.00	4.00	0.19	0.14	0.10						0.43	6561.79	51083.09	1.17	4.23	72.00
	6093.25	4.25	-	-	-	11.55	0.61	-	0.03	0.63	0.63	6868.96	57952.04	1.33	3.01	75.01
	6093.50	4.50	-	-	-	16.34	1.72	-	0.41	2.13	2.13	7141.29	65093.33	1.49	0.93	75.94
	6093.75	4.75	-	-	-	20.01	3.16	-	1.48	4.64	4.64	7413.61	72506.95	1.66	0.44	76.39
Top of Grate	6094.00	5.00	-	-	-	23.10	4.86	0.00	3.44	8.30	8.30	7685.94	80192.89	1.84	0.26	76.64
	6094.25	5.25	-	-	-	25.83	6.79	0.61	6.44	13.84	13.84	7950.75	88143.63	2.02	0.16	76.80
	6094.50	5.50	-	-	-	28.29	8.93	1.72	10.64	21.28	21.28	8207.95	96351.58	2.21	0.11	76.91
100-YR	6094.75	5.75	-	-	-	30.56	11.25	3.16	16.16	30.56	30.56	8465.14	104816.72	2.41	0.08	76.99
	6095.00	6.00	-	-	-	32.67	13.74	4.86	23.11	41.71	32.67	8722.34	113539.06	2.61	0.07	77.06
	6095.25	6.25	-	-	-	34.65	16.40	6.79	31.60	47.99	34.65	8990.33	122529.39	2.81	0.07	77.13
	6095.50	6.50	-	-	-	36.53	19.20	8.93	41.73	60.93	36.53	9269.21	131798.60	3.03	0.07	77.20
	6095.75	6.75	-	-	-	38.31	22.16	11.25	53.59	86.99	38.31	9548.10	141346.70	3.24	0.07	77.27
	6096.00	7.00	-	-	-	40.01	25.24	13.74	67.27	106.26	40.01	9826.98	151173.68	3.47	0.07	77.34
	6096.25	7.25	-	-	-	41.65	28.46	16.40	82.86	127.73	41.65	10139.07	161312.76	3.70	0.07	77.41
	6096.50	7.50	-	-	-	43.22	31.81	19.20	100.44	151.46	43.22	10484.71	171797.47	3.94	0.07	77.48
	6096.75	7.75	-	-	-	44.74	35.28	22.16	120.09	177.53	44.74	10830.35	182627.82	4.19	0.07	77.54
	6097.00	8.00	-	-	-	46.20	38.87	25.24	141.88	205.99	46.20	11175.99	193803.81	4.45	0.07	77.61

(Note: This sheet sizes WQ & EURV Orifice & 100 Year Grate inflows to the Pond Outlet)

Pond Inv:	6089.00	**Opening 1 Center =**	6089.08
$WQCV_{ELEV}$ =	6091.45	**Opening 2 Center =**	6091.59
$EURV_{ELEV}$ =	6092.92	**Opening 3 Center =**	6092.34
$T.O.S_{ELEV}$ =	6093.00		
$T.O.G_{ELEV}$ =	6094.00		
100 yr_{ELEV} =	6094.57		

WQCV Orifice

Area	0.02	SF		
Orifice Diameter	0.16	FT	1.90	IN

(1.9" Opening at invert 5389', orifice center at 6089.08')

EURV- Orifice

Area	0.02519	SF		
Orifice Diameter	0.18	FT	2.15	IN

(2.2" Opening at invert 5391.5', orifice center at 6091.59')
(2.2" Opening at invert 5392.25', orifice center at 6092.34')

100-yr Grate

Area	4.80	SF	
Weir Length	1.62	LF	(2 x 0.44')
Weir Width	8.00	LF	(2 x 4')

Orfice Clogging factor = 50 %

Min Required Opening Area for Grate 9.60 SF
(Min Grate available 3'x4' = 12 SF)
3'W x 4.0'L Grate, Grate Inv @ 6093')

NOTE:

1) 100-year outlet sized with Orifice Sheet
2) The outlet grates release more than the allowable release rate.
3) The orifices on the Orifice Design Sheet control the release rate.

Pond B Stage-Discharge-Volume-Drain Time Table (Orifce)

	STAGE		ORIFICE RELEASE RATES					VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 1	EURV Orifice 2	100-yr Orifice	Release	Stage			Stage	Cumulative
	ft	ft	cfs	Cfs	cfs	cfs	cfs	CF	CF	(Ac-Ft)	hours	hours
	6089.00	0	-				0.00	0.00	0.00	0.00	0.00	0.00
	6089.25	0.25	0.04				0.04	119.11	119.11	0.00	0.84	0.84
	6089.50	0.50	0.06				0.06	372.24	491.36	0.01	1.68	2.52
	6089.75	0.75	0.08				0.08	612.52	1103.88	0.03	2.18	4.70
	6090.00	1.00	0.09				0.09	851.35	1955.23	0.04	2.59	7.30
	6090.25	1.25	0.10				0.10	1225.95	3181.18	0.07	3.31	10.61
	6090.50	1.50	0.11				0.11	1753.48	4934.66	0.11	4.30	14.90
	6090.75	1.75	0.12				0.12	2279.68	7214.34	0.17	5.15	20.06
	6091.00	2.00	0.13				0.13	2805.31	10019.65	0.23	5.91	25.97
	6091.25	2.25	0.14				0.14	3354.62	13374.28	0.31	6.65	32.62
WQCV	6091.50	2.50	0.15	-			0.15	3929.16	17303.44	0.40	7.38	40.00
	6091.75	2.75	0.16	0.05			0.20	4503.55	21806.99	0.50	6.13	46.13
	6092.00	3.00	0.16	0.08			0.24	5077.83	26884.81	0.62	5.87	52.00
	6092.25	3.25	0.17	0.10	-		0.27	5537.34	32422.15	0.74	5.74	57.75
	6092.50	3.50	0.18	0.12	0.05		0.34	5878.83	38300.98	0.88	4.80	62.55
	6092.75	3.75	0.18	0.13	0.08		0.39	6220.31	44521.30	1.02	4.42	66.97
T.O.S / EURV	6093.00	4.00	0.19	0.14	0.10		0.43	6561.79	51083.09	1.17	4.23	71.20
	6093.25	4.25	-	-	-	26.27	26.27	6868.96	57952.04	1.33	0.07	71.27
	6093.50	4.50	-	-	-	27.03	27.03	7141.29	65093.33	1.49	0.07	71.35
	6093.75	4.75	-	-	-	27.78	27.78	7413.61	72506.95	1.66	0.07	71.42
Top of Grate	6094.00	5.00	-	-	-	28.50	28.50	7685.94	80192.89	1.84	0.07	71.49
	6094.25	5.25	-	-	-	29.20	29.20	7950.75	88143.63	2.02	0.08	71.57
	6094.50	5.50	-	-	-	29.89	29.89	8207.95	96351.58	2.21	0.08	71.65
100-YR	6094.75	5.75	-	-	-	30.56	30.56	8465.14	104816.72	2.41	0.08	71.72
	6095.00	6.00	-	-	-	31.22	31.22	8722.34	113539.06	2.61	0.08	71.80
	6095.25	6.25	-	-	-	31.86	31.86	8990.33	122529.39	2.81	0.08	71.88
	6095.50	6.50	-	-	-	32.49	32.49	9269.21	131798.60	3.03	0.08	71.96
	6095.75	6.75	-	-	-	33.11	33.11	9548.10	141346.70	3.24	0.08	72.04
	6096.00	7.00	-	-	-	33.72	33.72	9826.98	151173.68	3.47	0.08	72.12
	6096.25	7.25	-	-	-	34.32	34.32	10139.07	161312.76	3.70	0.08	72.20
	6096.50	7.50	-	-	-	34.90	34.90	10484.71	171797.47	3.94	0.08	72.29
	6096.75	7.75	-	-	-	35.48	35.48	10830.35	182627.82	4.19	0.08	72.37
	6097.00	8.00	-	-	-	36.05	36.05	11175.99	193803.81	4.45	0.09	72.46

(Note: This sheet sizes WQCV , EURV & 100 Year Orifices from Pond Outlet)

Pond Inv:	6089.00	**WQCV Orifice 1 Center =**	6089.08
$WQCV_{ELEV}$ =	6091.45	**WQCV Orifice 1 Center =**	6091.59
$EURV_{ELEV}$ =	6092.92	**EURV Orifice Center =**	6092.34
$T.O.S_{ELEV}$ =	6093.00		
100 yr $_{ELEV}$ =	6094.57		

WQCV Orifice

Area 0.02 SF

Orifice Diameter 0.16 FT 1.90 IN

(1.0'Wx 0.14'H Opening 1 at invert 5389', orifice center at 5389.08')

EURV- Orifice

Area 0.02519 SF

Orifice Diameter 0.18 FT 2.15 IN

(2.2" Opening at invert 5391.5', orifice center at 5391.59')
(2.2" Opening at invert 5392.25', orifice center at 5392.34')

100-yr Orifice

Area 2.65 SF

Opening Height = 1.31 LF (Remaining Area to be Covered by Restrictor Plate)

(1.31' Opening in 2.5' RCP to be achieved
with Restrictor Plate)

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Partially Full Pipe Flow Calculator and Equations

Fluid Flow Table of Contents | Hydraulic and Pneumatic Knowledge
Fluid Power Equipment

This engineering calculator determines the Flow within a partially full pipe using the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

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Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V

for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, **D** =	30	in
Depth of flow, **y** =	15.7	in

(must have y ≥ D/2)

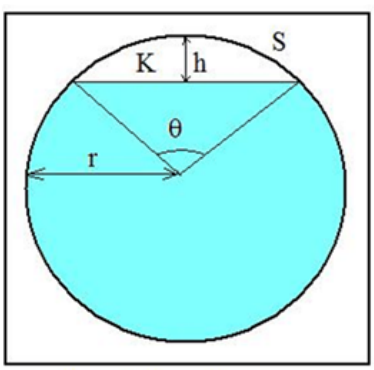
Full Pipe Manning roughness, n_{full} =	0.013	
Channel bottom slope, **S** =	0.005	ft/ft

Calculations

n/n_{full} =	1.2383333	
Partially Full Manning roughness, **n** =	0.016	

Calculations

Pipe Diameter, **D** =	2.5	ft
Pipe Radius, **r** =	1.25	ft
Circ. Segment Height, **h** =	1.192	ft
Central Angle, **q** =	3.05	radians
Cross-Sect. Area, **A** =	2.60	ft^2
Wetted Perimeter, **P** =	4.0	ft
Hydraulic Radius, **R** =	0.64	ft
Discharge, **Q** =	12.68	cfs
Ave. Velocity, **V** =	4.88	ft/sec
pipe % full [(A/A_{full})*100%] =	53.0%	



Partially Full Pipe Flow Parameters
(More Than Half Full)

r = D/2

h = 2r - y

(hydraulic radius)

R = A/P

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

V = Q/A P

$$\theta = 2\arccos\left(\frac{r-h}{r}\right)$$

$$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = 2\pi r - r*\theta$$

Equation used for n/n_{full}: $\mathbf{n/n_{full} = 1.25 - (y/D - 0.5)*0.5}$ (for $0.5 \le y/D \le 1$)

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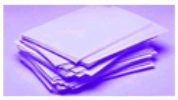


Become an Engineers Edge Contributor

POND C

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Pond C

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
8.68	4.49	1.60	106.7

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
5970	81.00	0	0	0	0	0	0
5971	10202	11,192	3,731	1	3,731	3,731	0.09
5972	28256	55,436	18,479	1	18,479	22,209	0.51
5973	39639	101,362	33,787	1	33,787	55,997	1.29
5974	48415	131,862	43,954	1	43,954	99,951	2.29
5975	55828	156,233	52,078	1	52,078	152,028	3.49
5976	64762	180,719	60,240	1	60,240	212,268	4.87
5977	71729	204,648	68,216	1	68,216	280,484	6.44
5978	79049	226,078	75,359	1	75,359	355,843	8.17
5979	87260	249,362	83,121	1	83,121	438,964	10.08
5980	96028	274,827	91,609	1	91,609	530,573	12.18

WQ ELEV	5973.31	FT	**WQ** VOLUME	1.60	AC-FT
EURV ELEV	5975.73	FT	**EURV** VOLUME	4.49	AC-FT
100YEAR ELEV	5978.27	FT	**100YEAR** VOLUME	8.68	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Pond C

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT^3)	(FT)
1.60	209.48	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
5970	371.00	0	0	0	0	0	0
5970.5	525.4	1,338	446	1	223	223	0.01

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Pond C**

Facility Location & Jurisdiction: **Trails at Crowfoot**

User Input: Watershed Characteristics

Watershed Slope =	0.028	ft/ft
Watershed Length =	3620	ft
Watershed Area =	98.50	acres
Watershed Imperviousness =	45.9%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent

Location for 1-hr Rainfall Depths (use dropdown):

Parker - Town Hall

WQCV Treatment Method =

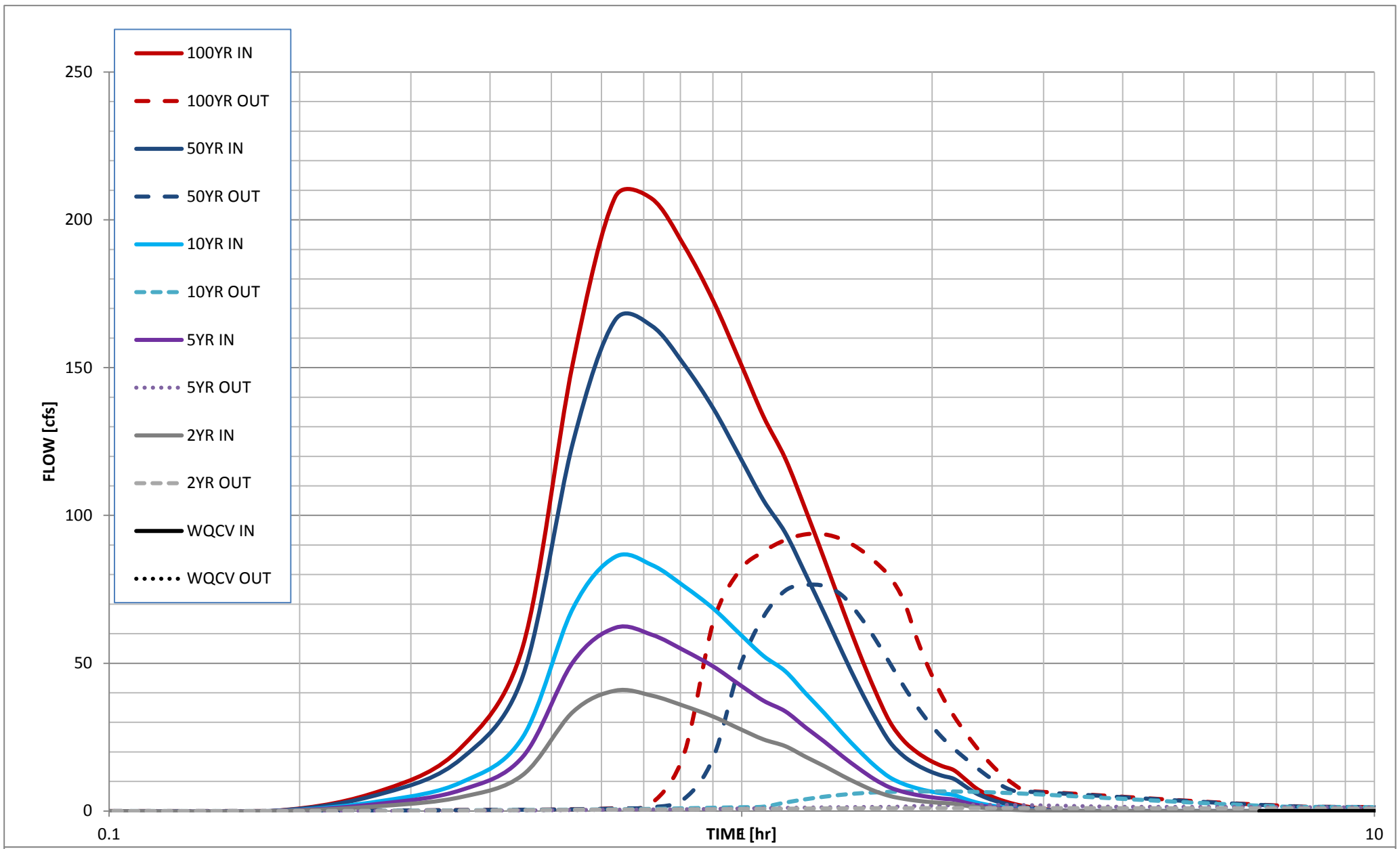
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	81	0.00	0.00
1.00	10,352	1.00	0.33
2.00	29,478	2.00	0.49
3.00	41,945	3.00	0.61
4.00	50,864	4.00	0.97
5.00	58,274	5.00	1.42
6.00	67,198	6.00	6.78
7.00	74,199	7.00	75.45
8.00	81,363	8.00	101.22

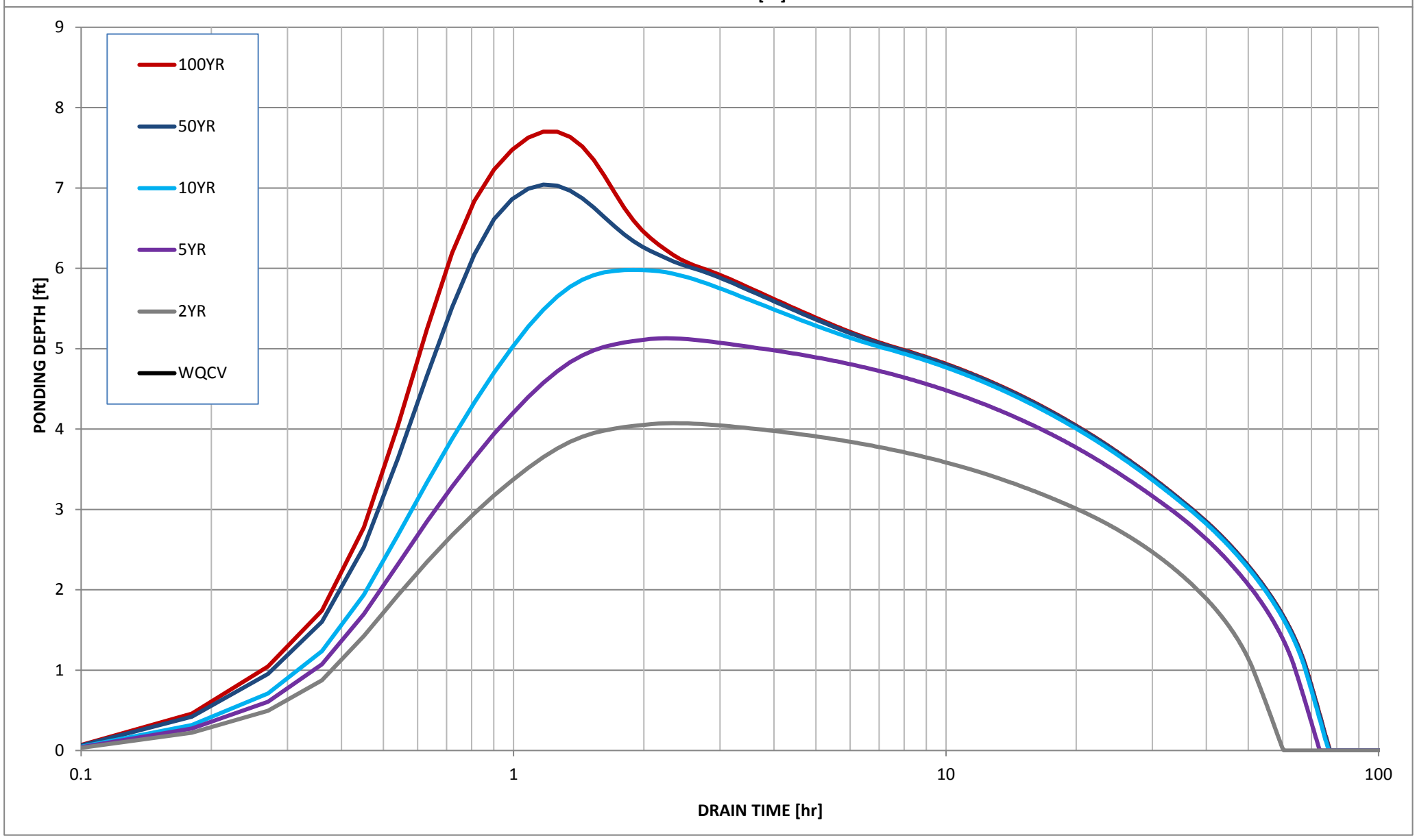
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	0.82	1.10	1.34	1.98	2.29	in
Calculated Runoff Volume =		2.701	4.138	5.788	11.393	14.378	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =		2.700	4.137	5.782	11.390	14.369	acre-ft
Time to Drain 97% of Inflow Volume =		52.9	**64.1**	65.9	61.2	58.9	hours
Time to Drain 99% of Inflow Volume =		56.0	67.9	70.5	68.4	**67.4**	hours
Maximum Ponding Depth =		4.07	5.13	5.98	7.04	7.70	ft
Maximum Ponded Area =		1.18	1.36	1.54	1.71	**1.82**	acres
Maximum Volume Stored =		2.537	3.879	5.116	6.834	8.002	acre-ft

Stormwater Detention and Infiltration Design Data Sheet

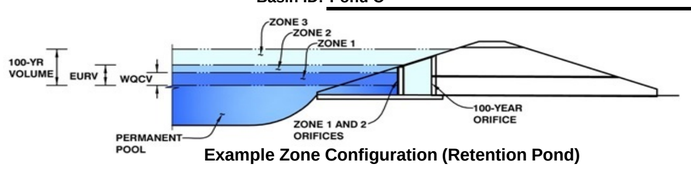




DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Trails at Crowfoot

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**	
Watershed Area =	98.50	acres
Watershed Length =	3,620	ft
Watershed Slope =	0.028	ft/ft
Watershed Imperviousness =	45.93%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - Parker Town Court	
Water Quality Capture Volume (WQCV) =	1.604	acre-feet
Excess Urban Runoff Volume (EURV) =	4.526	acre-feet
2-yr Runoff Volume (P1 = 0.96 in.) =	3.290	acre-feet
5-yr Runoff Volume (P1 = 1.4 in.) =	6.104	acre-feet
10-yr Runoff Volume (P1 = 1.65 in.) =	8.104	acre-feet
25-yr Runoff Volume (P1 = 1.98 in.) =	11.343	acre-feet
50-yr Runoff Volume (P1 = 2.3 in.) =	14.015	acre-feet
100-yr Runoff Volume (P1 = 2.61 in.) =	16.995	acre-feet
500-yr Runoff Volume (P1 = 3.25 in.) =	22.694	acre-feet
Approximate 2-yr Detention Volume =	3.109	acre-feet
Approximate 5-yr Detention Volume =	5.152	acre-feet
Approximate 10-yr Detention Volume =	5.662	acre-feet
Approximate 25-yr Detention Volume =	6.397	acre-feet
Approximate 50-yr Detention Volume =	7.617	acre-feet
Approximate 100-yr Detention Volume =	9.390	acre-feet

Optional User Input 1-hr Precipitation

	inches
	inches
	inches
	inches
	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.604	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.922	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.864	acre-feet
Total Detention Basin Volume =	9.390	acre-feet
Initial Surcharge Volume (ISV) =	210	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool									

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond C (Forebay 1)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 45.9 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.459
C) Contributing Watershed Area	Area = 79.650 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 1.297 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond C (Forebay 1)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.039 ac-ft
B) Actual Forebay Volume	V_F = 0.039 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 270.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 5.40 cfs
E) Forebay Discharge Design	Choose One ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 21.9 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One ○ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond C (Forebay 2)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 45.9 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.459
C) Contributing Watershed Area	Area = 18.850 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.307 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

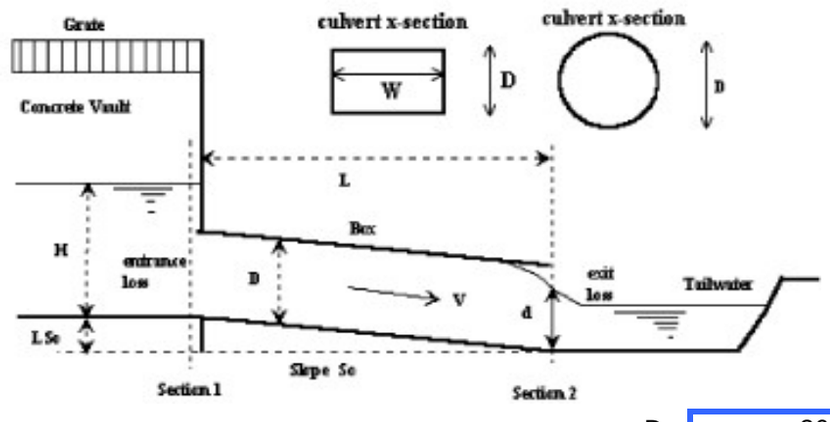
Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond C (Forebay 2)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.009 ac-ft
B) Actual Forebay Volume	V_F = 0.009 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 69.20 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.38 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir **(flow too small for berm w/ pipe)**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 7.4 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One: ○ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond C
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 30-78 deg. Flared Wingwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	5970	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	5961	ft. elev.
	Culvert Length in Feet	L =	91	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.65
Sum of All Loss Coefficients	K_s =	1.85
Orifice Inlet Condition Coefficient	C_d =	1.00
Minimum Energy Condition Coefficient	KE_{low} =	-0.2943

Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
5970.00	5971.33	0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
5971.00	5971.33	6.50	0.00	**0.00**	Min. Energy. Eqn.	N/A
5972.00	5971.33	22.10	34.11	**22.10**	Regression Eqn.	INLET
5973.00	5971.33	41.60	53.83	**41.60**	Regression Eqn.	INLET
5974.00	5971.33	58.10	68.08	**58.10**	Regression Eqn.	INLET
5975.00	5971.33	71.10	79.80	**71.10**	Regression Eqn.	INLET
5976.00	5971.33	82.10	90.03	**82.10**	Regression Eqn.	INLET
5977.00	5971.33	92.10	99.19	**92.10**	Regression Eqn.	INLET
5978.00	5971.33	101.20	107.58	**101.20**	Regression Eqn.	INLET
5979.00	5971.33	109.70	115.37	**109.70**	Regression Eqn.	INLET
5980.00	5971.33	116.80	122.67	**116.80**	Orifice Eqn.	INLET
5981.00	5971.33	123.50	129.55	**123.50**	Orifice Eqn.	INLET
5982.00	5971.33	129.80	136.07	**129.80**	Orifice Eqn.	INLET
5983.00	5971.33	135.90	142.31	**135.90**	Orifice Eqn.	INLET
5984.00	5971.33	141.70	148.28	**141.70**	Orifice Eqn.	INLET
5985.00	5971.33	147.20	154.02	**147.20**	Orifice Eqn.	INLET
5986.00	5971.33	152.60	159.55	**152.60**	Orifice Eqn.	INLET
5987.00	5971.33	157.80	164.90	**157.80**	Orifice Eqn.	INLET
5988.00	5971.33	162.80	170.08	**162.80**	Orifice Eqn.	INLET
5989.00	5971.33	167.60	175.11	**167.60**	Orifice Eqn.	INLET
5990.00	5971.33	172.30	179.99	**172.30**	Orifice Eqn.	INLET
5991.00	5971.33	176.90	184.75	**176.90**	Orifice Eqn.	INLET
5992.00	5971.33	181.40	189.39	**181.40**	Orifice Eqn.	INLET
5993.00	5971.33	185.80	193.92	**185.80**	Orifice Eqn.	INLET
5994.00	5971.33	190.10	198.35	**190.10**	Orifice Eqn.	INLET
5995.00	5971.33	194.20	202.67	**194.20**	Orifice Eqn.	INLET
5996.00	5971.33	198.30	206.90	**198.30**	Orifice Eqn.	INLET
5997.00	5971.33	202.30	211.06	**202.30**	Orifice Eqn.	INLET
5998.00	5971.33	206.30	215.13	**206.30**	Orifice Eqn.	INLET
5999.00	5971.33	210.10	219.12	**210.10**	Orifice Eqn.	INLET

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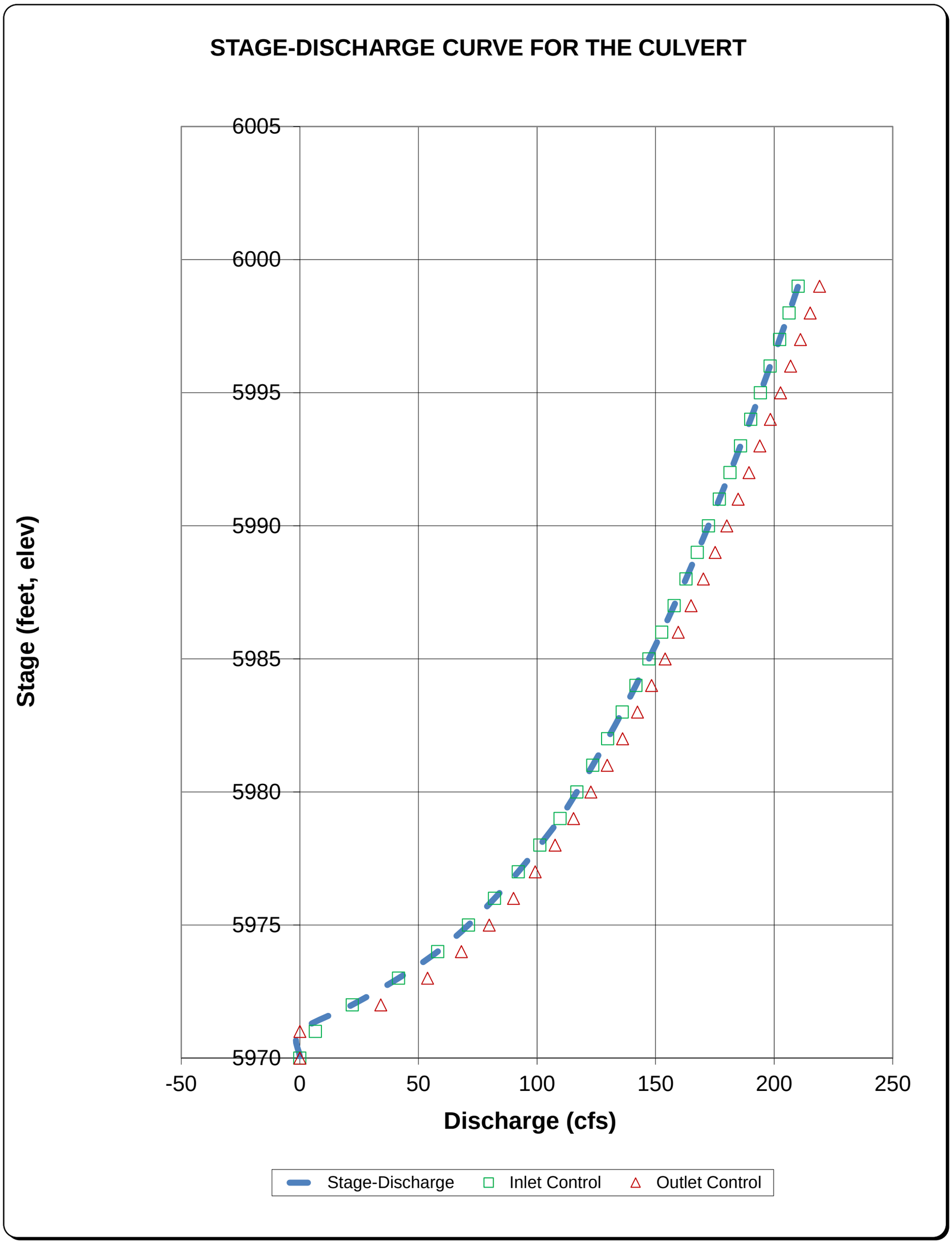
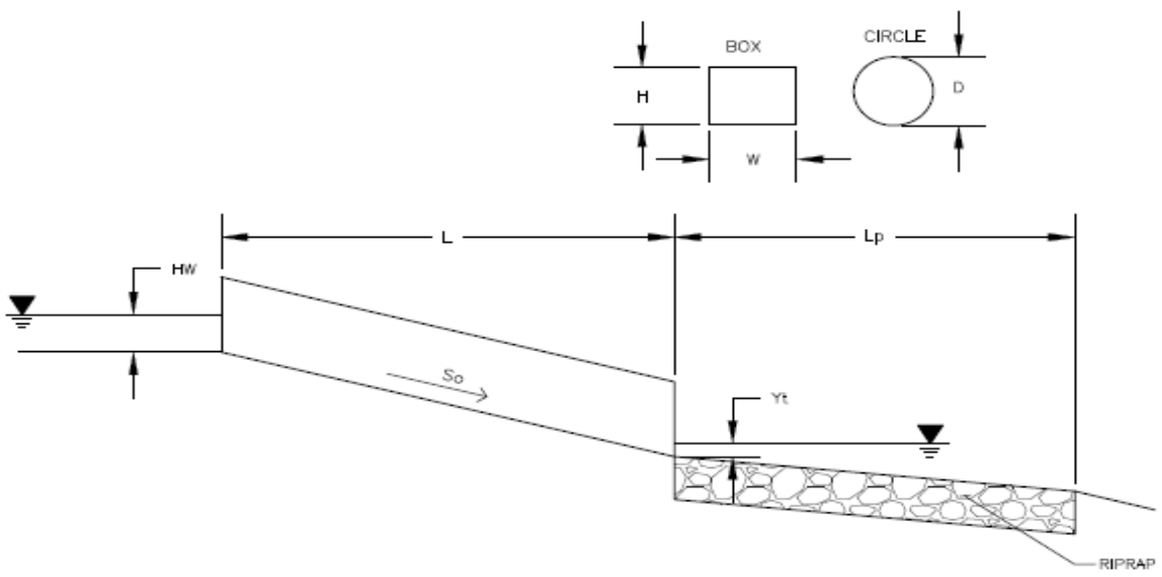
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond C



Determination of Culvert Headwater and Outlet Protection

Project: TRAILS AT CROWFOOT
Basin ID: POND C OUTFALL



Soil Type:
Choose One:
- (●) Sandy
- ( ) Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

Design Discharge	Q =	107.71	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	42	inches
Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Beveled Edge	
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	5969.5	ft
Outlet Elevation **OR** Slope	Elev OUT =	2.5	ft
Culvert Length	L =	51	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.40	ft
Flow Area at Max Channel Velocity	A_t =	21.54	ft^2
Culvert Cross Sectional Area Available	A =	9.62	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.25	
Sum of All Losses Coefficients	k_s =	1.45	ft
Culvert Normal Depth	Y_n =	0.24	ft
Culvert Critical Depth	Y_c =	3.15	ft
Tailwater Depth for Design	d =	3.32	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	1.87	ft
Expansion Factor	1/(2*tan(Θ)) =	5.62	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	4.70	$ft^{0.5}/s$
Froude Number	Fr =	169.05	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.75	
Inlet Control Headwater	HW_I =	2.97	ft
Outlet Control Headwater	HW_O =	-5,960.84	
Design Headwater Elevation	**HW =**	**5,972.47**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.85**	
Minimum Theoretical Riprap Size	d_{50} =	16	in
Nominal Riprap Size	d_{50} =	18	in
UDFCD Riprap Type	**Type =**	**H**	
Length of Protection	**L_p =**	**35**	**ft**
Width of Protection	**T =**	**10**	**ft**

Pond C Stage-Discharge-Volume-Drain Time Table (Grate)

	STAGE		WEIR / ORIFICE RELEASE RATES									VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 1	EURV Orifice 2	100-yr Orifice	100-yr Lower Horizontal Weir	100-yr Upper Horizontal Weir	100-yr Inclined Weir	100-yr Total Weir	Release	Stage			Stage	Cumulative
	ft	ft	cfs	cfs	cfs	cfs	cfs	cfs			cfs	CF	CF	(Ac-Ft)	hours	hours
Opening 1	5970.00	0	-								-	0.00	0.00	0.00	0.00	0.00
	5970.25	0.25	0.11								0.11	266.08	266.08	0.01	0.66	0.66
	5970.50	0.50	0.21								0.21	965.20	1231.28	0.03	1.26	1.92
	5970.75	0.75	0.28								0.28	1614.42	2845.70	0.07	1.61	3.53
	5971.00	1.00	0.33								0.33	2259.42	5105.12	0.12	1.89	5.42
	5971.25	1.25	0.38								0.38	3166.83	8271.95	0.19	2.33	7.75
	5971.50	1.50	0.42								0.42	4367.41	12639.36	0.29	2.89	10.64
	5971.75	1.75	0.46								0.46	5565.73	18205.09	0.42	3.39	14.03
	5972.00	2.00	0.49								0.49	6763.00	24968.09	0.57	3.83	17.85
	5972.25	2.25	0.52								0.52	7755.83	32723.92	0.75	4.12	21.97
	5972.50	2.50	0.55								0.55	8535.32	41259.24	0.95	4.28	26.26
	5972.75	2.75	0.58								0.58	9314.75	50573.99	1.16	4.44	30.70
	5973.00	3.00	0.61								0.61	10094.15	60668.14	1.39	4.60	35.30
Opening 2 / WQCV	5973.25	3.25	0.64	-							0.64	10763.77	71431.91	1.64	4.70	40.00
	5973.50	3.50	0.66	0.11							0.77	11321.26	82753.17	1.90	4.10	44.10
	5973.75	3.75	0.69	0.20							0.88	11878.75	94631.93	2.17	3.74	47.84
	5974.00	4.00	0.71	0.26							0.97	12436.24	107068.17	2.46	3.57	51.41
	5974.25	4.25	0.73	0.31							1.04	12946.87	120015.04	2.76	3.46	54.87
Opening 3	5974.50	4.50	0.75	0.35	-						1.10	13410.02	133425.06	3.06	3.38	58.24
	5974.75	4.75	0.77	0.39	0.11						1.27	13873.17	147298.23	3.38	3.04	61.28
	5975.00	5.00	0.80	0.42	0.20						1.42	14336.31	161634.54	3.71	2.81	64.09
	5975.25	5.25	0.82	0.45	0.26						1.53	14846.50	176481.04	4.05	2.70	66.79
	5975.50	5.50	0.84	0.48	0.31						1.63	15404.28	191885.33	4.41	2.63	69.42
T.O.S / EURV	5975.75	5.75	0.85	0.51	0.35						1.72	15962.06	207847.39	4.77	2.58	72.00
	5976.00	6.00	-	-	-	33.74	6.75	-	0.03	6.78	6.78	16519.84	224367.23	5.15	0.68	72.68
	5976.25	6.25	-	-	-	47.72	19.09	-	0.41	19.51	19.51	17017.81	241385.04	5.54	0.24	72.92
	5976.50	6.50	-	-	-	58.44	35.07	-	1.48	36.56	36.56	17455.39	258840.43	5.94	0.13	73.05
Top of Grate	5976.75	6.75	-	-	-	67.48	54.00	0.00	3.44	57.44	57.44	17892.96	276733.39	6.35	0.09	73.14
	5977.00	7.00	-	-	-	75.45	75.47	6.75	6.44	88.66	75.45	18330.53	295063.92	6.77	0.07	73.21
	5977.25	7.25	-	-	-	82.65	99.20	19.09	10.64	128.94	82.65	18773.18	313837.10	7.20	0.06	73.27
	5977.50	7.50	-	-	-	89.27	125.01	35.07	16.16	176.24	89.27	19220.94	333058.04	7.65	0.06	73.33
	5977.75	7.75	-	-	-	95.44	152.74	54.00	23.11	229.84	95.44	19668.70	352726.74	8.10	0.06	73.39
	5978.00	8.00	-	-	-	101.22	182.25	75.47	31.60	289.31	101.22	20116.46	372843.20	8.56	0.06	73.44
100-YR	5978.25	8.25	-	-	-	106.70	213.45	99.20	41.73	354.38	106.70	20576.45	393419.66	9.03	0.05	73.50
	5978.50	8.50	-	-	-	111.91	246.26	125.01	53.59	424.86	111.91	21048.78	414468.44	9.51	0.05	73.55
	5978.75	8.75	-	-	-	116.88	280.59	152.74	67.27	500.60	116.88	21521.10	435989.54	10.01	0.05	73.60
	5979.00	9.00	-	-	-	121.66	316.39	182.25	82.86	581.50	121.66	21993.42	457982.96	10.51	0.05	73.65

(Note: This sheet sizes WQ & EURV Orifice & 100 Year Grate inflows to the Pond Outlet)

Pond Inv:	5970.00	**Opening 1 Center =**	5970.15
$WQCV_{ELEV}$ =	5973.25	**Opening 2 Center =**	5973.40
$EURV_{ELEV}$ =	5975.58	**Opening 3 Center =**	5974.65
$T.O.S_{ELEV}$ =	5975.75		
$T.O.G_{ELEV}$ =	5976.75		
100 yr_{ELEV} =	5978.09		

WQCV Orifice

Area 0.08 SF

Orifice Diameter 0.31 FT 3.71 IN

(3.71" Opening at invert 5970', orifice center at 5970.15')

EURV- Orifice

Area 0.06931 SF

Orifice Diameter 0.30 FT 3.56 IN

(3.56" Opening at invert 5973.25', orifice center at 5973.40')
(3.56" Opening at invert 5974.5', orifice center at 5974.65')

100-yr Grate

Area 14.02 SF
Weir Length 18.00 LF (2 x 1.87)
Weir Width 8.00 LF (2 x 4')
Orfice Clogging factor = 50 %

Min Required Opening Area for Grate 72.00 SF

(18W x 4.0'L Grate, Grate Inv @ 5975.75)
(Use 6 @ 3'W x 4'L Grates)

NOTE:
1) 100-year outlet sized with Orifice Sheet
2) The outlet grates release more than the allowable release rate.
3) The orifices on the Orifice Design Sheet control the release rate.

Pond C Stage-Discharge-Volume-Drain Time Table (Orifce)

	STAGE		ORIFICE RELEASE RATES					VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 1	EURV Orifice 2	100-yr Orifice	Release	Stage			Stage	Cumulative
	ft	ft	cfs	Cfs	cfs	cfs	cfs	CF	CF	(Ac-Ft)	hours	hours
	5970.00	0	-				0.00	0.00	0.00	0.00	0.00	0.00
	5970.25	0.25	0.11				0.11	266.08	266.08	0.01	0.66	0.66
	5970.50	0.50	0.21				0.21	965.20	1231.28	0.03	1.26	1.92
	5970.75	0.75	0.28				0.28	1614.42	2845.70	0.07	1.61	3.53
	5971.00	1.00	0.33				0.33	2259.42	5105.12	0.12	1.89	5.42
	5971.25	1.25	0.38				0.38	3166.83	8271.95	0.19	2.33	7.75
	5971.50	1.50	0.42				0.42	4367.41	12639.36	0.29	2.89	10.64
	5971.75	1.75	0.46				0.46	5565.73	18205.09	0.42	3.39	14.03
	5972.00	2.00	0.49				0.49	6763.00	24968.09	0.57	3.83	17.85
	5972.25	2.25	0.52				0.52	7755.83	32723.92	0.75	4.12	21.97
	5972.50	2.50	0.55				0.55	8535.32	41259.24	0.95	4.28	26.26
	5972.75	2.75	0.58				0.58	9314.75	50573.99	1.16	4.44	30.70
	5973.00	3.00	0.61				0.61	10094.15	60668.14	1.39	4.60	35.30
WQCV	5973.25	3.25	0.64	-			0.64	10763.77	71431.91	1.64	4.70	40.00
	5973.50	3.50	0.66	0.11			0.77	11321.26	82753.17	1.90	4.10	44.10
	5973.75	3.75	0.69	0.20			0.88	11878.75	94631.93	2.17	3.74	47.84
	5974.00	4.00	0.71	0.26			0.97	12436.24	107068.17	2.46	3.57	51.41
	5974.25	4.25	0.73	0.31			1.04	12946.87	120015.04	2.76	3.46	54.87
	5974.50	4.50	0.75	0.35	-		1.10	13410.02	133425.06	3.06	3.38	58.24
	5974.75	4.75	0.77	0.39	0.11		1.27	13873.17	147298.23	3.38	3.04	61.28
	5975.00	5.00	0.80	0.42	0.20		1.42	14336.31	161634.54	3.71	2.81	64.09
	5975.25	5.25	0.82	0.45	0.26		1.53	14846.50	176481.04	4.05	2.70	66.79
	5975.50	5.50	0.84	0.48	0.31		1.63	15404.28	191885.33	4.41	2.63	69.42
T.O.S / EURV	5975.75	5.75	0.85	0.51	0.35		1.72	15962.06	207847.39	4.77	2.58	72.00
	5976.00	6.00	-	-	-	90.99	90.99	16519.84	224367.23	5.15	0.05	72.05
	5976.25	6.25	-	-	-	92.87	92.87	17017.81	241385.04	5.54	0.05	72.10
	5976.50	6.50	-	-	-	94.71	94.71	17455.39	258840.43	5.94	0.05	72.15
	5976.75	6.75	-	-	-	96.51	96.51	17892.96	276733.39	6.35	0.05	72.20
	5977.00	7.00	-	-	-	98.28	98.28	18330.53	295063.92	6.77	0.05	72.26
	5977.25	7.25	-	-	-	100.02	100.02	18773.18	313837.10	7.20	0.05	72.31
	5977.50	7.50	-	-	-	101.73	101.73	19220.94	333058.04	7.65	0.05	72.36
	5977.75	7.75	-	-	-	103.42	103.42	19668.70	352726.74	8.10	0.05	72.41
	5978.00	8.00	-	-	-	105.07	105.07	20116.46	372843.20	8.56	0.05	72.47
100-YR	5978.25	8.25	-	-	-	106.70	106.70	20576.45	393419.66	9.03	0.05	72.52

(Note: This sheet sizes WQCV , EURV & 100 Year Orifices from Pond Outlet)

Pond Inv:	5970.00	**WQCV Orifice 1 Center =**	5970.15
$WQCV_{ELEV}$ =	5973.25	**WQCV Orifice 1 Center =**	5973.40
$EURV_{ELEV}$ =	5975.58	**EURV Orifice Center =**	5974.65
$T.O.S_{ELEV}$ =	5975.75		
100 yr $_{ELEV}$ =	5978.09		

WQCV Orifice

Area 0.08 SF

Orifice Diameter 0.31 FT 3.71 IN

(3.71" Opening at invert 5970', orifice center at 5970.15')

EURV- Orifice

Area 0.06931 SF

Orifice Diameter 0.30 FT 3.56 IN

(3.56" Opening at invert 5973.25', orifice center at 5973.40')
(3.56" Opening at invert 5974.5', orifice center at 5974.65')

100-yr Orifice

Area 7.72 SF

Opening Height = 2.66 LF (Remaining Area to be Covered by Restrictor Plate)

(2.69' Opening in 3.5' RCP to be achieved
with Restrictor Plate)

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Partially Full Pipe Flow Calculator and Equations

Fluid Flow Table of Contents | Hydraulic and Pneumatic Knowledge
Fluid Power Equipment

This engineering calculator determines the Flow within a partially full pipe using the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

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Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V

for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, **D** =	42	in
Depth of flow, **y** =	32	in

(must have y ≥ D/2)

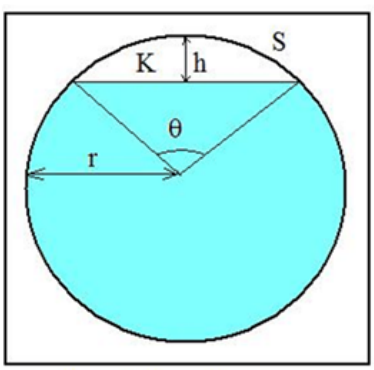
Full Pipe Manning roughness, n_{full} =	0.012	
Channel bottom slope, **S** =	0.0003	ft/ft

Calculations

n/n_{full} =	1.1190476	
Partially Full Manning roughness, **n** =	0.013	

Calculations

Pipe Diameter, **D** =	3.5	ft
Pipe Radius, **r** =	1.75	ft
Circ. Segment Height, **h** =	0.833	ft
Central Angle, **q** =	2.04	radians
Cross-Sect. Area, **A** =	7.87	ft^2
Wetted Perimeter, **P** =	7.4	ft
Hydraulic Radius, **R** =	1.06	ft
Discharge, **Q** =	15.70	cfs
Ave. Velocity, **V** =	2.00	ft/sec
pipe % full [(A/A_{full})*100%] =	81.8%	



Partially Full Pipe Flow Parameters
(More Than Half Full)

r = D/2

h = 2r - y

(hydraulic radius)

R = A/P

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

V = Q/A P

$$\theta = 2\arccos\left(\frac{r-h}{r}\right)$$

$$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = 2\pi r - r*\theta$$

Equation used for n/n_{full}: $\mathbf{n/n_{full} = 1.25 - (y/D - 0.5)*0.5}$ (for $0.5 \le y/D \le 1$)

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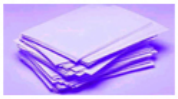

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Pond D

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Pond D

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
4.96	2.95	0.97	58.3

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
5986	77.00	0	0	0	0	0	0
5987	5948	6,702	2,234	1	2,234	2,234	0.05
5988	22697	40,264	13,421	1	13,421	15,655	0.36
5989	28487	76,612	25,537	1	25,537	41,193	0.95
5990	31739	90,295	30,098	1	30,098	71,291	1.64
5991	35091	100,203	33,401	1	33,401	104,692	2.40
5992	38544	110,412	36,804	1	36,804	141,496	3.25
5993	49506	131,732	43,911	1	43,911	185,407	4.26
5994	53361	154,264	51,421	1	51,421	236,828	5.44

WQ ELEV	5989.04	FT	**WQ** VOLUME	0.97	AC-FT
EURV ELEV	5991.65	FT	**EURV** VOLUME	2.95	AC-FT
100YEAR ELEV	5993.60	FT	**100**YEAR VOLUME	4.96	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS

Pond D

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT^3)	(FT)
0.97	126.89	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft^2	ft^2	ft^2	ft	ft^3	ft^3	ac-ft
5986	77.00	0	0	0	0	0	0
5986.5	5948	6,702	2,234	1	1,117	1,117	0.03

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Pond D**

Facility Location & Jurisdiction: **Trails at Crowfoot**

User Input: Watershed Characteristics

Watershed Slope =	0.028	ft/ft
Watershed Length =	4015	ft
Watershed Area =	52.76	acres
Watershed Imperviousness =	55.2%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent

Location for 1-hr Rainfall Depths (use dropdown):

Parker - Town Hall

WQCV Treatment Method =

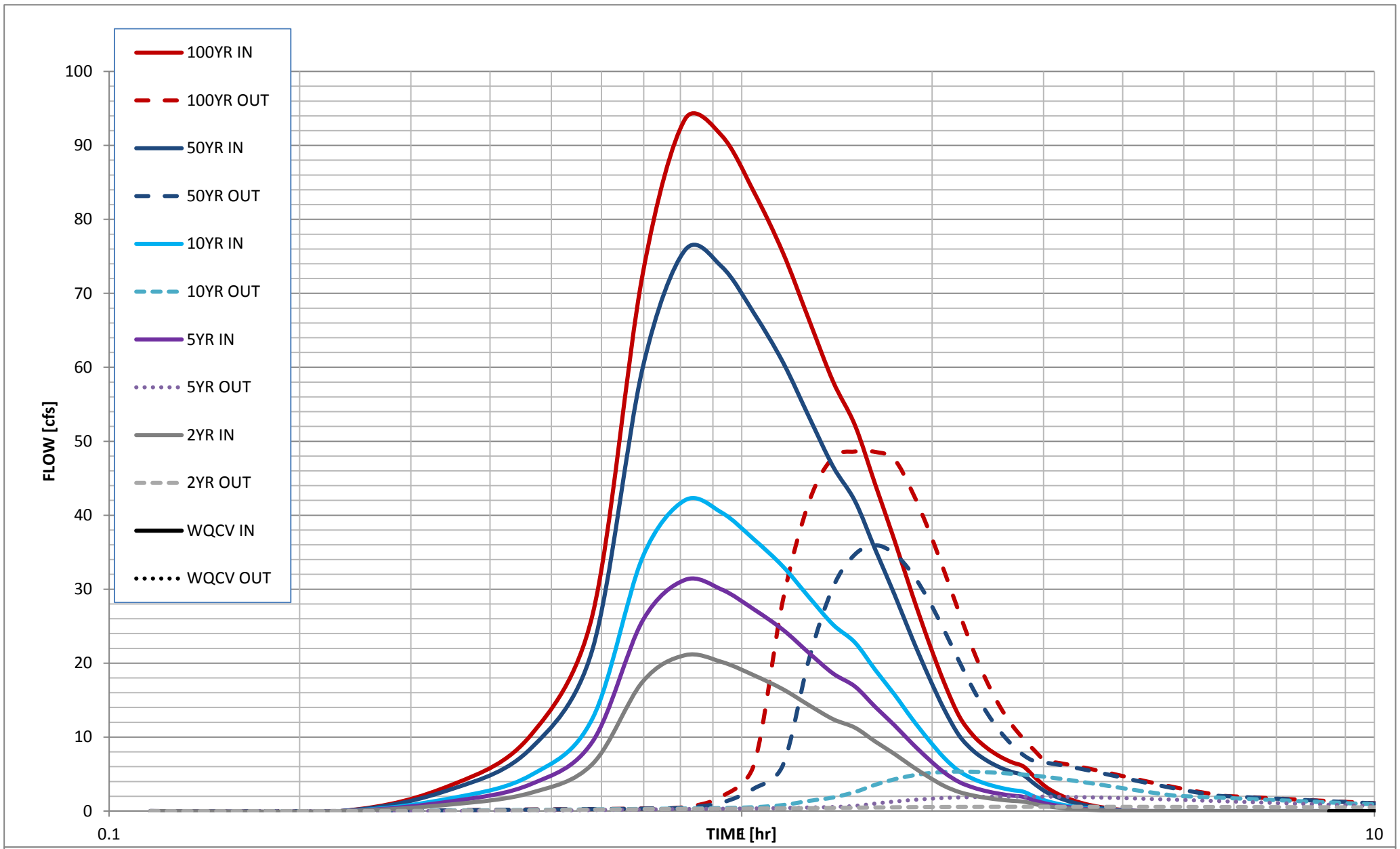
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	77	0.00	0.00
1.00	5,948	1.00	0.21
2.00	22,697	2.00	0.30
3.00	28,487	3.00	0.37
4.00	31,739	4.00	0.58
5.00	35,091	5.00	2.05
6.00	38,544	6.00	6.78
7.00	49,506	7.00	47.70
8.00	53,361	8.00	61.58

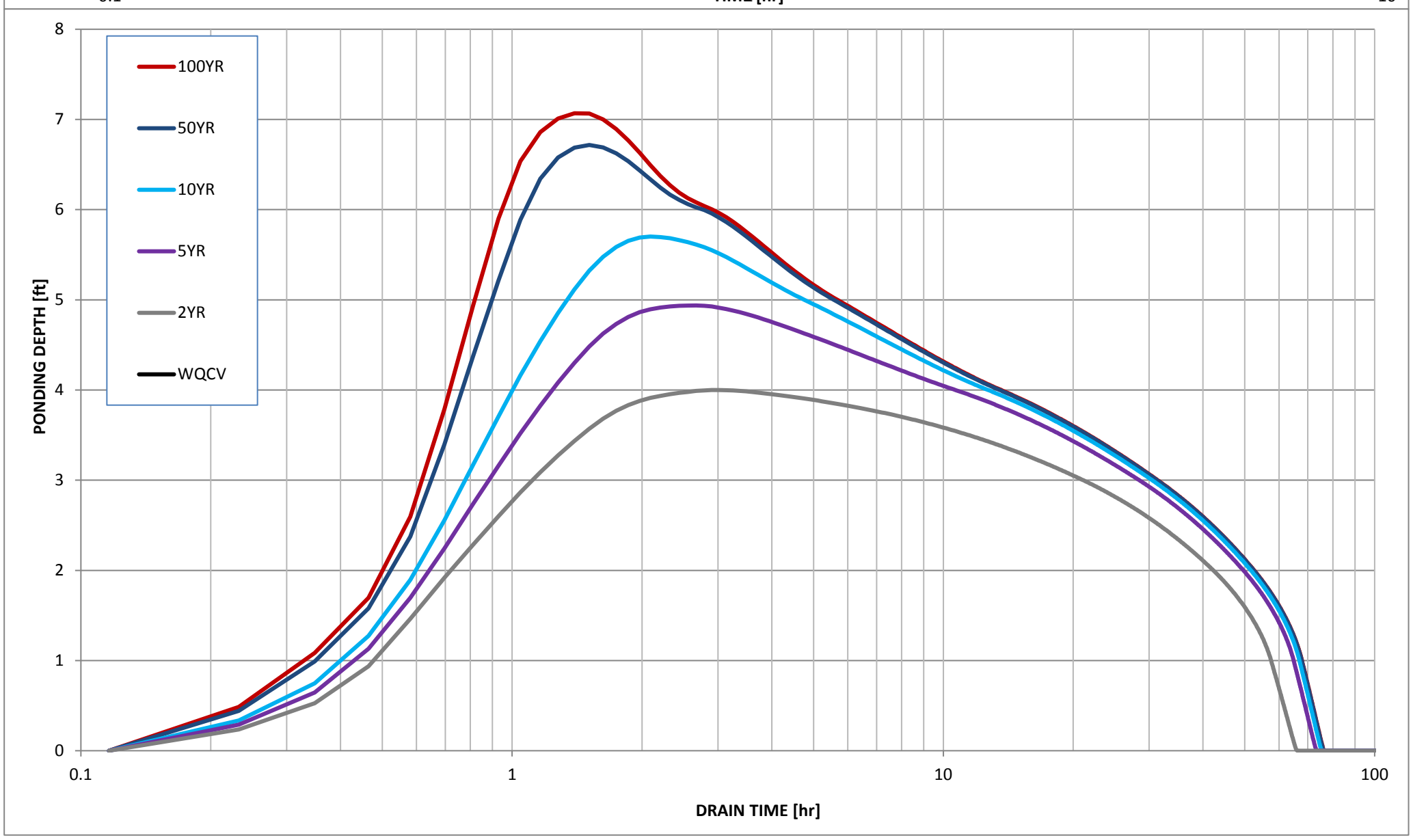
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	0.82	1.10	1.34	1.98	2.29	in
Calculated Runoff Volume =		1.790	2.670	3.606	6.598	8.185	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =		1.790	2.670	3.606	6.592	8.178	acre-ft
Time to Drain 97% of Inflow Volume =		58.5	**64.4**	64.8	61.1	59.0	hours
Time to Drain 99% of Inflow Volume =		61.6	68.1	69.2	68.0	**67.1**	hours
Maximum Ponding Depth =		4.00	4.94	5.70	6.72	7.07	ft
Maximum Ponded Area =		0.73	0.80	0.86	1.06	**1.14**	acres
Maximum Volume Stored =		1.669	2.388	3.023	3.983	4.368	acre-ft

Stormwater Detention and Infiltration Design Data Sheet

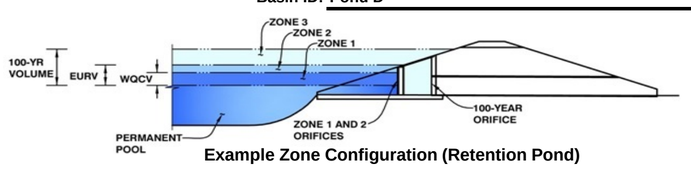




DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Trails at Crowfoot

Basin ID: Pond D



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	52.76	acres
Watershed Length =	4,015	ft
Watershed Slope =	0.028	ft/ft
Watershed Imperviousness =	55.15%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - Parker Town Court	
Water Quality Capture Volume (WQCV) =	0.971	acre-feet
Excess Urban Runoff Volume (EURV) =	2.954	acre-feet
2-yr Runoff Volume (P1 = 0.96 in.) =	2.168	acre-feet
5-yr Runoff Volume (P1 = 1.4 in.) =	3.770	acre-feet
10-yr Runoff Volume (P1 = 1.65 in.) =	4.862	acre-feet
25-yr Runoff Volume (P1 = 1.98 in.) =	6.572	acre-feet
50-yr Runoff Volume (P1 = 2.3 in.) =	8.027	acre-feet
100-yr Runoff Volume (P1 = 2.61 in.) =	9.617	acre-feet
500-yr Runoff Volume (P1 = 3.25 in.) =	12.685	acre-feet
Approximate 2-yr Detention Volume =	2.053	acre-feet
Approximate 5-yr Detention Volume =	3.279	acre-feet
Approximate 10-yr Detention Volume =	3.595	acre-feet
Approximate 25-yr Detention Volume =	4.006	acre-feet
Approximate 50-yr Detention Volume =	4.658	acre-feet
Approximate 100-yr Detention Volume =	5.594	acre-feet

Optional User Input
1-hr Precipitation

	inches
	inches
	inches
	inches
	inches
	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.971	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.983	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.640	acre-feet
Total Detention Basin Volume =	5.594	acre-feet
Initial Surcharge Volume (ISV) =	127	ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool									

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond D (Forebay 1)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 55.2 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.552
C) Contributing Watershed Area	Area = 23.580 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.434 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond D (Forebay 1)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.013 ac-ft
B) Actual Forebay Volume	V_F = 0.013 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 82.70 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.65 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ● Wall with Rect. Notch; ○ Wall with V-Notch Weir — (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 8.4 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One: ○ Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond D (Forebay 2)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 55.2 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.552
C) Contributing Watershed Area	Area = 23.660 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.436 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond D (Forebay 2)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.013 ac-ft
B) Actual Forebay Volume	V_F = 0.013 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 78.50 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.57 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ● Wall with Rect. Notch; ○ Wall with V-Notch Weir — (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 8.1 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One: ○ Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond D (Forebay 3)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 55.2 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.552
C) Contributing Watershed Area	Area = 5.800 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.107 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	

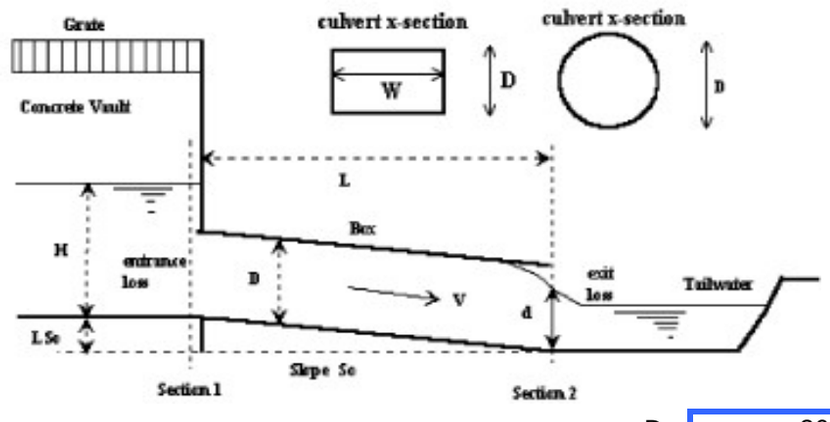
Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**ASFUND KHAN**
Company:	**CVL Consultants**
Date:	**May 9, 2017**
Project:	**Trails at Crowfoot**
Location:	**Pond D (Forebay 3)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV)	V_{FMIN} = 0.002 ac-ft
B) Actual Forebay Volume	V_F = 0.002 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 36.40 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.73 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ● Wall with Rect. Notch; ○ Wall with V-Notch Weir — (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 5.0 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = sq ft
C) Outlet Type	Choose One: ○ Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond D
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Beveled Edge	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Bevel w/ 90 Deg. Headwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	5985.75	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	5983.51	ft. elev.
	Culvert Length in Feet	L =	59	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.42
Sum of All Loss Coefficients	K_s =	1.62
Orifice Inlet Condition Coefficient	C_d =	1.03
Minimum Energy Condition Coefficient	KE_{low} =	-0.1547

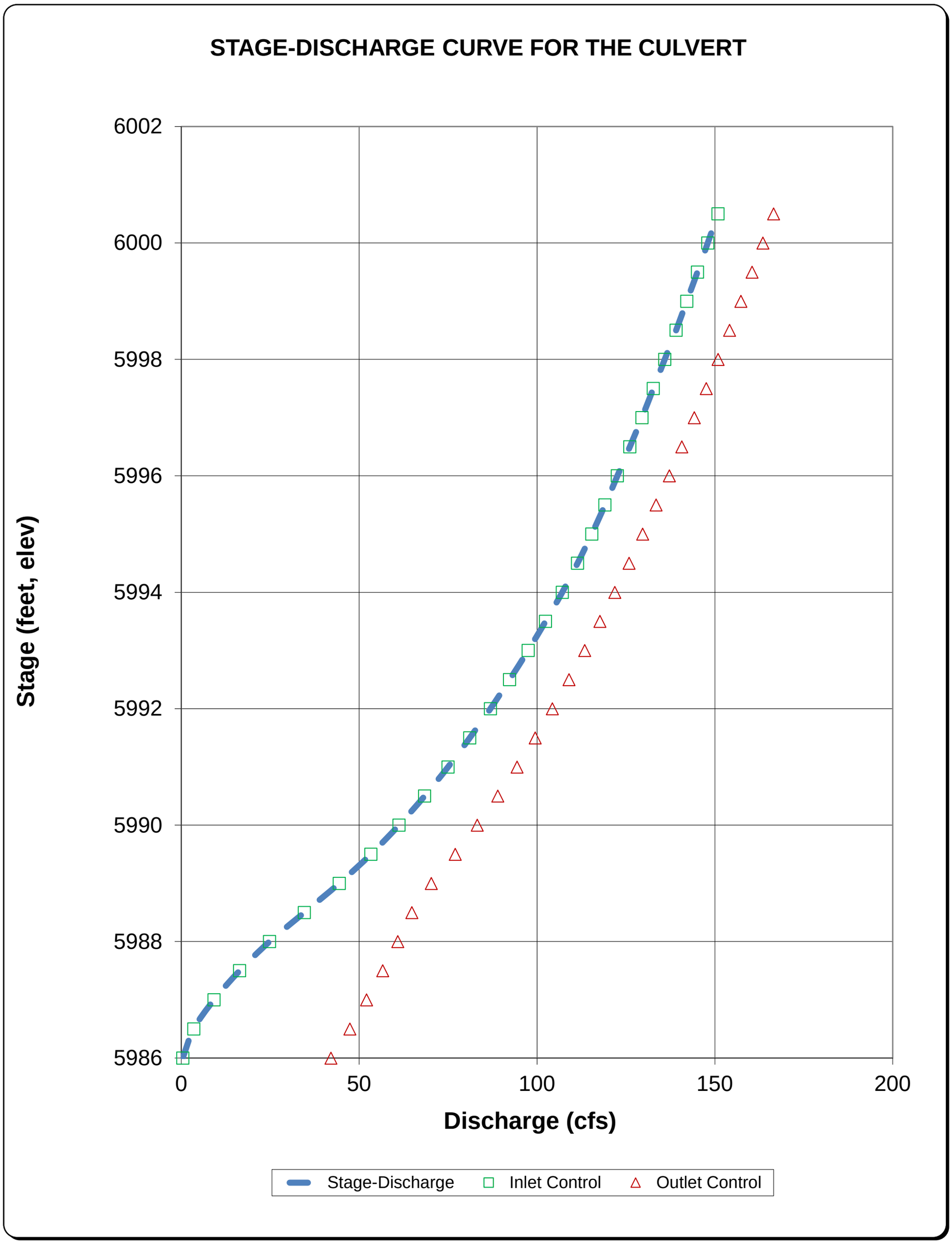
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
5986.00	5971.33	0.40	42.04	**0.40**	Min. Energy. Eqn.	INLET
5986.50	5971.33	3.50	47.37	**3.50**	Min. Energy. Eqn.	INLET
5987.00	5971.33	9.20	52.05	**9.20**	Min. Energy. Eqn.	INLET
5987.50	5971.33	16.40	56.60	**16.40**	Regression Eqn.	INLET
5988.00	5971.33	24.80	60.82	**24.80**	Regression Eqn.	INLET
5988.50	5971.33	34.60	64.79	**34.60**	Regression Eqn.	INLET
5989.00	5971.33	44.40	70.24	**44.40**	Regression Eqn.	INLET
5989.50	5971.33	53.30	77.00	**53.30**	Regression Eqn.	INLET
5990.00	5971.33	61.20	83.18	**61.20**	Regression Eqn.	INLET
5990.50	5971.33	68.40	88.96	**68.40**	Regression Eqn.	INLET
5991.00	5971.33	75.00	94.35	**75.00**	Regression Eqn.	INLET
5991.50	5971.33	81.10	99.49	**81.10**	Regression Eqn.	INLET
5992.00	5971.33	86.90	104.29	**86.90**	Regression Eqn.	INLET
5992.50	5971.33	92.30	108.97	**92.30**	Regression Eqn.	INLET
5993.00	5971.33	97.50	113.39	**97.50**	Regression Eqn.	INLET
5993.50	5971.33	102.40	117.68	**102.40**	Regression Eqn.	INLET
5994.00	5971.33	107.10	121.84	**107.10**	Regression Eqn.	INLET
5994.50	5971.33	111.40	125.87	**111.40**	Regression Eqn.	INLET
5995.00	5971.33	115.40	129.70	**115.40**	Orifice Eqn.	INLET
5995.50	5971.33	119.10	133.47	**119.10**	Orifice Eqn.	INLET
5996.00	5971.33	122.60	137.17	**122.60**	Orifice Eqn.	INLET
5996.50	5971.33	126.10	140.68	**126.10**	Orifice Eqn.	INLET
5997.00	5971.33	129.50	144.19	**129.50**	Orifice Eqn.	INLET
5997.50	5971.33	132.70	147.57	**132.70**	Orifice Eqn.	INLET
5998.00	5971.33	135.90	150.88	**135.90**	Orifice Eqn.	INLET
5998.50	5971.33	139.10	154.13	**139.10**	Orifice Eqn.	INLET
5999.00	5971.33	142.10	157.32	**142.10**	Orifice Eqn.	INLET
5999.50	5971.33	145.10	160.44	**145.10**	Orifice Eqn.	INLET
6000.00	5971.33	148.00	163.49	**148.00**	Orifice Eqn.	INLET
6000.50	5971.33	150.90	166.48	**150.90**	Orifice Eqn.	INLET

Processing Time: 00.61 Seconds

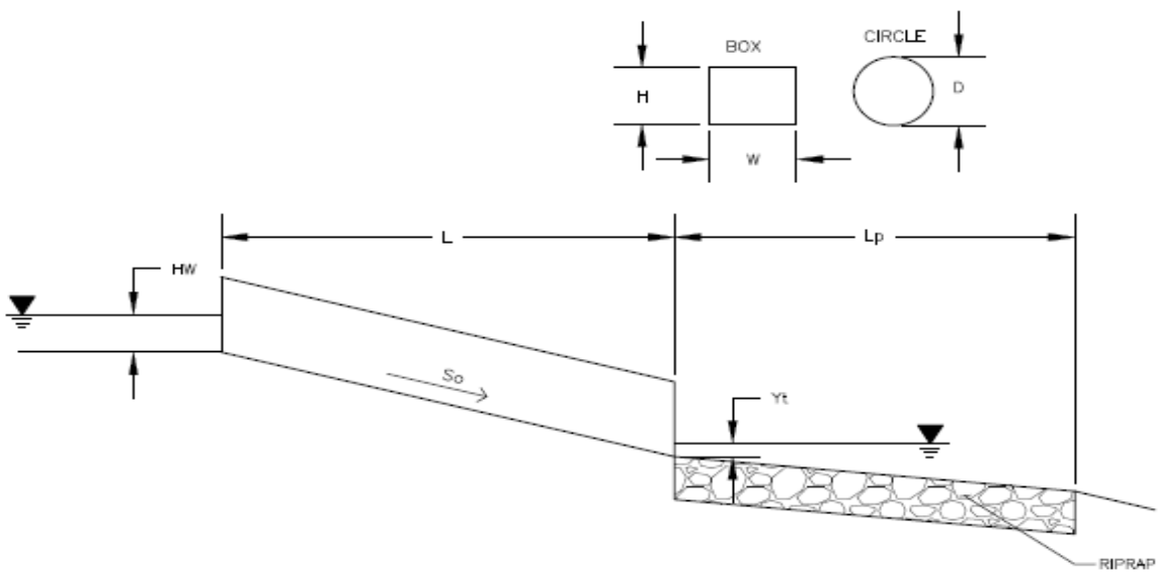
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond D



Determination of Culvert Headwater and Outlet Protection

Project: TRAILS AT CROWFOOT
Basin ID: POND D



Soil Type:
Choose One:
○ Sandy
◉ Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

Design Discharge	Q =	58.42	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	36	inches
Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Beveled Edge	
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	5985.75	ft
Outlet Elevation **OR** Slope	Elev OUT =	3.8	ft
Culvert Length	L =	59	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.20	ft
Flow Area at Max Channel Velocity	A_t =	8.35	ft^2
Culvert Cross Sectional Area Available	A =	7.07	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.36	
Sum of All Losses Coefficients	k_s =	1.56	ft
Culvert Normal Depth	Y_n =	0.19	ft
Culvert Critical Depth	Y_c =	2.47	ft
Tailwater Depth for Design	d =	2.74	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	1.60	ft
Expansion Factor	1/(2*tan(Θ)) =	6.70	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	3.75	$ft^{0.5}/s$
Froude Number	Fr =	152.09	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.75	
Inlet Control Headwater	HW_I =	2.36	ft
Outlet Control Headwater	HW_O =	-5,977.56	
Design Headwater Elevation	**HW =**	**5,988.11**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.79**	
Minimum Theoretical Riprap Size	d_{50} =	11	in
Nominal Riprap Size	d_{50} =	12	in
UDFCD Riprap Type	**Type =**	**M**	
Length of Protection	**L_p =**	**27**	**ft**
Width of Protection	**T =**	**8**	**ft**

Pond D Stage-Discharge-Volume-Drain Time Table (Grate)

	STAGE		WEIR / ORIFICE RELEASE RATES									VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 1	EURV Orifice 2	100-yr Orifice	100-yr Lower Horizontal Weir	100-yr Upper Horizontal Weir	100-yr Inclined Weir	100-yr Total Weir	Release	Stage			Stage	Cumulative
	ft	ft	cfs	cfs	cfs	cfs	cfs	cfs			cfs	CF	CF	(Ac-Ft)	hours	hours
Opening 1	5986.00	0	-								-	0.00	0.00	0.00	0.00	0.00
	5986.25	0.25	0.08								0.08	163.89	163.89	0.00	0.58	0.58
	5986.50	0.50	0.13								0.13	559.54	723.42	0.02	1.15	1.73
	5986.75	0.75	0.17								0.17	930.55	1653.97	0.04	1.49	3.22
	5987.00	1.00	0.21								0.21	1299.21	2953.18	0.07	1.76	4.98
	5987.25	1.25	0.23								0.23	1987.30	4940.47	0.11	2.37	7.35
	5987.50	1.50	0.26								0.26	3042.17	7982.65	0.18	3.29	10.63
	5987.75	1.75	0.28								0.28	4092.86	12075.51	0.28	4.07	14.70
	5988.00	2.00	0.30								0.30	5141.96	17217.46	0.40	4.76	19.46
	5988.25	2.25	0.32								0.32	5854.26	23071.72	0.53	5.09	24.55
	5988.50	2.50	0.34								0.34	6216.18	29287.90	0.67	5.11	29.66
	5988.75	2.75	0.36								0.36	6578.11	35866.01	0.82	5.15	34.81
Opening 2 / WQCV	5989.00	3.00	0.37								0.37	6940.03	42806.04	0.98	5.19	40.00
	5989.25	3.25	0.39	-							0.39	7223.14	50029.17	1.15	5.18	45.18
	5989.50	3.50	0.40	0.10							0.50	7426.39	57455.57	1.32	4.10	49.28
	5989.75	3.75	0.42	0.13							0.55	7629.65	65085.22	1.49	3.89	53.17
	5990.00	4.00	0.43	0.15							0.58	7832.91	72918.12	1.67	3.74	56.90
	5990.25	4.25	0.44	0.17							0.62	8039.27	80957.39	1.86	3.63	60.53
Opening 3	5990.50	4.50	0.46	0.19	-						0.65	8248.78	89206.17	2.05	3.54	64.07
	5990.75	4.75	0.47	0.20	0.06						0.74	8458.28	97664.46	2.24	3.19	67.26
	5991.00	5.00	0.48	0.22	1.35						2.05	8667.79	106332.24	2.44	1.17	68.43
	5991.25	5.25	0.50	0.23	1.36						2.09	8880.44	115212.68	2.64	1.18	69.61
	5991.50	5.50	0.51	0.25	1.37						2.12	9096.26	124308.94	2.85	1.19	70.80
T.O.S / EURV	5991.75	5.75	0.52	0.26	1.38						2.16	9312.07	133621.01	3.07	1.20	72.00
	5992.00	6.00	-	-	-	19.47	2.25	-	0.03	2.28	2.28	9527.89	143148.90	3.29	1.16	73.16
	5992.25	6.25	-	-	-	27.54	6.36	-	0.41	6.78	6.78	9976.60	153125.50	3.52	0.41	73.57
	5992.50	6.50	-	-	-	33.73	11.69	-	1.48	13.17	13.17	10661.85	163787.36	3.76	0.22	73.80
Top of Grate	5992.75	6.75	-	-	-	38.95	18.00	0.00	3.44	21.44	21.44	11347.09	175134.44	4.02	0.15	73.94
	5993.00	7.00	-	-	-	43.54	25.16	2.25	6.44	33.85	33.85	12032.31	187166.76	4.30	0.10	74.04
	5993.25	7.25	-	-	-	47.70	33.07	6.36	10.64	50.07	47.70	12496.78	199663.53	4.58	0.07	74.11
	5993.50	7.50	-	-	-	51.52	41.67	11.69	16.16	69.52	51.52	12737.72	212401.25	4.88	0.07	74.18
	5993.75	7.75	-	-	-	55.08	50.91	18.00	23.11	92.02	55.08	12978.66	225379.90	5.17	0.07	74.25
100-YR	5994.00	8.00	-	-	-	58.42	60.75	25.16	31.60	117.50	58.42	13219.60	238599.50	5.48	0.06	74.31
	5994.25	8.25	-	-	-	61.58	71.15	33.07	41.73	145.94	61.58	0.00	238599.50	5.48	0.00	74.31
	5994.50	8.50	-	-	-	64.59	82.09	41.67	53.59	177.34	64.59	0.00	238599.50	5.48	0.00	74.31
	5994.75	8.75	-	-	-	67.46	93.53	50.91	67.27	211.71	67.46	0.00	238599.50	5.48	0.00	74.31
	5995.00	9.00	-	-	-	70.21	105.46	60.75	82.86	249.08	70.21	0.00	238599.50	5.48	0.00	74.31

(Note: This sheet sizes WQ & EURV Orifice & 100 Year Grate inflows to the Pond Outlet)

Pond Inv:	5986.00	**Opening 1 Center =**	5986.12
$WQCV_{ELEV}$ =	5989.04	**Opening 2 Center =**	5989.10
$EURV_{ELEV}$ =	5991.65	**Opening 3 Center =**	5990.60
$T.O.S_{ELEV}$ =	5991.75		
$T.O.G_{ELEV}$ =	5992.75		
100 yr_{ELEV} =	5993.55		

WQCV Orifice

Area	0.05	SF		
Orifice Diameter	0.24	FT	2.89	IN

(2.89" Opening at invert 5986', orifice center at 5986.12')

EURV- Orifice

Area	0.03314	SF		
Orifice Diameter	0.21	FT	2.46	IN

2.46" Opening at invert 5989', orifice center at 5989.10')
(2.46" Opening at invert 5990.5', orifice center at 5990.60')

100-yr Grate

Area	8.09	SF	
Weir Length	6.00	LF	(2 x 0.93)
Weir Width	8.00	LF	(2 x 4')

Orfice Clogging factor = 50 %

Min Required Opening Area for Grate 24.00 SF

(6'W x 4.0'L Grate, Grate Inv @ 5991.75)
(Use 2 @ 3'W x 4'L Grates)

NOTE:
1) 100-year outlet sized with Orifice Sheet
2) The outlet grates release more than the allowable release rate.
3) The orifices on the Orifice Design Sheet control the release rate.

Pond D Stage-Discharge-Volume-Drain Time Table (Orifce)

	STAGE		ORIFICE RELEASE RATES					VOLUME	CUM. VOLUME	CUM. VOLUME	DRAIN TIME	
	Elevation	Stage	WQ Orifice 1	EURV Orifice 1	EURV Orifice 2	100-yr Orifice	Release	Stage			Stage	Cumulative
	ft	ft	cfs	Cfs	cfs	cfs	cfs	CF	CF	(Ac-Ft)	hours	hours
	5986.00	0	-				0.00	0.00	0.00	0.00	0.00	0.00
	5986.25	0.25	0.08				0.08	163.89	163.89	0.00	0.58	0.58
	5986.50	0.50	0.13				0.13	559.54	723.42	0.02	1.15	1.73
	5986.75	0.75	0.17				0.17	930.55	1653.97	0.04	1.49	3.22
	5987.00	1.00	0.21				0.21	1299.21	2953.18	0.07	1.76	4.98
	5987.25	1.25	0.23				0.23	1987.30	4940.47	0.11	2.37	7.35
	5987.50	1.50	0.26				0.26	3042.17	7982.65	0.18	3.29	10.63
	5987.75	1.75	0.28				0.28	4092.86	12075.51	0.28	4.07	14.70
	5988.00	2.00	0.30				0.30	5141.96	17217.46	0.40	4.76	19.46
	5988.25	2.25	0.32				0.32	5854.26	23071.72	0.53	5.09	24.55
	5988.50	2.50	0.34				0.34	6216.18	29287.90	0.67	5.11	29.66
	5988.75	2.75	0.36				0.36	6578.11	35866.01	0.82	5.15	34.81
WQCV	5989.00	3.00	0.37				0.37	6940.03	42806.04	0.98	5.19	40.00
	5989.25	3.25	0.39	-			0.39	7223.14	50029.17	1.15	5.18	45.18
	5989.50	3.50	0.40	0.10			0.50	7426.39	57455.57	1.32	4.10	49.28
	5989.75	3.75	0.42	0.13			0.55	7629.65	65085.22	1.49	3.89	53.17
	5990.00	4.00	0.43	0.15			0.58	7832.91	72918.12	1.67	3.74	56.90
	5990.25	4.25	0.44	0.17			0.62	8039.27	80957.39	1.86	3.63	60.53
	5990.50	4.50	0.46	0.19	-		0.65	8248.78	89206.17	2.05	3.54	64.07
	5990.75	4.75	0.47	0.20	0.06		0.74	8458.28	97664.46	2.24	3.19	67.26
	5991.00	5.00	0.48	0.22	1.35		2.05	8667.79	106332.24	2.44	1.17	68.43
	5991.25	5.25	0.50	0.23	1.36		2.09	8880.44	115212.68	2.64	1.18	69.61
	5991.50	5.50	0.51	0.25	1.37		2.12	9096.26	124308.94	2.85	1.19	70.80
T.O.S / EURV	5991.75	5.75	0.52	0.26	1.38		2.16	9312.07	133621.01	3.07	1.20	72.00
	5992.00	6.00	-	-	-	51.40	51.40	9527.89	143148.90	3.29	0.05	72.05
	5992.25	6.25	-	-	-	52.46	52.46	9976.60	153125.50	3.52	0.05	72.10
	5992.50	6.50	-	-	-	53.50	53.50	10661.85	163787.36	3.76	0.06	72.16
	5992.75	6.75	-	-	-	54.52	54.52	11347.09	175134.44	4.02	0.06	72.22
	5993.00	7.00	-	-	-	55.52	55.52	12032.31	187166.76	4.30	0.06	72.28
	5993.25	7.25	-	-	-	56.50	56.50	12496.78	199663.53	4.58	0.06	72.34
	5993.50	7.50	-	-	-	57.47	57.47	12737.72	212401.25	4.88	0.06	72.40
100-YR	5993.75	7.75	-	-	-	58.42	58.42	12978.66	225379.90	5.17	0.06	72.46
	5994.00	8.00	-	-	-	59.35	59.35	13219.60	238599.50	5.48	0.06	72.52

Pond Inv:	5986.00	**WQCV Orifice 1 Center =**	5986.12
$WQCV_{ELEV}$ =	5989.04	**WQCV Orifice 1 Center =**	5989.10
$EURV_{ELEV}$ =	5991.65	**EURV Orifice Center =**	5990.60
$T.O.S_{ELEV}$ =	5991.75		
100 yr $_{ELEV}$ =	5993.55		

WQCV Orifice

Area	0.05	SF		
Orifice Diameter	0.24	FT	2.89	IN

(2.89" Opening at invert 5986', orifice center at 5986.12')

EURV- Orifice

Area	0.03314	SF		
Orifice Diameter	0.21	FT	2.46	IN

2.46" Opening at invert 5989', orifice center at 5989.10')
(2.46" Opening at invert 5990.5', orifice center at 5990.60')

100-yr Orifice

Area	4.36	SF	
Opening Height =	2.10	LF	(Remaining Area to be Covered by Restrictor Plate)

(2.1' Opening in 3.0' RCP to be achieved
with Restrictor Plate)

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Partially Full Pipe Flow Calculator and Equations

Fluid Flow Table of Contents | Hydraulic and Pneumatic Knowledge
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This engineering calculator determines the Flow within a partially full pipe using the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

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Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V

for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, **D** =	30	in
Depth of flow, **y** =	25	in

(must have y ≥ D/2)

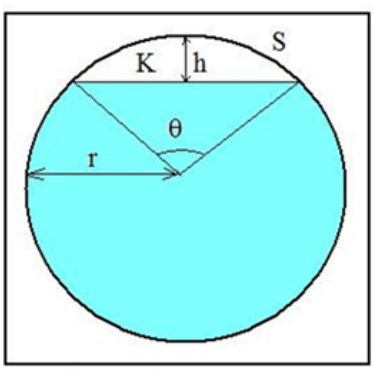
Full Pipe Manning roughness, n_{full} =	0.012	
Channel bottom slope, **S** =	0.0003	ft/ft

Calculations

n/n_{full} =	1.0833333
Partially Full Manning roughness, **n** =	0.013

Calculations

Pipe Diameter, **D** =	2.5	ft
Pipe Radius, **r** =	1.25	ft
Circ. Segment Height, **h** =	0.417	ft
Central Angle, **q** =	1.68	radians
Cross-Sect. Area, **A** =	4.37	ft^2
Wetted Perimeter, **P** =	5.8	ft
Hydraulic Radius, **R** =	0.76	ft
Discharge, **Q** =	7.23	cfs
Ave. Velocity, **V** =	1.65	ft/sec
pipe % full [(A/A_{full})*100%] =	89.0%	



Partially Full Pipe Flow Parameters
(More Than Half Full)

r = D/2

h = 2r - y

(hydraulic radius)

R = A/P

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

V = Q/A P

$$\theta = 2\arccos\left(\frac{r-h}{r}\right)$$

$$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = 2\pi r - r*\theta$$

Equation used for n/n_{full}: $n/n_{full} = 1.25 - (y/D - 0.5)*0.5$ (for $0.5 \le y/D \le 1$)

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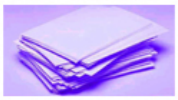

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III. Hydraulic Computations

1. CUHP & SWMM

A. 5 & 100 YEAR CUHP
B. 5 & 100 YEAR SWMM

Trails at Crowfoot_5 Year Analysis

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A-1	0.088	0.110	37.0	4.62	19.2	3.27	7.7	23	67,228	0.82	55,256	35.0	12	55,111	0.64
A-2	0.091	0.119	30.3	4.28	15.8	3.02	7.1	38	89,008	0.77	68,525	35.0	17	68,228	0.71
A-3	0.092	0.086	34.9	3.80	18.2	2.68	6.3	17	45,041	0.74	33,504	35.0	8	33,412	0.62
A-4	0.097	0.071	45.4	3.97	23.6	2.80	6.6	12	40,571	0.63	25,740	40.0	5	25,689	0.44
B-1	0.098	0.120	39.4	5.15	20.5	3.64	8.6	46	140,004	0.62	86,452	40.0	19	86,263	0.49
B-2	0.087	0.145	32.1	5.07	16.7	3.59	8.5	47	117,093	0.86	100,261	35.0	24	100,020	0.74
C-1	0.090	0.115	37.8	4.85	19.7	3.42	8.1	28	81,636	0.77	63,267	35.0	13	63,097	0.60
D-1	0.086	0.128	25.6	4.01	13.3	2.83	6.7	43	84,381	0.89	74,921	35.0	21	74,697	0.89
E-1	0.089	0.208	27.0	5.82	14.1	4.11	9.7	137	286,904	0.80	230,270	35.0	64	229,665	0.81
F-1	0.087	0.139	32.2	4.94	16.7	3.49	8.2	43	107,166	0.86	91,861	35.0	22	91,625	0.74
F-2	0.096	0.089	32.5	3.73	16.9	2.63	6.2	26	65,882	0.64	42,318	35.0	11	42,128	0.58
OS-1	0.157	0.084	37.3	3.89	19.4	2.75	6.5	17	50,021	0.24	11,915	35.0	4	11,882	0.26
OS-2	0.157	0.067	52.8	4.23	27.5	2.99	7.0	8	30,863	0.24	7,351	40.0	2	7,339	0.19
OS-3	0.157	0.054	51.3	3.64	26.7	2.58	6.1	5	19,288	0.24	4,593	40.0	1	4,580	0.20
OS-4	0.157	0.041	94.8	4.45	49.3	3.15	7.4	1	10,028	0.24	2,388	45.0	0	2,386	0.11
OS-5	0.157	0.053	29.6	2.71	15.4	1.91	4.5	8	18,213	0.24	4,337	35.0	2	4,272	0.32

Trails at Crowfoot_5 Year Analysis

Summary of CUHP Input Parameters (Version 2.0.0)

								Storage		Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A-1	A-1	R5	0.029	0.252	0.466	0.015	51.2	0.35	0.10	3.75	0.55	0.0018	0.00	0.86	0.23	49.42
A-2	A-2	R5	0.038	0.238	0.369	0.015	46.9	0.35	0.10	3.75	0.55	0.0018	0.00	0.83	0.22	45.11
A-3	A-3	R5	0.019	0.192	0.299	0.015	44.8	0.35	0.10	3.75	0.55	0.0018	0.00	0.82	0.21	42.96
A-4	A-4	R5	0.017	0.177	0.338	0.015	36.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.72	0.19	33.78
B-1	B-1	R5	0.060	0.285	0.464	0.015	34.7	0.35	0.10	3.75	0.55	0.0018	0.00	0.69	0.18	32.34
B-2	B-2	R5	0.050	0.289	0.556	0.015	54.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.87	0.25	52.28
C-1	C-1	R5	0.035	0.303	0.429	0.015	47.4	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	45.54
D-1	D-1	R5	0.036	0.204	0.387	0.015	56.5	0.35	0.10	3.75	0.55	0.0018	0.00	0.88	0.26	54.91
E-1	E-1	R5	0.123	0.365	0.621	0.015	49.6	0.35	0.10	3.75	0.55	0.0018	0.00	0.85	0.23	47.82
F-1	F-1	R5	0.046	0.292	0.509	0.015	54.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.87	0.25	52.36
F-2	F-2	R5	0.028	0.169	0.290	0.015	36.6	0.35	0.10	3.75	0.55	0.0018	0.00	0.73	0.19	34.45
OS-1	OS-1	R5	0.022	0.110	0.215	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.60
OS-2	OS-2	R5	0.013	0.130	0.237	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.60
OS-3	OS-3	R5	0.008	0.106	0.177	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.58
OS-4	OS-4	R5	0.004	0.157	0.233	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.58
OS-5	OS-5	R5	0.008	0.056	0.101	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.58

Trails at Crowfoot_100 Year

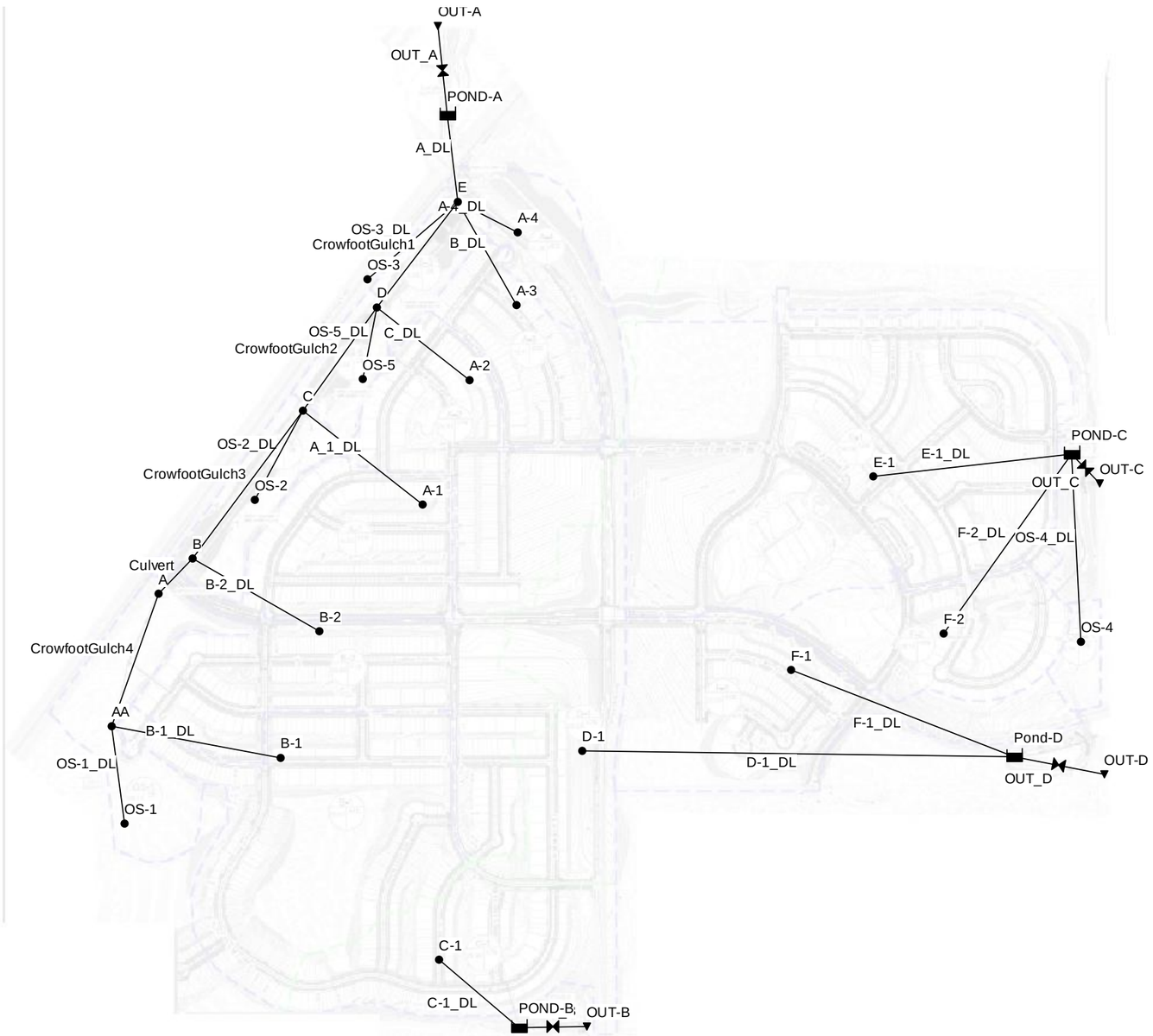
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A-1	0.088	0.111	36.6	4.61	19.0	3.26	7.7	24	67,228	2.13	143,277	45.0	32	142,942	1.75
A-2	0.090	0.120	30.0	4.27	15.6	3.02	7.1	38	89,008	2.08	184,928	40.0	48	184,183	1.97
A-3	0.091	0.086	34.5	3.79	17.9	2.67	6.3	17	45,041	2.05	92,371	45.0	22	92,109	1.76
A-4	0.096	0.072	44.4	3.95	23.1	2.79	6.6	12	40,571	1.94	78,696	45.0	16	78,545	1.42
B-1	0.097	0.123	38.5	5.12	20.0	3.62	8.5	47	140,004	1.92	269,185	45.0	61	268,509	1.58
B-2	0.087	0.146	31.8	5.06	16.5	3.58	8.4	48	117,093	2.17	253,675	45.0	63	253,010	1.95
C-1	0.090	0.116	37.3	4.83	19.4	3.41	8.1	28	81,636	2.08	170,042	45.0	38	169,608	1.70
D-1	0.086	0.128	25.3	4.00	13.2	2.83	6.7	43	84,381	2.20	185,542	40.0	54	184,931	2.30
E-1	0.089	0.210	26.7	5.80	13.9	4.10	9.7	139	286,904	2.11	605,759	40.0	174	604,289	2.20
F-1	0.087	0.140	31.9	4.93	16.6	3.48	8.2	43	107,166	2.17	232,271	45.0	57	231,631	1.94
F-2	0.096	0.090	31.8	3.71	16.6	2.62	6.2	27	65,882	1.95	128,310	40.0	33	127,722	1.80
OS-1	0.156	0.083	37.3	3.88	19.4	2.74	6.5	17	50,021	1.53	76,325	45.0	19	76,113	1.38
OS-2	0.156	0.067	52.8	4.22	27.5	2.98	7.0	8	30,863	1.53	47,093	50.0	9	47,011	1.07
OS-3	0.156	0.054	51.3	3.64	26.7	2.57	6.1	5	19,288	1.53	29,430	50.0	6	29,349	1.09
OS-4	0.156	0.040	94.8	4.44	49.3	3.14	7.4	1	10,028	1.53	15,301	65.0	2	15,287	0.68
OS-5	0.156	0.053	29.6	2.70	15.4	1.91	4.5	8	18,213	1.53	27,790	40.0	8	27,371	1.60

Trails at Crowfoot_100 Year

Summary of CUHP Input Parameters (Version 2.0.0)

								Storage		Parameters			DCIA Level and Fractions			
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A-1	A-1	R100	0.029	0.252	0.466	0.015	51.2	0.35	0.10	3.75	0.55	0.0018	0.00	0.86	0.23	50.15
A-2	A-2	R100	0.038	0.238	0.369	0.015	46.9	0.35	0.10	3.75	0.55	0.0018	0.00	0.83	0.22	45.88
A-3	A-3	R100	0.019	0.192	0.299	0.015	44.8	0.35	0.10	3.75	0.55	0.0018	0.00	0.82	0.21	43.74
A-4	A-4	R100	0.017	0.177	0.338	0.015	36.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.72	0.19	34.73
B-1	B-1	R100	0.060	0.285	0.464	0.015	34.7	0.35	0.10	3.75	0.55	0.0018	0.00	0.69	0.18	33.33
B-2	B-2	R100	0.050	0.289	0.556	0.015	54.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.87	0.25	52.98
C-1	C-1	R100	0.035	0.303	0.429	0.015	47.4	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	46.30
D-1	D-1	R100	0.036	0.204	0.387	0.015	56.5	0.35	0.10	3.75	0.55	0.0018	0.00	0.88	0.26	55.58
E-1	E-1	R100	0.123	0.365	0.621	0.015	49.6	0.35	0.10	3.75	0.55	0.0018	0.00	0.85	0.23	48.57
F-1	F-1	R100	0.046	0.292	0.509	0.015	54.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.87	0.25	53.06
F-2	F-2	R100	0.028	0.169	0.290	0.015	36.6	0.35	0.10	3.75	0.55	0.0018	0.00	0.73	0.19	35.38
OS-1	OS-1	R100	0.022	0.110	0.215	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.77
OS-2	OS-2	R100	0.013	0.130	0.237	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.77
OS-3	OS-3	R100	0.008	0.106	0.177	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.76
OS-4	OS-4	R100	0.004	0.157	0.233	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.76
OS-5	OS-5	R100	0.008	0.056	0.101	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.76



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```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

WARNING 04: minimum elevation drop used for Conduit C-1_DL
WARNING 04: minimum elevation drop used for Conduit F-1_DL
WARNING 04: minimum elevation drop used for Conduit C_DL
WARNING 04: minimum elevation drop used for Conduit B_DL
WARNING 04: minimum elevation drop used for Conduit B-2_DL
WARNING 04: minimum elevation drop used for Conduit B-1_DL
WARNING 04: minimum elevation drop used for Conduit OS-1_DL
WARNING 04: minimum elevation drop used for Conduit A_1_DL
WARNING 04: minimum elevation drop used for Conduit OS-2_DL
WARNING 04: minimum elevation drop used for Conduit OS-3_DL
WARNING 04: minimum elevation drop used for Conduit A-4_DL
WARNING 04: minimum elevation drop used for Conduit OS-5_DL
WARNING 04: minimum elevation drop used for Conduit D-1_DL
WARNING 02: maximum depth increased for Node E
WARNING 02: maximum depth increased for Node D
WARNING 02: maximum depth increased for Node C
WARNING 02: maximum depth increased for Node B
WARNING 02: maximum depth increased for Node A
WARNING 02: maximum depth increased for Node AA

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************
```

```
****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/02/2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        20.669          6.735
External Outflow .........        13.524          4.407
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         7.240          2.359
Continuity Error (%) .....        -0.457
```

```
********************************
Highest Flow Instability Indexes
********************************
Link CrowfootGulch1 (1)
Link A_DL (1)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00


******************
Node Depth Summary
******************

-------------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type         Feet     Feet     Feet  days hr:min        Feet
-------------------------------------------------------------------------------
E                    JUNCTION     0.14     1.83  6003.83     0  00:59        1.83
A-1                  JUNCTION     0.00     0.00  6004.74     0  00:00        0.00
A-4                  JUNCTION     0.00     0.00  6002.00     0  00:00        0.00
A-3                  JUNCTION     0.00     0.00  6002.00     0  00:00        0.00
B-1                  JUNCTION     0.00     0.00  6007.80     0  00:00        0.00
B-2                  JUNCTION     0.00     0.00  6007.00     0  00:00        0.00
A-2                  JUNCTION     0.00     0.00  6003.40     0  00:00        0.00
D                    JUNCTION     0.13     1.83  6005.23     0  00:54        1.81
C-1                  JUNCTION     0.00     0.00  6095.00     0  00:00        0.00
C                    JUNCTION     0.12     1.70  6006.44     0  00:50        1.67
E-1                  JUNCTION     0.00     0.00  5980.00     0  00:00        0.00
```

F-1	JUNCTION	0.00	0.00	6010.00	0	00:00	0.00
B	JUNCTION	0.09	1.60	6008.60	0	00:37	1.57
A	JUNCTION	0.06	1.16	6008.66	0	00:47	1.06
AA	JUNCTION	0.06	1.29	6009.09	0	00:40	1.27
OS-1	JUNCTION	0.00	0.00	6007.80	0	00:00	0.00
OS-2	JUNCTION	0.00	0.00	6004.74	0	00:00	0.00
OS-3	JUNCTION	0.00	0.00	6002.00	0	00:00	0.00
OS-5	JUNCTION	0.00	0.00	6003.40	0	00:00	0.00
D-1	JUNCTION	0.00	0.00	6010.00	0	00:00	0.00
F-2	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OS-4	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OUT-A	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OUT-B	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OUT-C	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OUT-D	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-A	STORAGE	3.67	4.84	5995.84	0	02:31	4.83
POND-B	STORAGE	3.49	4.26	6099.26	0	02:56	4.26
POND-C	STORAGE	4.69	6.13	5977.13	0	02:03	6.13
Pond-D	STORAGE	4.29	5.99	6015.99	0	02:12	5.99

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
E	JUNCTION	0.00	78.47	0	00:58	0	3	0.000
A-1	JUNCTION	11.78	11.78	0	00:35	0.412	0.412	0.000
A-4	JUNCTION	4.94	4.94	0	00:40	0.192	0.192	0.000
A-3	JUNCTION	7.63	7.63	0	00:35	0.25	0.25	0.000
B-1	JUNCTION	18.85	18.85	0	00:40	0.645	0.645	0.000
B-2	JUNCTION	23.86	23.86	0	00:35	0.748	0.748	0.000
A-2	JUNCTION	17.35	17.35	0	00:35	0.51	0.51	0.000

D	JUNCTION	0.00	68.34	0	00:54	0	2.52	0.000
C-1	JUNCTION	13.41	13.41	0	00:35	0.472	0.472	0.000
C	JUNCTION	0.00	55.04	0	00:50	0	1.97	0.000
E-1	JUNCTION	64.15	64.15	0	00:35	1.72	1.72	0.000
F-1	JUNCTION	21.80	21.80	0	00:35	0.685	0.685	0.000
B	JUNCTION	0.00	45.82	0	00:37	0	1.48	0.000
A	JUNCTION	0.00	25.46	0	00:47	0	0.734	-0.000
AA	JUNCTION	0.00	22.45	0	00:40	0	0.734	0.000
OS-1	JUNCTION	3.61	3.61	0	00:35	0.0889	0.0889	0.000
OS-2	JUNCTION	1.65	1.65	0	00:40	0.0549	0.0549	0.000
OS-3	JUNCTION	1.06	1.06	0	00:40	0.0343	0.0343	0.000
OS-5	JUNCTION	1.60	1.60	0	00:35	0.032	0.032	0.000
D-1	JUNCTION	20.73	20.73	0	00:35	0.559	0.559	0.000
F-2	JUNCTION	10.61	10.61	0	00:35	0.315	0.315	0.000
OS-4	JUNCTION	0.31	0.31	0	00:45	0.0178	0.0178	0.000
OUT-A	OUTFALL	0.00	22.06	0	02:31	0	1.92	0.000
OUT-B	OUTFALL	0.00	0.72	0	02:56	0	0.279	0.000
OUT-C	OUTFALL	0.00	13.47	0	02:03	0	1.36	0.000
OUT-D	OUTFALL	0.00	6.68	0	02:12	0	0.845	0.000
POND-A	STORAGE	0.00	78.47	0	00:58	0	3	0.026
POND-B	STORAGE	0.00	13.41	0	00:35	0	0.472	0.002
POND-C	STORAGE	0.00	75.04	0	00:35	0	2.05	0.029
Pond-D	STORAGE	0.00	42.53	0	00:35	0	1.24	0.028

```
*********************
Node Flooding Summary
*********************

No nodes were flooded.
```

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow CFS
POND-A	214.320	24	0	0	327.378	36	0	02:31	22.06
POND-B	39.353	16	0	0	58.433	24	0	02:55	0.72
POND-C	147.388	32	0	0	233.452	51	0	02:03	13.47
Pond-D	84.055	29	0	0	143.072	49	0	02:12	6.68

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OUT-A	99.36	2.40	22.06	1.924
OUT-B	99.42	0.35	0.72	0.279
OUT-C	99.42	1.69	13.47	1.358
OUT-D	99.42	1.05	6.68	0.845
System	99.40	5.49	37.83	4.407

```
********************
Link Flow Summary
********************
```

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A_DL	DUMMY	78.47	0	00:58			
C-1_DL	DUMMY	13.41	0	00:35			
E-1_DL	DUMMY	64.15	0	00:35			
F-1_DL	DUMMY	21.80	0	00:35			
CrowfootGulch4	CHANNEL	25.46	0	00:47	1.62	0.04	0.24
Culvert	CONDUIT	24.61	0	00:48	5.77	0.11	0.18
CrowfootGulch2	CHANNEL	54.02	0	00:55	1.75	0.08	0.35
C_DL	DUMMY	17.35	0	00:35			
B_DL	DUMMY	7.63	0	00:35			
B-2_DL	DUMMY	23.86	0	00:35			
B-1_DL	DUMMY	18.85	0	00:40			
OS-1_DL	DUMMY	3.61	0	00:35			
A_1_DL	DUMMY	11.78	0	00:35			
OS-2_DL	DUMMY	1.65	0	00:40			
OS-3_DL	DUMMY	1.06	0	00:40			
A-4_DL	DUMMY	4.94	0	00:40			
CrowfootGulch1	CHANNEL	67.60	0	00:59	1.82	0.10	0.38
OS-5_DL	DUMMY	1.60	0	00:35			
CrowfootGulch3	CHANNEL	43.04	0	00:50	1.75	0.06	0.32
D-1_DL	DUMMY	20.73	0	00:35			
F-2_DL	DUMMY	10.61	0	00:35			
OS-4_DL	DUMMY	0.31	0	00:45			
OUT_A	DUMMY	22.06	0	02:31			
OUT_B	DUMMY	0.72	0	02:56			
OUT_C	DUMMY	13.47	0	02:03			
OUT_D	DUMMY	6.68	0	02:12			

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 13:38:04 2017
Analysis ended on:  Tue Oct 31 13:38:04 2017
Total elapsed time: < 1 sec
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

WARNING 04: minimum elevation drop used for Conduit C-1_DL
WARNING 04: minimum elevation drop used for Conduit F-1_DL
WARNING 04: minimum elevation drop used for Conduit C_DL
WARNING 04: minimum elevation drop used for Conduit B_DL
WARNING 04: minimum elevation drop used for Conduit B-2_DL
WARNING 04: minimum elevation drop used for Conduit B-1_DL
WARNING 04: minimum elevation drop used for Conduit OS-1_DL
WARNING 04: minimum elevation drop used for Conduit A_1_DL
WARNING 04: minimum elevation drop used for Conduit OS-2_DL
WARNING 04: minimum elevation drop used for Conduit OS-3_DL
WARNING 04: minimum elevation drop used for Conduit A-4_DL
WARNING 04: minimum elevation drop used for Conduit OS-5_DL
WARNING 04: minimum elevation drop used for Conduit D-1_DL
WARNING 02: maximum depth increased for Node E
WARNING 02: maximum depth increased for Node D
WARNING 02: maximum depth increased for Node C
WARNING 02: maximum depth increased for Node B
WARNING 02: maximum depth increased for Node A
WARNING 02: maximum depth increased for Node AA

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************
```

```
****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/02/2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        58.139         18.945
External Outflow .........        50.820         16.560
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         7.366          2.400
Continuity Error (%) .....        -0.080
```

```
********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00


******************
Node Depth Summary
******************
```

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
E	JUNCTION	0.21	2.96	6004.96	0 00:57	2.95
A-1	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
A-4	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
A-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
B-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
B-2	JUNCTION	0.00	0.00	6007.00	0 00:00	0.00
A-2	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00
D	JUNCTION	0.20	2.96	6006.36	0 00:54	2.93
C-1	JUNCTION	0.00	0.00	6095.00	0 00:00	0.00
C	JUNCTION	0.18	2.68	6007.42	0 00:52	2.64
E-1	JUNCTION	0.00	0.00	5980.00	0 00:00	0.00
F-1	JUNCTION	0.00	0.00	6010.00	0 00:00	0.00

B	JUNCTION	0.15	2.43	6009.44	0	00:46	2.43
A	JUNCTION	0.12	1.94	6009.45	0	00:46	1.94
AA	JUNCTION	0.12	1.95	6009.75	0	00:45	1.94
OS-1	JUNCTION	0.00	0.00	6007.80	0	00:00	0.00
OS-2	JUNCTION	0.00	0.00	6004.74	0	00:00	0.00
OS-3	JUNCTION	0.00	0.00	6002.00	0	00:00	0.00
OS-5	JUNCTION	0.00	0.00	6003.40	0	00:00	0.00
D-1	JUNCTION	0.00	0.00	6010.00	0	00:00	0.00
F-2	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OS-4	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OUT-A	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OUT-B	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OUT-C	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OUT-D	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-A	STORAGE	3.80	6.16	5997.16	0	01:32	6.15
POND-B	STORAGE	3.69	5.46	6100.46	0	01:32	5.46
POND-C	STORAGE	4.85	8.06	5979.06	0	01:22	8.01
Pond-D	STORAGE	4.43	7.57	6017.57	0	01:23	7.53

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
E	JUNCTION	0.00	268.86	0	00:57	0	9	0.000
A-1	JUNCTION	32.38	32.38	0	00:45	1.07	1.07	0.000
A-4	JUNCTION	15.86	15.86	0	00:45	0.588	0.588	0.000
A-3	JUNCTION	21.84	21.84	0	00:45	0.689	0.689	0.000
B-1	JUNCTION	61.05	61.05	0	00:45	2.01	2.01	0.000
B-2	JUNCTION	62.79	62.79	0	00:45	1.89	1.89	0.000
A-2	JUNCTION	48.39	48.39	0	00:40	1.38	1.38	0.000
D	JUNCTION	0.00	229.25	0	00:54	0	7.5	0.000

C-1	JUNCTION	38.25	38.25	0	00:45	1.27	1.27	0.000
C	JUNCTION	0.00	179.59	0	00:52	0	5.92	-0.000
E-1	JUNCTION	173.68	173.68	0	00:40	4.52	4.52	0.000
F-1	JUNCTION	57.30	57.30	0	00:45	1.73	1.73	0.000
B	JUNCTION	0.00	142.42	0	00:46	0	4.47	0.000
A	JUNCTION	0.00	79.96	0	00:46	0	2.58	0.000
AA	JUNCTION	0.00	80.13	0	00:45	0	2.58	0.000
OS-1	JUNCTION	19.08	19.08	0	00:45	0.569	0.569	0.000
OS-2	JUNCTION	9.06	9.06	0	00:50	0.352	0.352	0.000
OS-3	JUNCTION	5.77	5.77	0	00:50	0.22	0.22	0.000
OS-5	JUNCTION	8.04	8.04	0	00:40	0.205	0.205	0.000
D-1	JUNCTION	53.51	53.51	0	00:40	1.38	1.38	0.000
F-2	JUNCTION	32.70	32.70	0	00:40	0.955	0.955	0.000
OS-4	JUNCTION	1.87	1.87	0	01:05	0.114	0.114	0.000
OUT-A	OUTFALL	0.00	172.36	0	01:32	0	7.91	0.000
OUT-B	OUTFALL	0.00	20.07	0	01:32	0	1.06	0.000
OUT-C	OUTFALL	0.00	102.63	0	01:22	0	4.88	0.000
OUT-D	OUTFALL	0.00	55.98	0	01:23	0	2.71	0.000
POND-A	STORAGE	0.00	268.86	0	00:57	0	9	0.109
POND-B	STORAGE	0.00	38.25	0	00:45	0	1.27	0.129
POND-C	STORAGE	0.00	207.89	0	00:40	0	5.59	0.066
Pond-D	STORAGE	0.00	110.81	0	00:40	0	3.12	0.069

```
*********************
Node Flooding Summary
*********************
```

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min		Maximum Outflow CFS
POND-A	227.728	25	0	0	486.960	54	0	01:31	172.36
POND-B	44.563	18	0	0	95.082	39	0	01:32	20.07
POND-C	157.718	34	0	0	378.305	83	0	01:22	102.63
Pond-D	89.480	30	0	0	216.016	73	0	01:23	55.98

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OUT-A	99.39	9.85	172.36	7.906
OUT-B	99.58	1.32	20.07	1.063
OUT-C	99.67	6.06	102.63	4.879
OUT-D	99.67	3.37	55.98	2.711
System	99.58	20.60	349.14	16.559

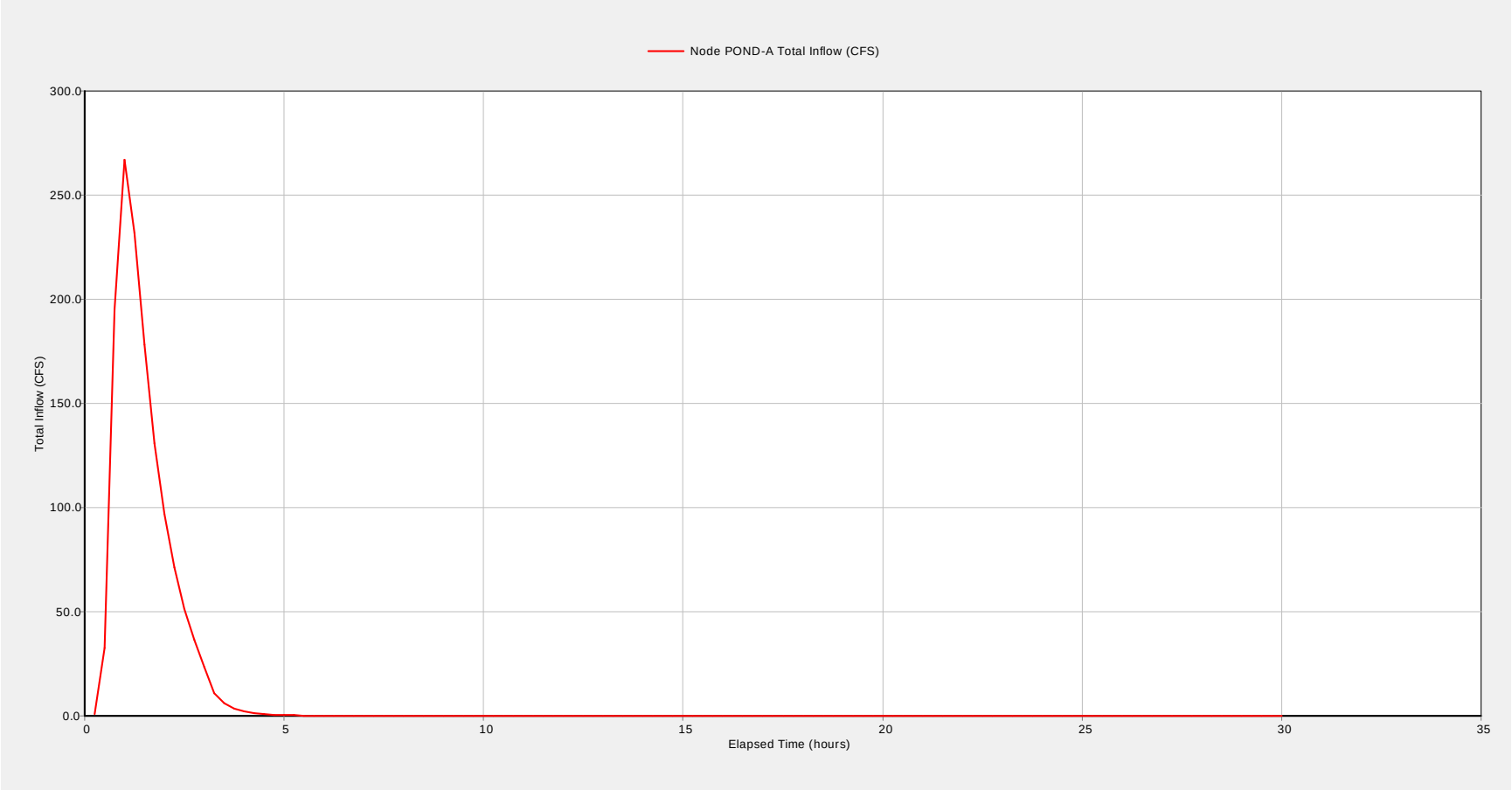
```
********************
Link Flow Summary
********************
```

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A_DL	DUMMY	268.86	0	00:57			
C-1_DL	DUMMY	38.25	0	00:45			
E-1_DL	DUMMY	173.68	0	00:40			
F-1_DL	DUMMY	57.30	0	00:45			
CrowfootGulch4	CHANNEL	79.96	0	00:46	1.75	0.12	0.40
Culvert	CONDUIT	79.98	0	00:46	8.32	0.37	0.40
CrowfootGulch2	CHANNEL	178.85	0	00:55	2.29	0.26	0.55
C_DL	DUMMY	48.39	0	00:40			
B_DL	DUMMY	21.84	0	00:45			
B-2_DL	DUMMY	62.79	0	00:45			
B-1_DL	DUMMY	61.05	0	00:45			
OS-1_DL	DUMMY	19.08	0	00:45			
A_1_DL	DUMMY	32.38	0	00:45			
OS-2_DL	DUMMY	9.06	0	00:50			
OS-3_DL	DUMMY	5.77	0	00:50			
A-4_DL	DUMMY	15.86	0	00:45			
CrowfootGulch1	CHANNEL	228.36	0	00:57	2.49	0.33	0.61
OS-5_DL	DUMMY	8.04	0	00:40			
CrowfootGulch3	CHANNEL	139.55	0	00:53	2.14	0.20	0.50
D-1_DL	DUMMY	53.51	0	00:40			
F-2_DL	DUMMY	32.70	0	00:40			
OS-4_DL	DUMMY	1.87	0	01:05			
OUT_A	DUMMY	172.36	0	01:32			
OUT_B	DUMMY	20.07	0	01:32			
OUT_C	DUMMY	102.63	0	01:22			
OUT_D	DUMMY	55.98	0	01:23			

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 13:34:36 2017
Analysis ended on:  Tue Oct 31 13:34:36 2017
Total elapsed time: < 1 sec
```



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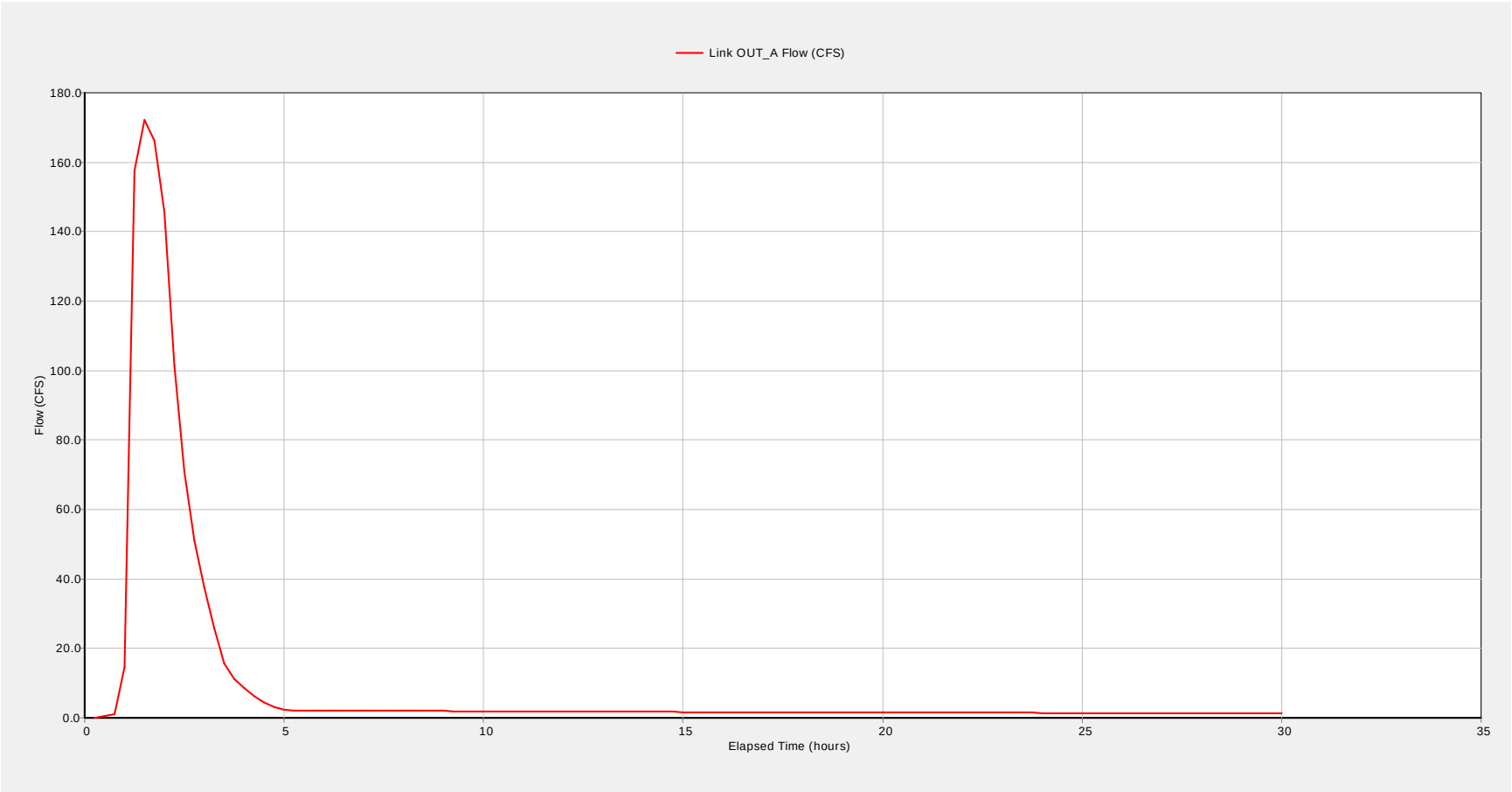
POND A OUTFLOW



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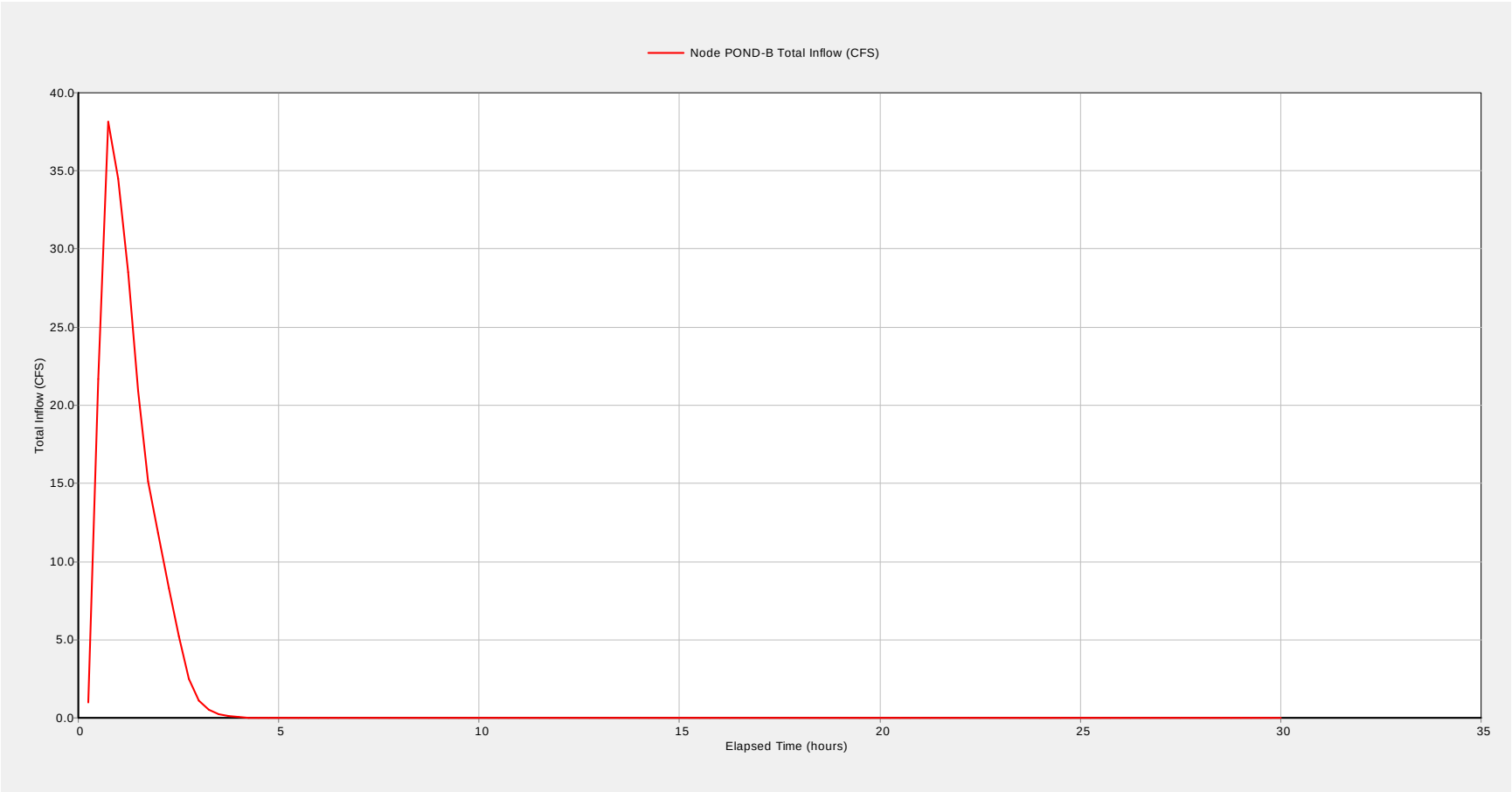
POND B INFLOW



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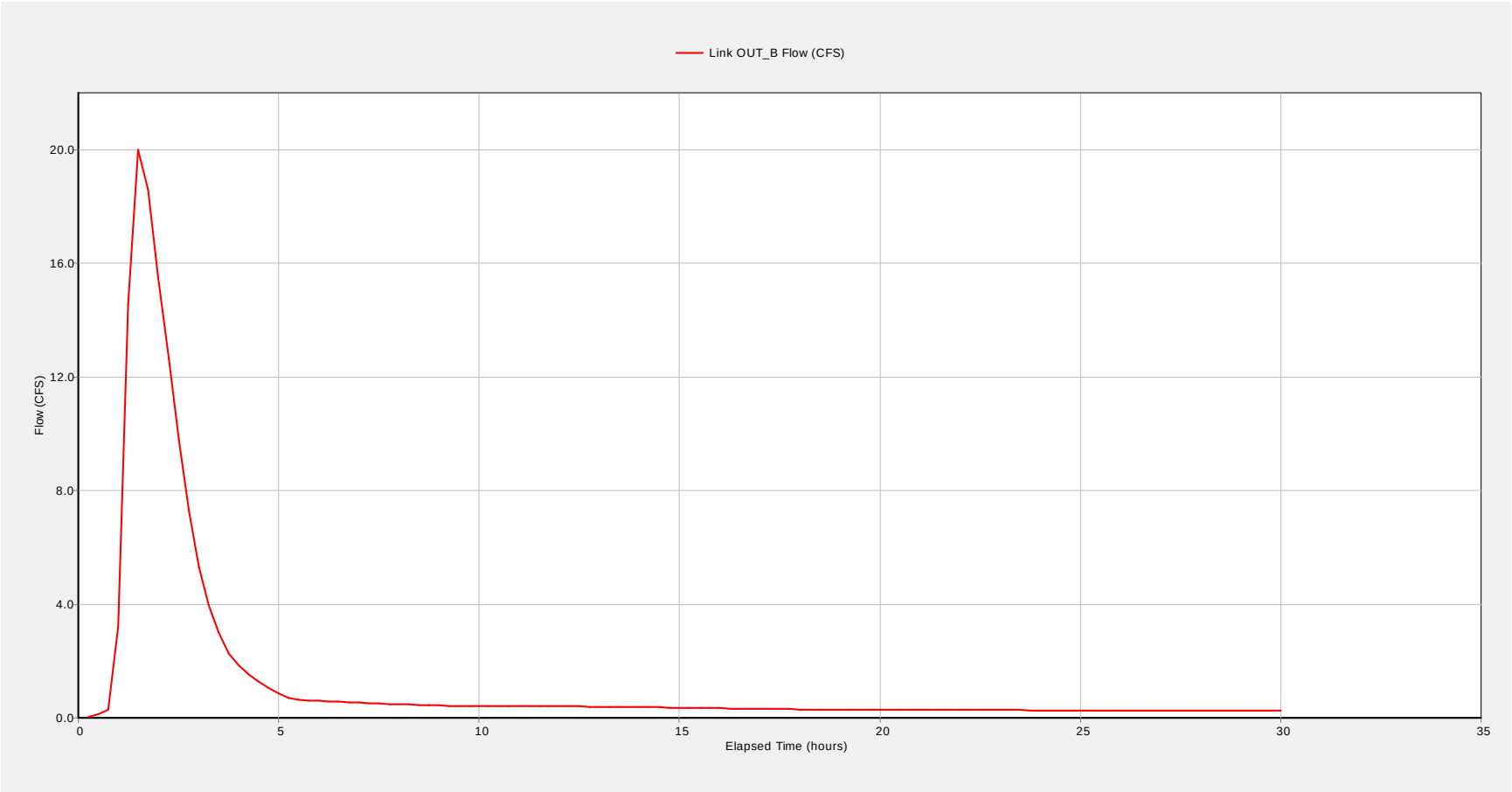
POND B OUTFLOW



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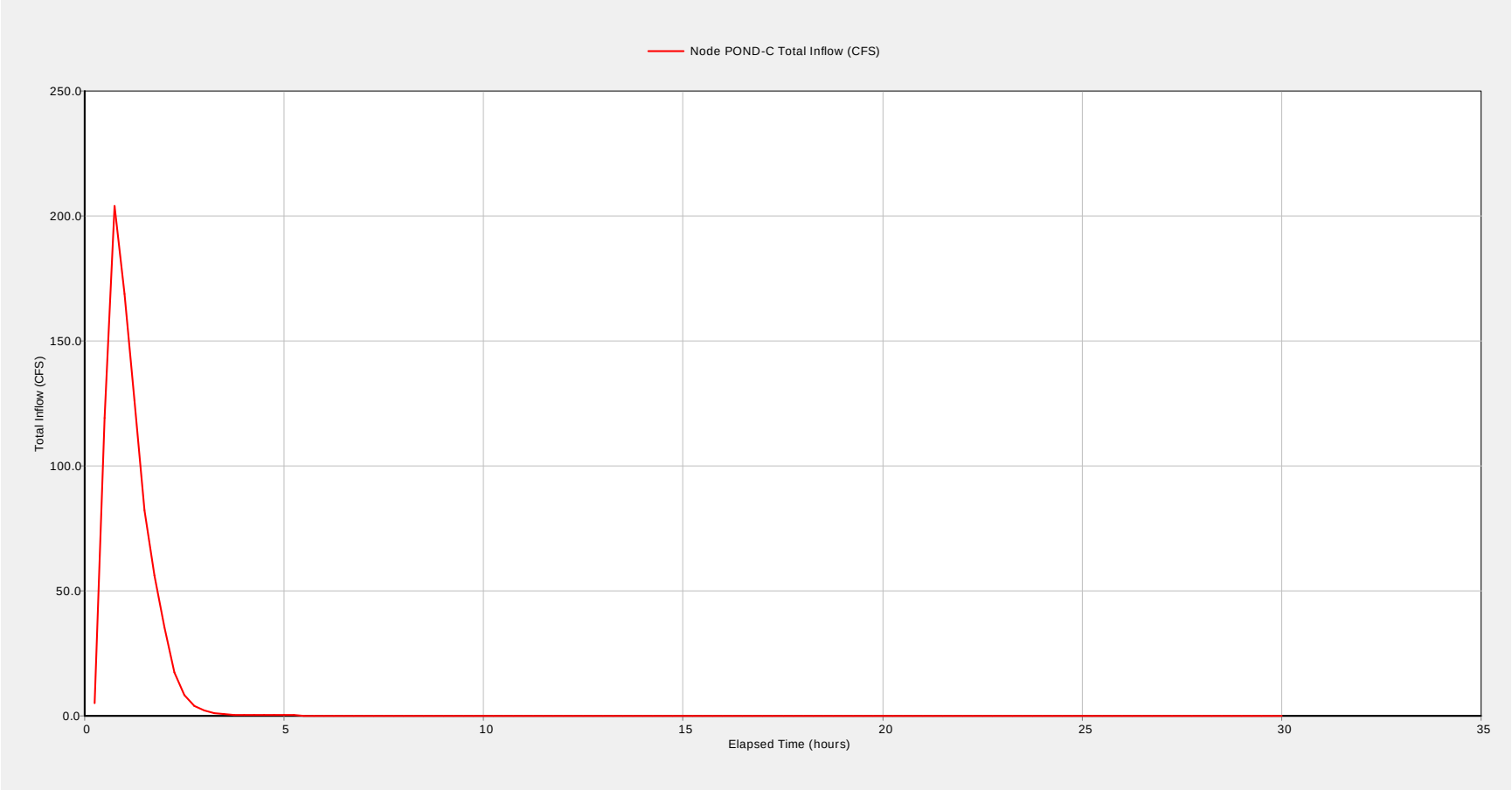
POND C INFLOW



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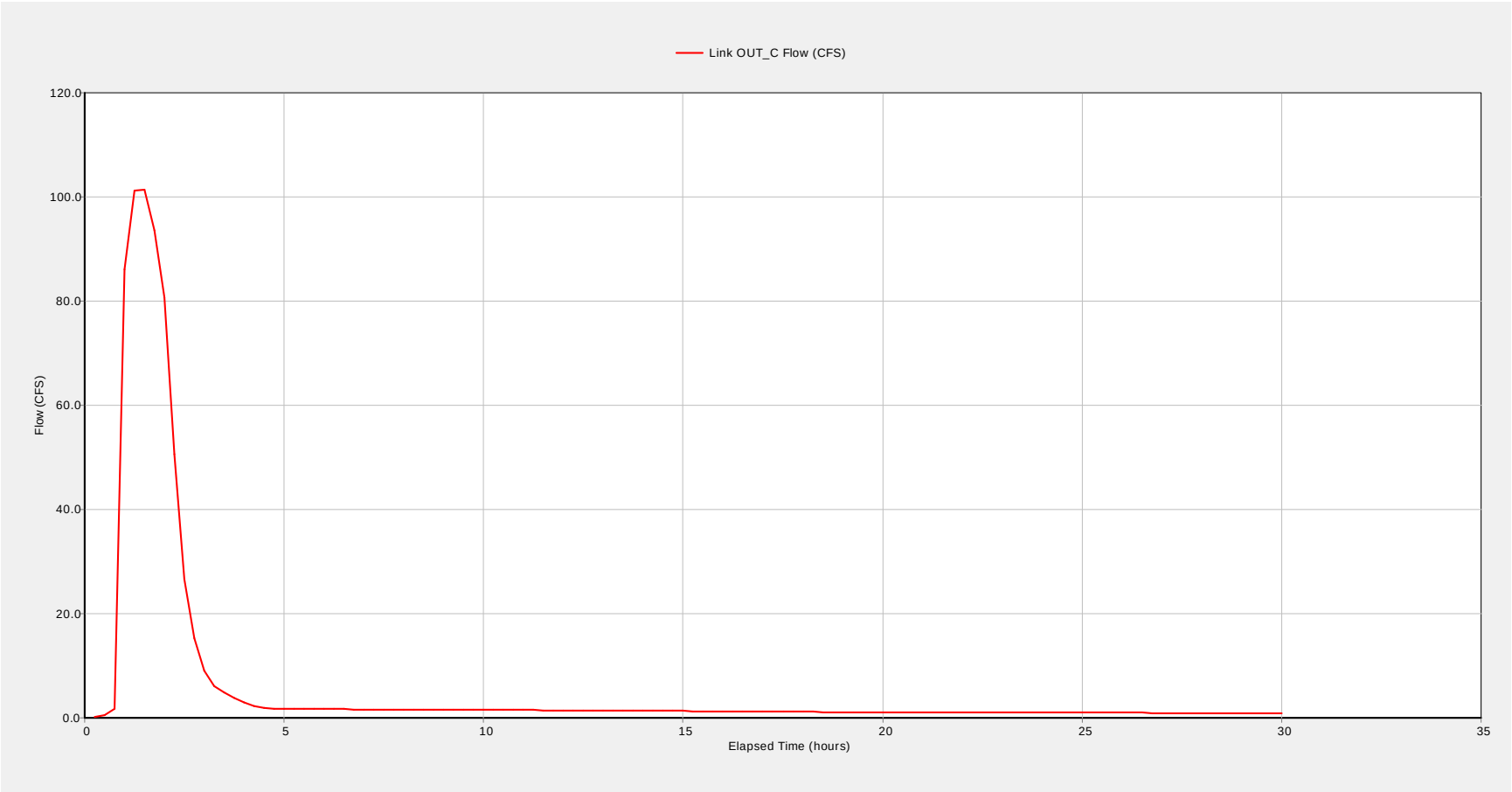
POND C OUTFLOW



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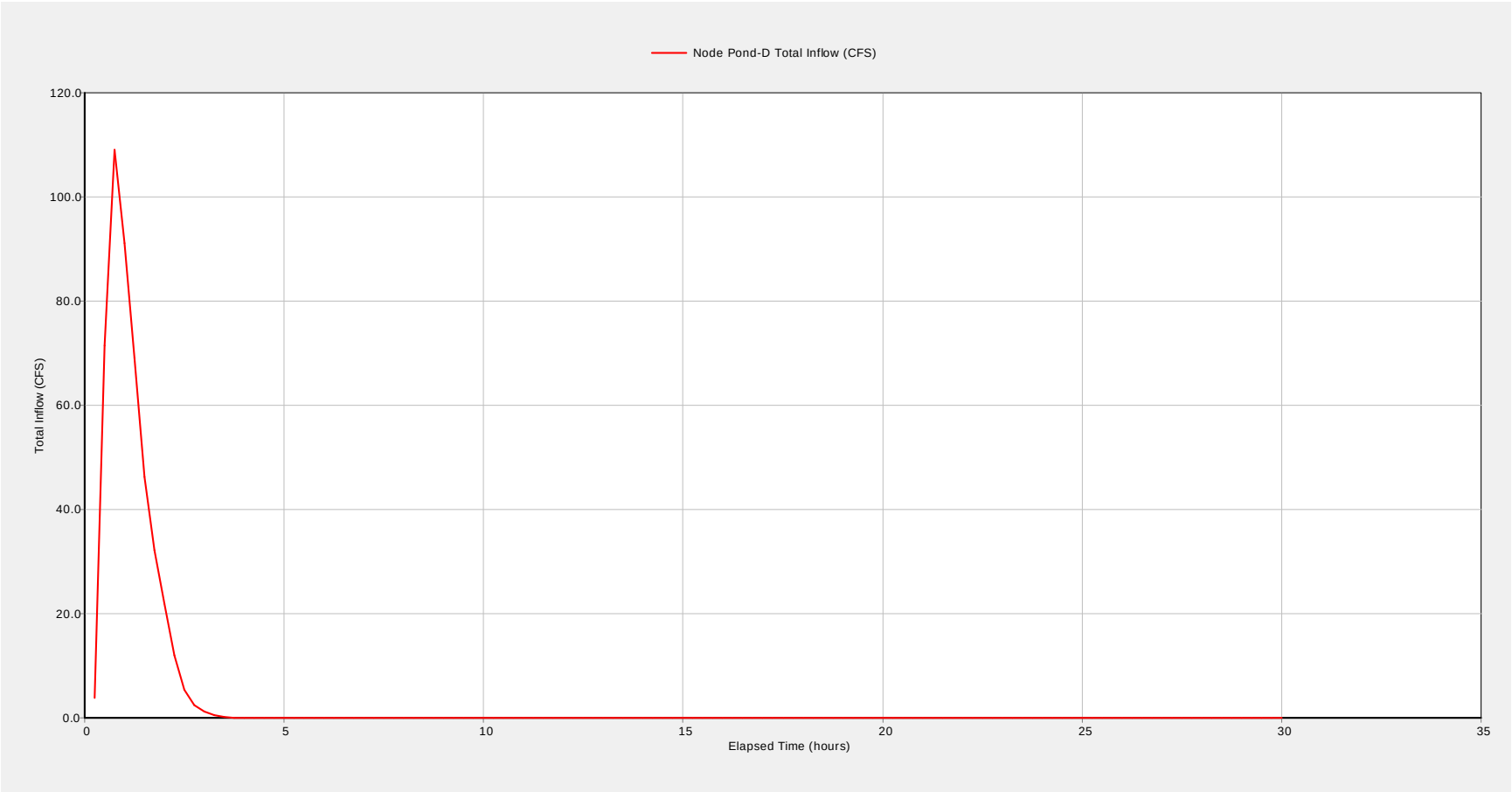

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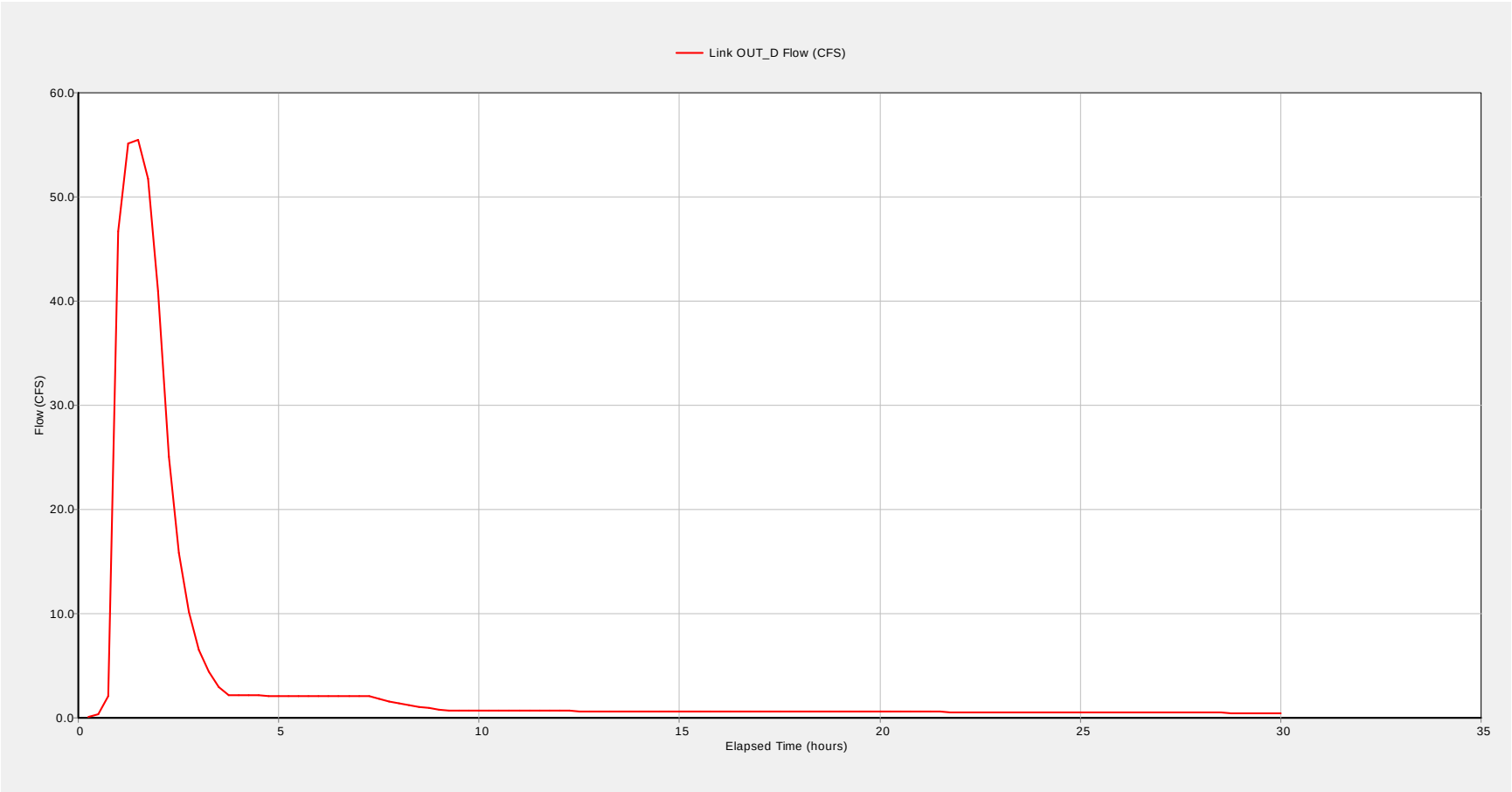
POND D OUTFLOW



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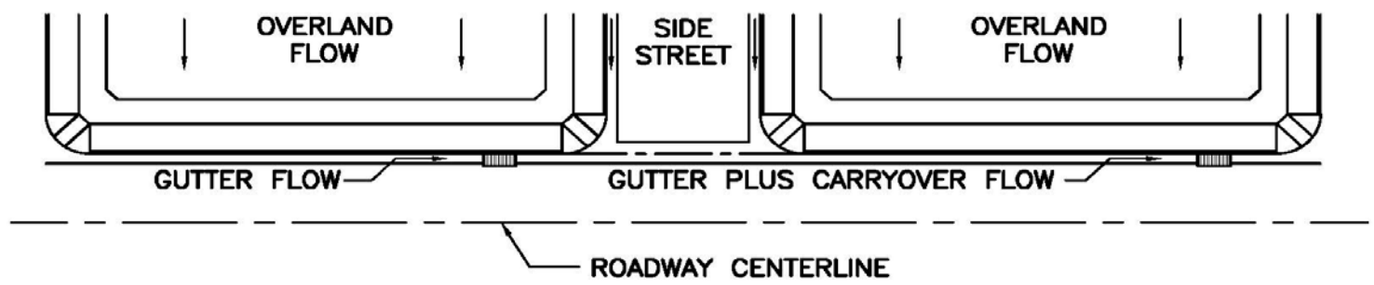
III. Hydraulic Computations

2. Inlet and Street Capacity UD Inlet

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.8	17.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

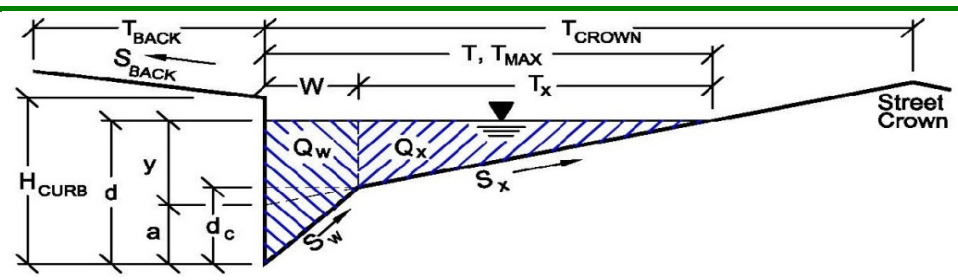
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.8**	**17.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

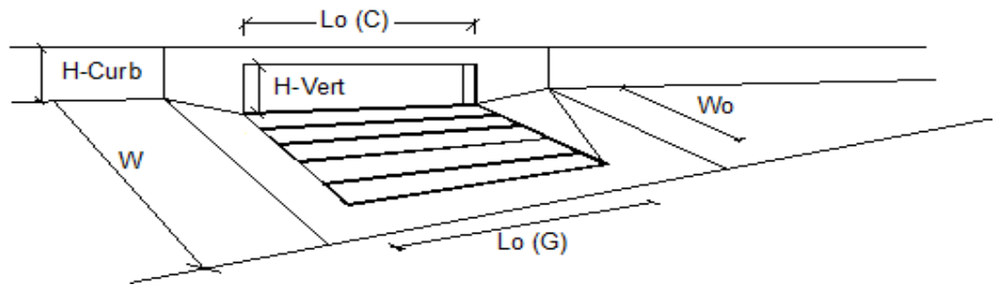
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1A



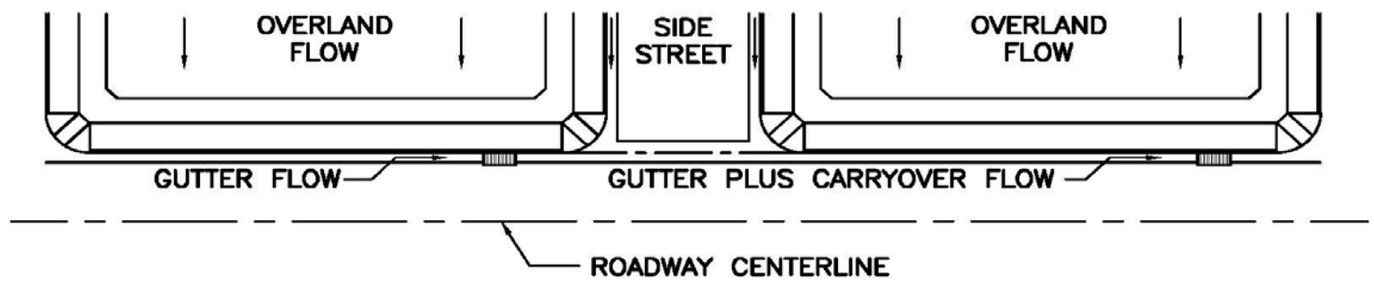
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.84**	**10.14**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**7.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**57**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.2	60.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

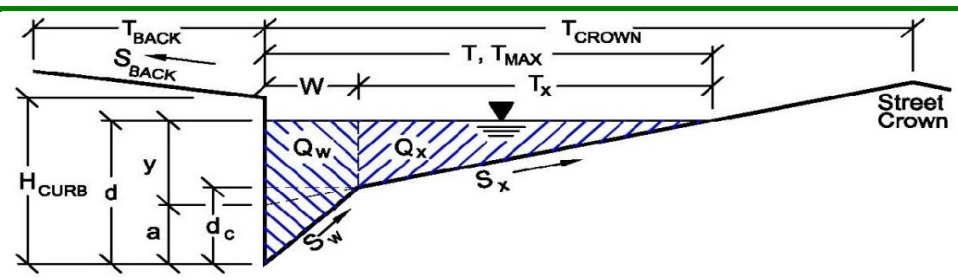
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.2**	**60.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

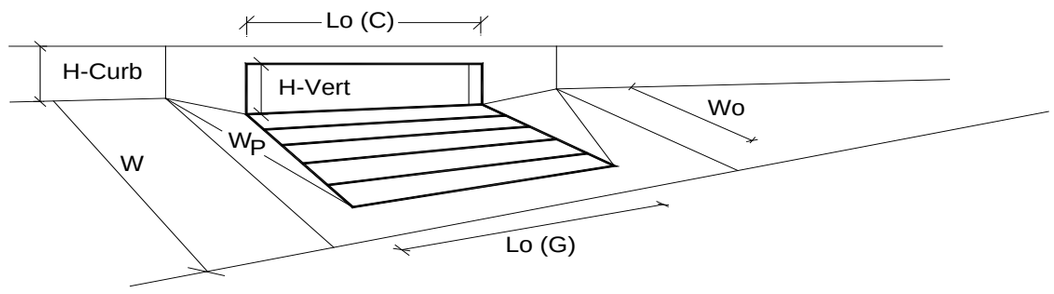
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1B**

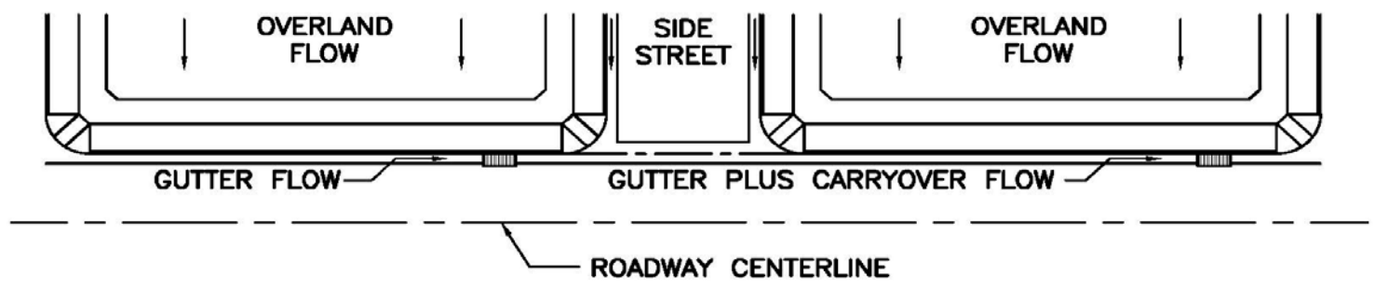


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**42.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	2.2	60.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1C



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.2	13.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

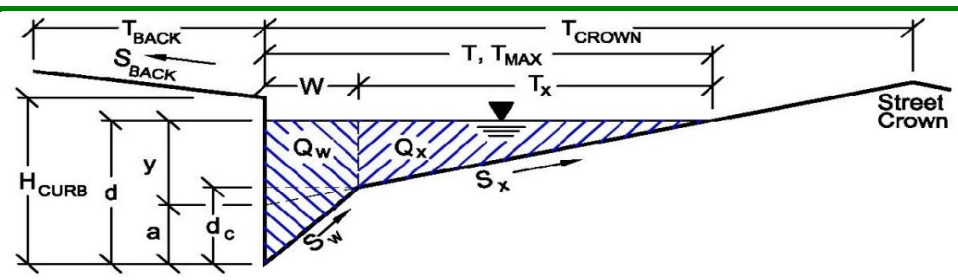
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**18.5**	**cfs**
Total Design Peak Flow, Q =	**3.2**	**32.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

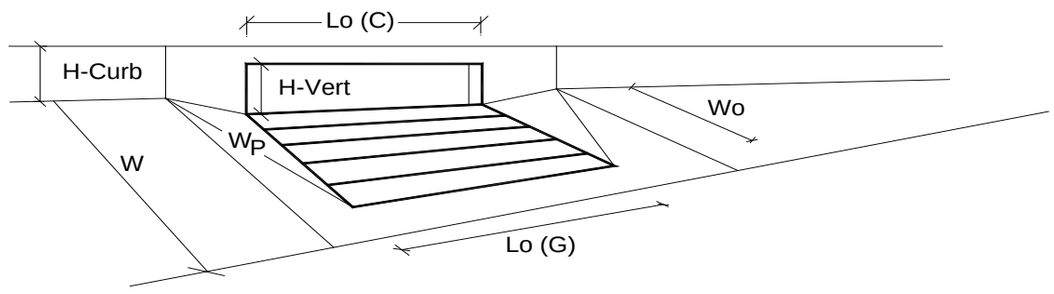
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1C**

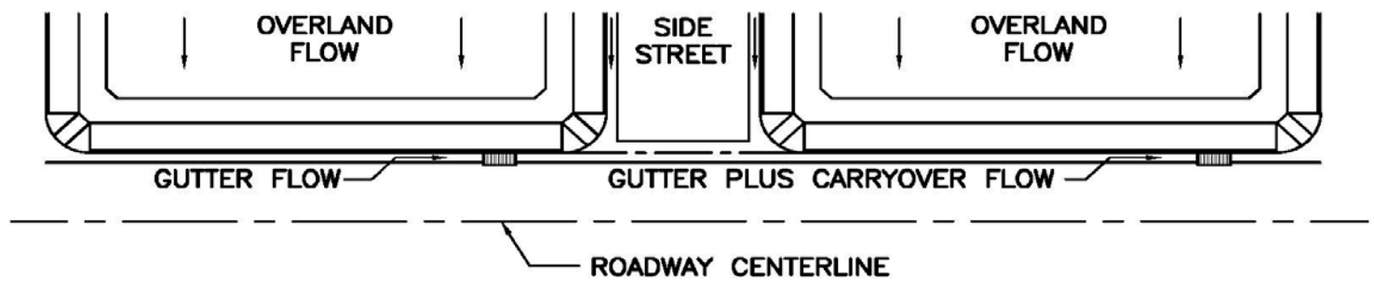


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**42.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.2	32.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1D



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.8	15.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

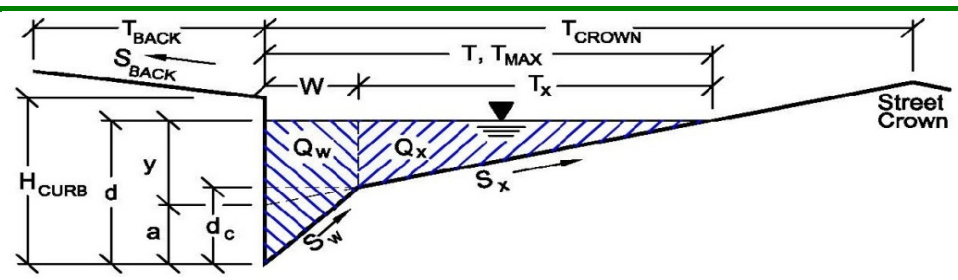
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**26.7**	**cfs**
Total Design Peak Flow, Q =	**2.8**	**42.1**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1D**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

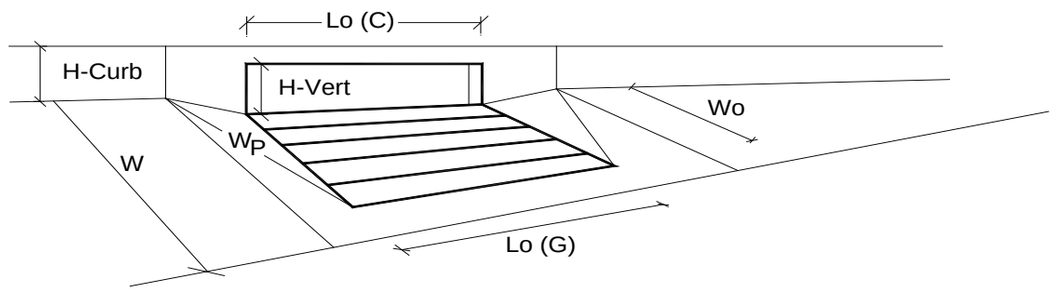
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1D**

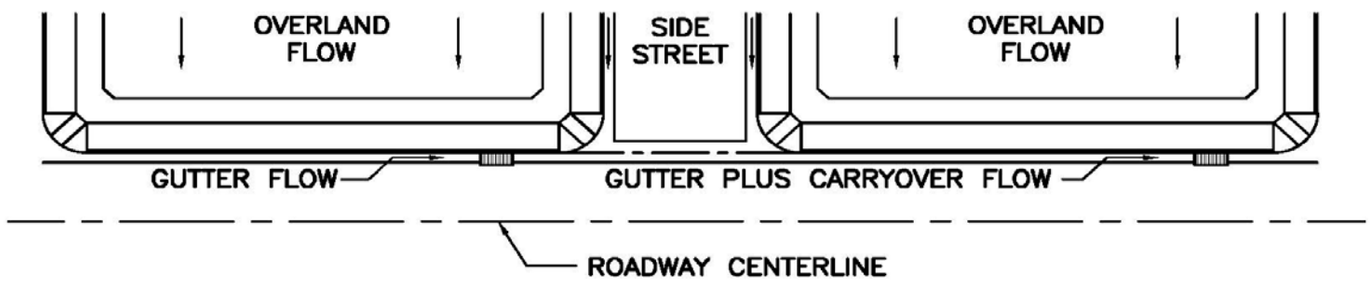


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**42.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.8	42.1	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.3	68.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

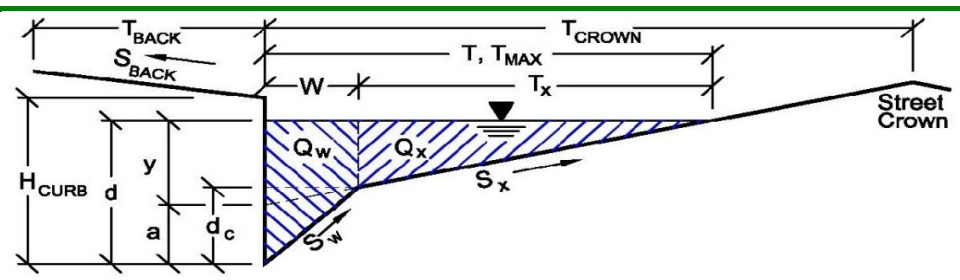
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.3**	**68.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1E**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

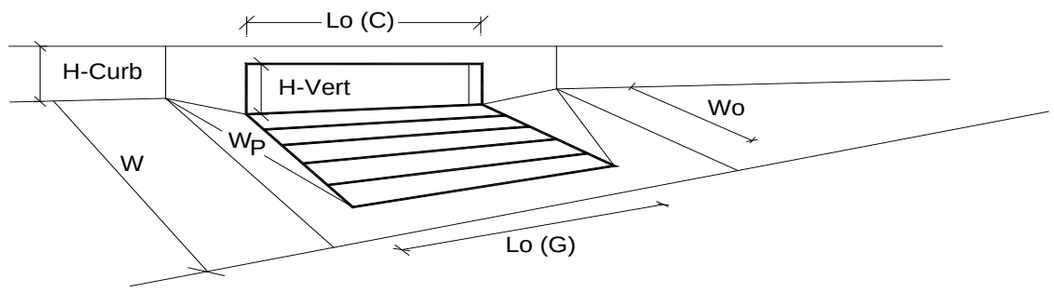
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1E**

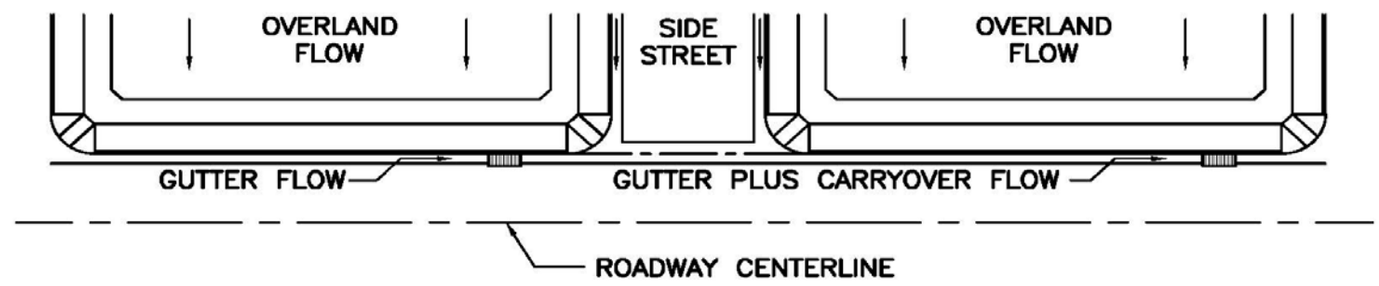


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**42.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	2.3	68.7	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1F



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.6	45.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

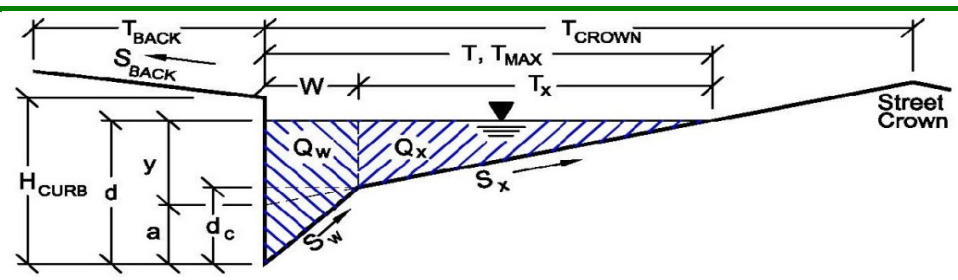
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.6**	**45.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1F**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.1**	**162.5**	**cfs**

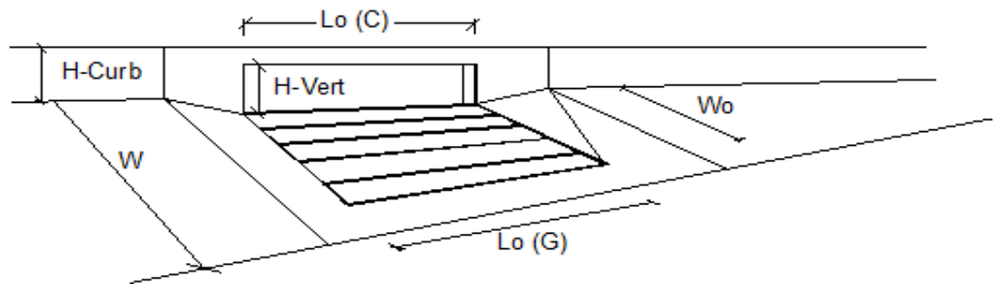
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1F



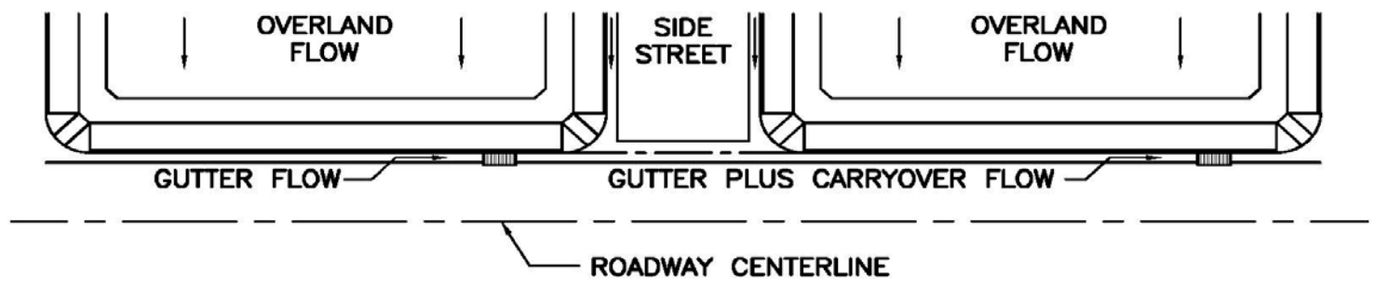
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.60**	**14.60**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**30.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**32**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1G



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.0	55.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

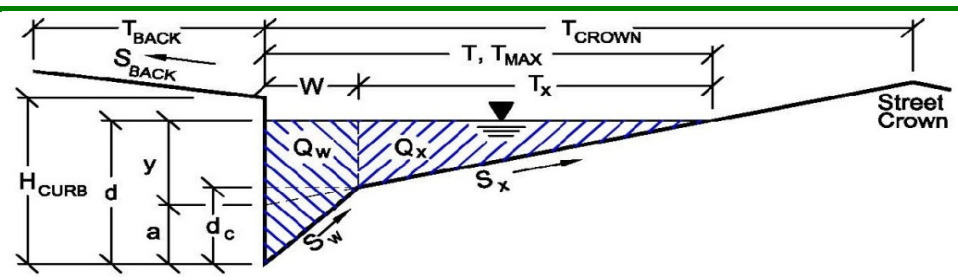
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.0**	**55.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1G**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**6.8**	**127.1**	**cfs**

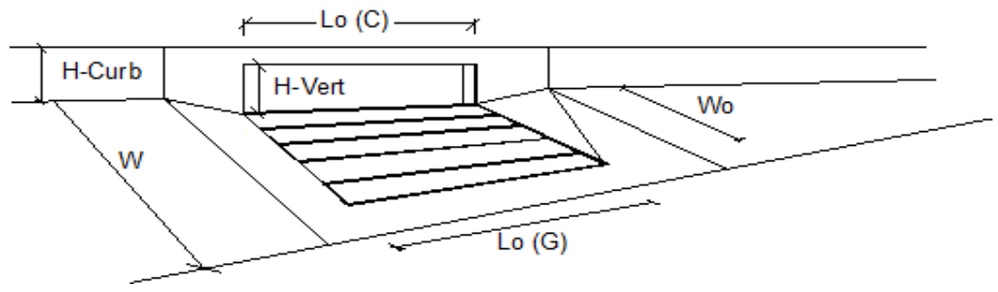
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1G



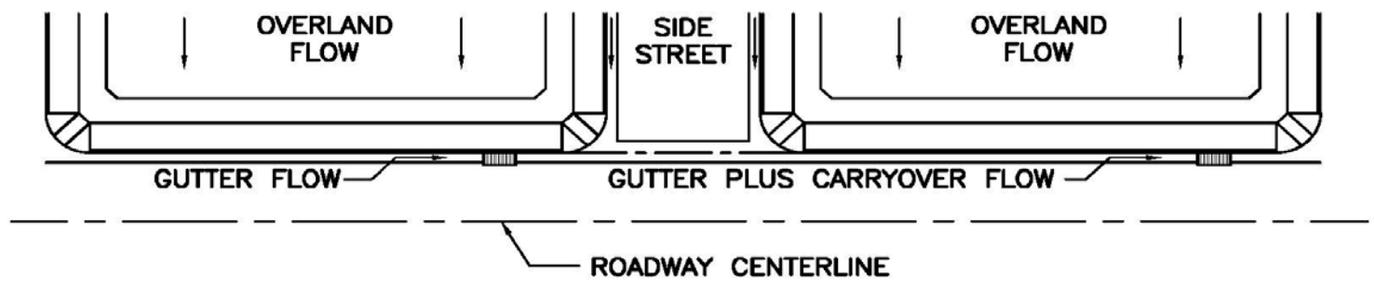
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.95**	**16.28**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**39.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**29**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1H



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.5	94.1	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

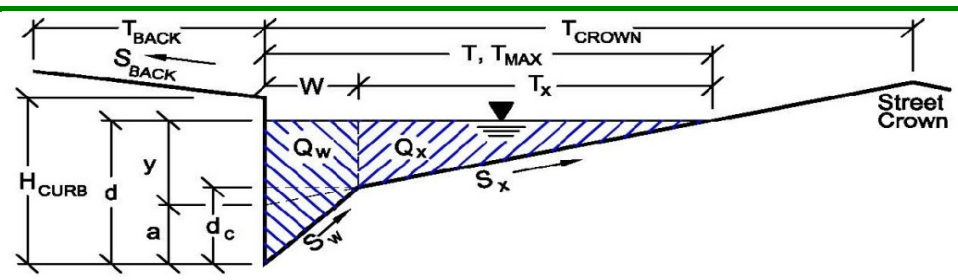
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.5**	**94.1**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1H**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

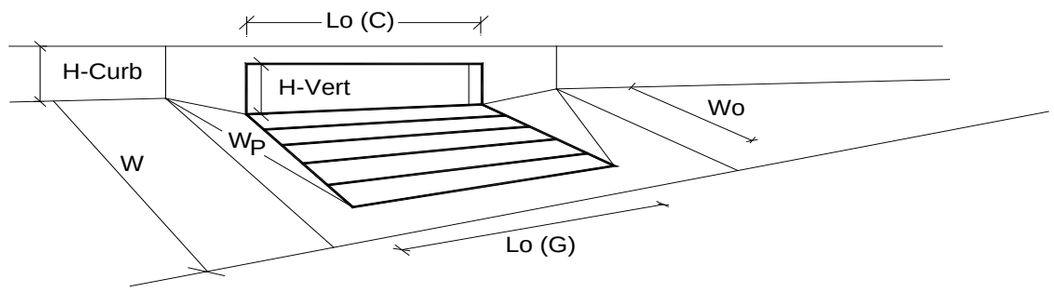
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1H**

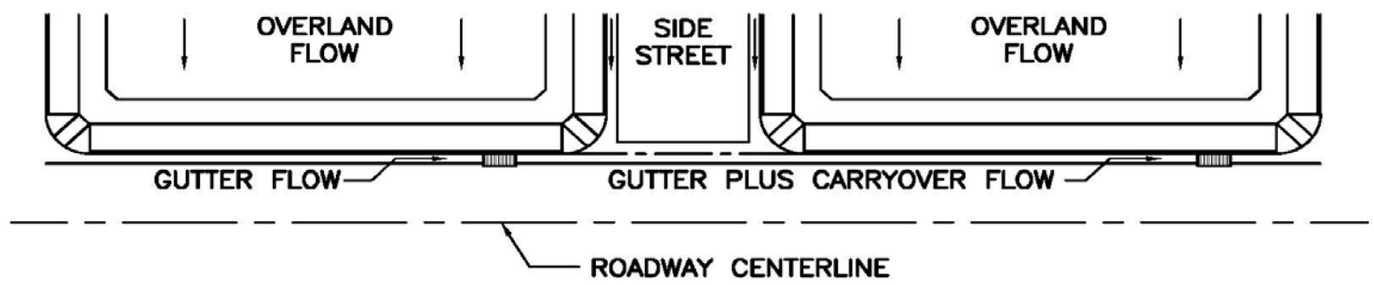


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	3.5	94.1	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 1J



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.5	18.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

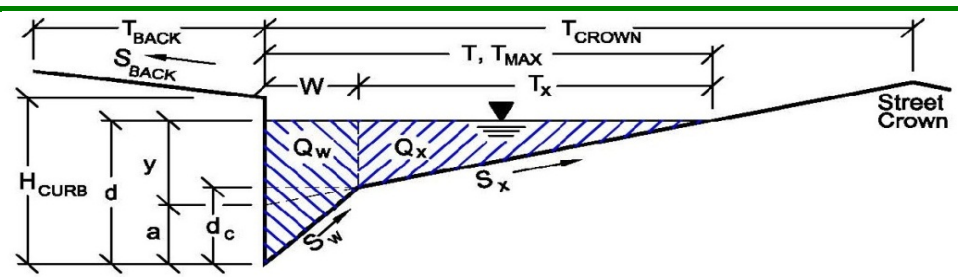
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.5**	**18.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **1J**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	19.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.50	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

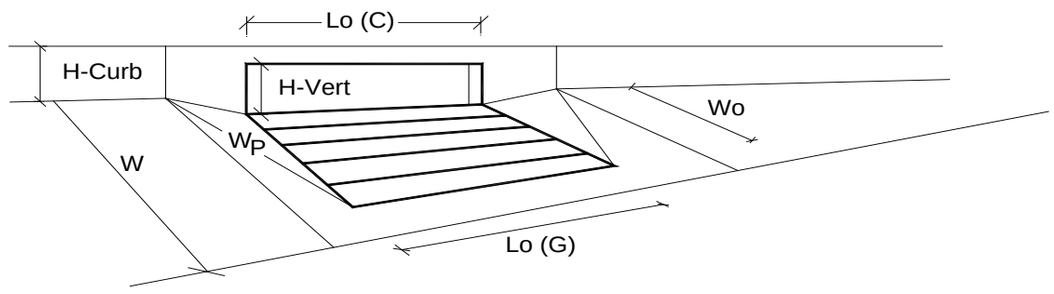
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **1J**

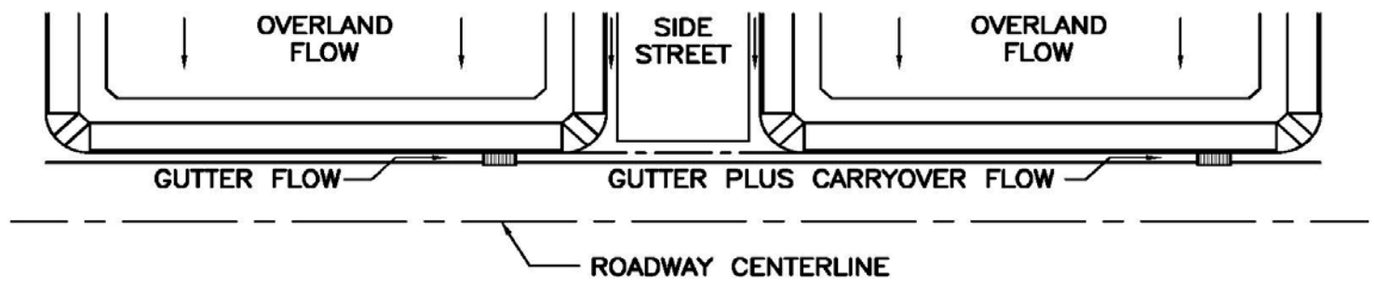


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.50	2.50	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.2**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.5	18.3	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1K



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.9	11.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

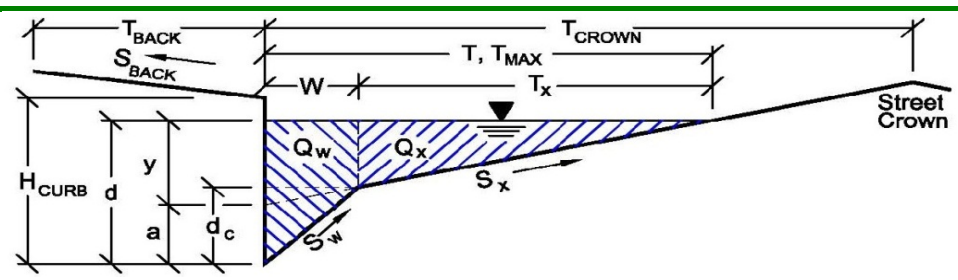
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.9**	**11.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1K**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

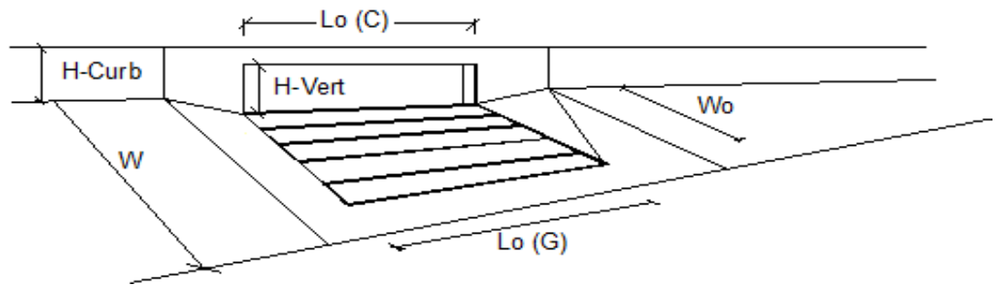
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1K



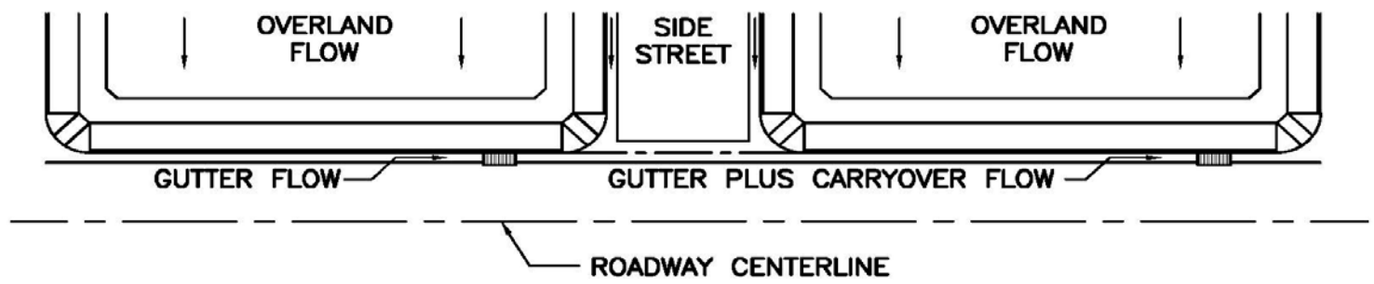
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.90**	**8.40**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**72**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1L



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.2	14.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

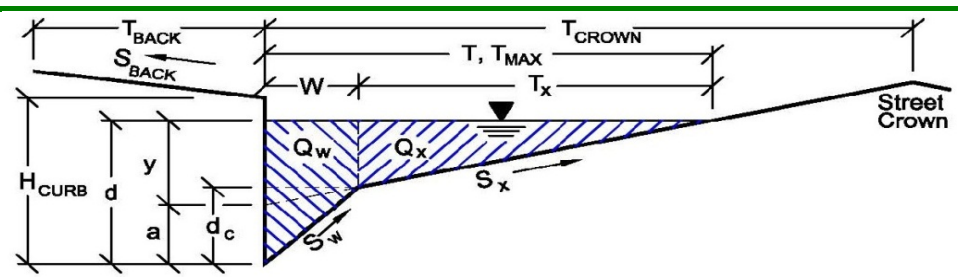
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.2**	**14.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1L**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.1**	**162.5**	**cfs**

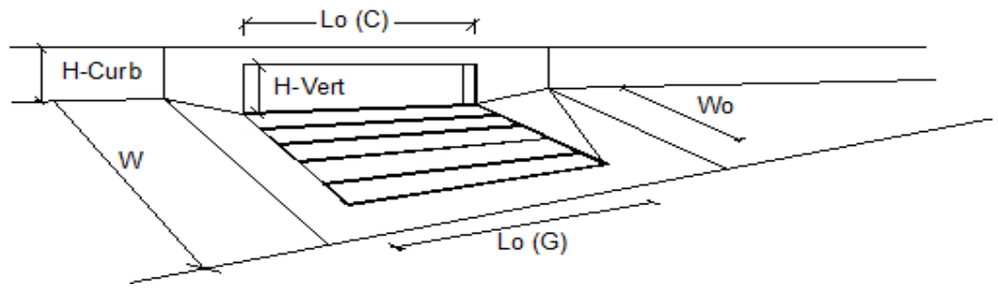
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1L



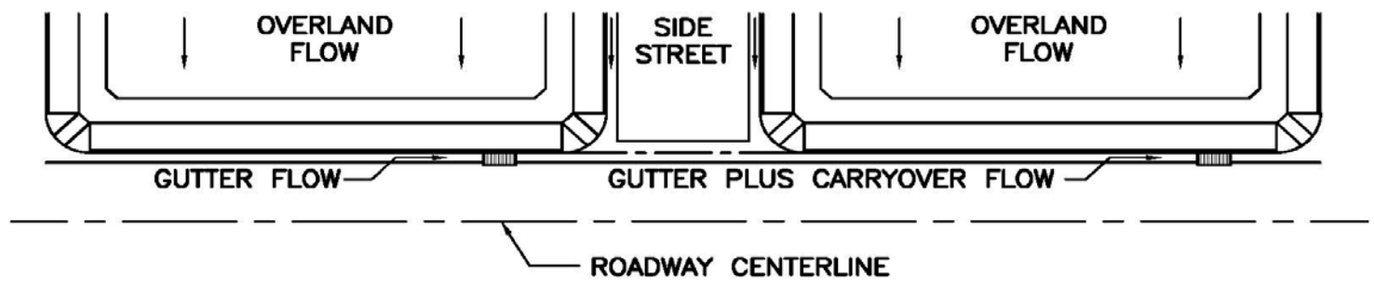
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.20**	**9.02**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**4.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**65**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1M



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	6.8	30.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

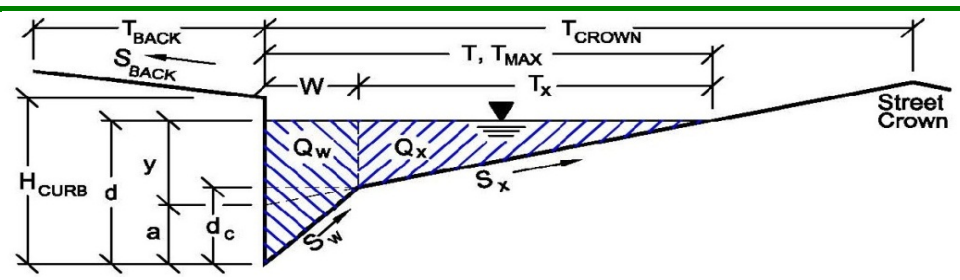
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**6.8**	**30.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1M**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**7.6**	**118.9**	**cfs**

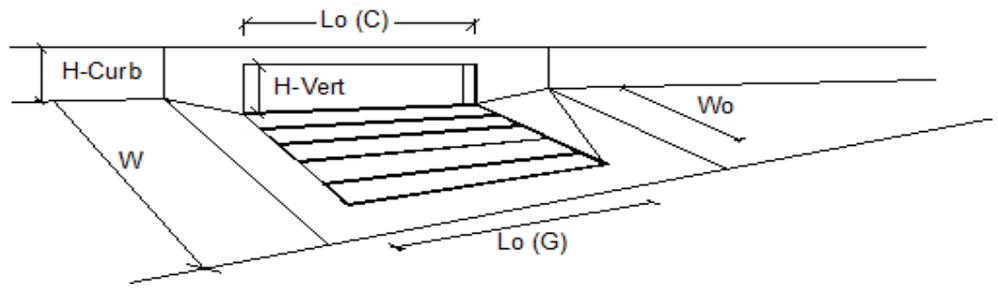
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1M



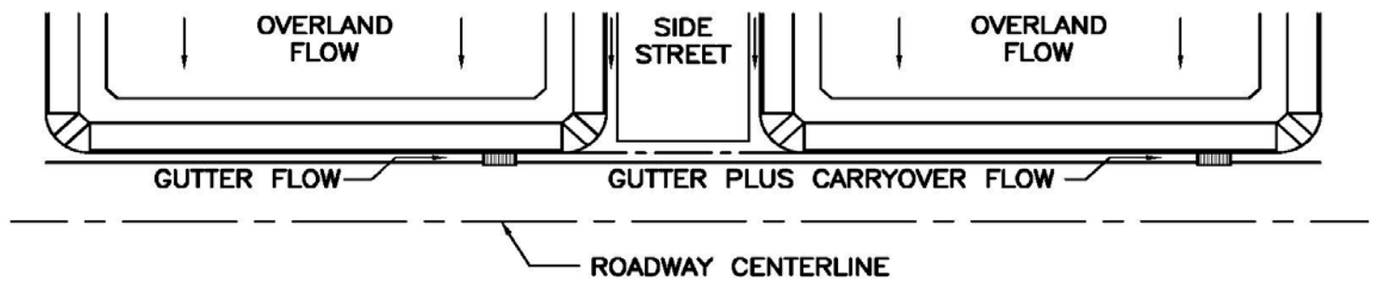
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.80**	**27.59**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**92**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1N



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.9	49.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

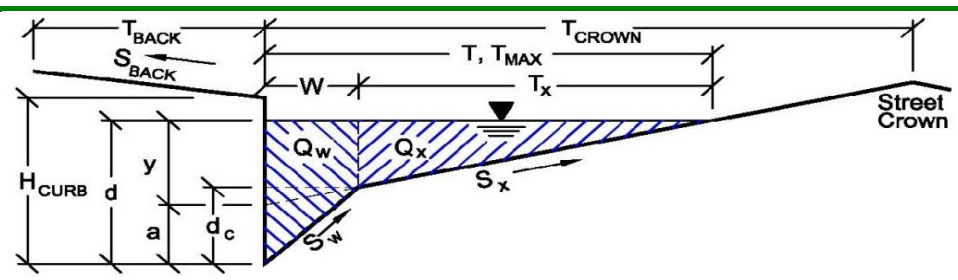
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**1.9**	**49.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1N**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

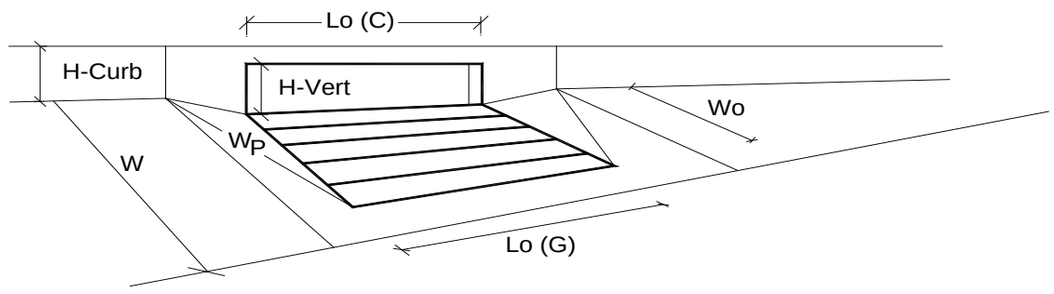
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1N**

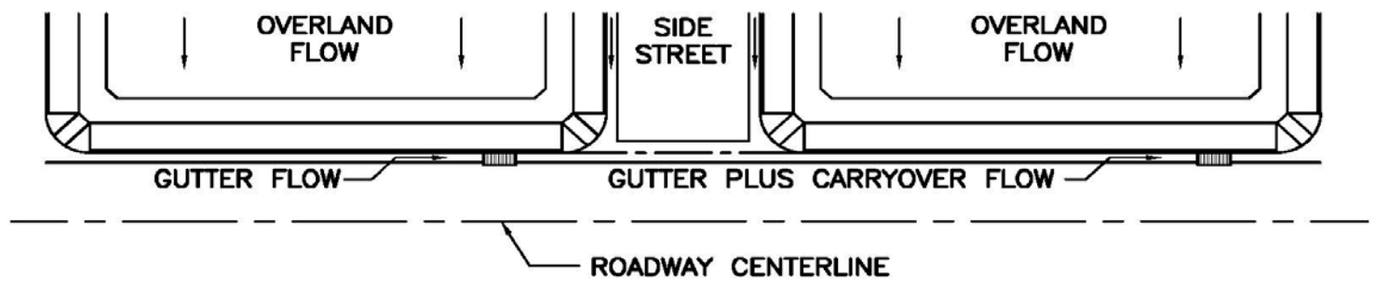


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**14.4**	**56.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.9	49.8	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1O



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.6	24.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

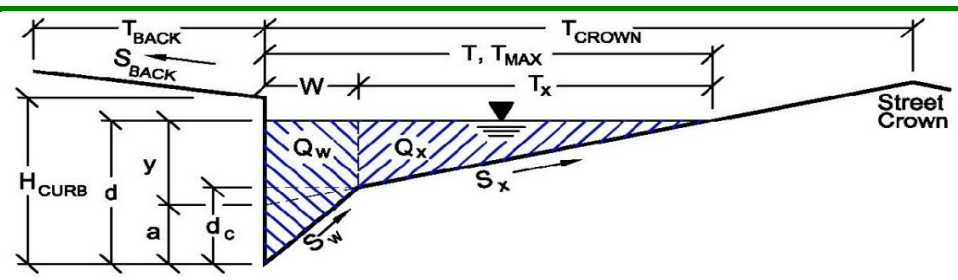
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.6**	**24.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1O**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

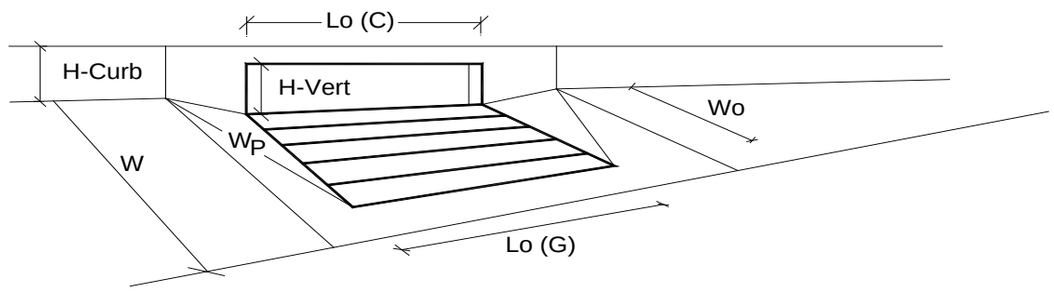
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **DP 1O**

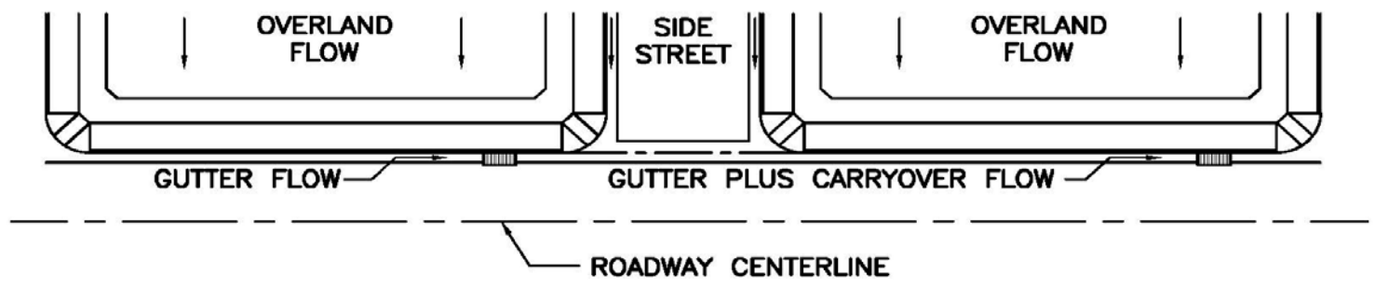


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.6	24.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1P



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.4	21.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

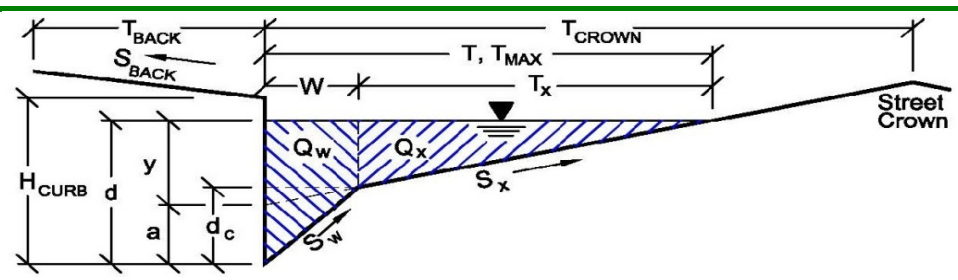
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**1.4**	**21.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1P**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

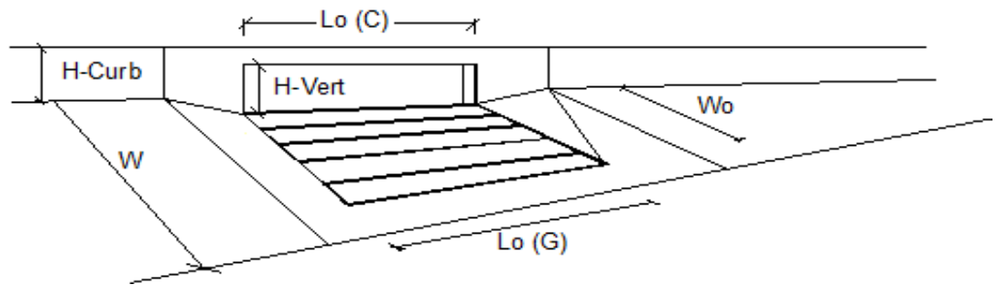
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1P



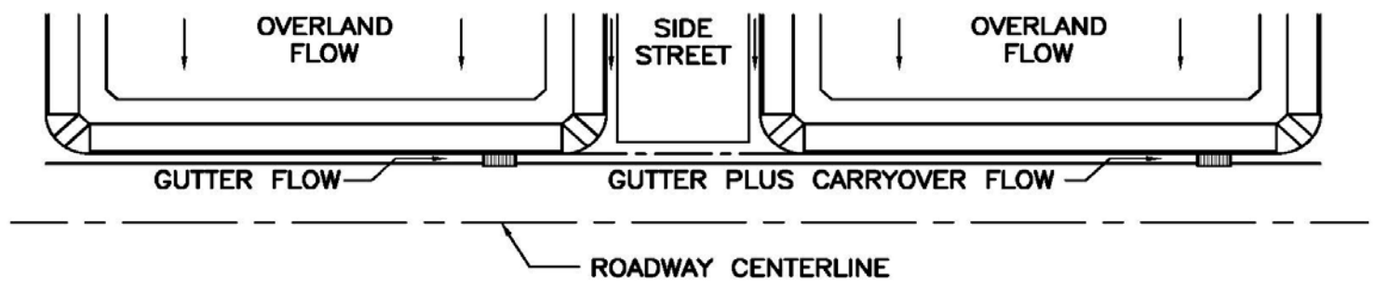
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.40**	**5.70**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**15.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**26**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1Q



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.2	27.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

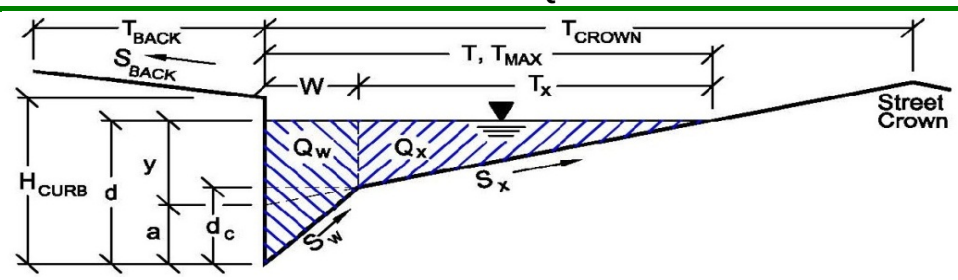
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.2**	**27.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1Q**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

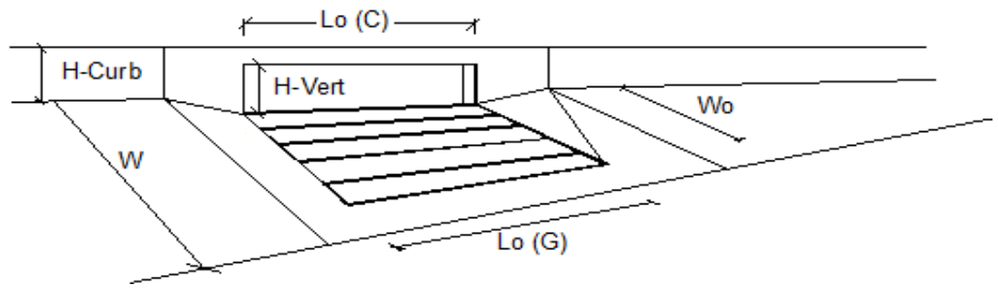
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1Q



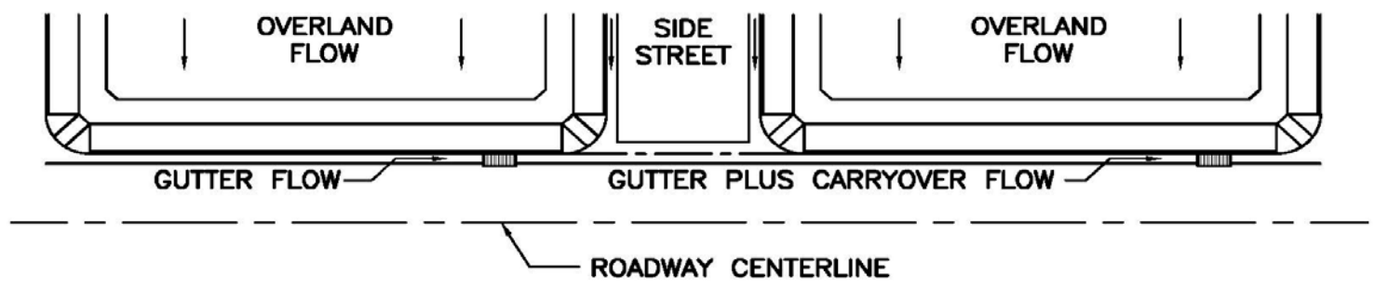
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.20**	**12.23**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**15.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**44**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1R



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.0	12.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

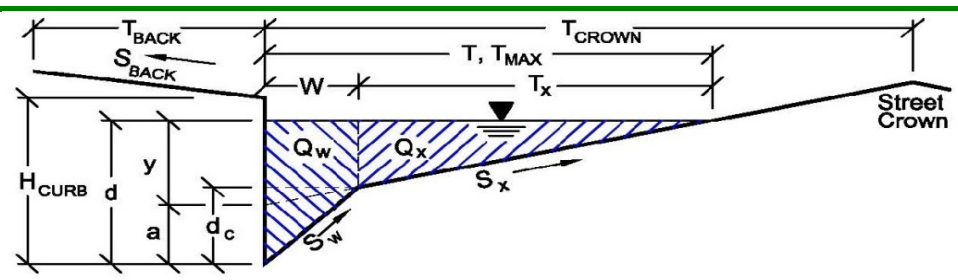
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.0**	**12.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1R**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

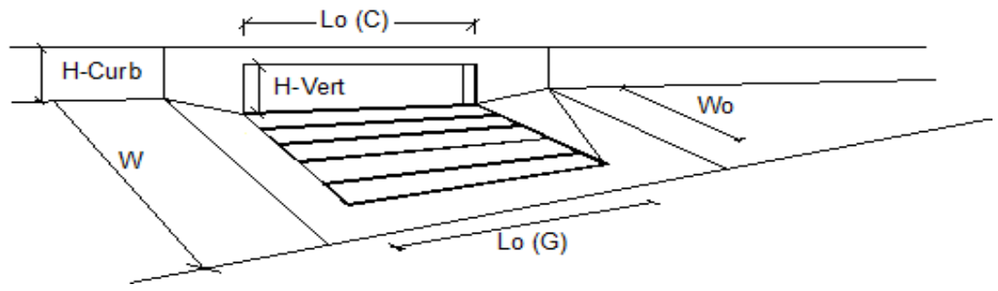
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1R



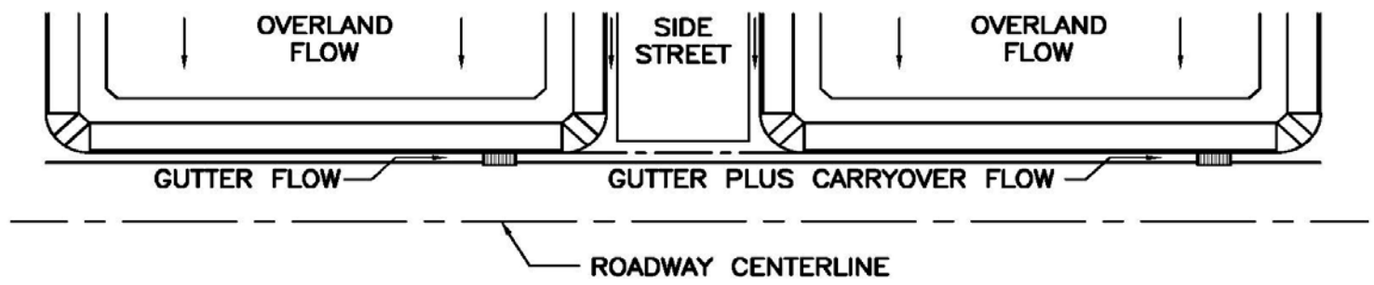
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.00**	**8.49**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**71**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1S



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.5	10.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

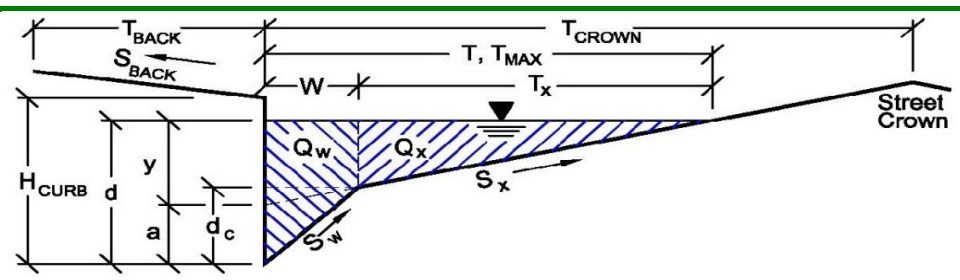
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.5**	**10.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1S**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**6.8**	**127.1**	**cfs**

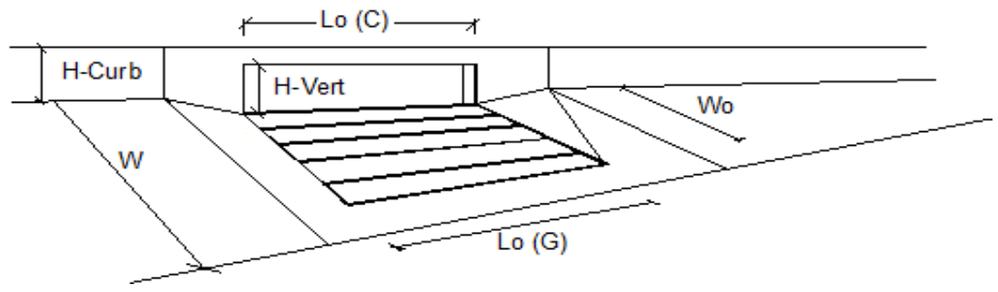
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1S



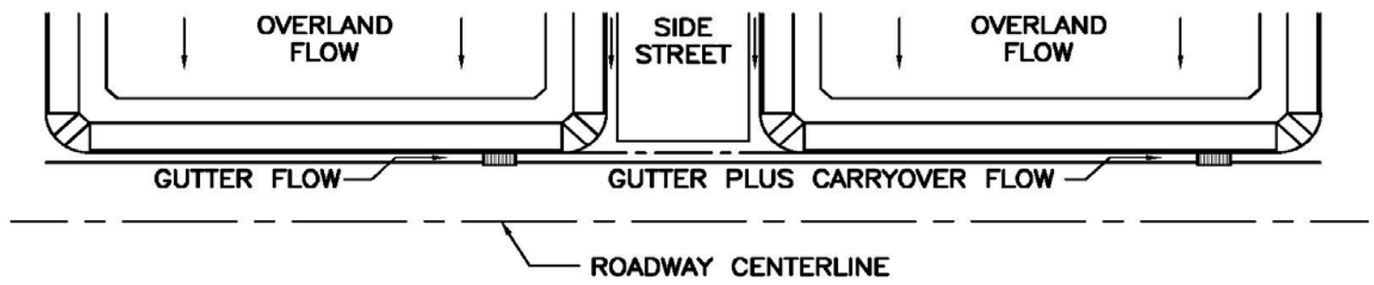
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.50**	**13.26**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**-2.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**128**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1T



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.3	37.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

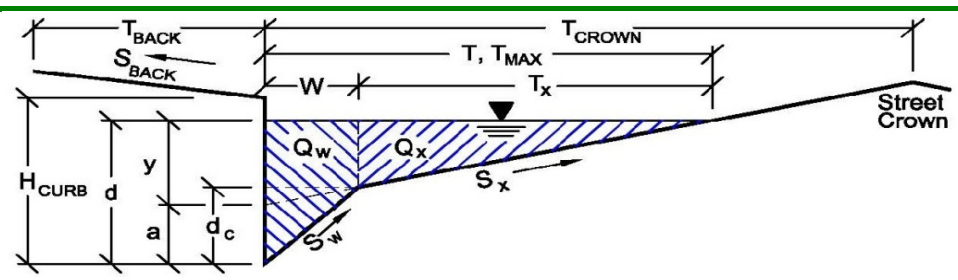
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.3**	**37.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1T**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

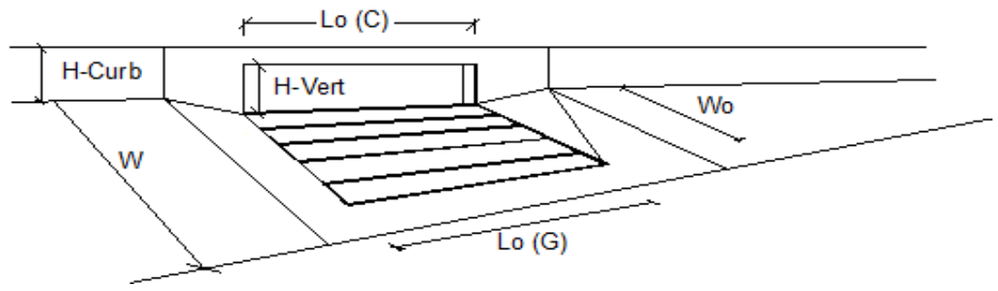
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1T



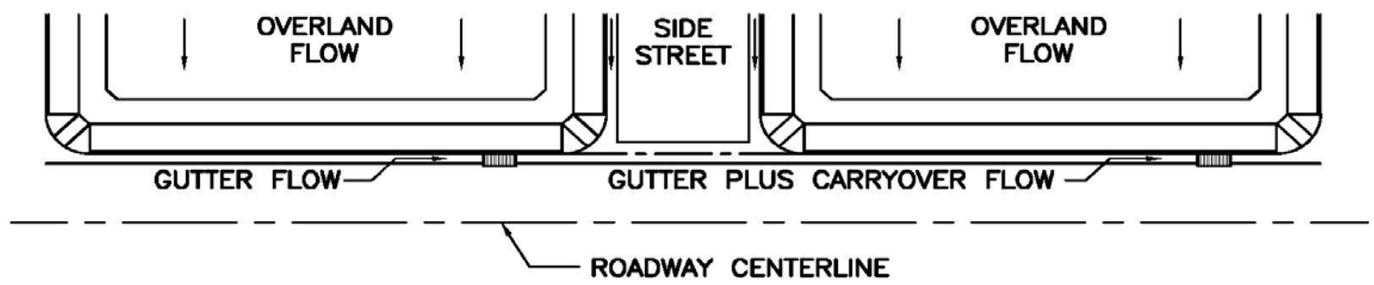
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.30**	**13.74**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**23.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**37**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1U



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.7	27.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

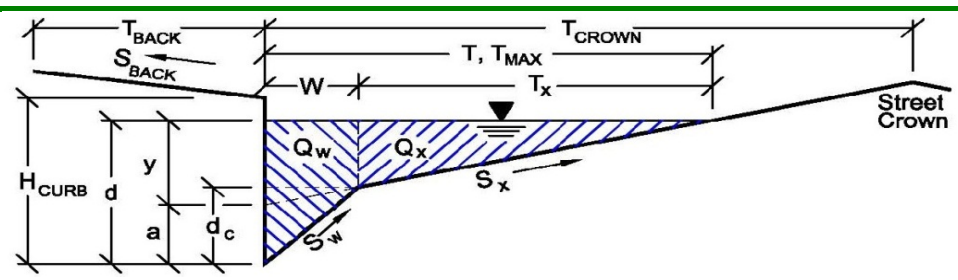
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.7**	**27.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 1U**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.1**	**162.5**	**cfs**

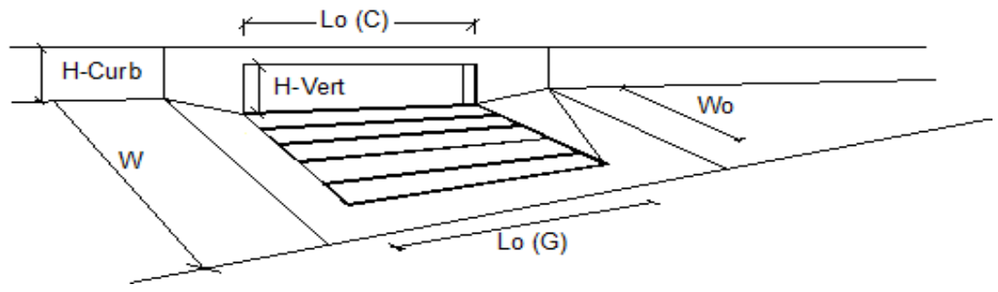
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1U



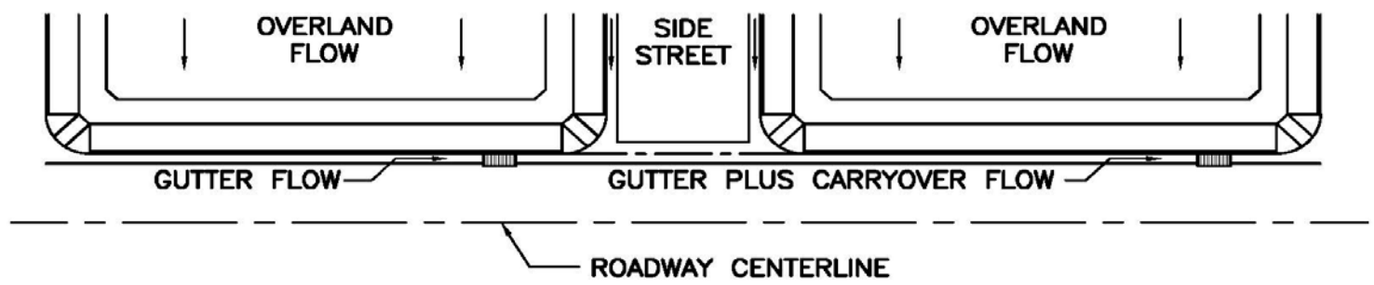
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.70**	**12.07**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**15.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**44**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	8.5	74.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

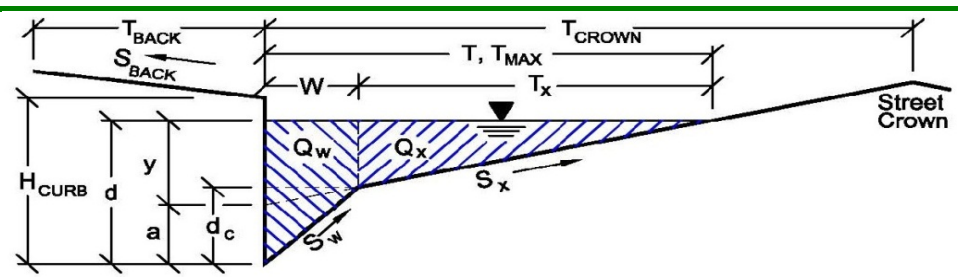
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**8.5**	**74.4**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.070	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**9.0**	**107.5**	**cfs**

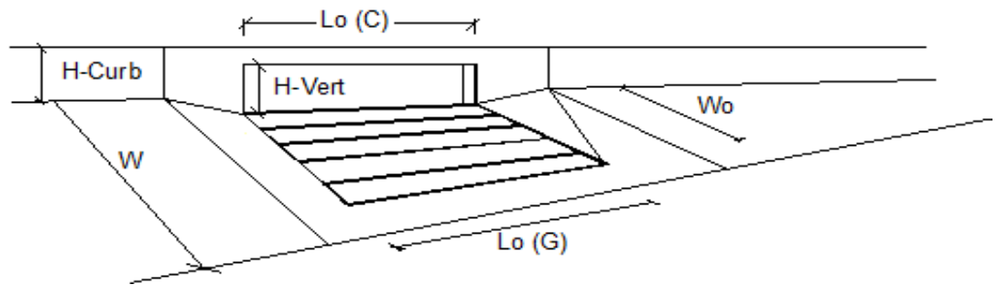
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2A



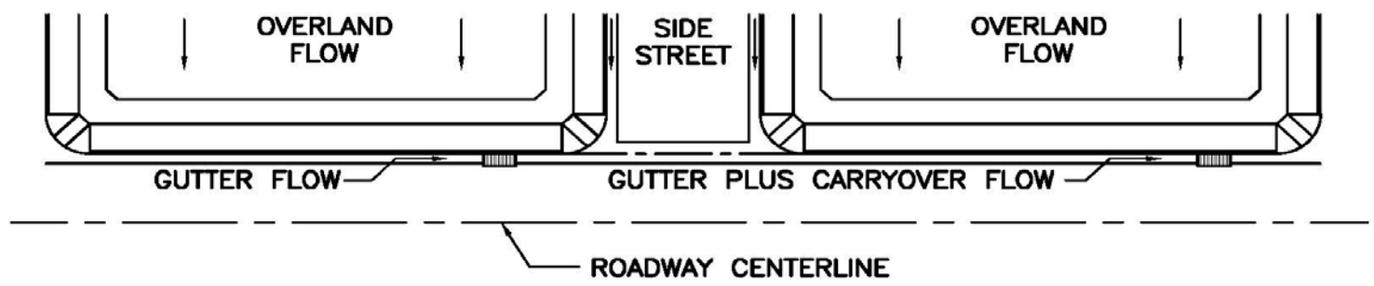
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.50**	**47.95**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**26.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**64**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.8	15.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

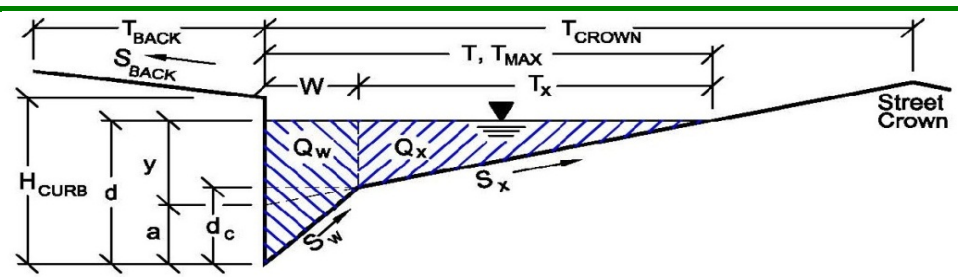
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.8**	**15.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.9**	**138.6**	**cfs**

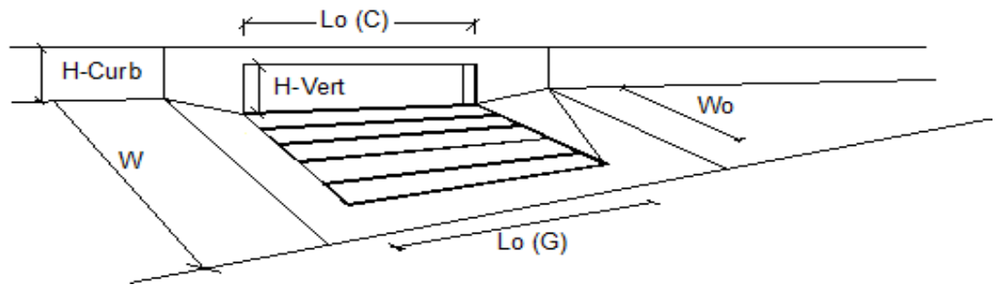
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2B



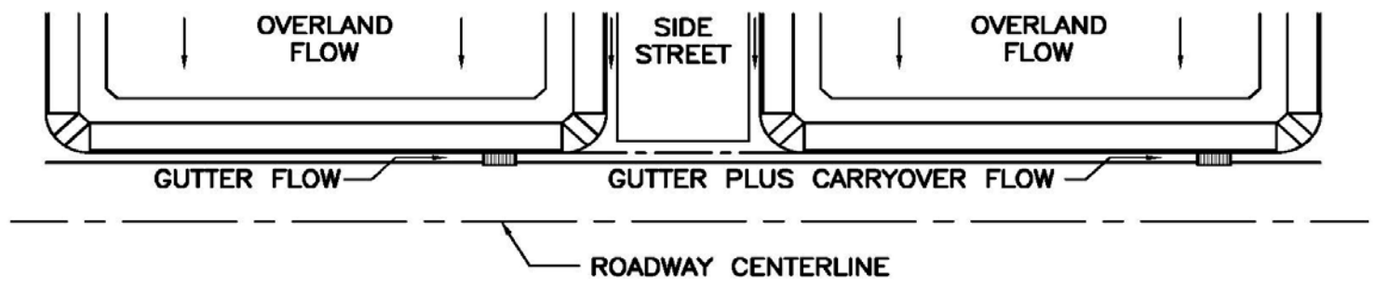
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.80**	**9.77**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**6.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**62**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2C



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.6	33.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

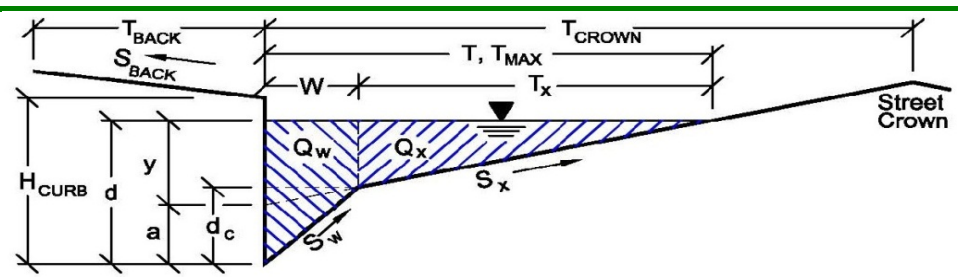
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.6**	**33.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.9**	**138.6**	**cfs**

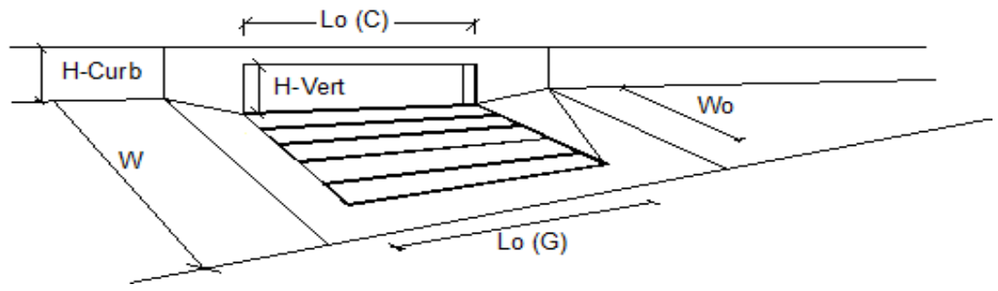
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2C



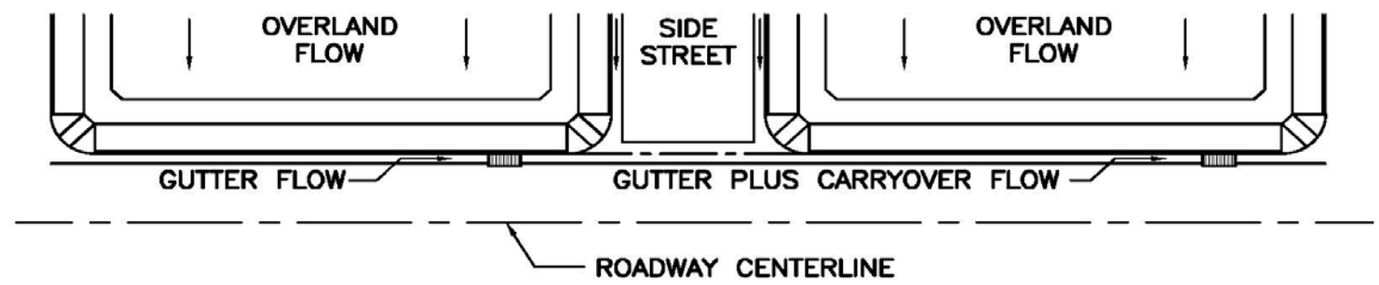
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.60**	**18.84**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**14.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**57**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2D



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.1	54.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

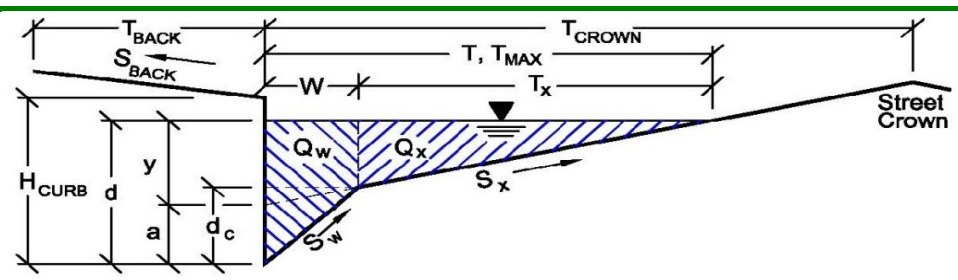
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.1**	**54.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2D**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**7.6**	**118.9**	**cfs**

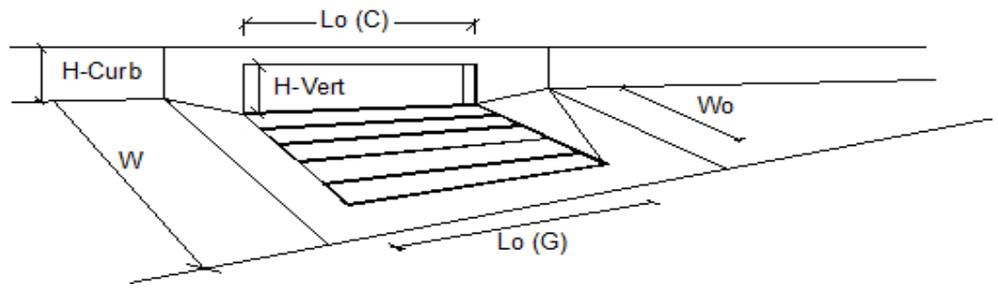
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2D



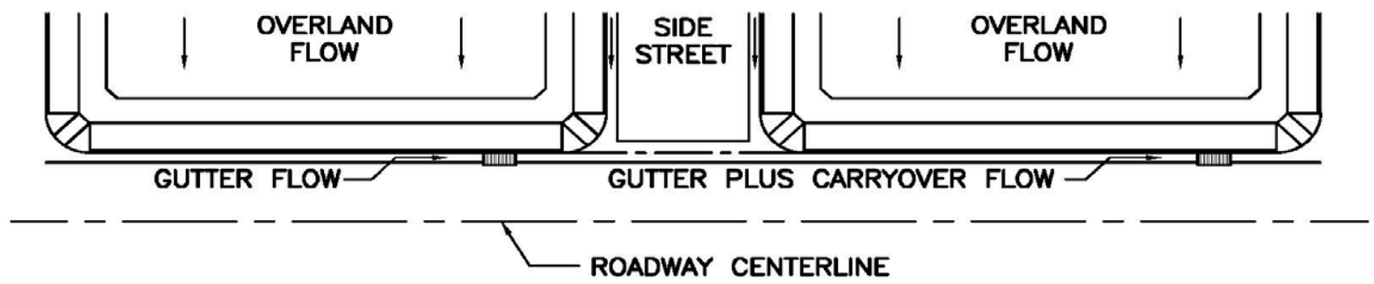
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.10**	**16.26**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**38.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**30**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.9	28.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

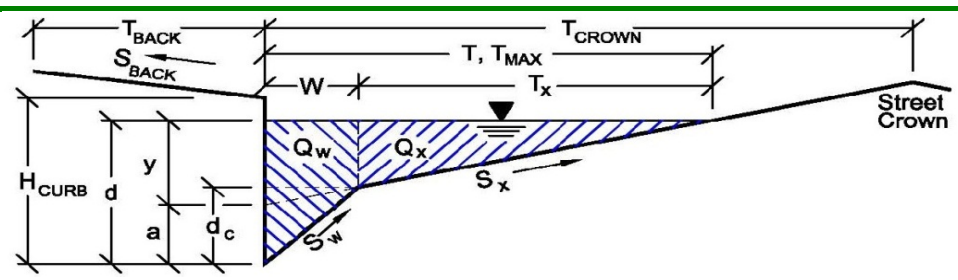
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**13.3**	**cfs**
Total Design Peak Flow, Q =	**3.9**	**41.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2E**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.3**	**112.6**	**cfs**

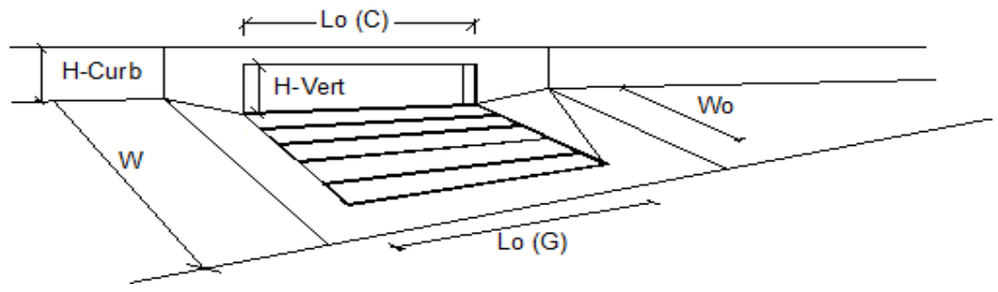
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2E



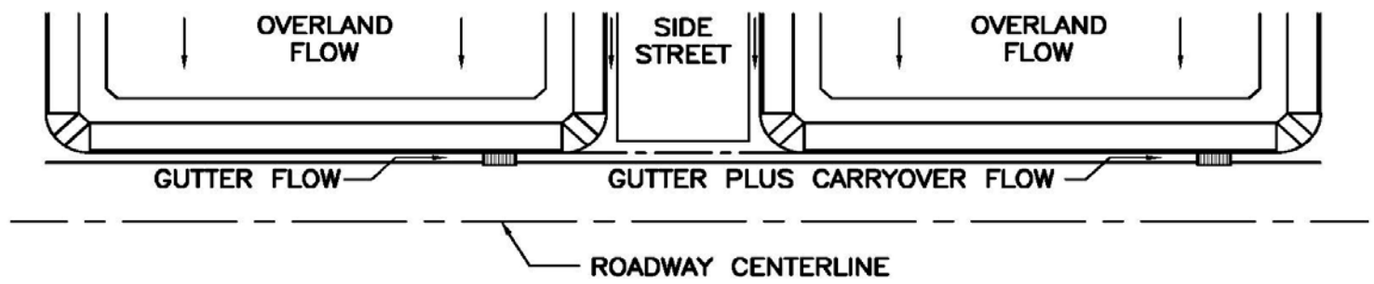
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.90**	**34.82**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**6.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**84**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2F



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.9	28.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

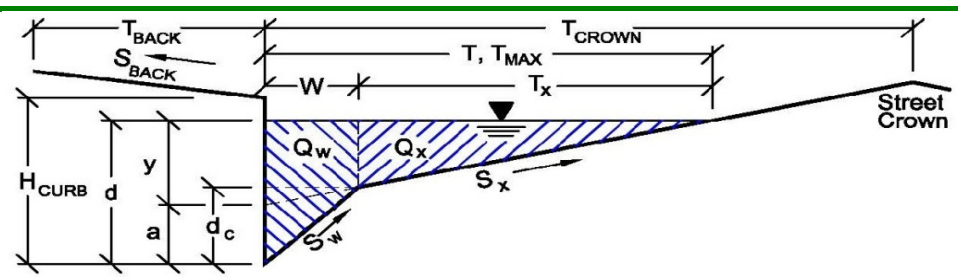
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**3.4**	**cfs**
Total Design Peak Flow, Q =	**3.9**	**31.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2F**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**8.3**	**112.6**	**cfs**

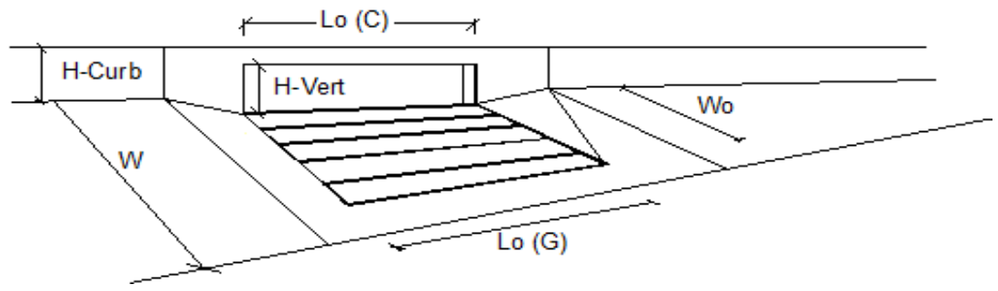
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2F



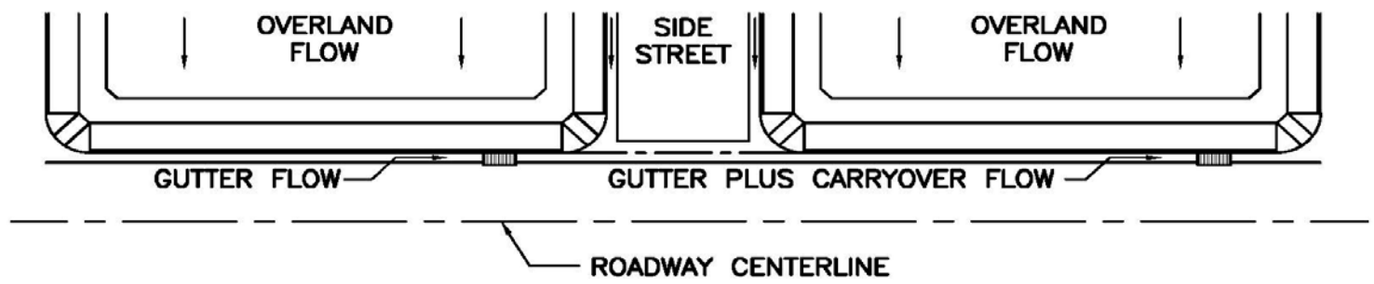
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.90**	**29.09**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**91**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2G



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.8	24.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

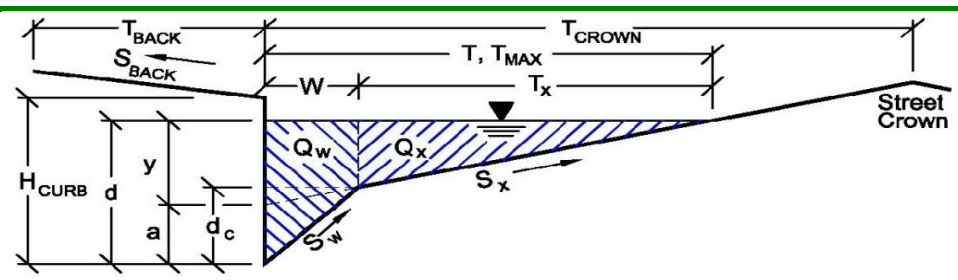
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.8**	**24.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2G**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.3**	**112.6**	**cfs**

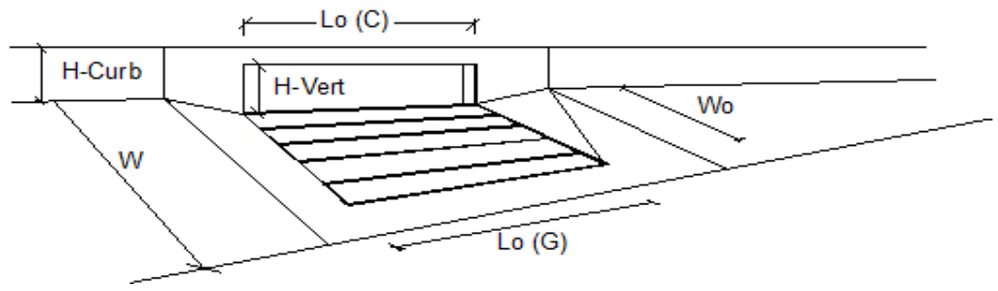
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2G



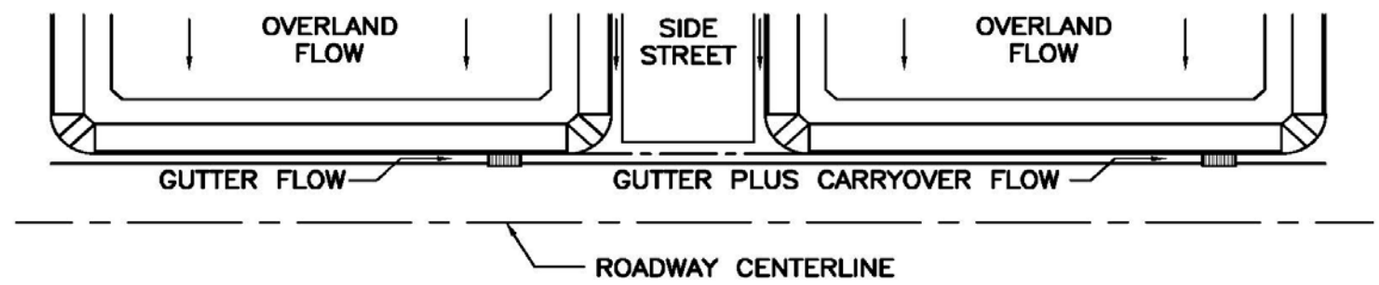
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.80**	**16.85**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**7.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**69**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2H



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.0	21.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

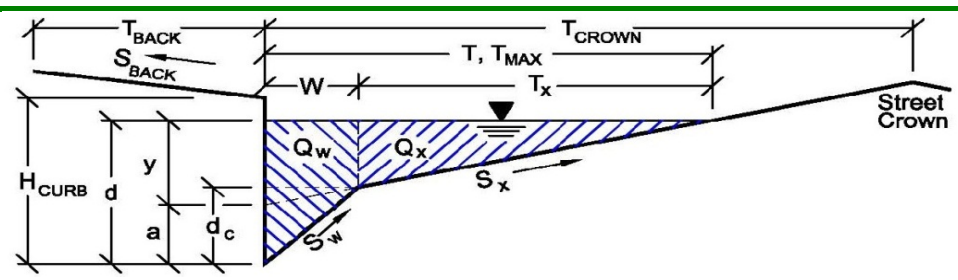
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**1.4**	**cfs**
Total Design Peak Flow, Q =	**5.0**	**23.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2H**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

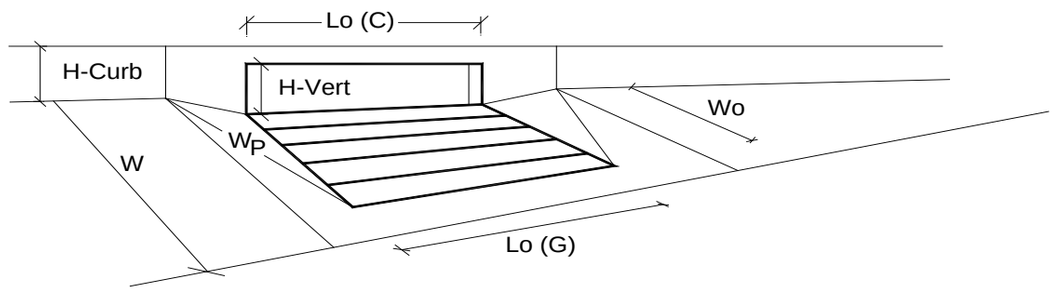
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **2H**

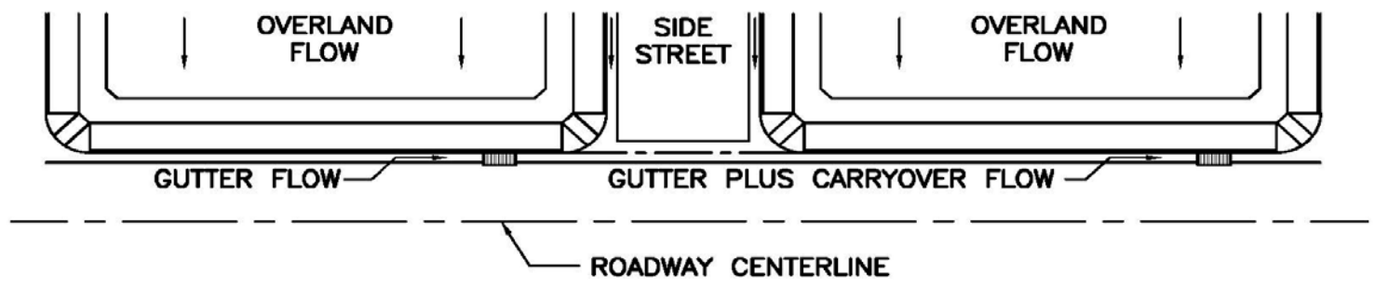


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**14.4**	**29.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.0	23.2	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2I



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.9	35.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

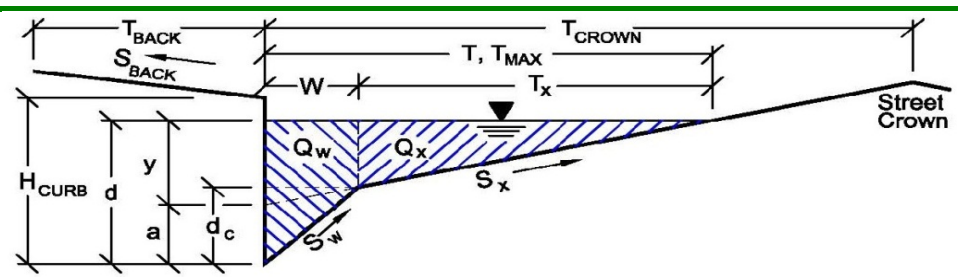
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.9**	**35.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2I**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

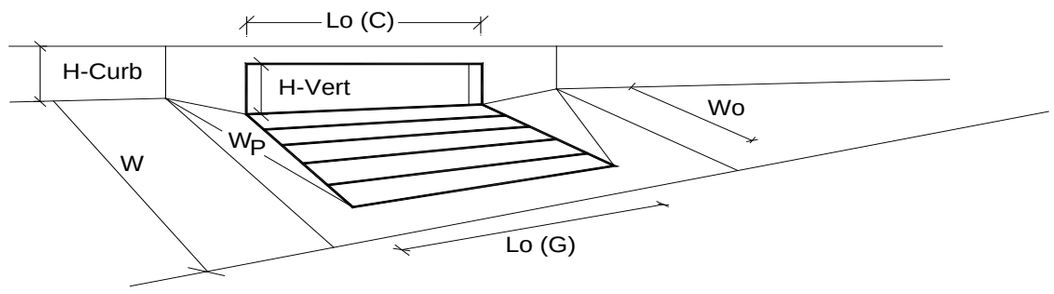
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **2I**

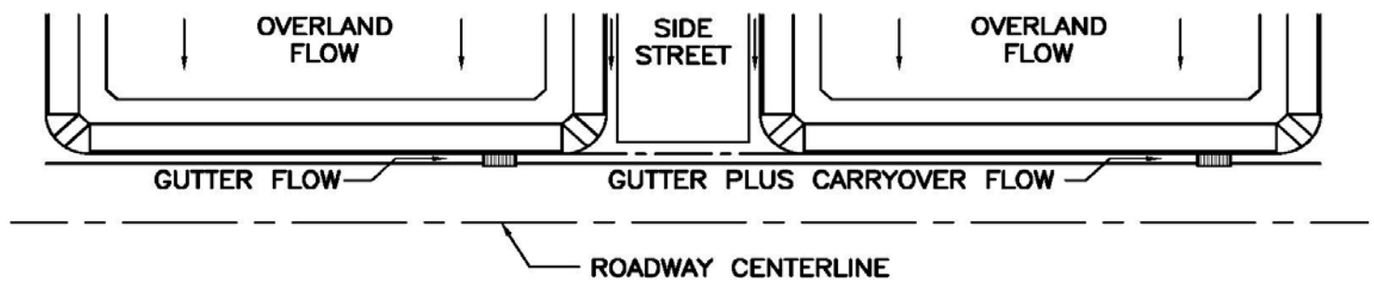


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**19.9**	**41.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.9	35.7	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2J



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.3	46.7	cfs

<---
FILL IN THIS SECTION OR…

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW.
<---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

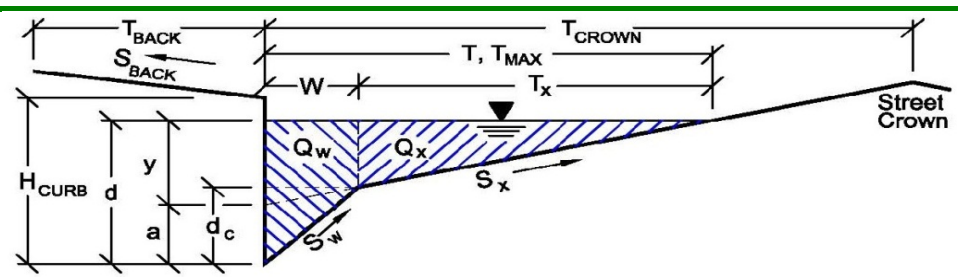
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**1.3**	**46.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2J**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

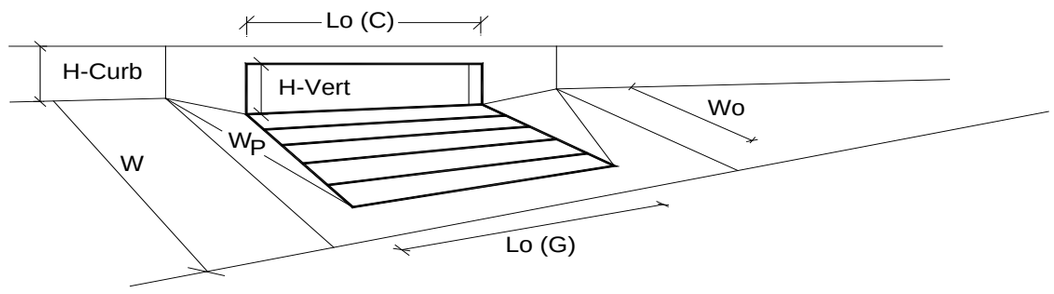
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **2J**

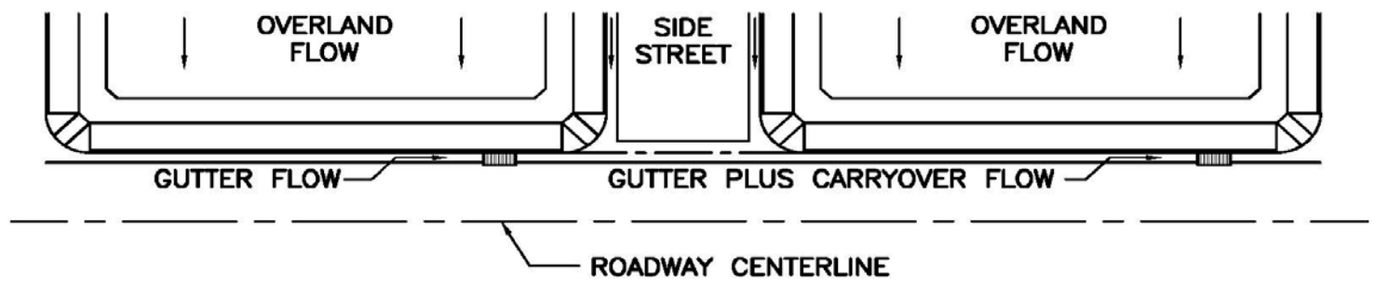


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**14.4**	**56.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.3	46.7	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2K



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.6	5.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

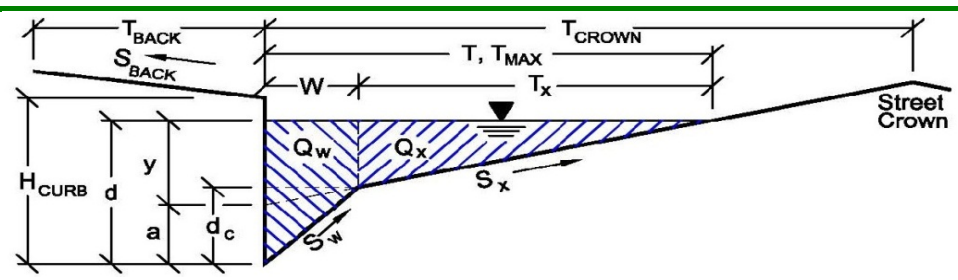
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**1.6**	**5.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2K**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

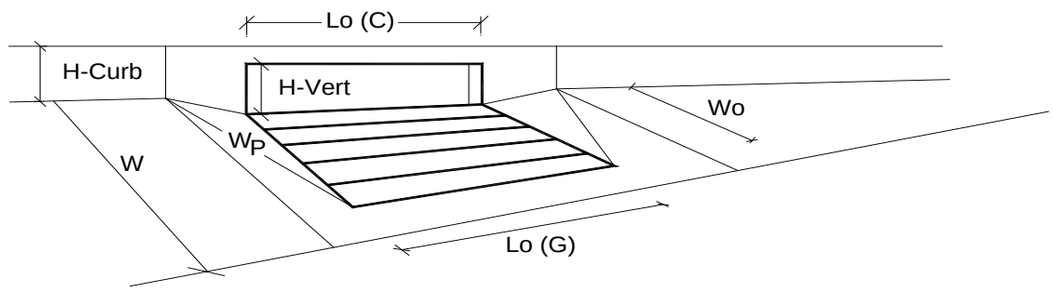
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **2K**

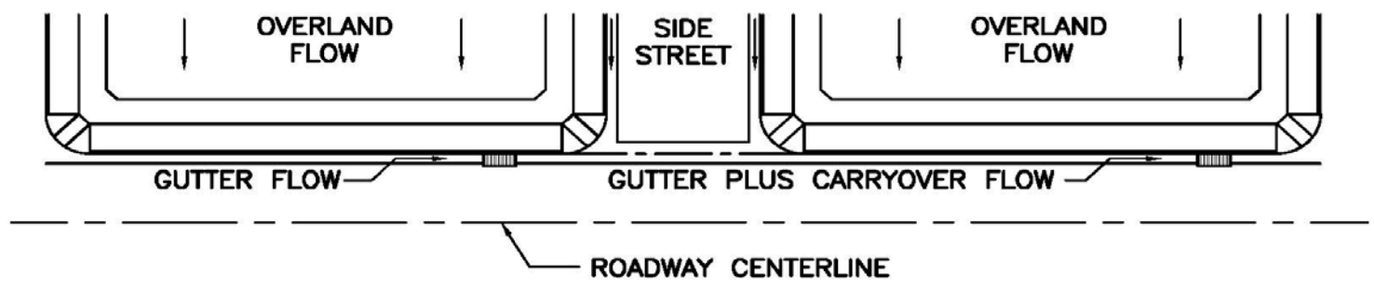


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**13.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.6	5.2	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2L



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.9	46.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

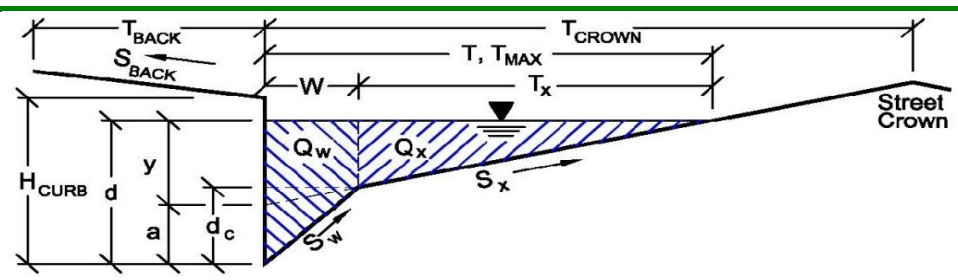
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.9**	**46.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2L**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.9**	**138.6**	**cfs**

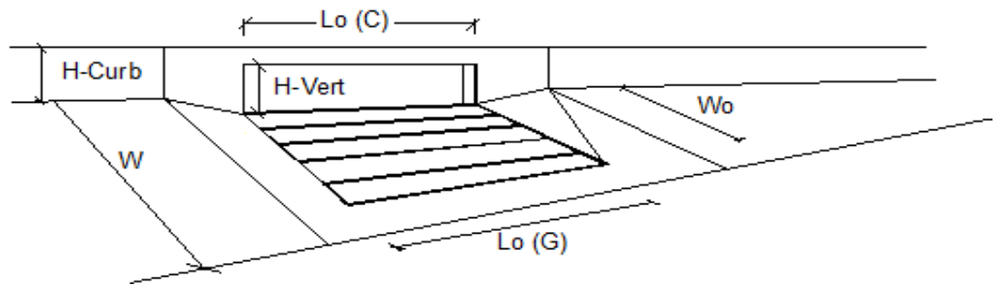
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2L



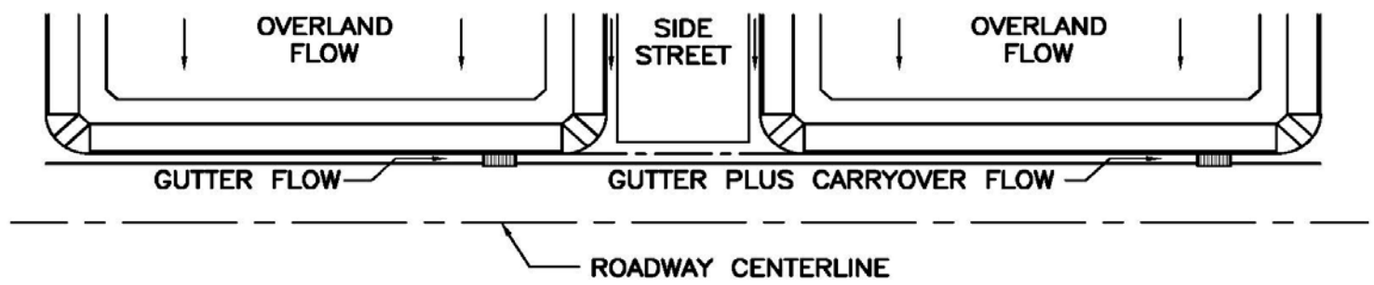
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.85**	**21.82**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**25.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**47**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2M



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.9	15.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

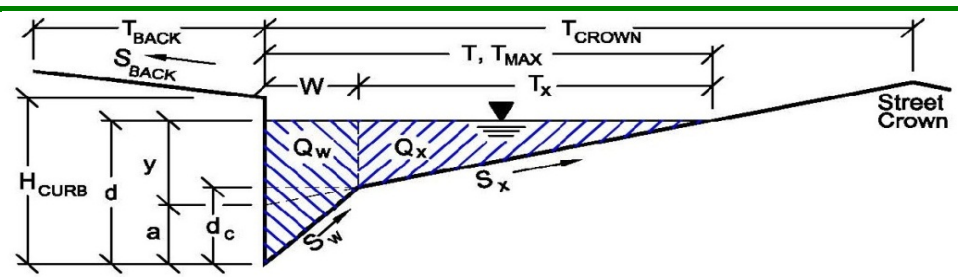
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.9**	**15.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2M**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

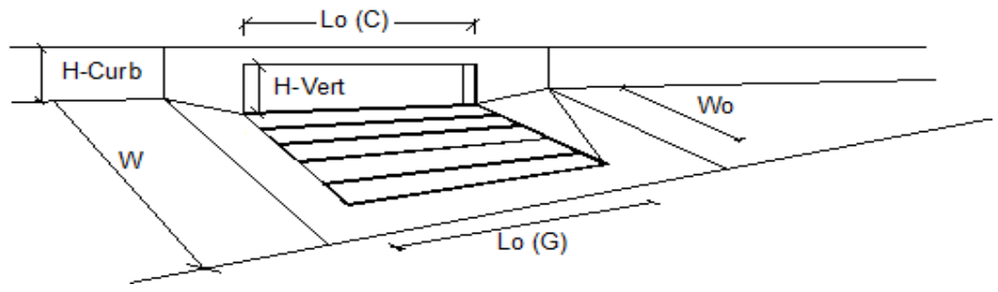
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2M



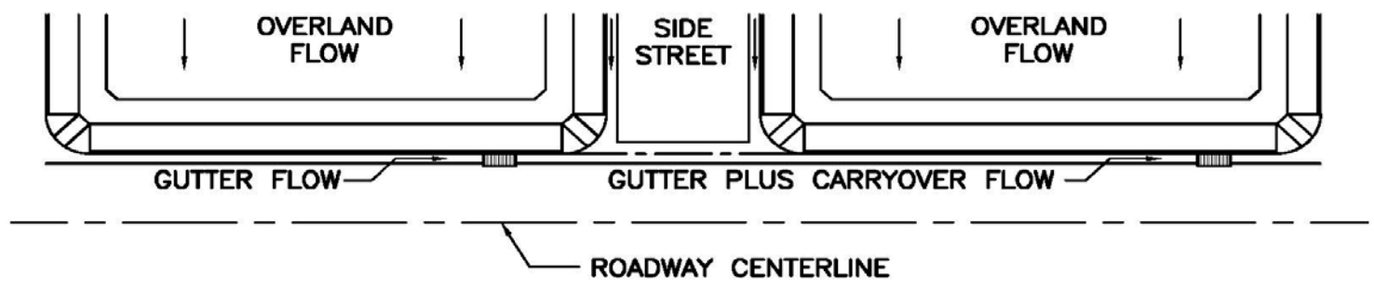
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.90**	**9.62**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**6.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**61**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2N



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.9	15.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

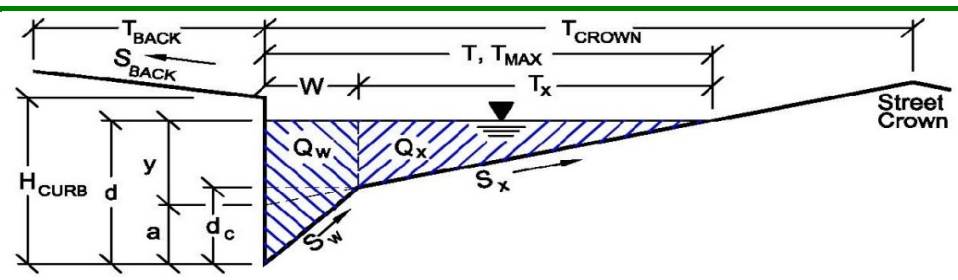
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.9**	**15.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2N**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

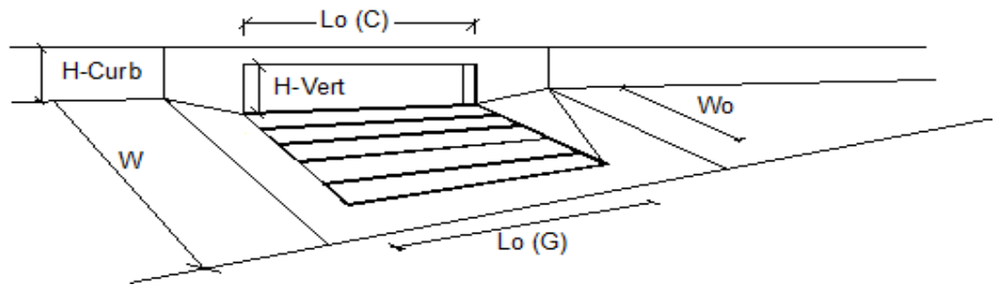
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2N



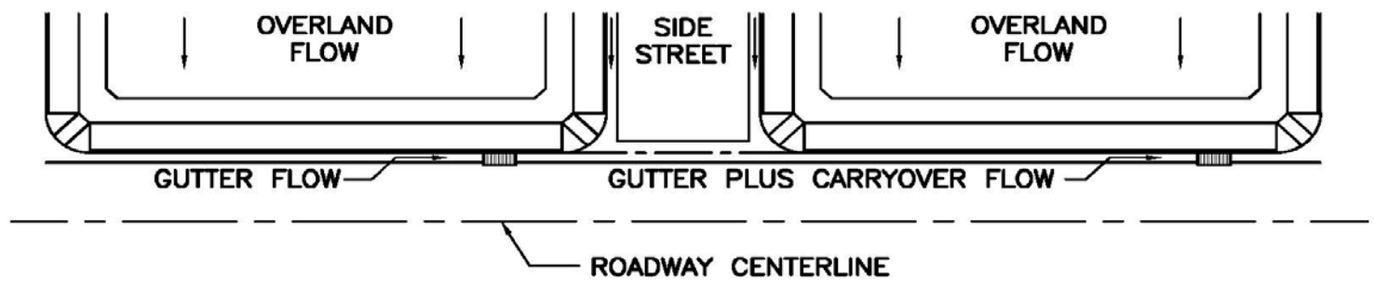
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.90**	**9.62**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**6.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**61**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2O



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.5	10.1	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

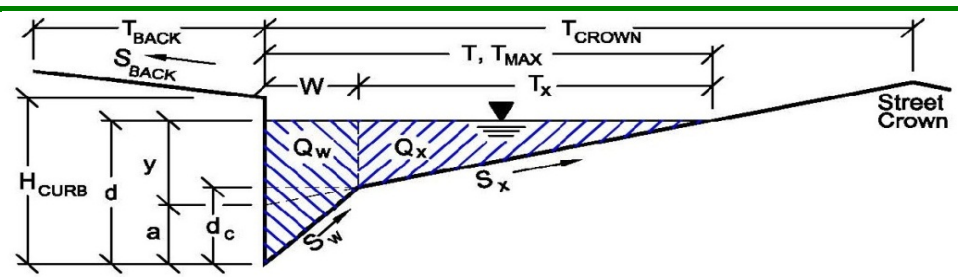
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.5**	**10.1**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **2O**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**3.4**	**132.7**	**cfs**

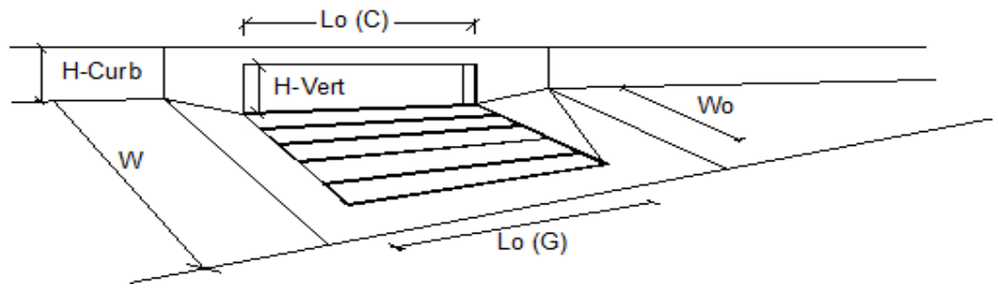
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2O



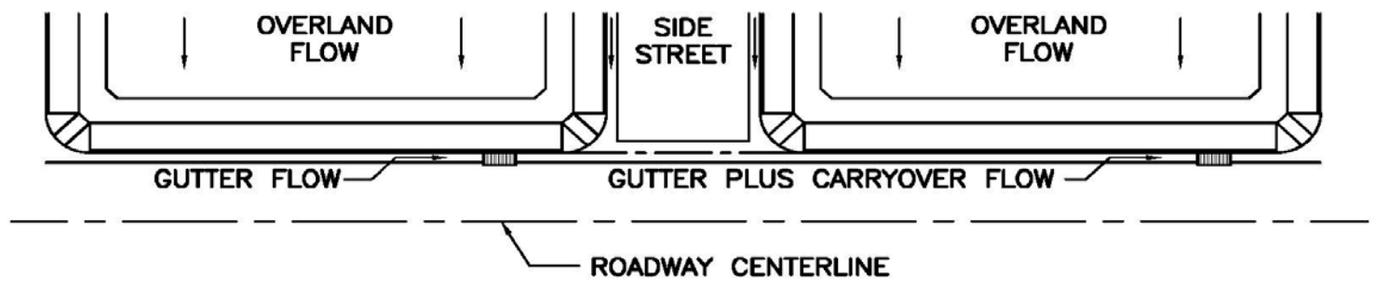
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.50**	**7.61**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**75**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.3	25.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

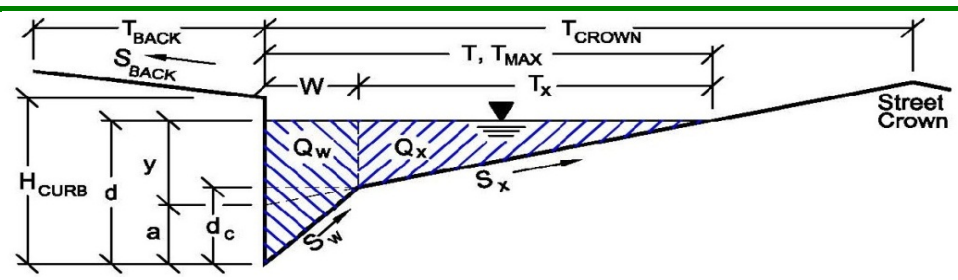
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.3**	**25.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

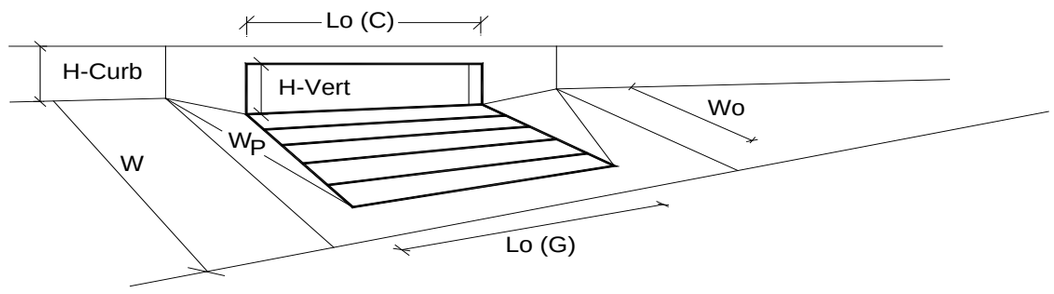
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **4A**

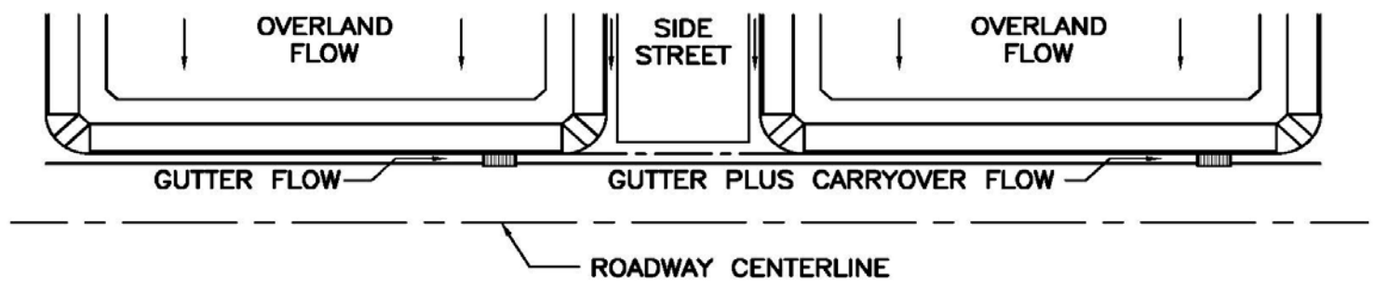


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.3	25.2	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.6	24.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

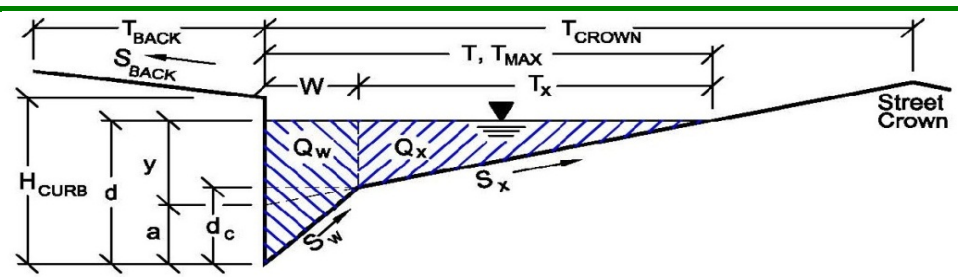
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.6**	**24.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.3**	**112.6**	**cfs**

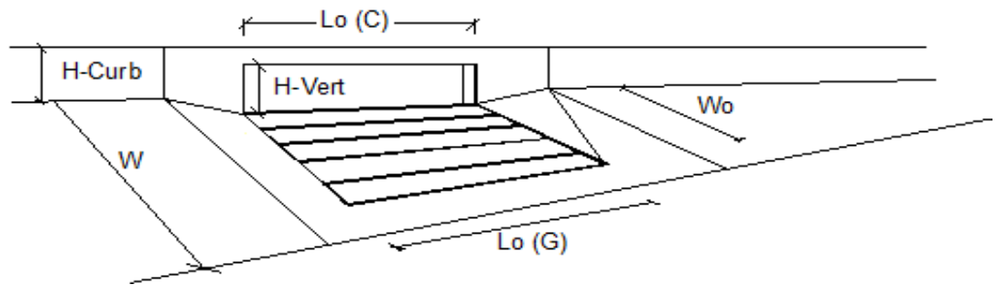
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 4B

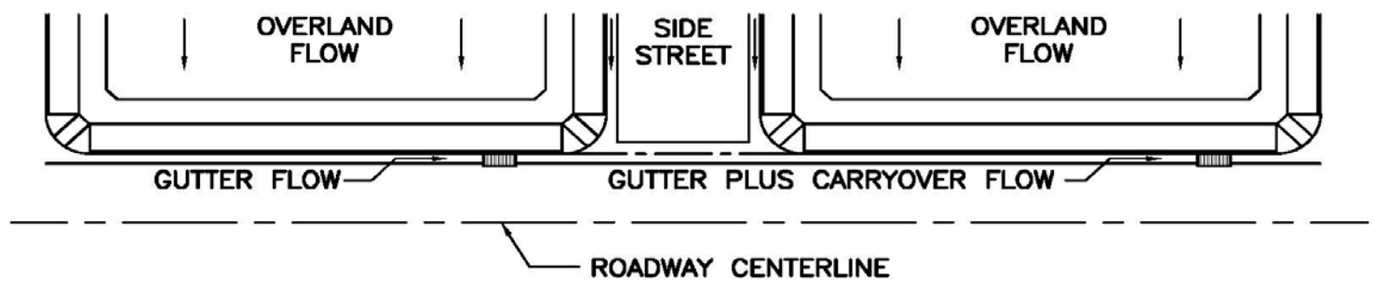


	Design Information (Input)		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Warning 1	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.20	0.20	
	Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**5.60**	**16.52**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**8.3**	**cfs**
	Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**67**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	13.6	54.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

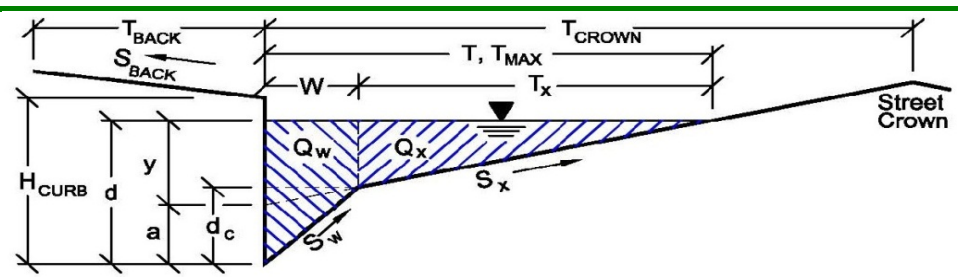
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**13.6**	**54.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4E**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

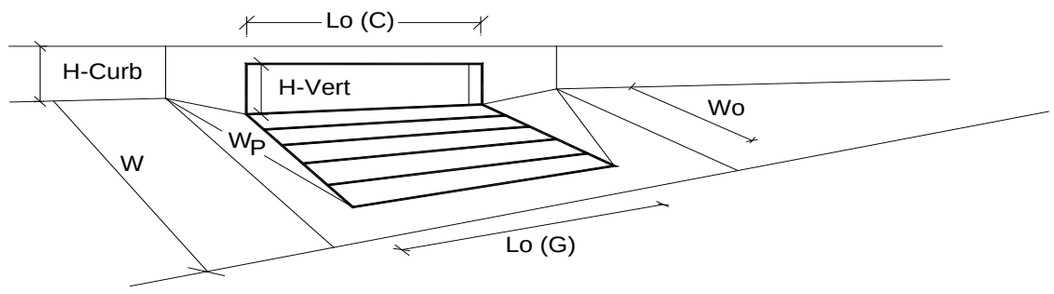
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **4E**

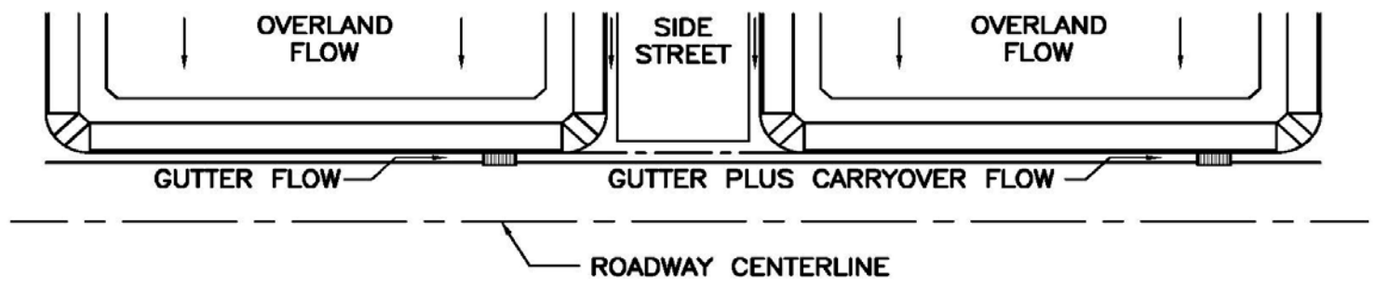


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**14.4**	**56.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	13.6	54.5	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4F



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.9	24.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

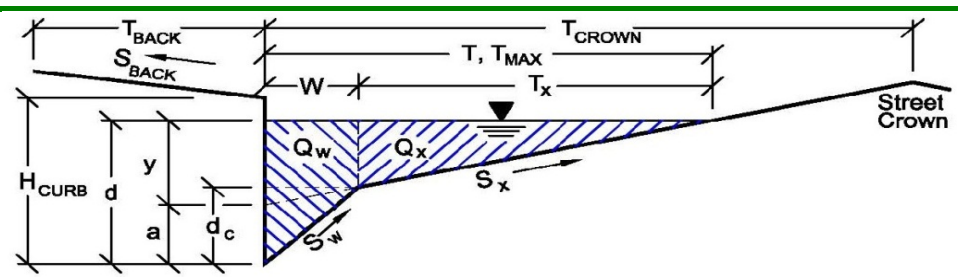
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.9**	**24.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4F**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	19.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.50	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

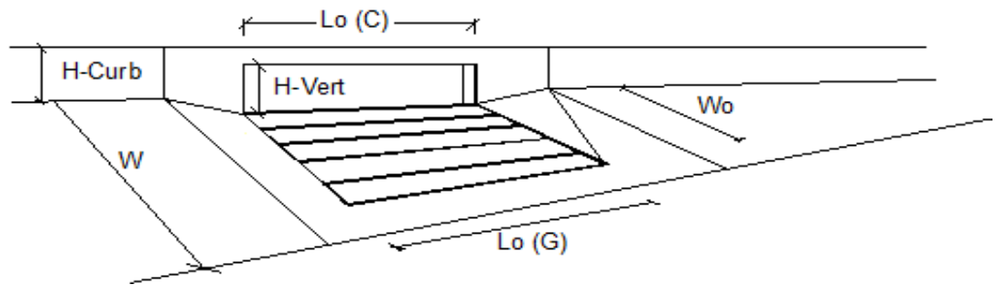
	Minor Storm	Major Storm	
Q_{allow} =	**12.2**	**91.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: 4F



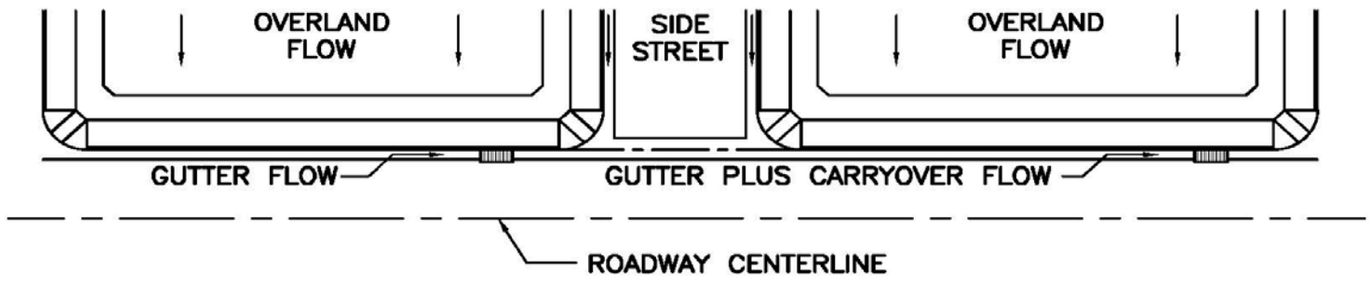
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.90**	**24.05**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**99**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 4G



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.5	11.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

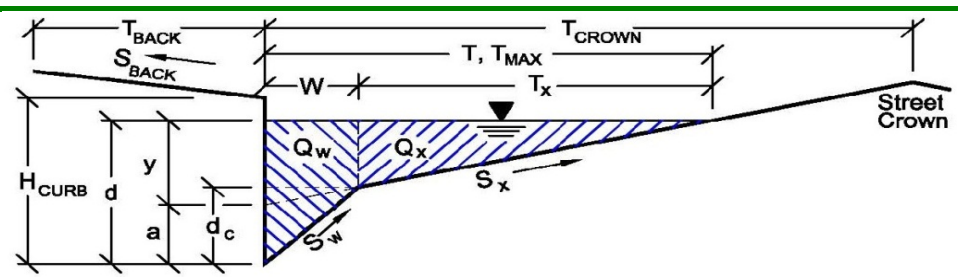
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.5**	**11.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 4G**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**6.8**	**127.1**	**cfs**

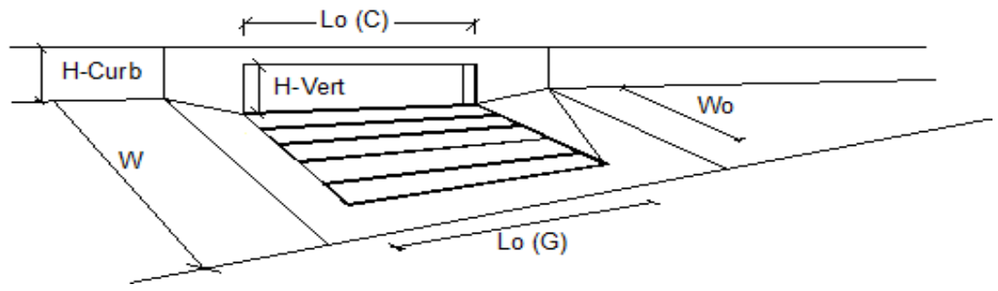
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 4G



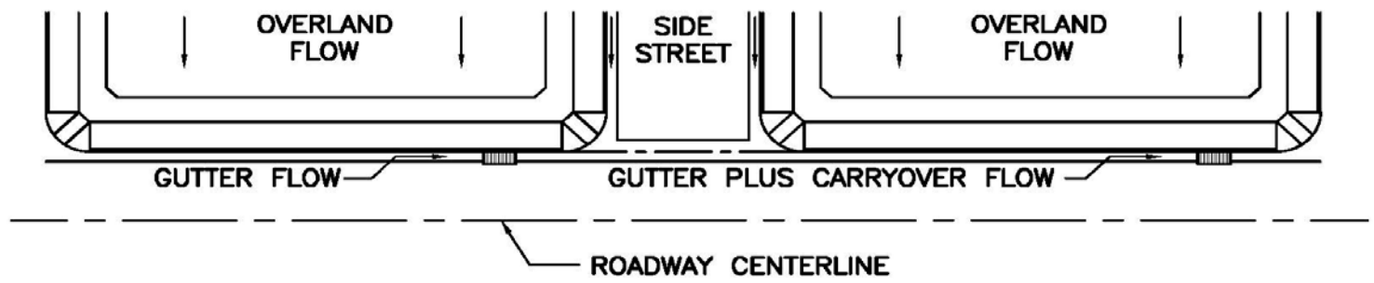
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.50**	**11.63**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**99**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4I



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.3	19.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

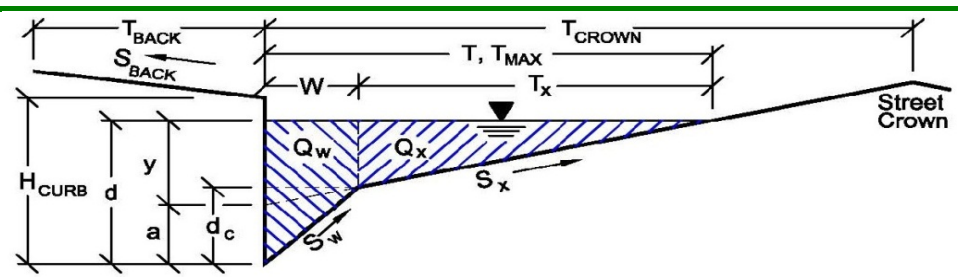
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.3**	**19.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4I**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

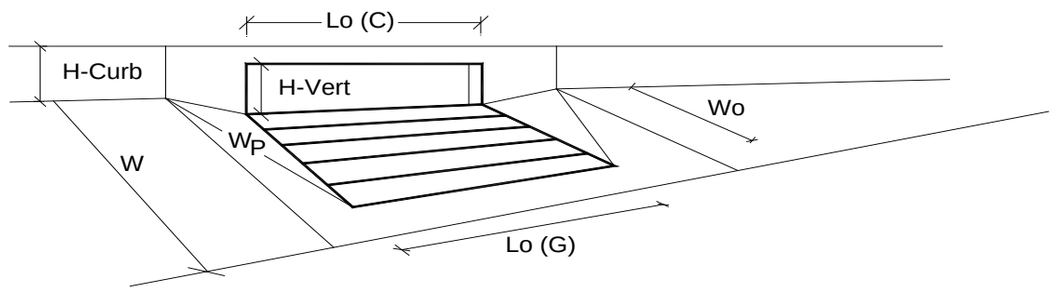
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **4I**

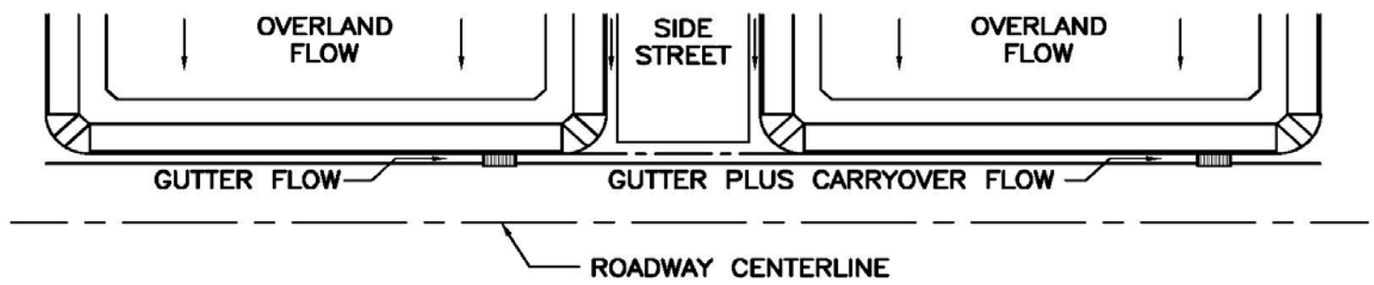


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.3	19.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4J



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.6	45.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

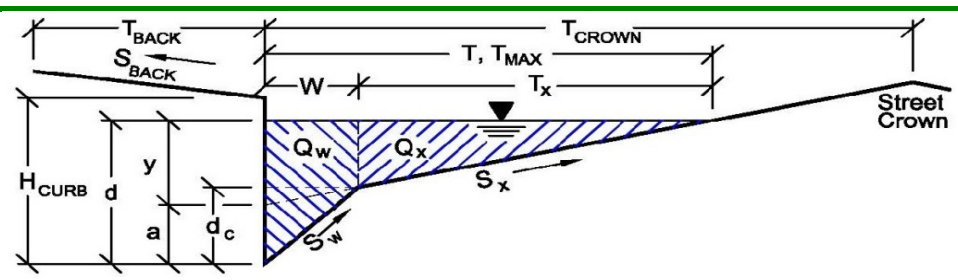
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.6**	**45.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4J**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

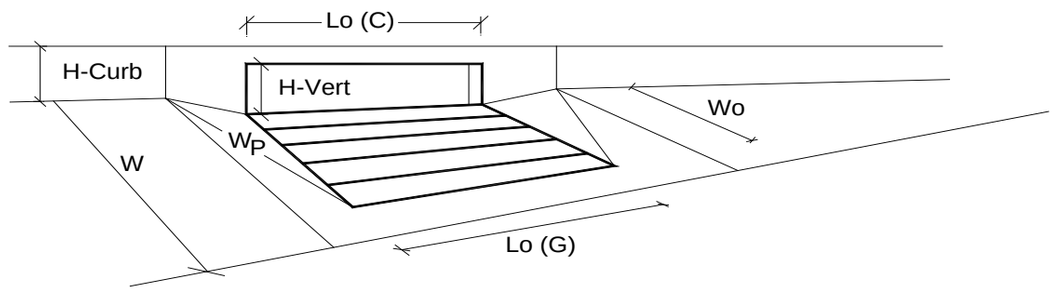
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **4J**

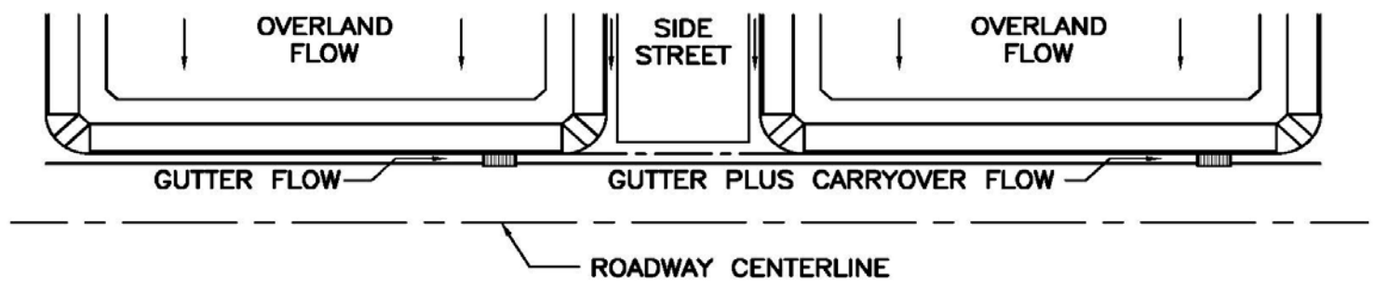


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**14.4**	**56.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.6	45.7	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4K



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	6.2	19.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

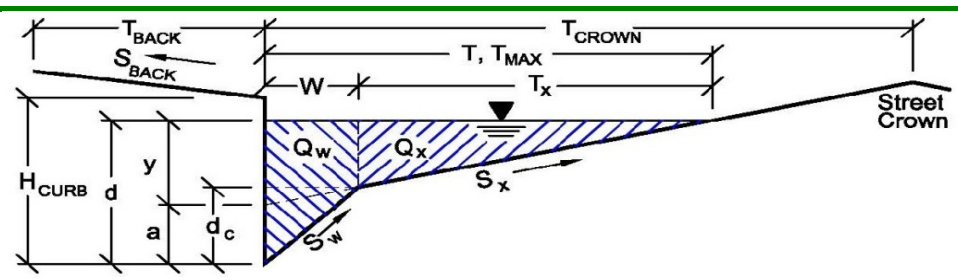
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**6.2**	**19.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4K**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

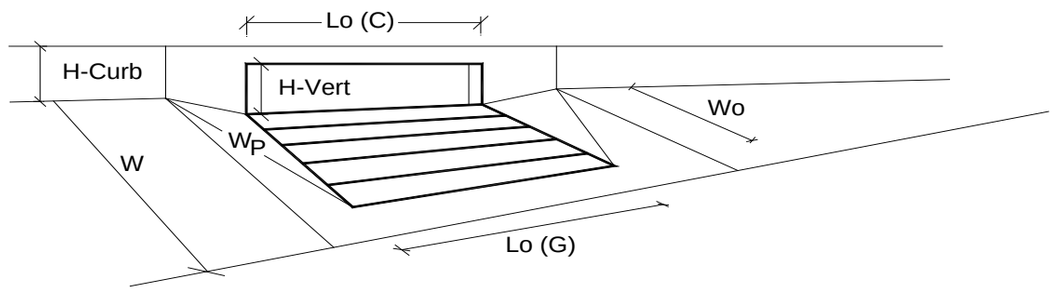
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **4K**

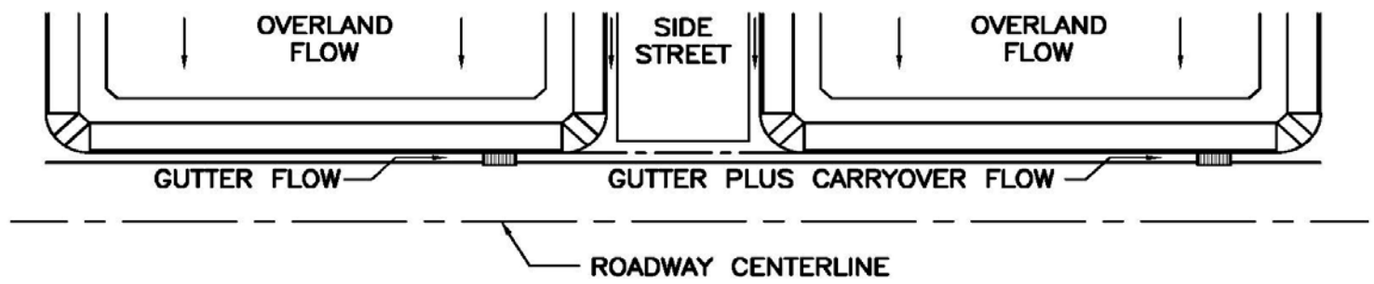


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.2	19.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4L



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.1	10.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

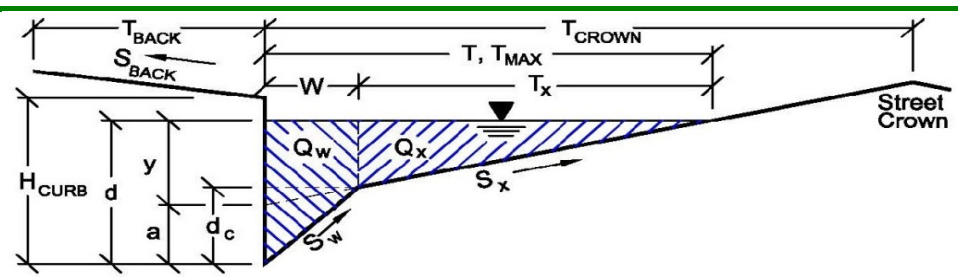
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.1**	**10.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **4L**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**4.1**	**137.8**	**cfs**

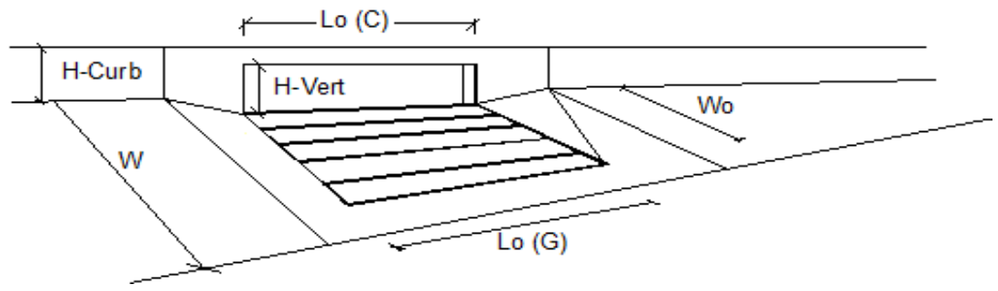
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 4L

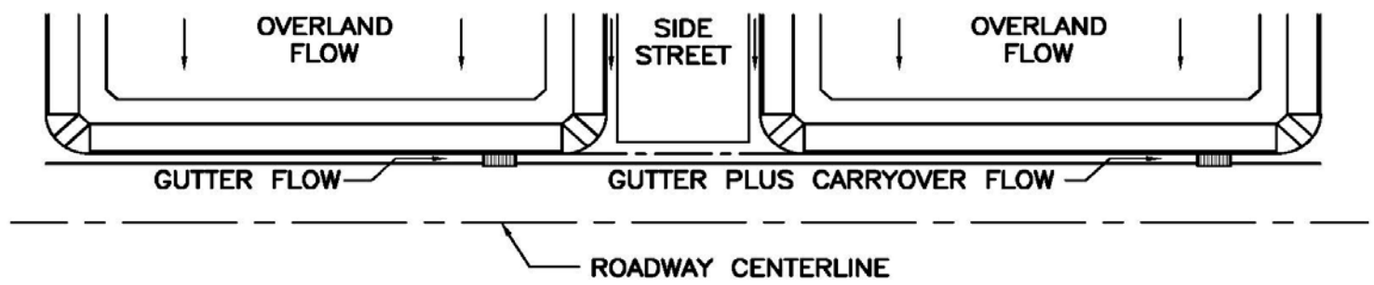


	Design Information (Input)		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
	Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Warning 1	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.20	0.20	
	Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**2.10**	**10.00**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 3A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	6.4	43.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

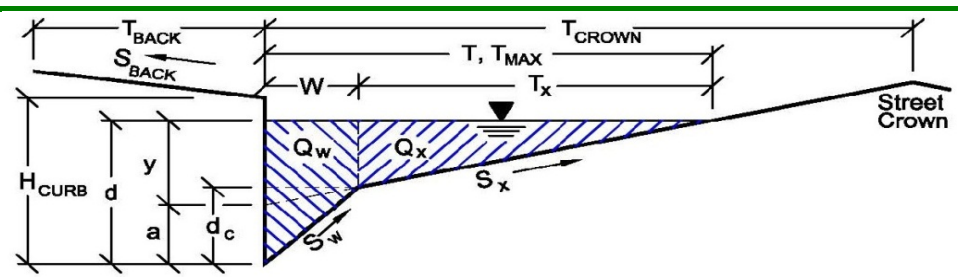
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**6.4**	**43.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **3A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

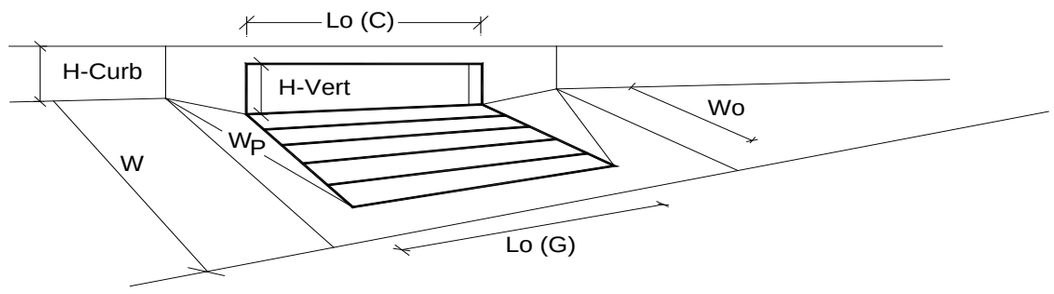
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **3A**

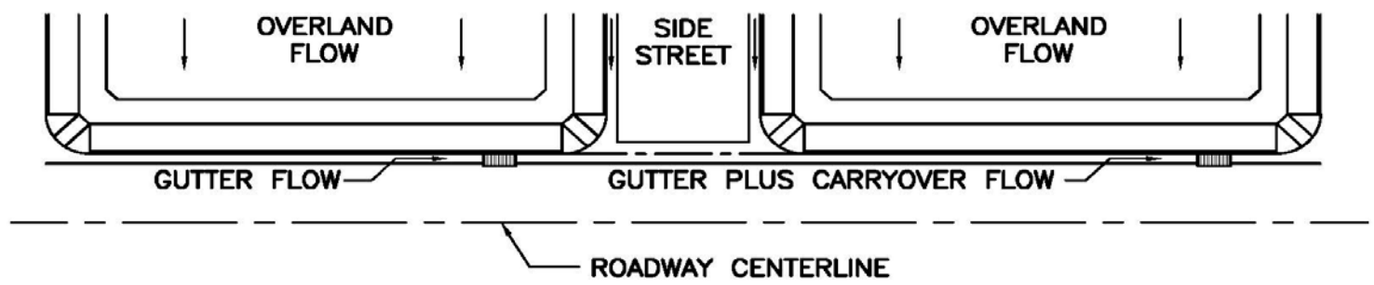


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**14.4**	**56.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.4	43.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.9	56.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

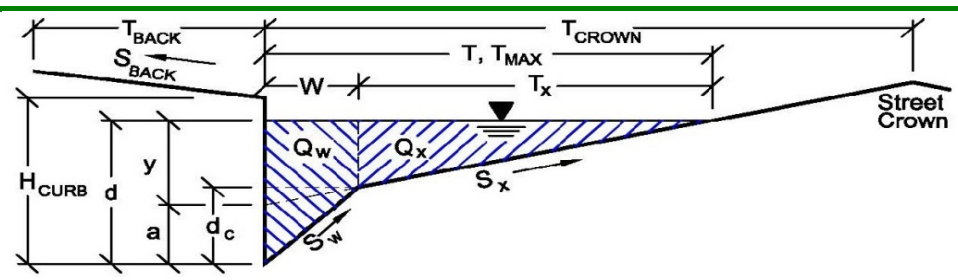
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.9**	**56.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.027	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.6**	**142.4**	**cfs**

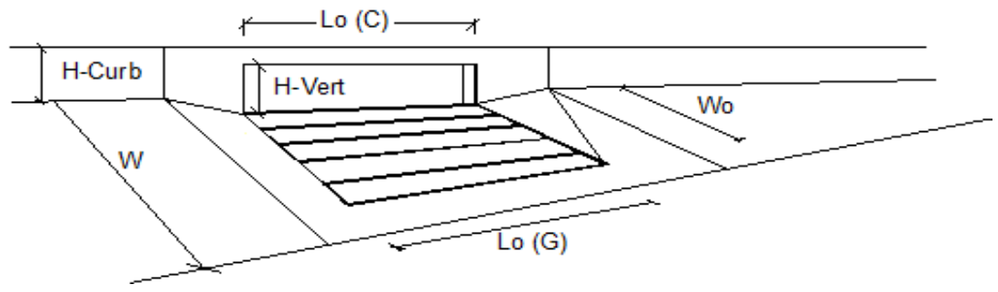
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5A



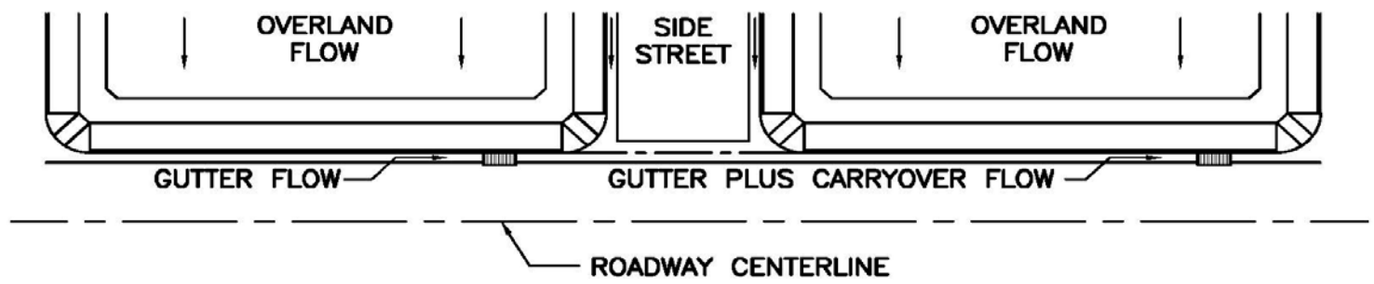
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.90**	**39.98**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**16.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**71**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.4	19.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

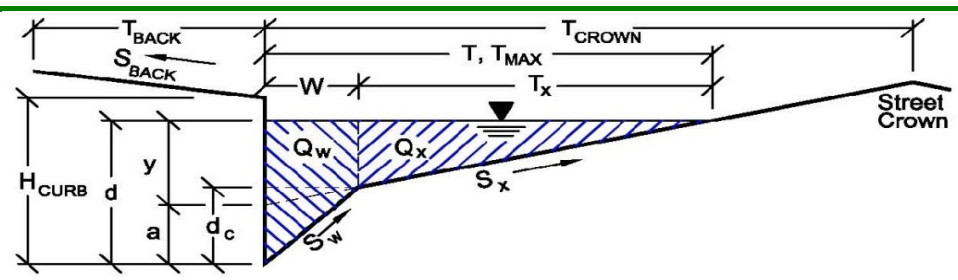
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**21.4**	**cfs**
Total Design Peak Flow, Q =	**5.4**	**40.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **5B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

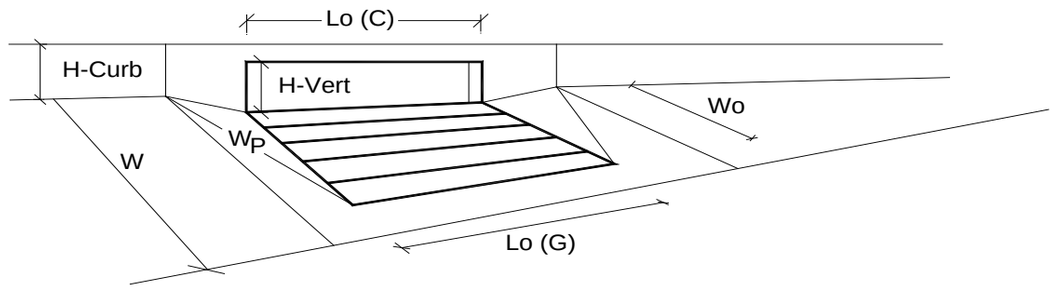
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **5B**

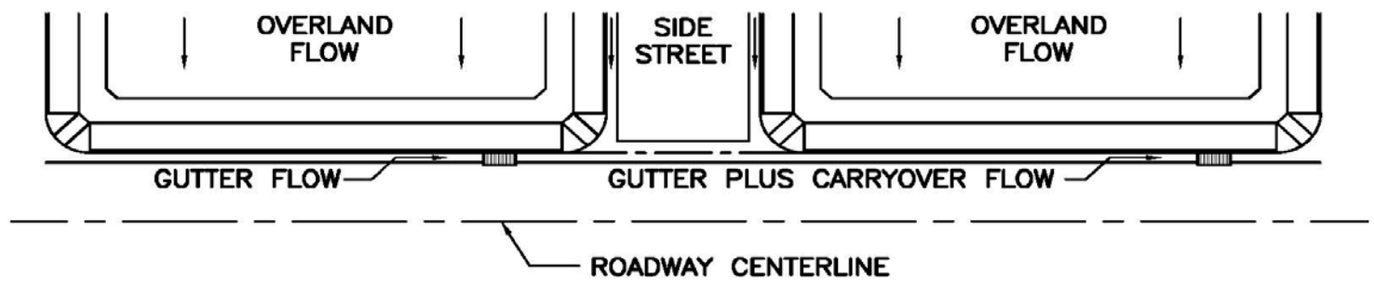


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**42.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.4	40.8	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5C



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.6	70.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

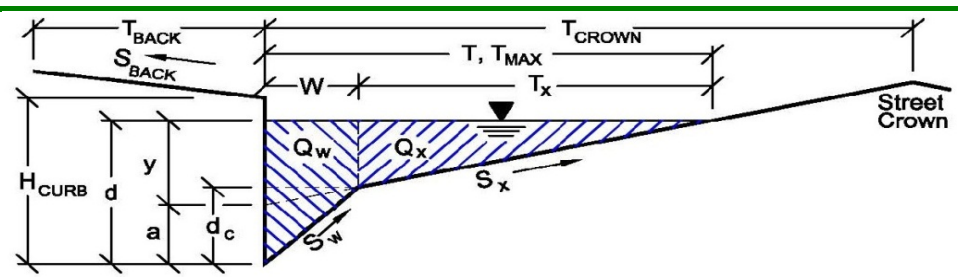
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.6**	**70.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.9**	**138.6**	**cfs**

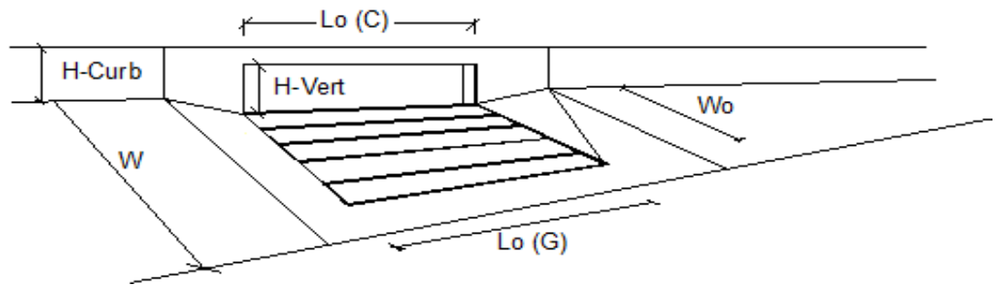
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5C



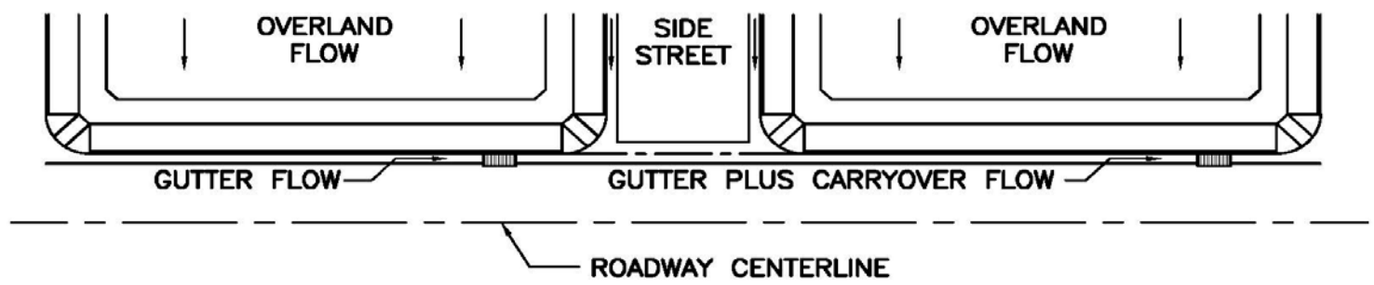
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.60**	**25.77**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**45.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**36**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5D



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.8	80.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

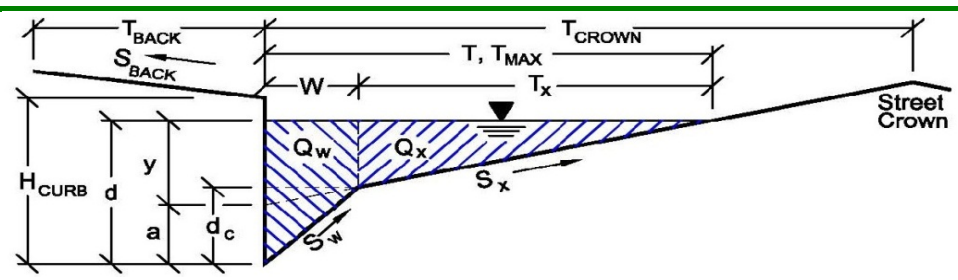
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.8**	**80.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5D**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**6.8**	**127.1**	**cfs**

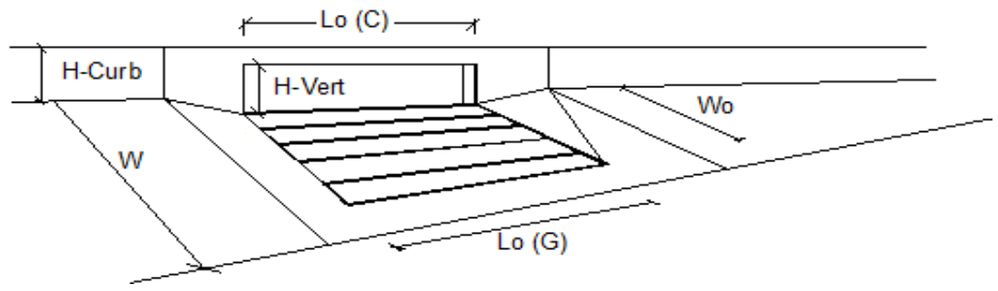
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5D



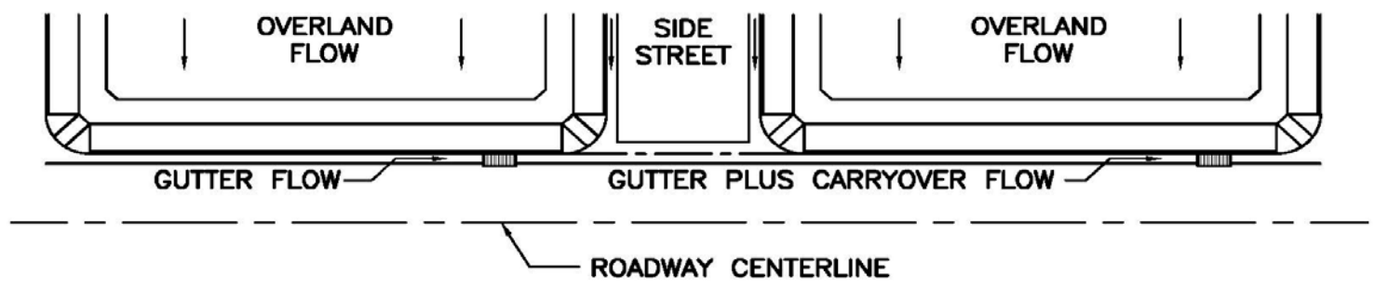
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.80**	**18.60**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**61.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**23**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.1	83.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

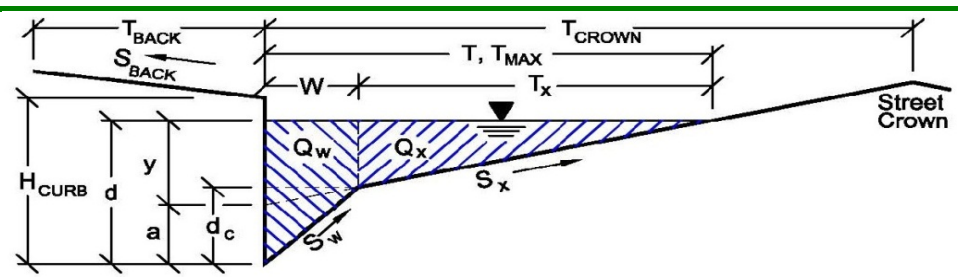
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.1**	**83.4**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **5E**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

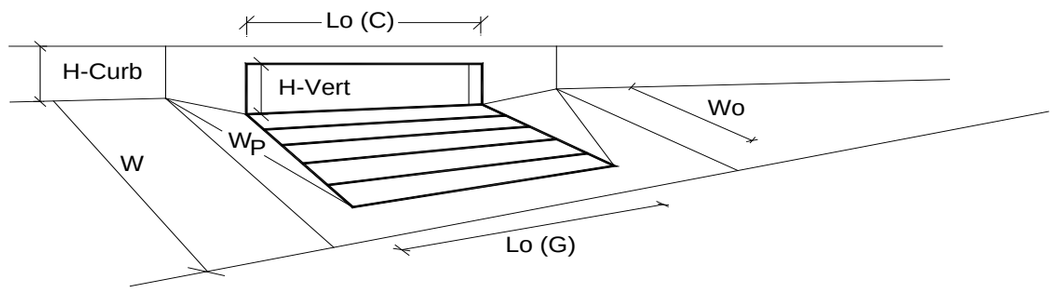
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **5E**

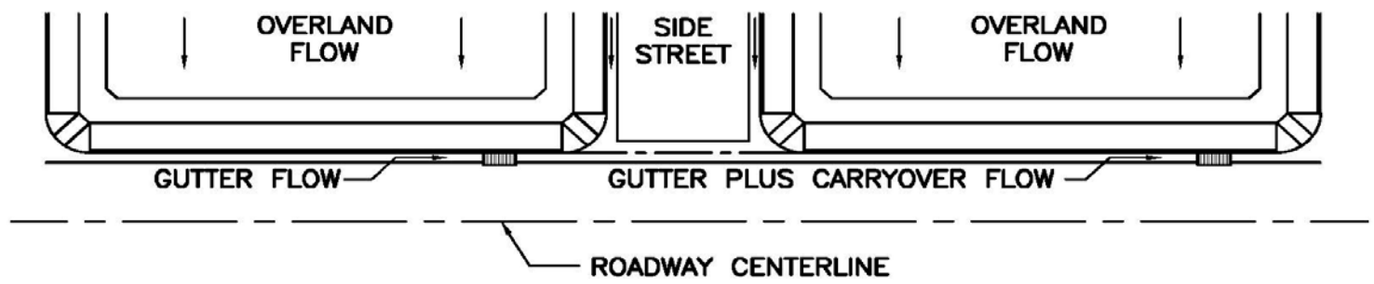


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**19.9**	**86.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.1	83.4	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5F



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.1	12.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

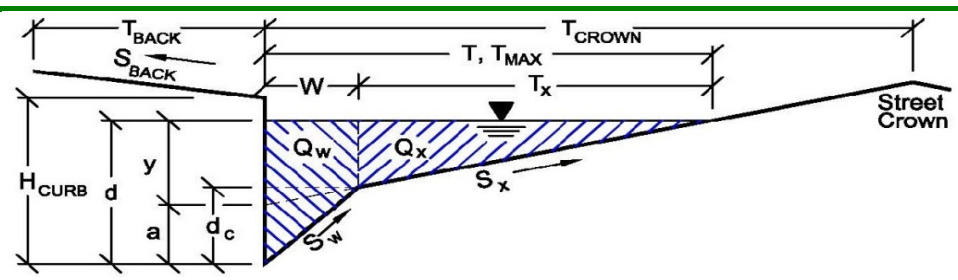
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.1**	**12.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5F**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**3.4**	**132.7**	**cfs**

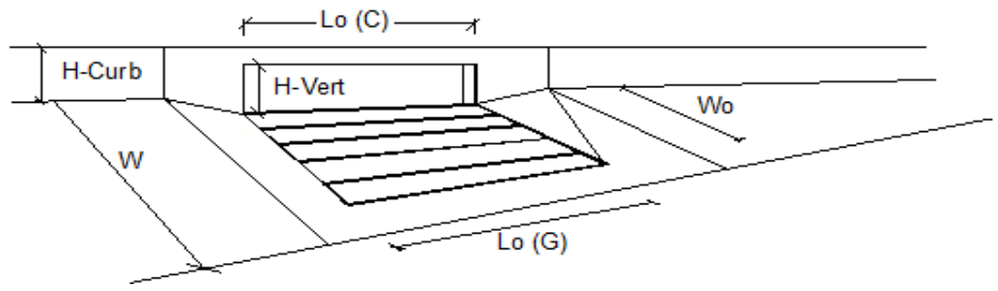
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5F



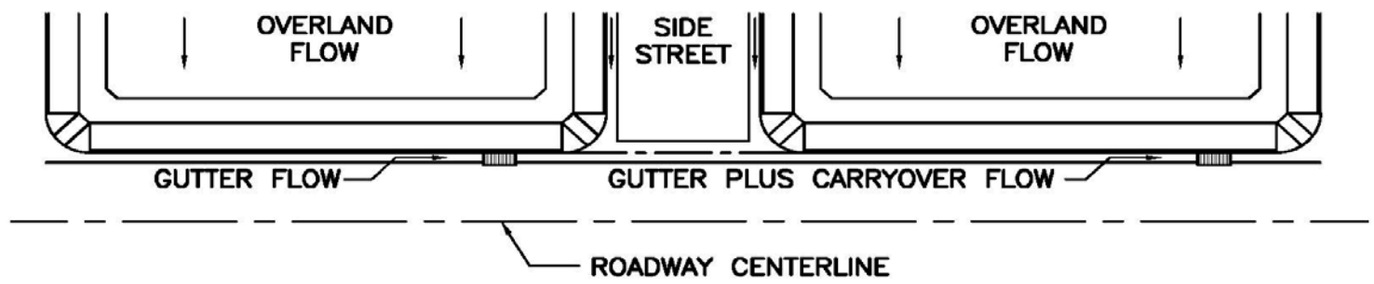
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.10**	**8.39**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**4.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**68**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5G



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	6.2	107.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

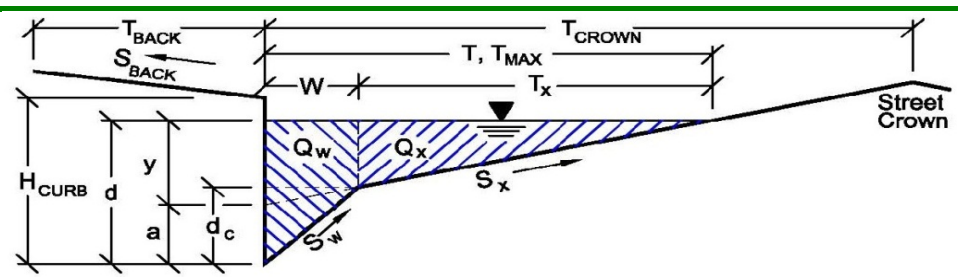
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**6.2**	**107.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **5G**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

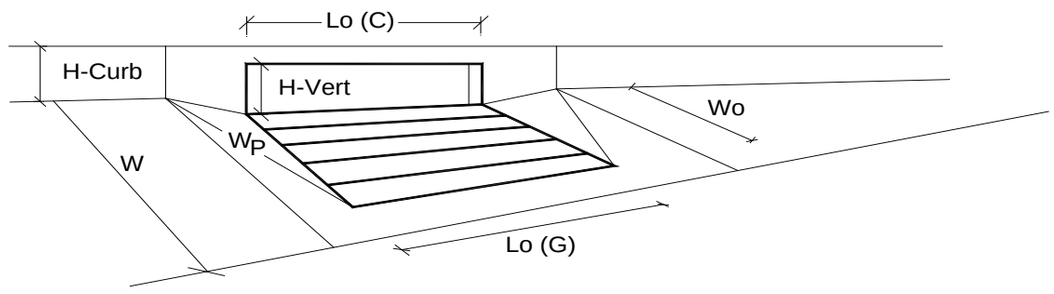
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **5G**

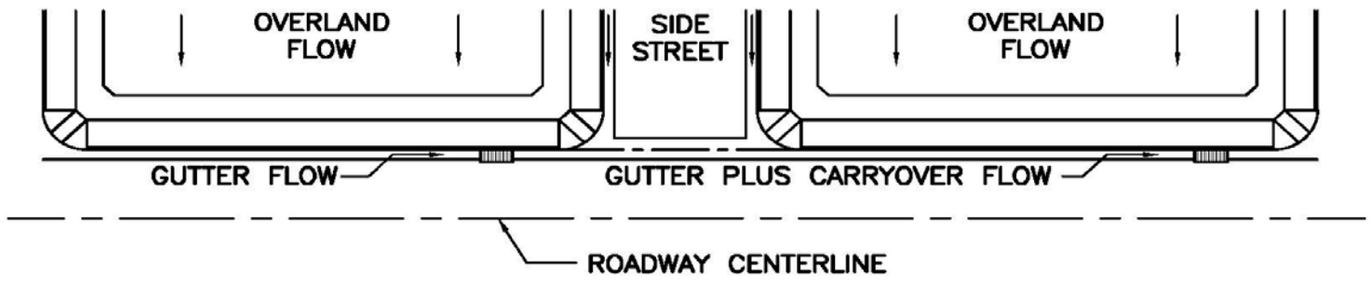


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**19.9**	**86.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	6.2	107.5	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5H



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.1	81.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

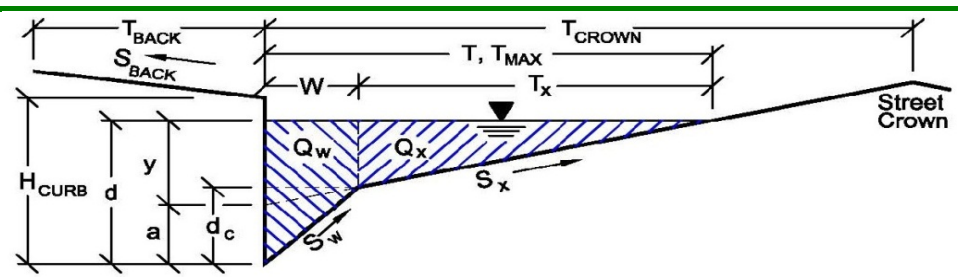
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.1**	**81.3**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5H**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

		Minor Storm	Major Storm	
	Q_{allow} =	**4.8**	**156.5**	**cfs**

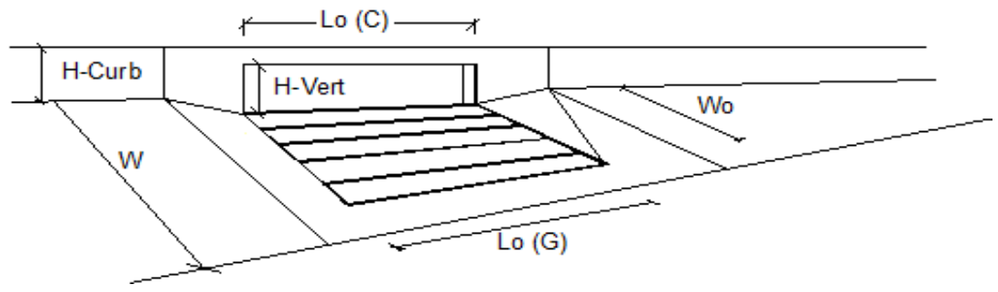
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5H



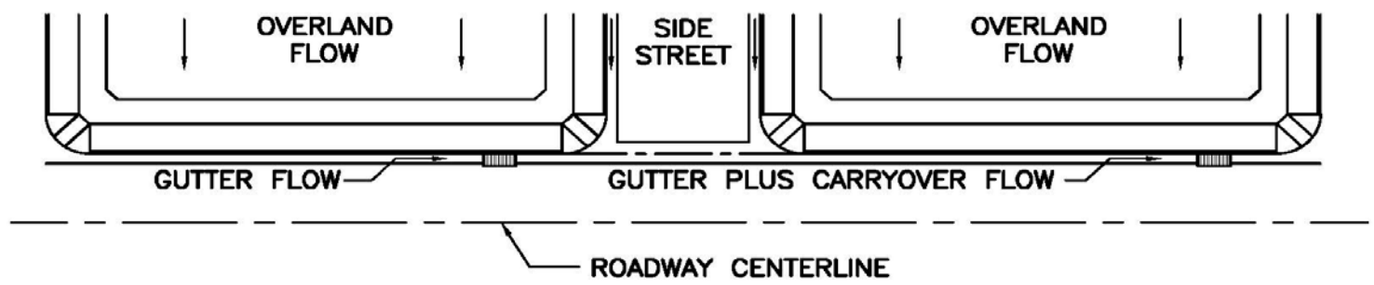
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.10**	**26.87**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**54.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**33**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5I



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.9	19.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

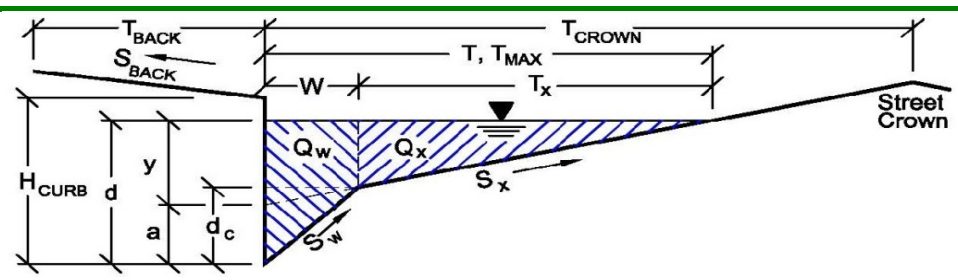
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.9**	**19.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5I**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

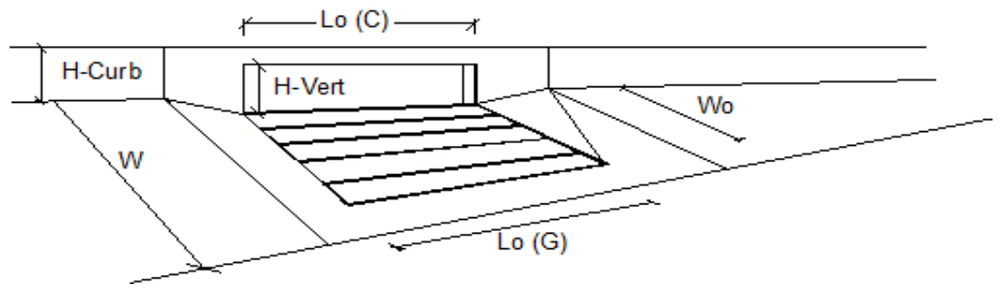
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5I



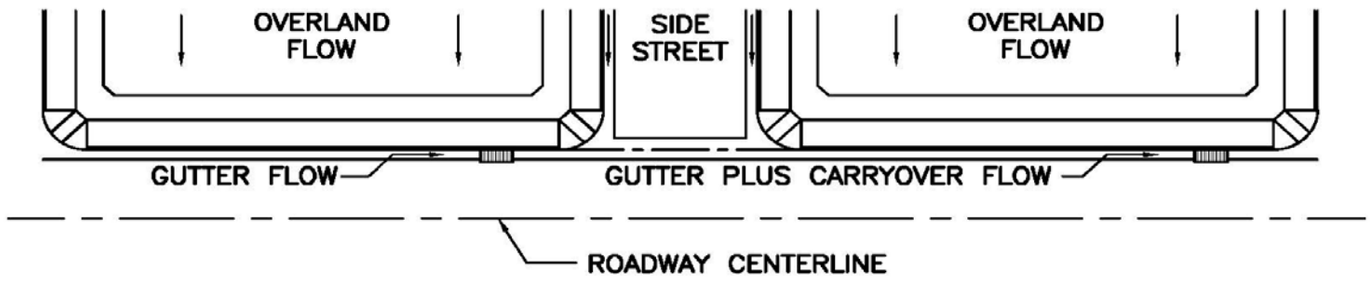
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.90**	**14.42**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**5.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**74**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5L



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.6	27.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

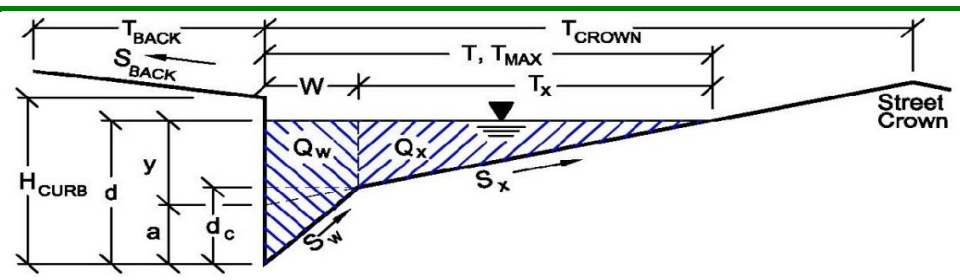
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.6**	**27.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5L**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.3**	**112.6**	**cfs**

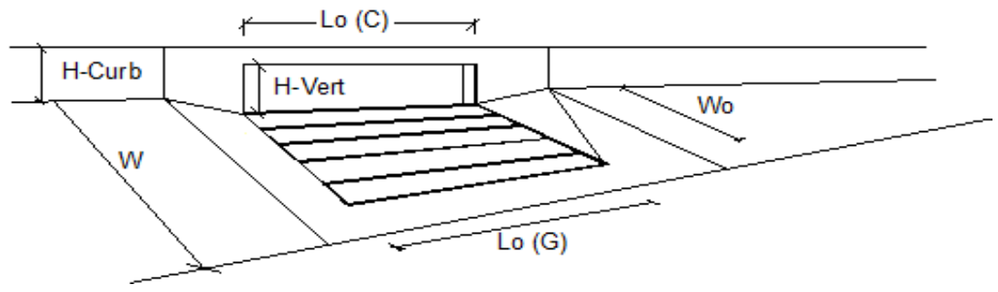
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5L



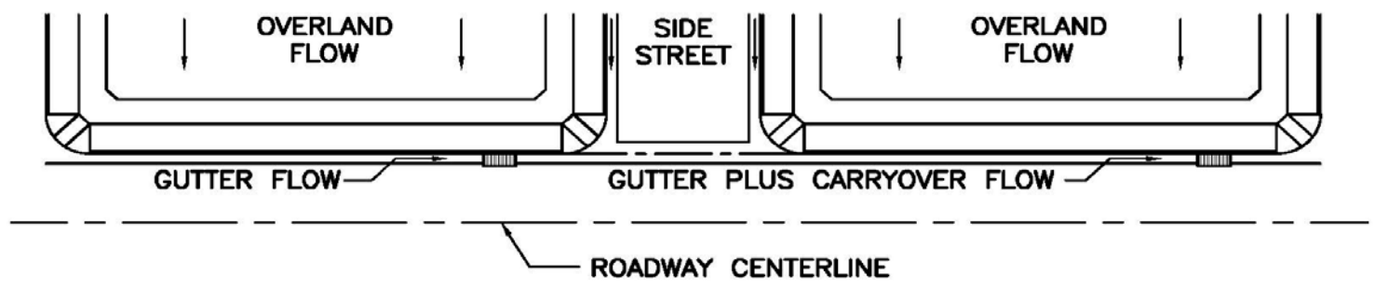
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.60**	**26.12**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**94**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5N



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	7.0	59.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

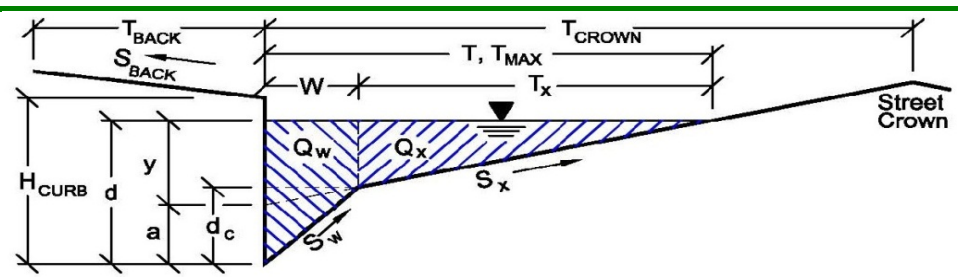
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**7.0**	**59.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **5N**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

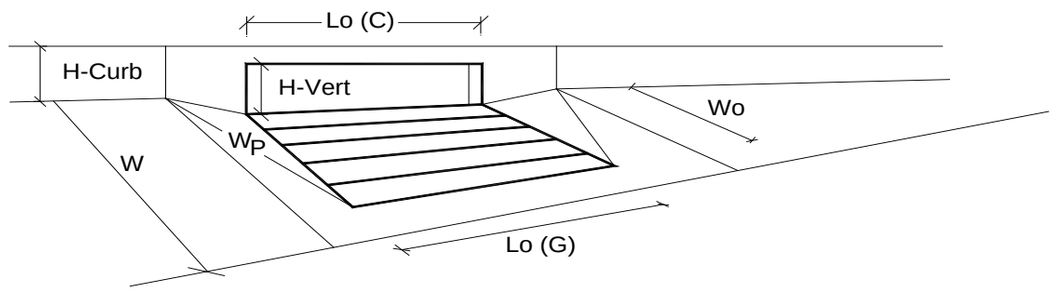
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **5N**

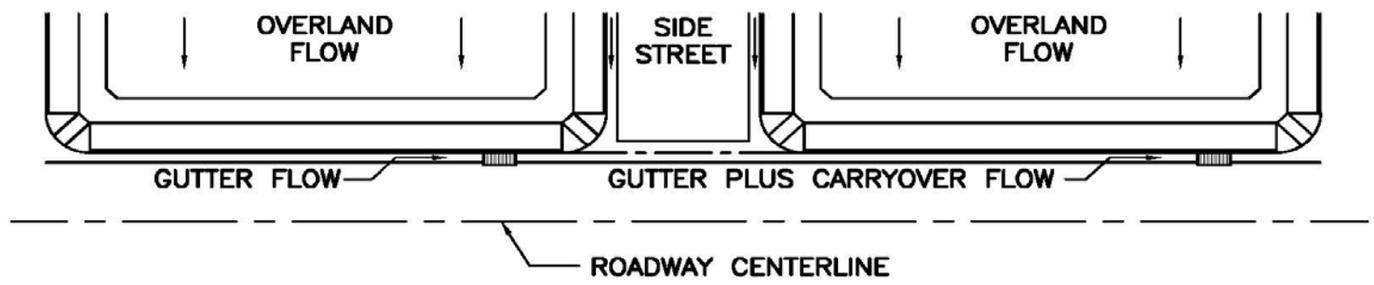


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**19.9**	**86.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.0	59.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5O



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.1	8.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

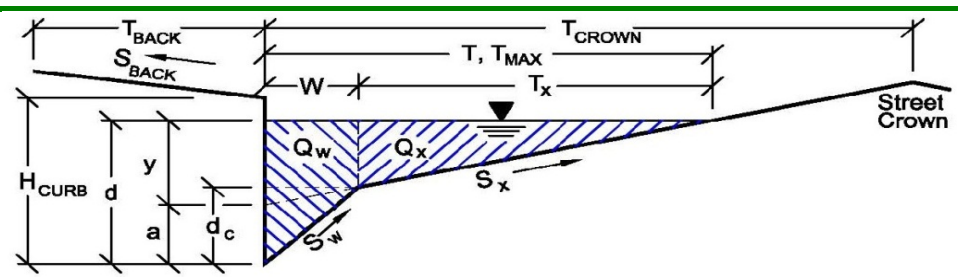
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.1**	**8.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5O**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

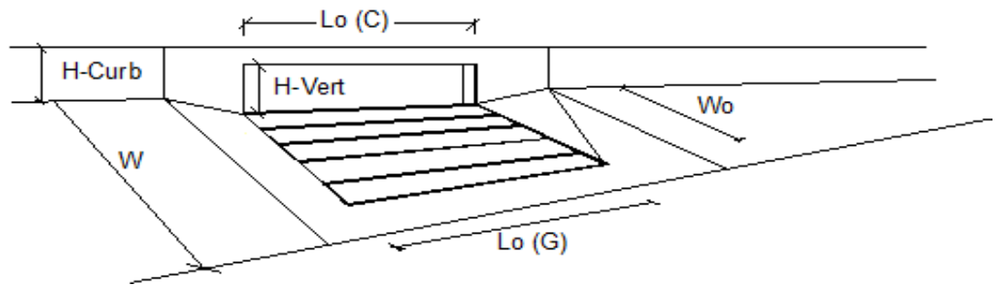
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5O



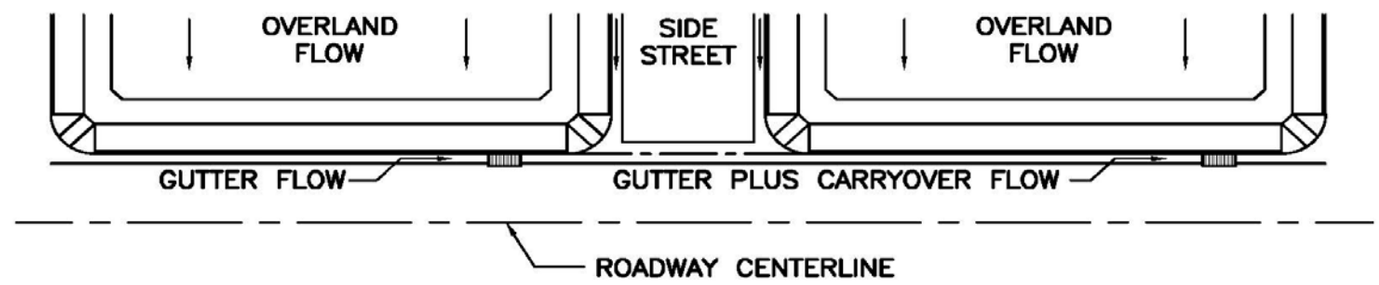
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.10**	**7.11**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**83**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5P



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.8	49.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

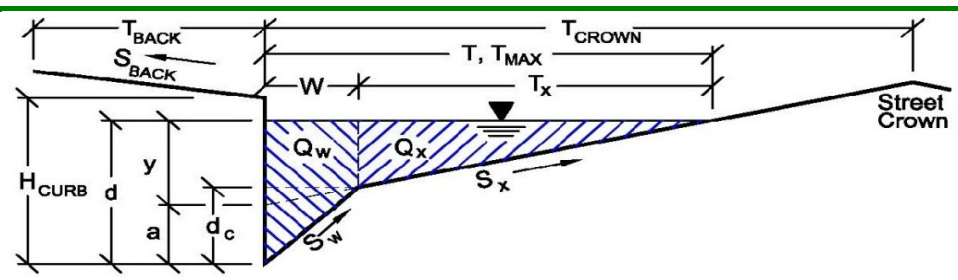
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.8**	**49.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5P**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.060	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.3**	**112.6**	**cfs**

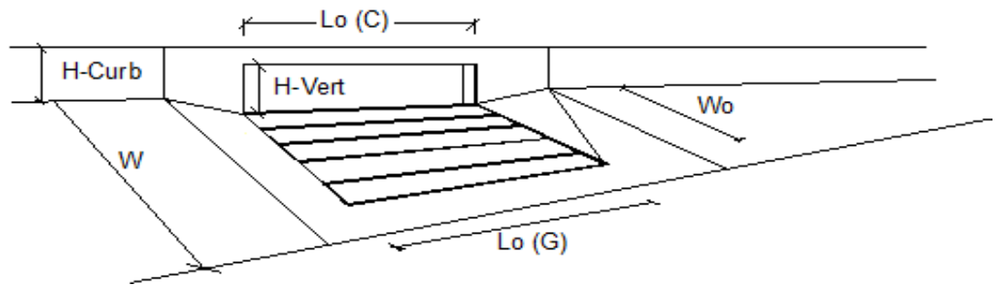
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5P



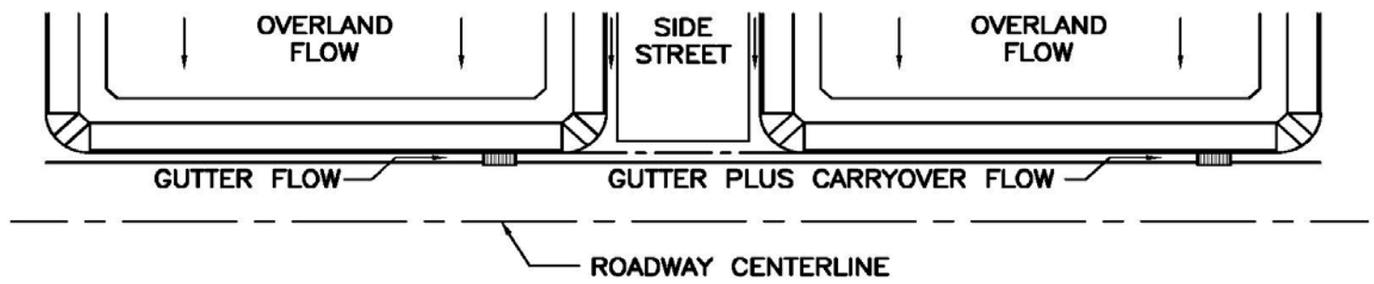
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.80**	**38.71**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**11.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**78**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5R



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.4	14.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

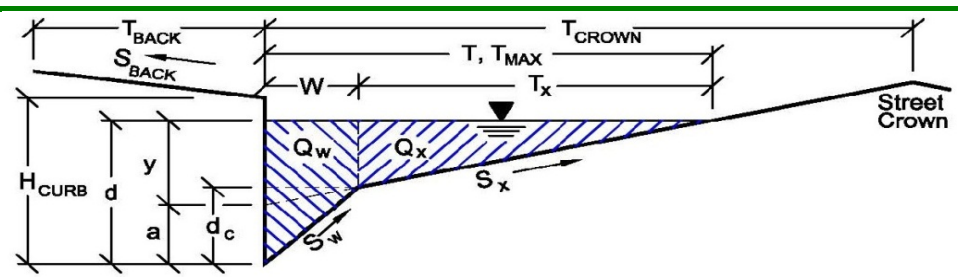
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.4**	**14.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **5R**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**4.1**	**162.5**	**cfs**

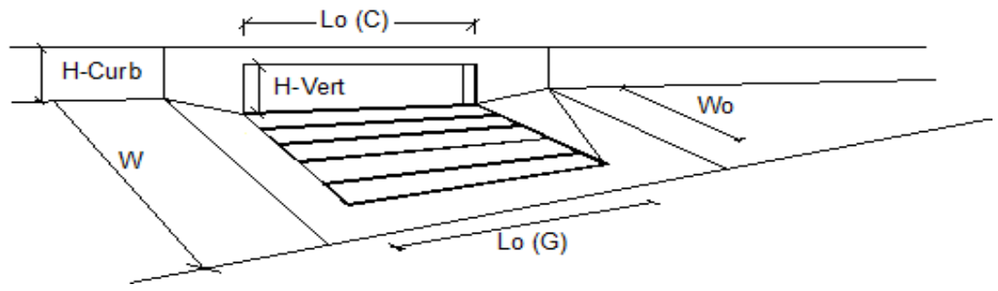
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 5R



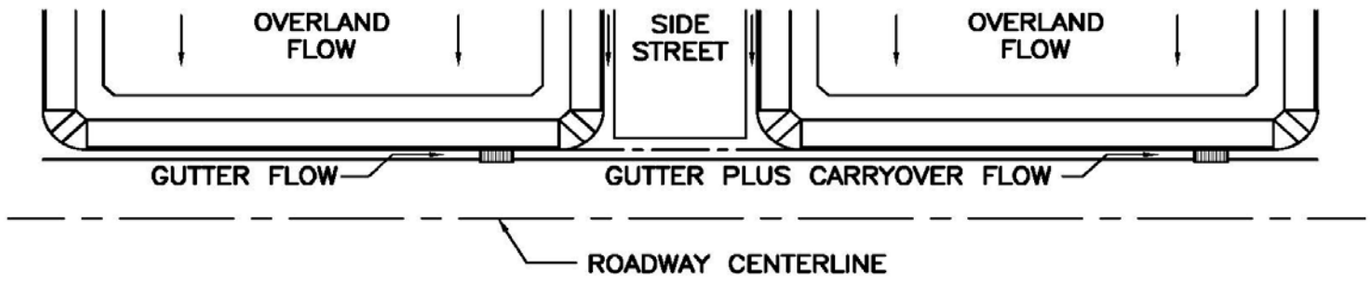
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.40**	**9.04**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**5.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**65**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5S



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.6	67.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

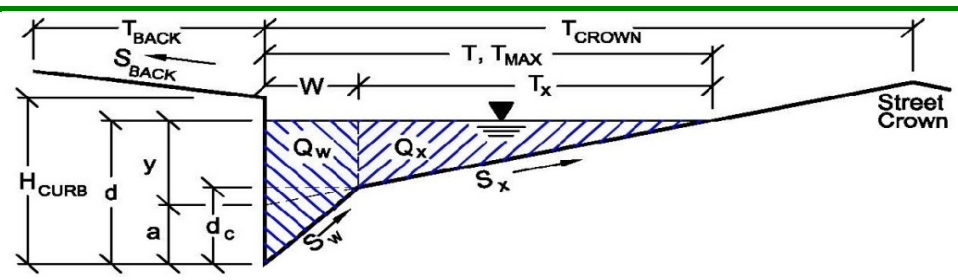
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.6**	**67.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5S**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**3.7**	**145.3**	**cfs**

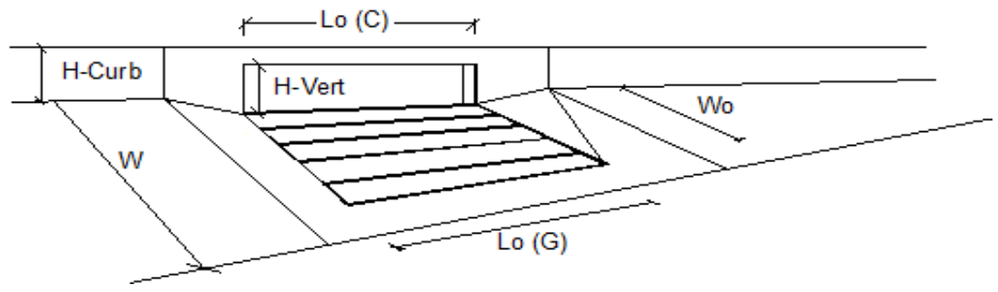
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5S



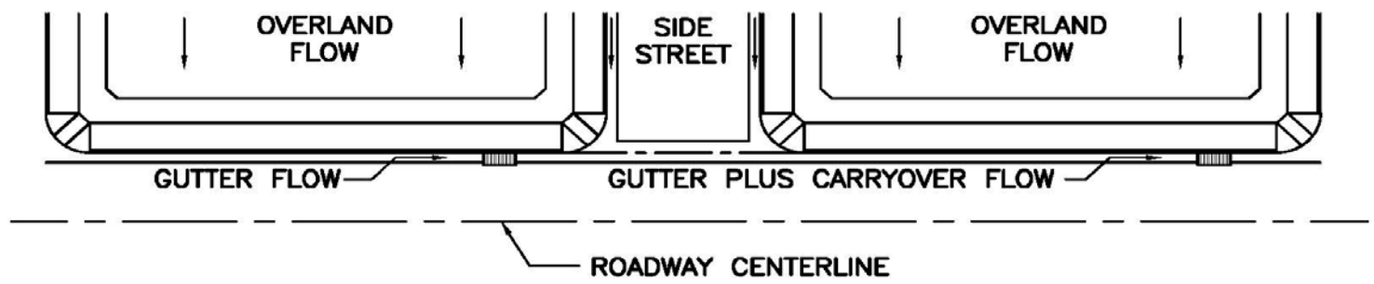
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.60**	**16.94**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**51.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**25**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5U



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.6	10.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

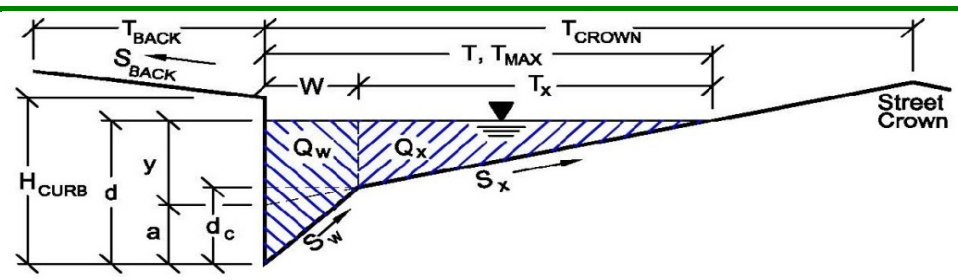
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.6**	**10.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5U**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

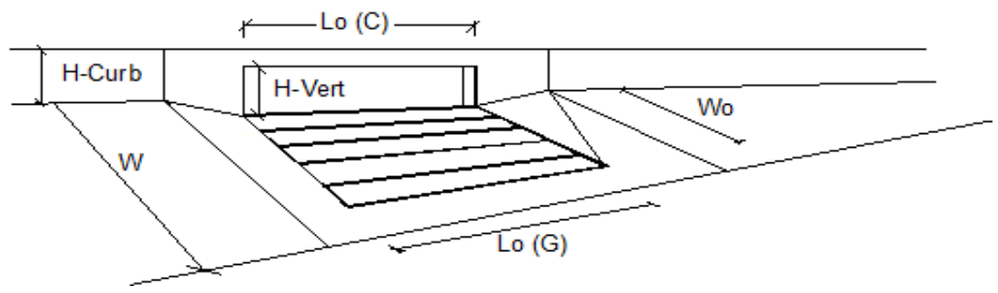
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5U



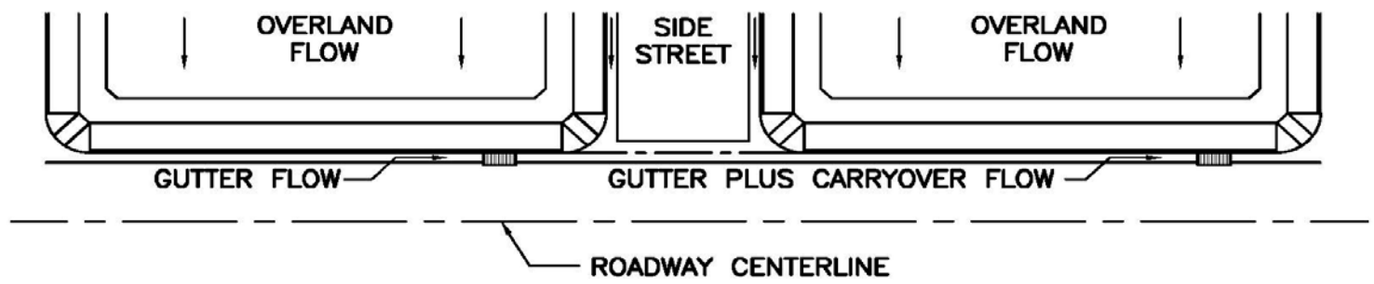
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.60**	**7.82**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**77**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5V



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.4	39.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

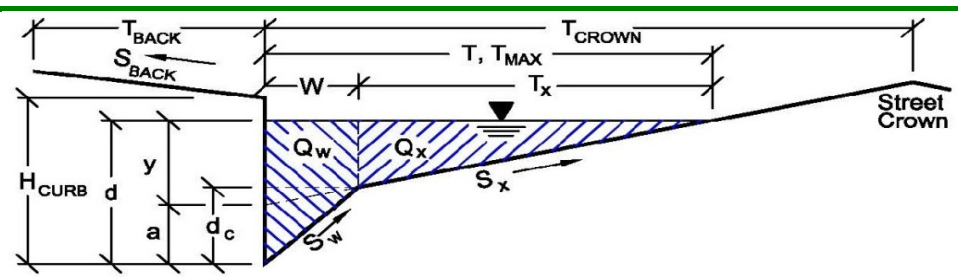
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.4**	**39.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5V**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.027	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**5.6**	**142.4**	**cfs**

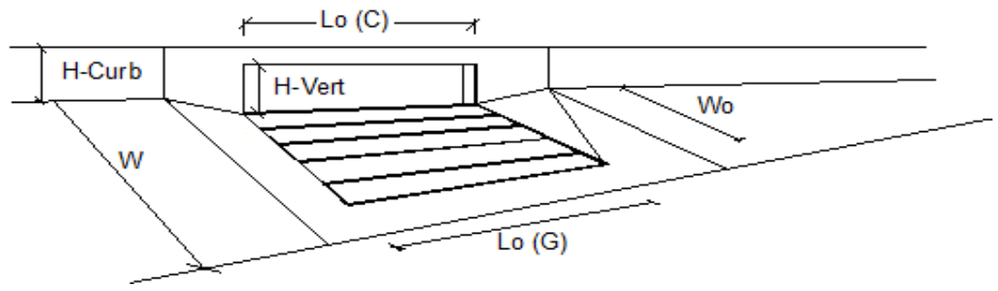
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5V



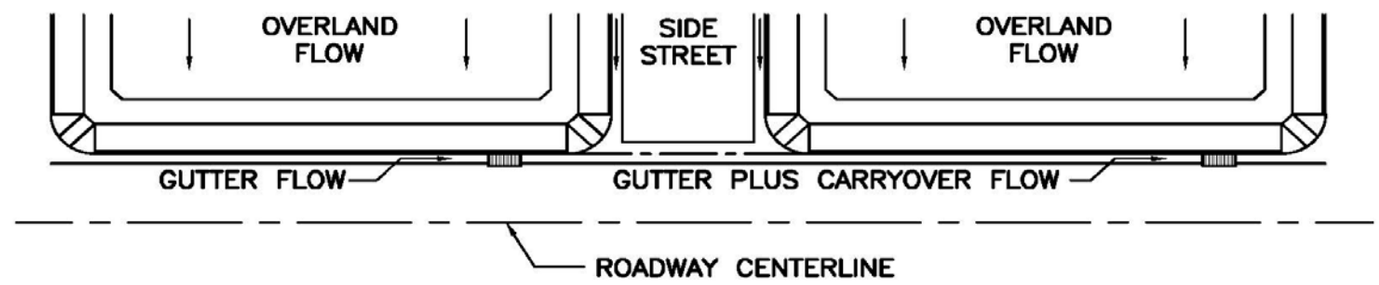
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.40**	**20.25**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**19.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**51**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5W



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.8	19.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

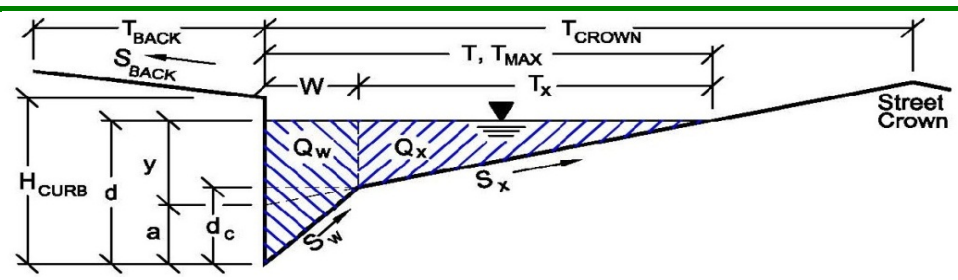
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.8**	**19.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5W**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.027	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.6**	**142.4**	**cfs**

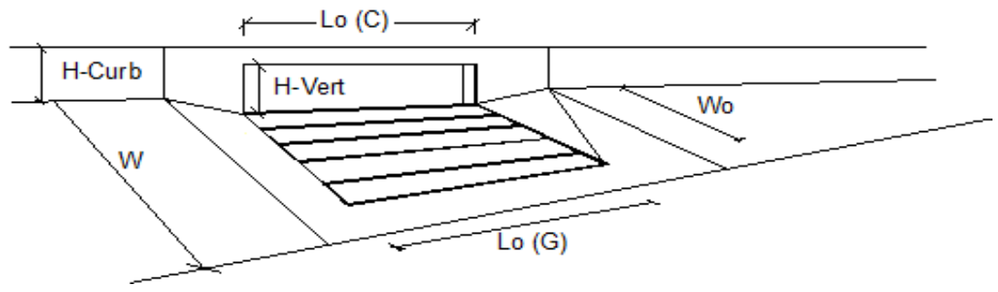
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5W



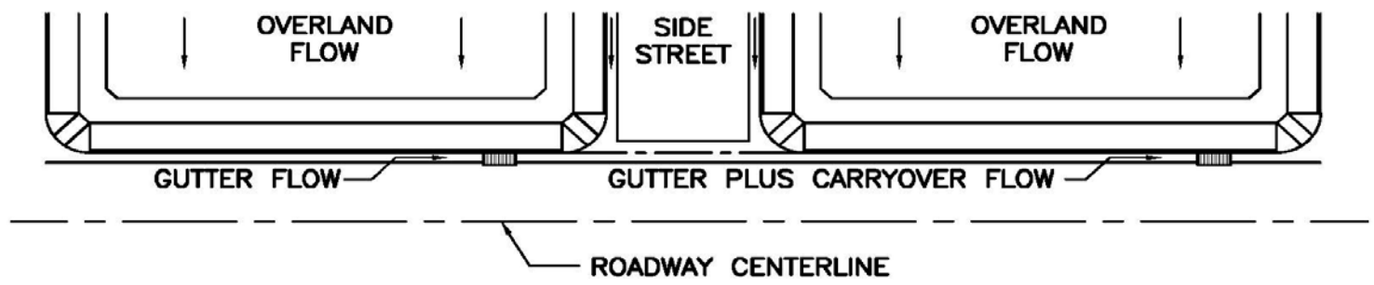
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.77**	**10.77**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**9.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**54**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5Y



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.6	33.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

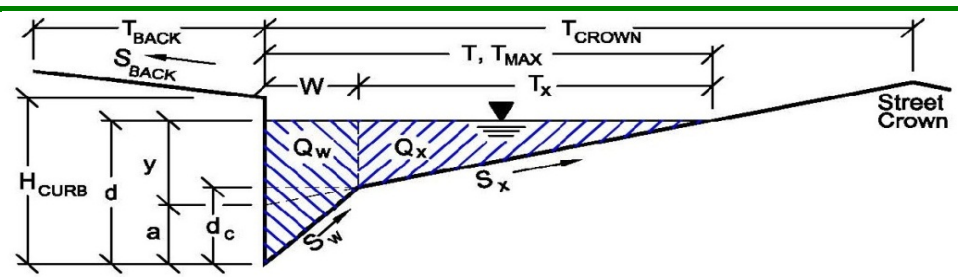
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.6**	**33.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5Y**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

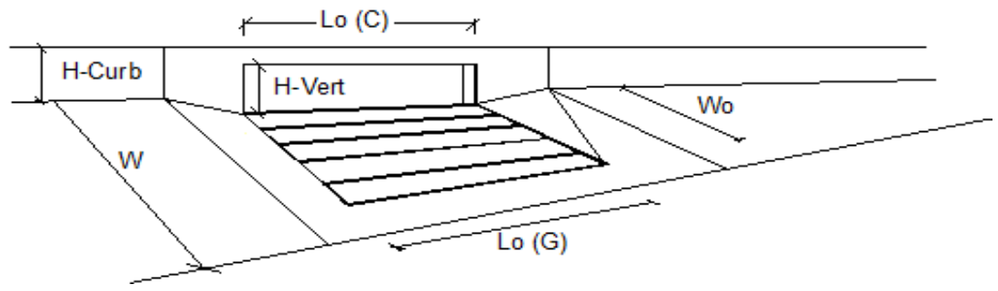
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5Y



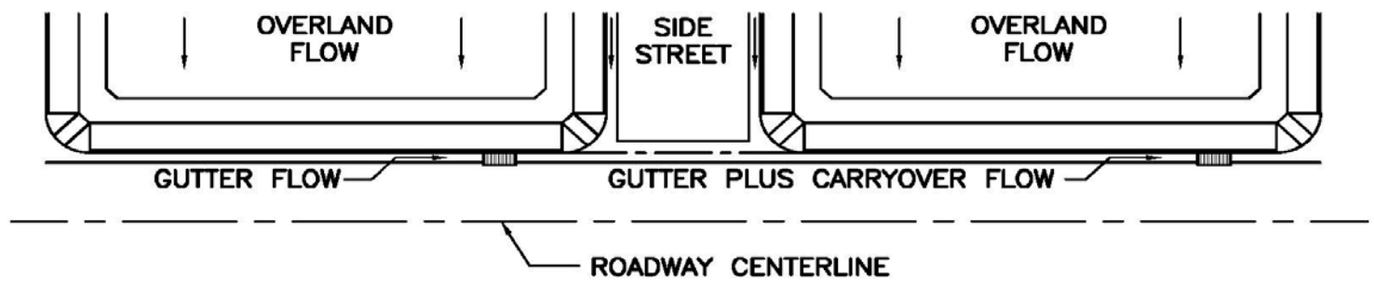
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.59**	**13.16**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**20.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**39**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5Z



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.2	15.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

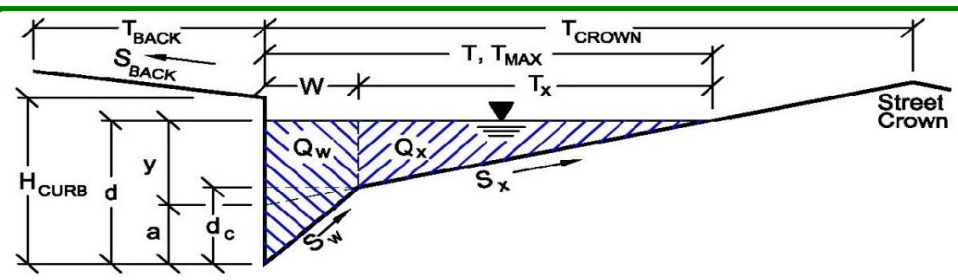
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.2**	**15.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5Z**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

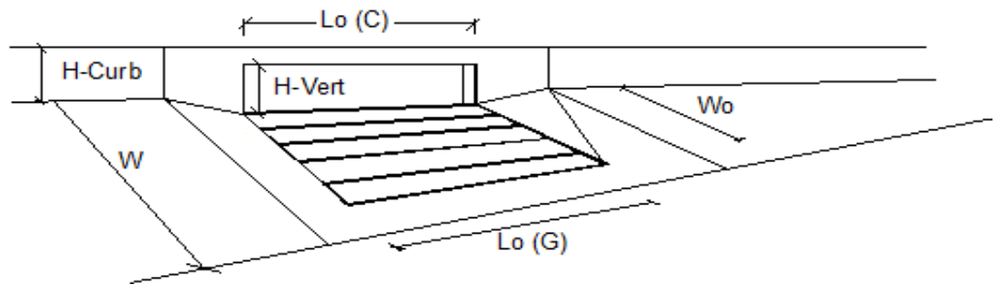
	Minor Storm	Major Storm	
Q_{allow} =	**4.8**	**156.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 5Z



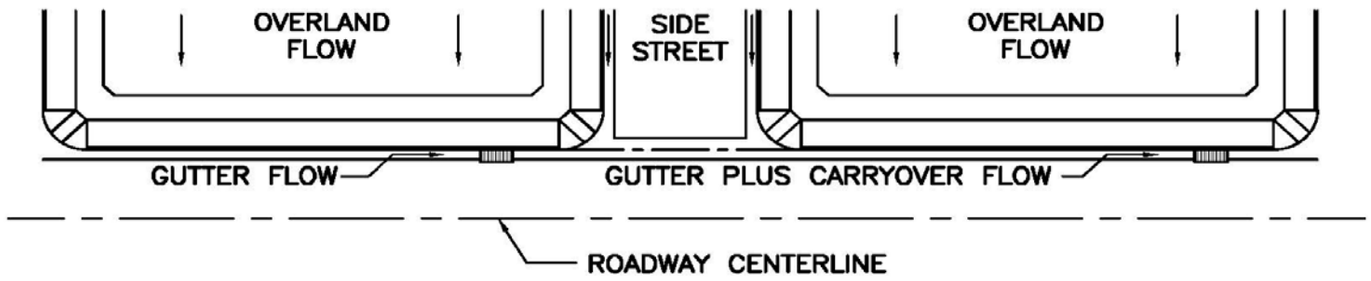
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.24**	**9.67**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**6.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**61**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6M



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.8	16.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

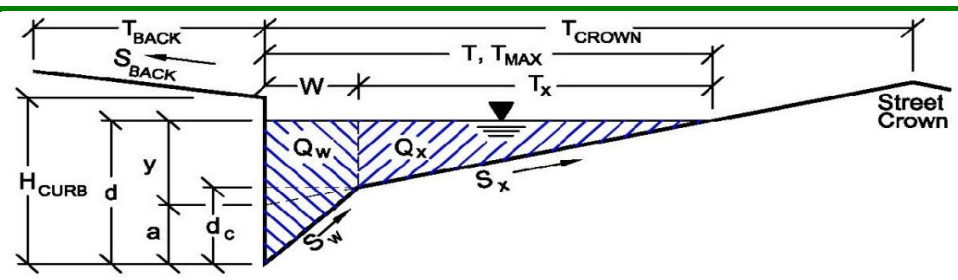
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.8**	**16.7**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6M**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**3.4**	**132.7**	**cfs**

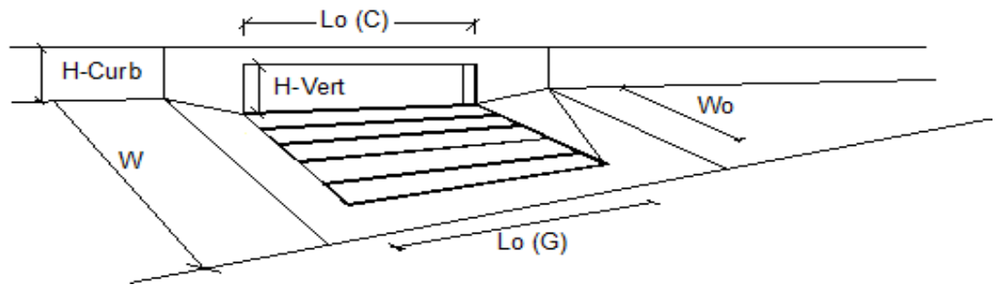
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6M



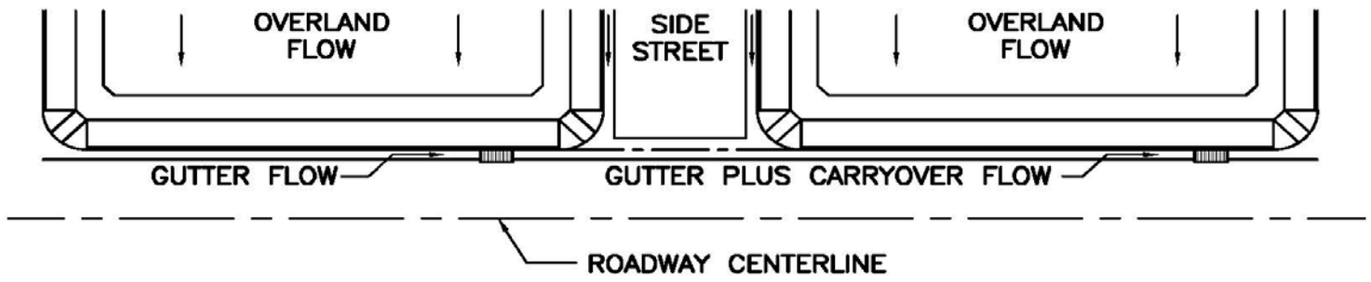
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.80**	**9.62**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**7.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**58**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5Q



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.6	24.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

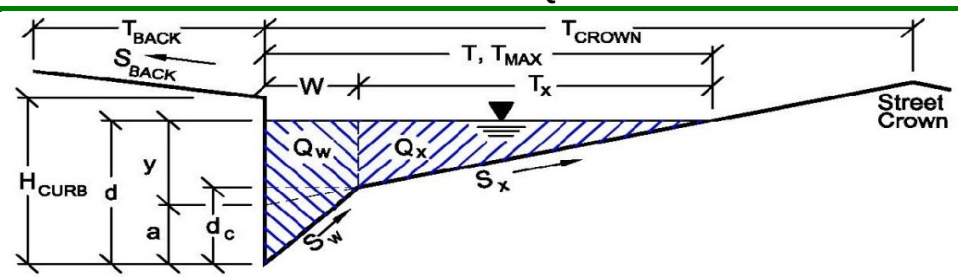
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**2.6**	**24.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 5Q**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**3.4**	**132.7**	**cfs**

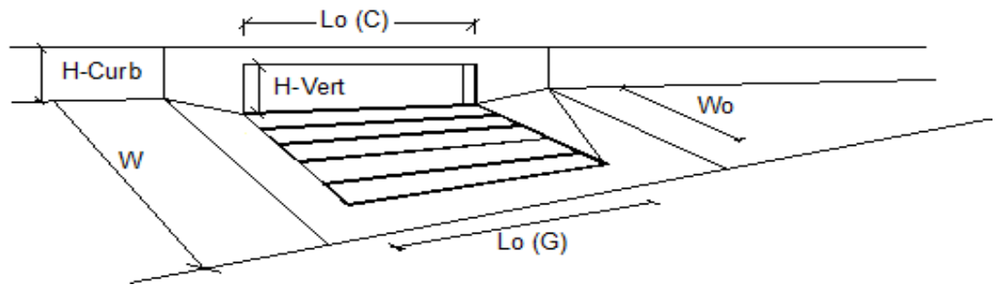
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5Q



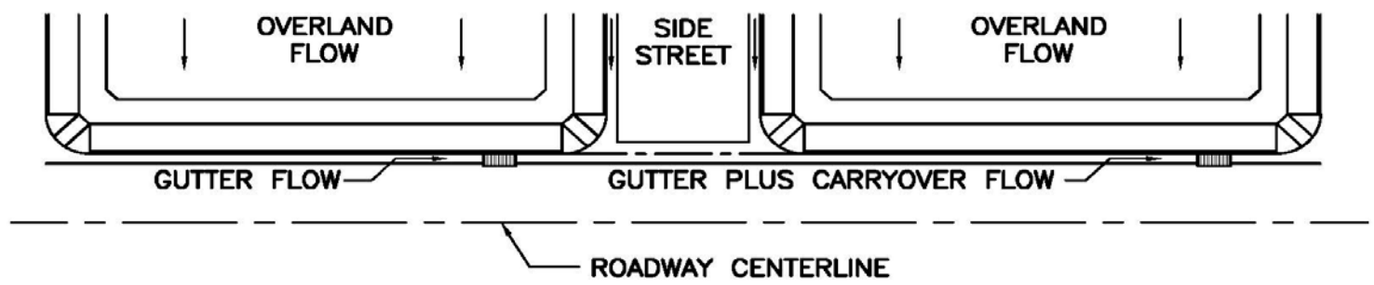
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.60**	**11.22**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**12.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**47**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.6	58.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

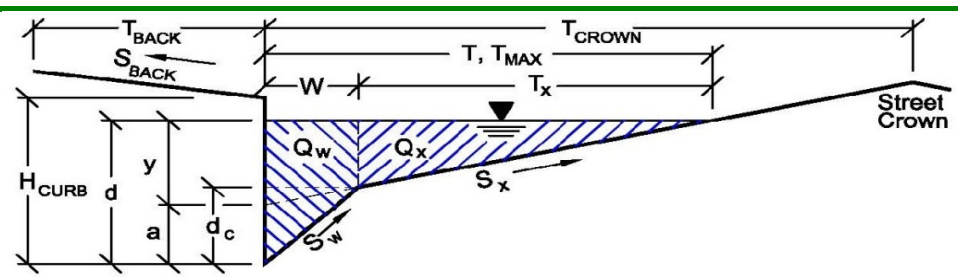
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.6**	**58.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**5.4**	**146.4**	**cfs**

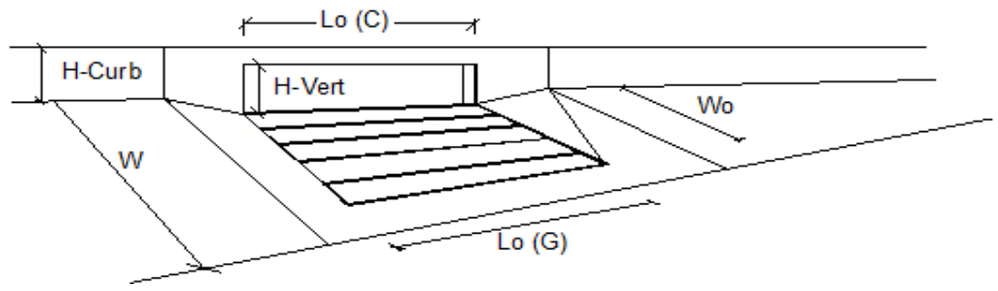
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6A



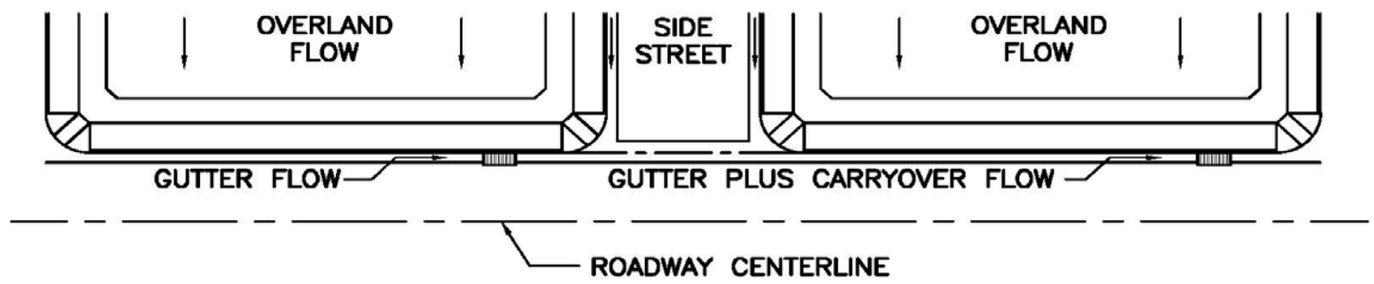
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.60**	**40.78**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**18.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**69**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.0	23.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

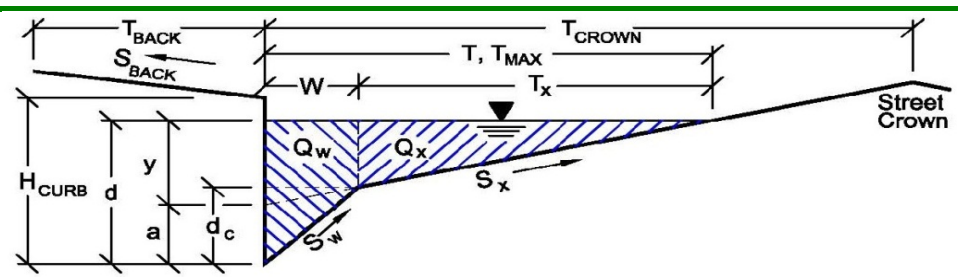
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.0**	**23.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**5.4**	**146.4**	**cfs**

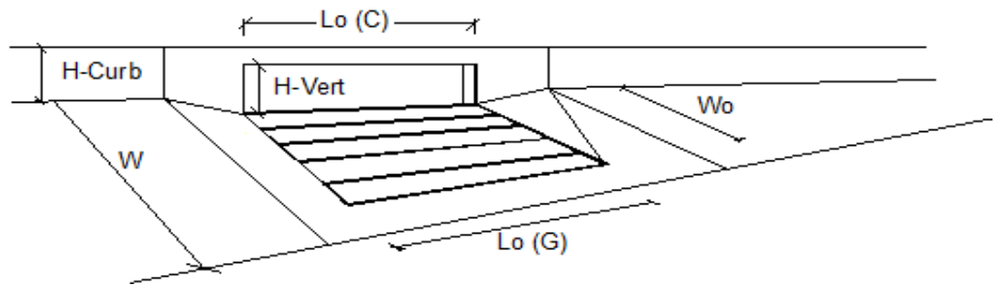
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6B



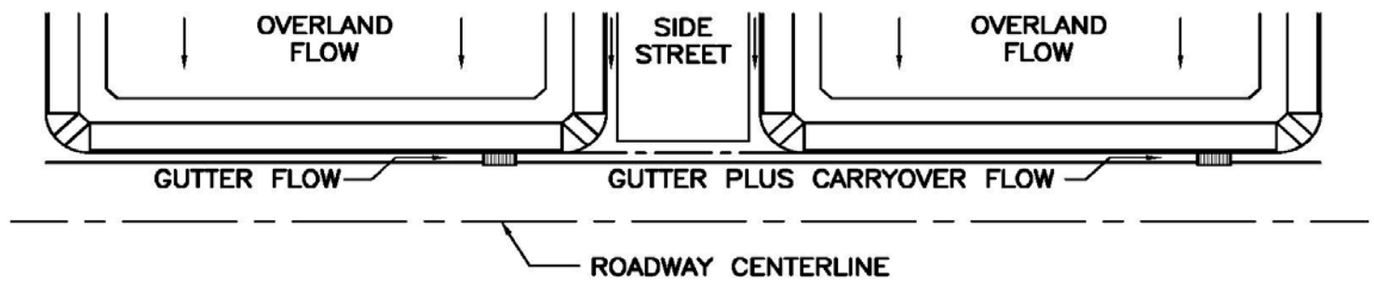
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.94**	**11.59**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**12.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**48**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6C



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.5	44.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

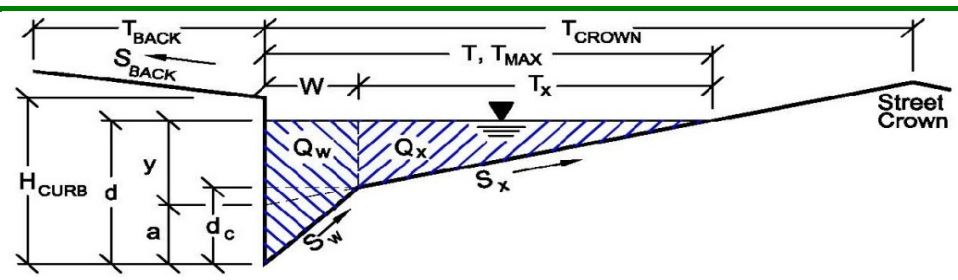
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**1.5**	**44.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**3.4**	**132.7**	**cfs**

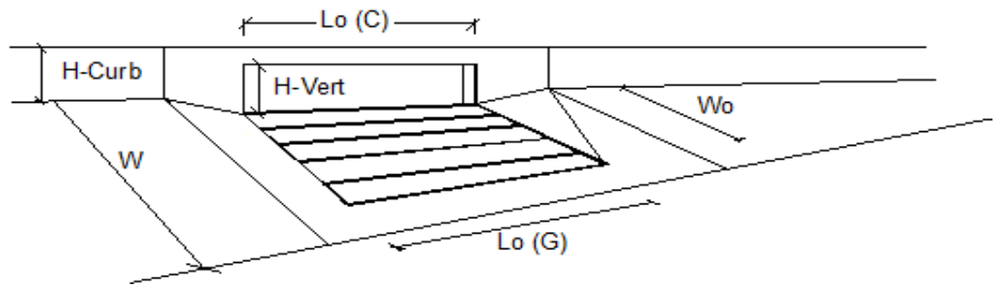
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6C



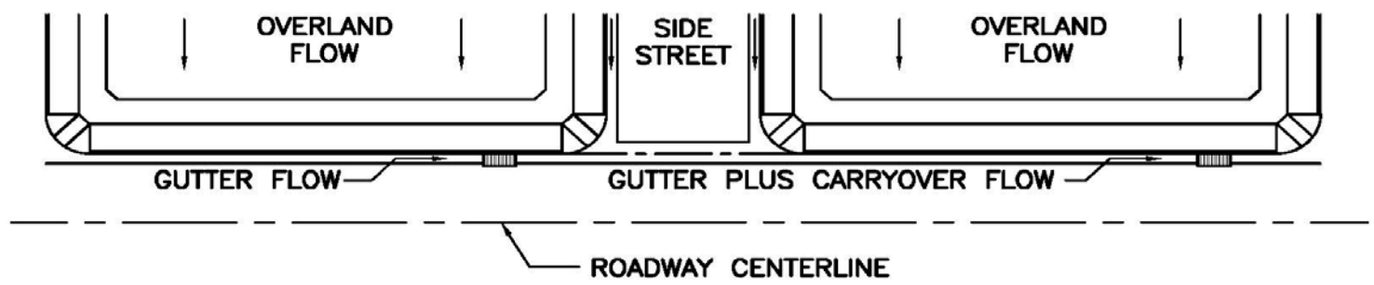
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.50**	**14.39**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**30.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**32**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6D



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.6	18.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…

FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

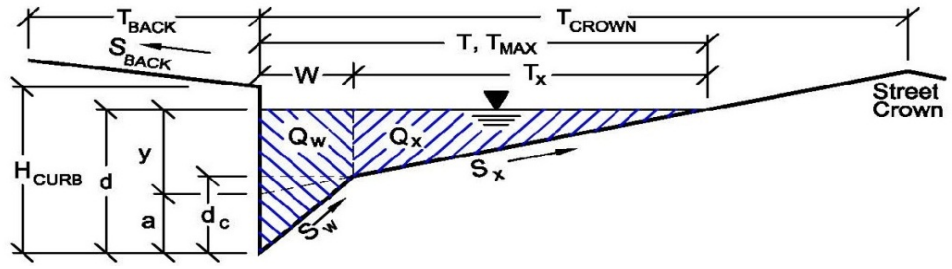
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.6**	**18.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6D**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

		Minor Storm	Major Storm	
	Q_{allow} =	**6.8**	**127.1**	**cfs**

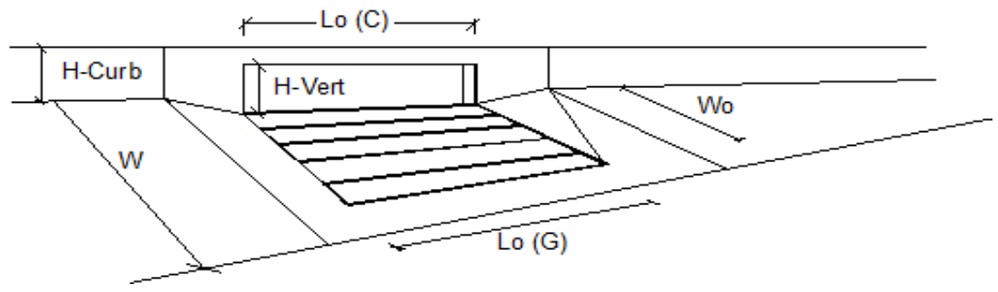
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6D



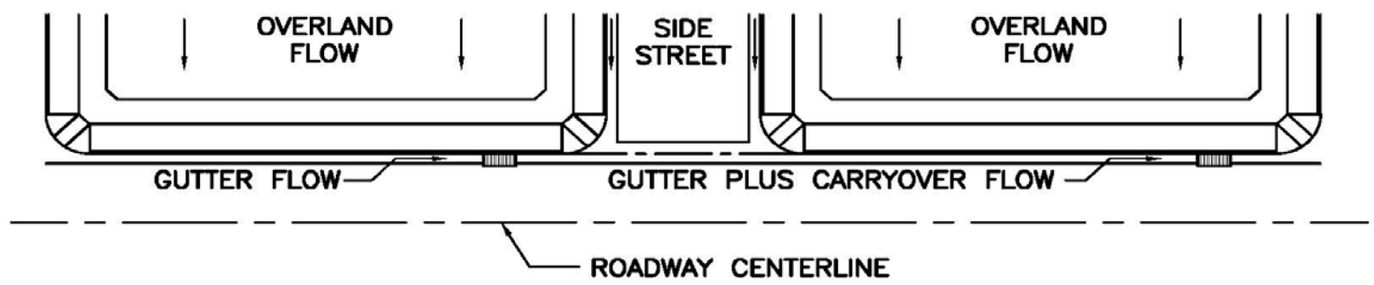
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.59**	**10.59**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**7.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**57**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.5	58.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

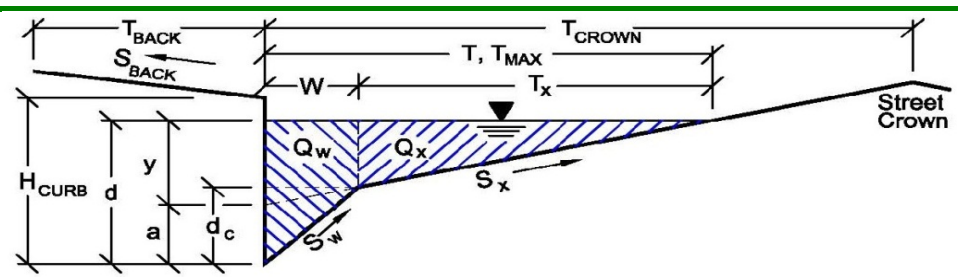
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.5**	**58.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6E**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

		Minor Storm	Major Storm	
	Q_{allow} =	**6.8**	**127.1**	**cfs**

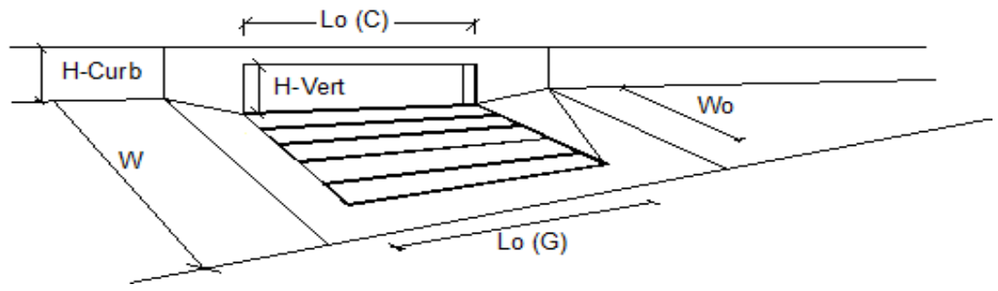
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6E



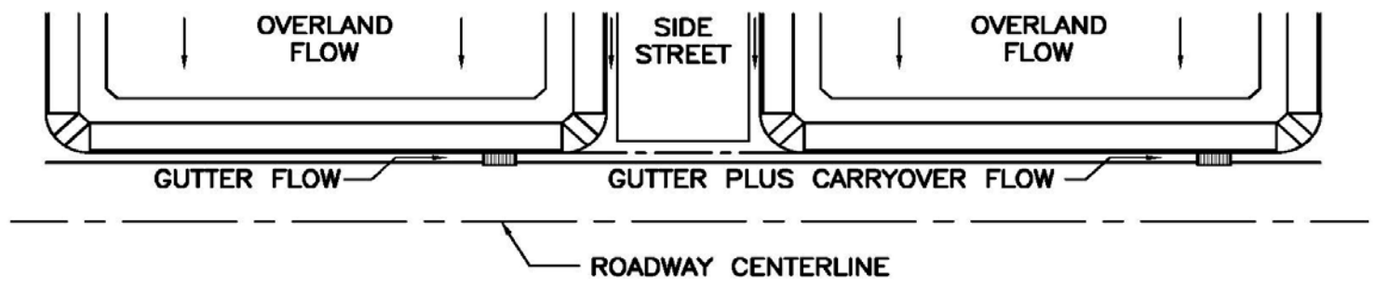
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.50**	**16.62**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**42.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**28**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6F



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.7	18.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

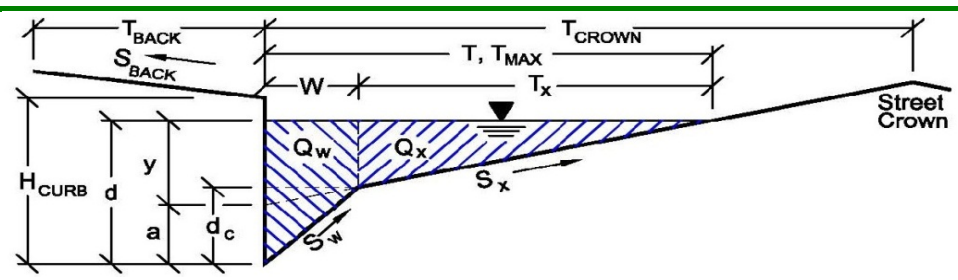
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**6.3**	**cfs**
Total Design Peak Flow, Q =	**3.7**	**25.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **6F**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

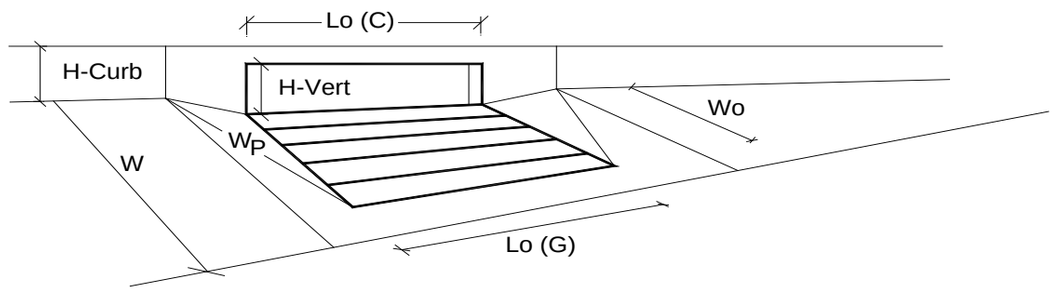
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **6F**

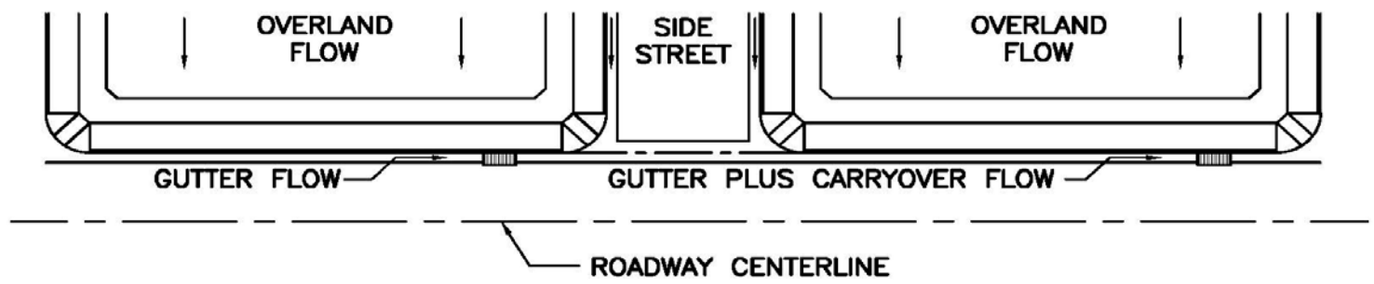


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.7	25.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6G



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.7	15.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

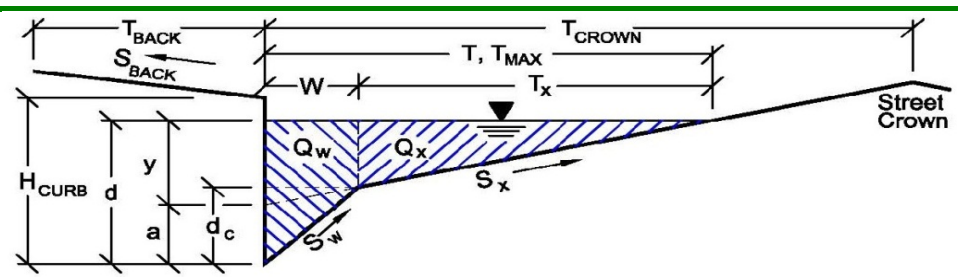
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**9.4**	**cfs**
Total Design Peak Flow, Q =	**1.7**	**24.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **6G**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

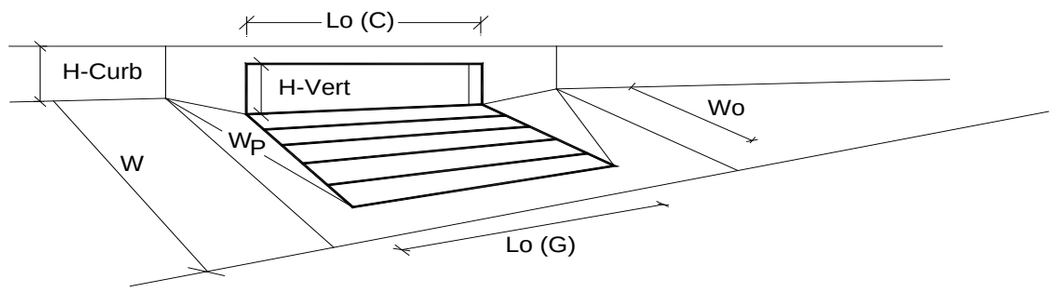
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **6G**

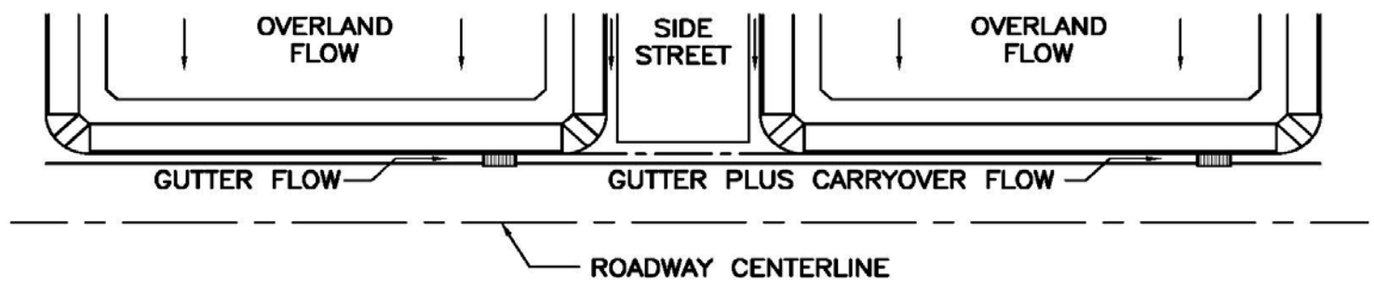


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.7	24.8	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6H



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.5	48.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<---
FILL IN THIS SECTION OR…
FILL IN THE SECTIONS BELOW.
<---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

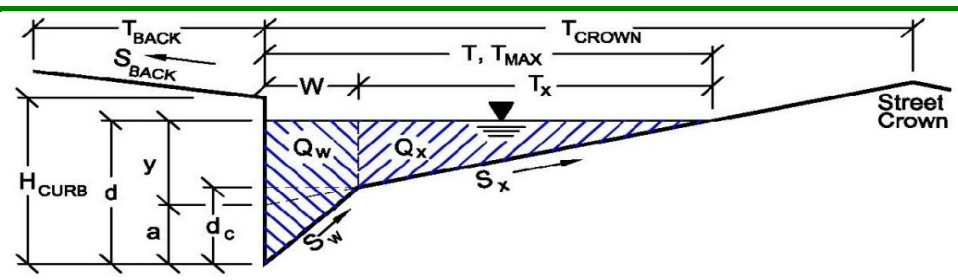
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.5**	**48.4**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **6H**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

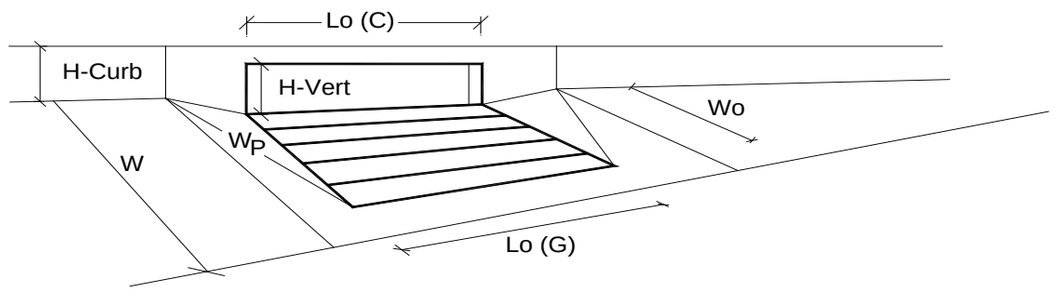
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **6H**

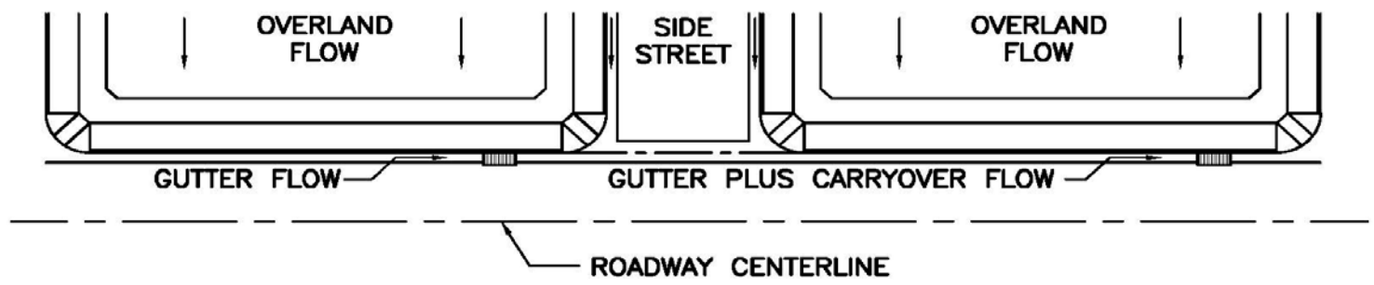


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**42.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	4.5	48.4	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6I



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.8	6.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

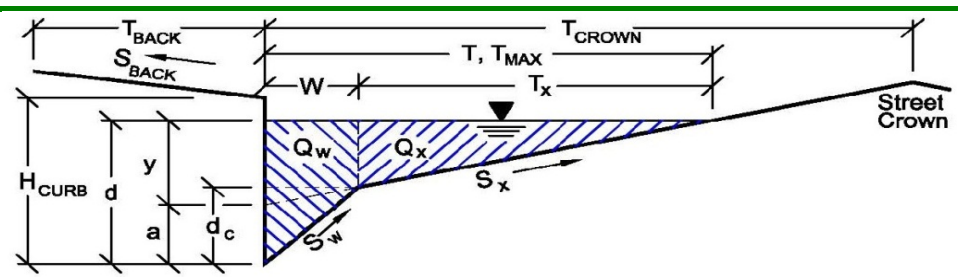
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**9.4**	**cfs**
Total Design Peak Flow, Q =	**1.8**	**15.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **6I**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

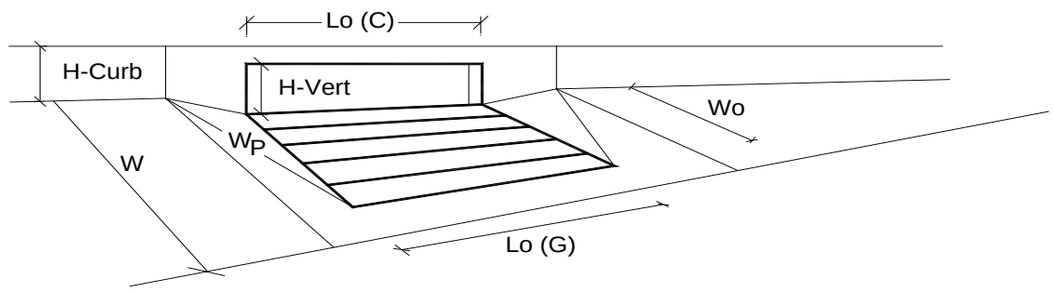
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = **Trails at Crowfoot**

Inlet ID = **6I**

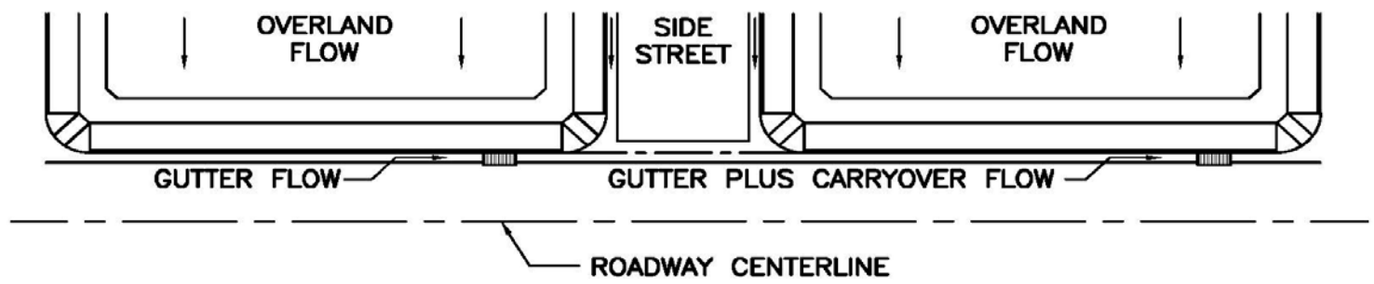


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**27.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.8	15.5	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6Ia



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.4	97.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

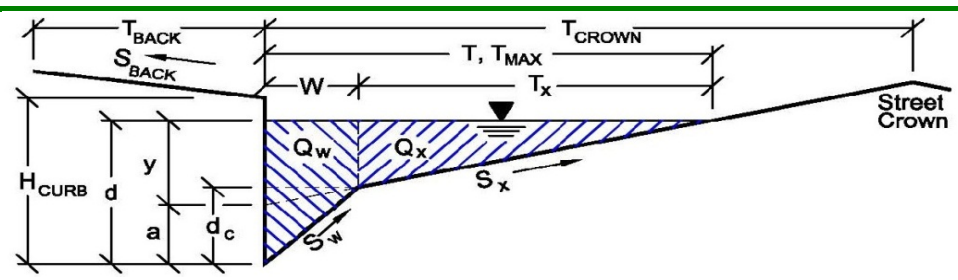
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.4**	**97.2**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **6Ia**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.055	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**7.9**	**115.5**	**cfs**

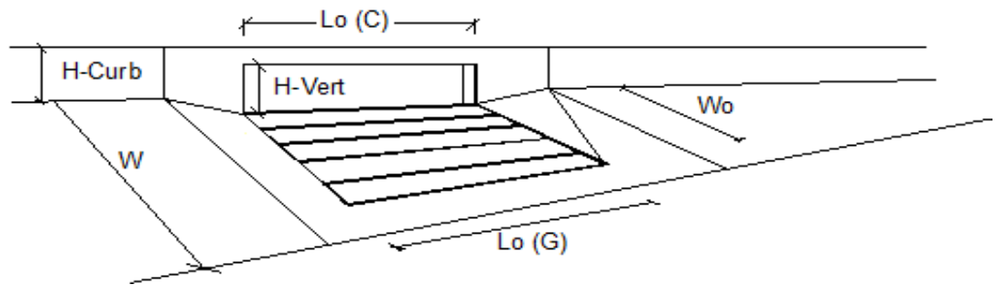
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 6Ia



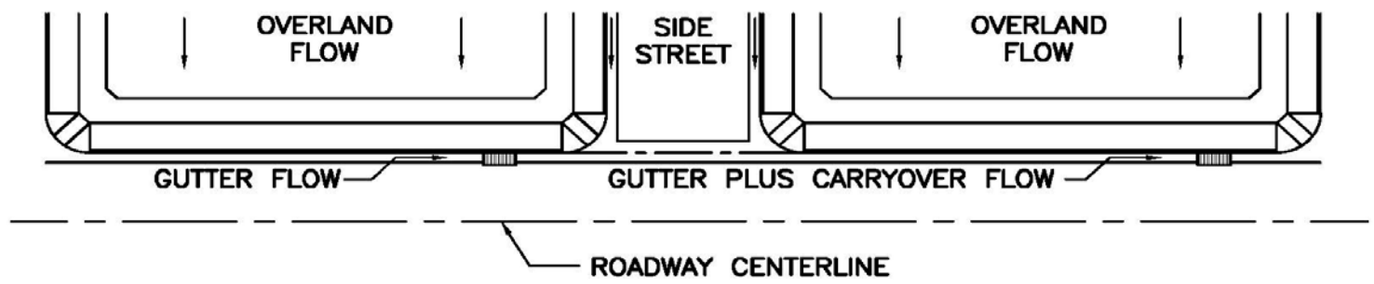
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	4	4	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.40**	**78.50**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**18.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6J



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.3	46.8	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

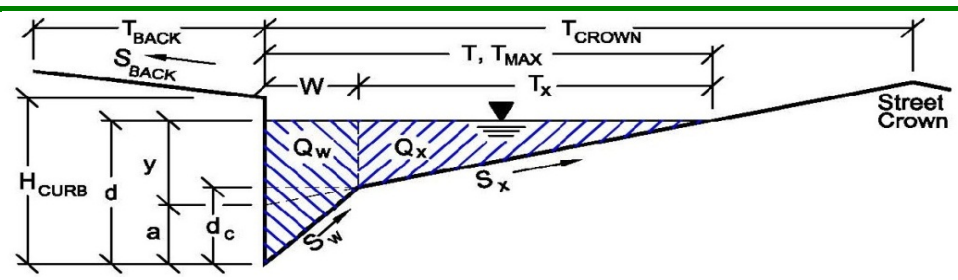
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**5.3**	**46.8**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6J**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.4**	**146.4**	**cfs**

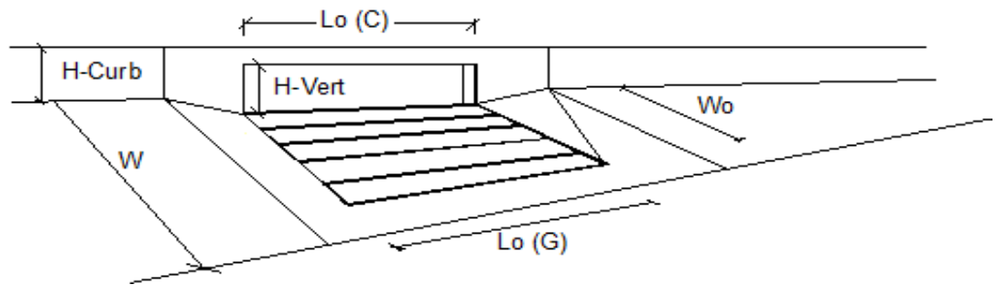
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6J



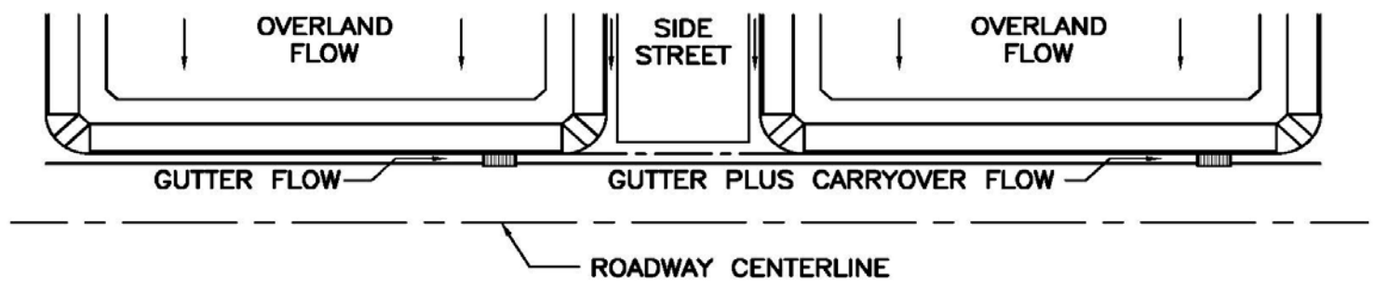
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.30**	**21.67**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**25.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**46**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6K



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.1	34.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

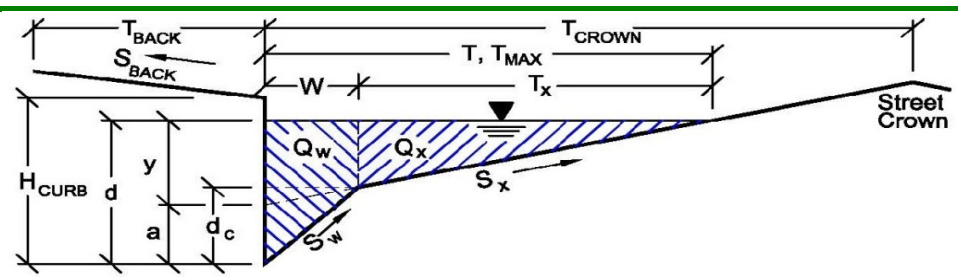
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.1**	**34.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6K**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**5.4**	**146.4**	**cfs**

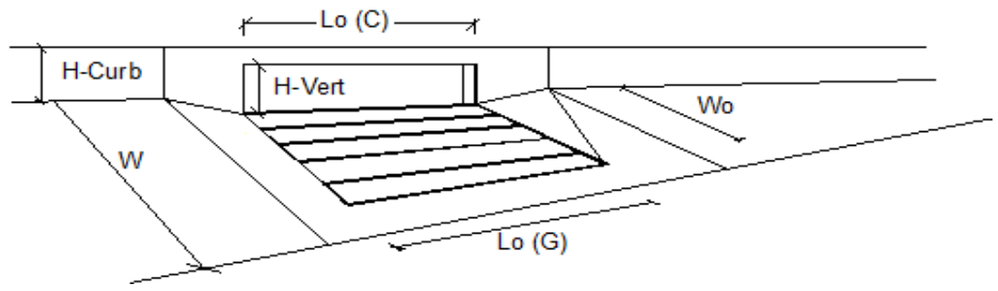
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6K



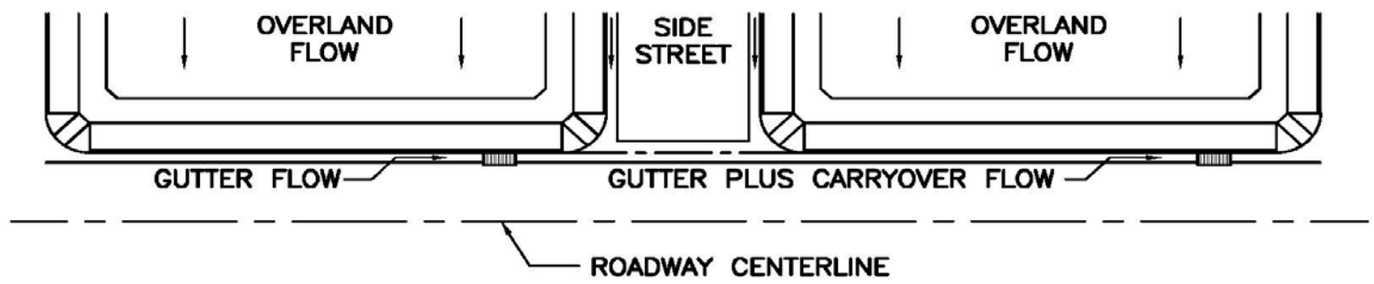
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.10**	**13.32**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**20.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**39**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6L



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.4	10.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

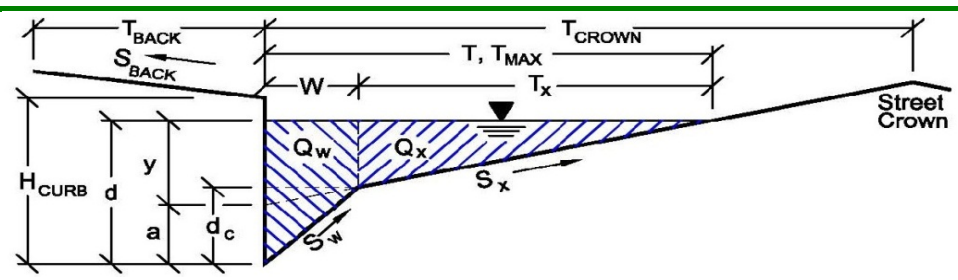
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**3.4**	**10.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6L**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**5.4**	**146.4**	**cfs**

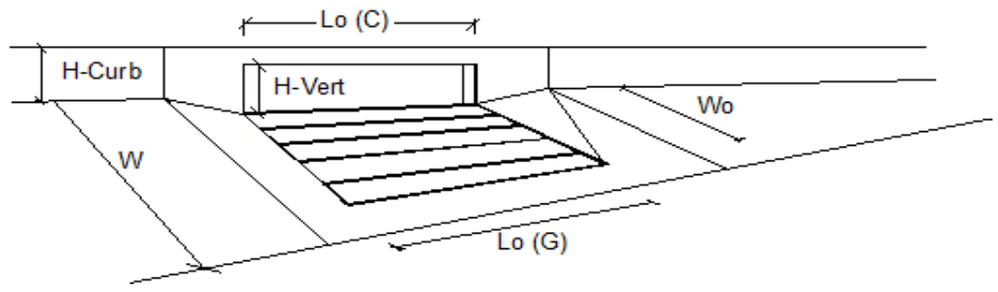
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6L



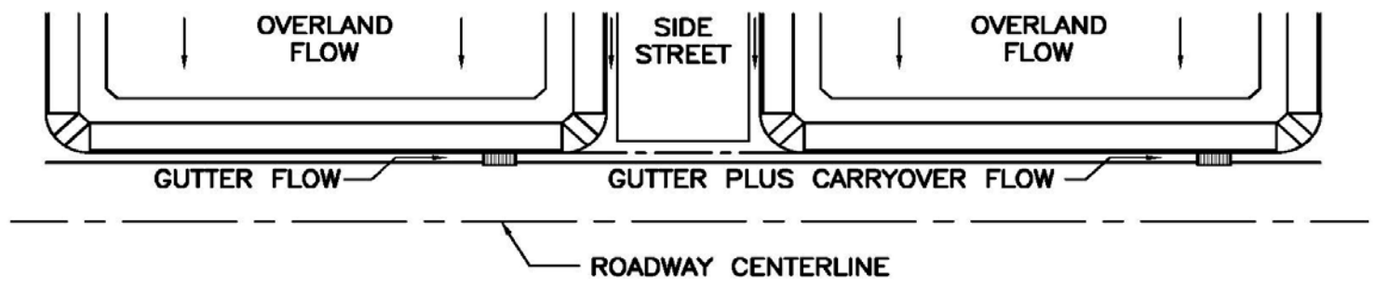
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.40**	**7.77**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**78**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6M



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	4.4	35.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR… FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

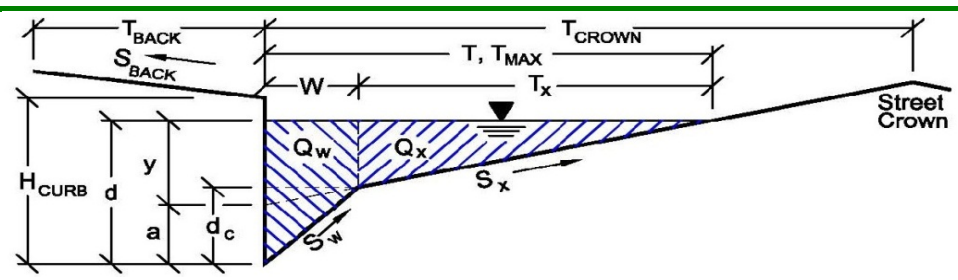
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.4**	**35.4**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Trails at Crowfoot**

Inlet ID: **DP 6M**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**6.8**	**127.1**	**cfs**

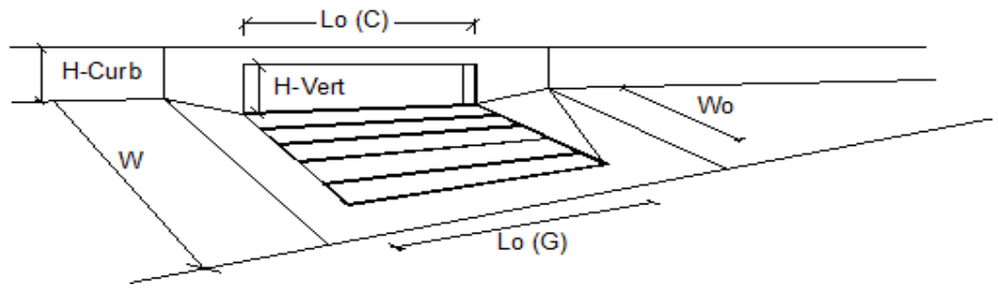
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6M



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.40**	**13.74**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**21.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**39**	**%**

III. Hydraulic Computations

3. UD SEWER

POND A

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/17/2017 10:31:44 AM	**UDSewer Results Summary** **Project Title:** Hess Ranch Pond A_1 **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6031.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond A-	6032.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1										
SDMH 28	6043.63	18.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 9	6047.67	18.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 135	6047.92	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 10	6047.70	5.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 11	6046.41	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 134	6046.43	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 78	6046.27	2.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 13	6047.20	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 133	6048.93	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 14	6049.10	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 132	6051.42	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 15	6051.91	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 131	6056.08	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 130	6057.13	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 129	6057.60	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 128	6058.47	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 127	6058.69	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 76	6058.50	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 77	6058.60	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 11	6051.73	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 75	6051.24	2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**

Outfall Pond A-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.94	
SDMH 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.94	Surface Water Present (Downstream)
SDIN 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.94	
SDMH 135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.83	
SDIN 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04	
SDMH 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.85	
SDMH 134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.85	
SDIN 78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	
SDMH 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 129	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	
SDIN 76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	
SDIN 77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.84	
SDIN 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.19	
SDIN 75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.92	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 28	258.00	6031.49	1.1	6034.33	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 9	156.00	6034.52	3.0	6039.20	0.013	0.94	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 135	28.00	6039.89	2.0	6040.45	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 10	6.00	6040.65	2.0	6040.77	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 11	31.00	6040.74	2.0	6041.36	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 134	16.00	6041.55	2.0	6041.87	0.013	0.20	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 78	8.00	6042.17	1.0	6042.25	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 13	56.00	6042.07	2.0	6043.19	0.013	0.08	0.00	CIRCULAR	0.00 in	0.00 in
SDMH 133	84.00	6043.38	2.0	6045.06	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 14	24.00	6045.26	1.5	6045.62	0.013	0.46	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 132	113.00	6045.82	1.0	6046.95	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 15	25.00	6047.14	1.0	6047.39	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 131	212.00	6047.65	1.8	6051.47	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 130	72.00	6051.67	1.0	6052.39	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 129	46.00	6052.58	1.0	6053.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 128	84.00	6053.20	0.6	6053.70	0.013	0.07	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 127	22.00	6053.88	2.8	6054.50	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 76	25.00	6054.70	1.0	6054.95	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 77	52.00	6053.99	1.0	6054.51	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 11	25.00	6047.69	1.0	6047.94	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 75	52.00	6047.25	1.0	6047.77	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 28	70.14	9.92	16.74	5.88	12.78	8.43	1.68	Supercritical	18.94	0.00	
SDIN 9	115.84	16.39	16.74	5.88	9.85	12.08	2.78	Supercritical	18.94	0.00	
SDMH 135	58.16	11.85	16.12	5.89	10.69	10.08	2.19	Supercritical	15.83	0.00	
SDIN 10	58.16	11.85	8.88	4.14	5.97	7.27	2.17	Supercritical	5.04	0.00	
SDMH 11	32.08	10.21	13.47	5.43	9.13	8.98	2.11	Supercritical	9.85	0.00	
SDMH 134	32.08	10.21	13.47	5.43	9.13	8.98	2.11	Supercritical	9.85	0.00	
SDIN 78	10.53	5.96	7.83	4.00	6.52	5.11	1.42	Supercritical	2.95	0.00	
SDMH 13	14.90	8.43	12.20	5.41	8.61	8.27	1.95	Supercritical	6.90	0.00	
SDMH 133	32.08	10.21	11.18	4.81	7.56	8.14	2.12	Supercritical	6.90	0.00	
SDMH 14	27.78	8.84	11.18	4.81	8.15	7.34	1.84	Supercritical	6.90	0.00	
SDMH 132	22.68	7.22	11.18	4.81	9.08	6.34	1.49	Supercritical	6.90	0.00	
SDMH 15	22.68	7.22	11.18	4.81	9.08	6.34	1.49	Supercritical	6.90	0.00	
SDMH 131	14.13	8.00	10.38	4.79	7.44	7.33	1.89	Supercritical	5.05	0.00	
SDMH 130	10.53	5.96	10.38	4.79	8.78	5.90	1.38	Supercritical	5.05	0.00	
SDMH 129	10.53	5.96	10.38	4.79	8.78	5.90	1.38	Supercritical	5.05	0.00	
SDMH 128	8.16	4.62	10.38	4.79	10.25	4.86	1.02	Supercritical	5.05	0.00	
SDMH 127	17.62	9.97	5.30	3.20	3.42	5.95	2.35	Supercritical	1.39	0.00	
SDIN 76	10.53	5.96	5.30	3.20	4.42	4.13	1.43	Supercritical	1.39	0.00	
SDIN 77	10.53	5.96	8.99	4.35	7.52	5.49	1.41	Supercritical	3.84	0.00	

SDIN 11	10.53	5.96	9.41	4.48	7.89	5.62	1.40	Supercritical	4.19	0.00	
SDIN 75	10.53	5.96	7.79	3.98	6.48	5.10	1.42	Supercritical	2.92	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 28	18.94	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 9	18.94	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 135	15.83	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDIN 10	5.04	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 11	9.85	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 134	9.85	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 78	2.95	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 13	6.90	CIRCULAR	0.00 in	0.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 133	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 14	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 132	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 15	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 131	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 130	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 129	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 128	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 127	1.39	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 76	1.39	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 77	3.84	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 11	4.19	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 75	2.92	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6031.50

	Invert Elev.	Downstream	HGL	EGL

			Manhole Losses						
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 28	6031.49	6034.33	0.00	0.00	6032.56	6035.72	6033.66	2.60	6036.26
SDIN 9	6034.52	6039.20	0.10	0.00	6035.83	6040.59	6037.61	3.53	6041.13
SDMH 135	6039.89	6040.45	0.01	0.00	6040.89	6041.79	6042.05	0.28	6042.33
SDIN 10	6040.65	6040.77	0.00	0.00	6042.30	6042.30	6042.33	0.01	6042.34
SDMH 11	6040.74	6041.36	0.20	0.00	6041.99	6042.48	6042.75	0.19	6042.94
SDMH 134	6041.55	6041.87	0.03	0.00	6042.51	6043.30	6043.56	0.00	6043.56
SDIN 78	6042.17	6042.25	0.06	0.00	6043.57	6043.57	6043.62	0.00	6043.62
SDMH 13	6042.07	6043.19	0.02	0.00	6043.32	6044.21	6043.85	0.81	6044.66
SDMH 133	6043.38	6045.06	0.06	0.00	6044.27	6045.99	6045.04	1.31	6046.35
SDMH 14	6045.26	6045.62	0.03	0.00	6046.03	6046.55	6046.78	0.14	6046.91
SDMH 132	6045.82	6046.95	0.00	0.00	6046.58	6047.88	6047.20	1.04	6048.24
SDMH 15	6047.14	6047.39	0.00	0.00	6047.90	6048.32	6048.52	0.16	6048.68
SDMH 131	6047.65	6051.47	0.01	0.00	6048.33	6052.33	6049.11	3.58	6052.69
SDMH 130	6051.67	6052.39	0.01	0.00	6052.40	6053.25	6052.94	0.67	6053.61
SDMH 129	6052.58	6053.04	0.01	0.00	6053.31	6053.90	6053.85	0.41	6054.26
SDMH 128	6053.20	6053.70	0.01	0.00	6054.05	6054.56	6054.42	0.50	6054.92
SDMH 127	6053.88	6054.50	0.00	0.00	6054.90	6054.94	6054.92	0.18	6055.10
SDIN 76	6054.70	6054.95	0.01	0.00	6055.07	6055.39	6055.33	0.22	6055.55
SDIN 77	6053.99	6054.51	0.10	0.00	6054.66	6055.26	6055.08	0.47	6055.55
SDIN 11	6047.69	6047.94	0.12	0.00	6048.44	6048.72	6048.84	0.20	6049.04
SDIN 75	6047.25	6047.77	0.06	0.00	6048.20	6048.42	6048.30	0.37	6048.67

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 28	258.00	4.00	6.00	6.67	0.00	1.62	0.00	16.60	10.13	5.97	492.27	Sewer Too Shallow
SDIN 9	156.00	4.00	6.00	6.67	16.22	9.94	5.78	14.94	9.30	5.14	486.03	
SDMH 135	28.00	3.50	6.00	6.08	14.06	8.57	4.99	13.44	8.26	4.68	68.36	
SDIN 10	6.00	3.50	6.00	6.08	13.04	8.06	4.48	12.36	7.72	4.14	13.11	
SDMH 11	31.00	3.00	4.00	5.50	13.36	7.76	4.93	9.10	5.63	2.80	53.03	
SDMH 134	16.00	3.00	4.00	5.50	8.72	5.44	2.61	8.12	5.14	2.31	18.53	
SDIN 78	8.00	2.50	4.00	4.92	8.02	4.80	2.55	7.54	4.56	2.31	7.43	
SDMH 13	56.00	2.50	4.00	4.92	8.22	4.90	2.65	7.52	4.55	2.30	52.79	
SDMH 133	84.00	3.00	4.00	5.50	6.64	4.40	1.57	6.74	4.45	1.62	76.88	Sewer Too Shallow
SDMH 14	24.00	3.00	4.00	5.50	6.34	4.25	1.42	5.96	4.06	1.23	20.43	Sewer Too Shallow
SDMH 132	113.00	3.00	4.00	5.50	5.56	3.86	1.03	7.94	5.05	2.22	105.74	Sewer Too Shallow
SDMH 15	25.00	3.00	4.00	5.50	7.56	4.86	2.03	8.04	5.10	2.27	26.62	
SDMH 131	212.00	2.50	4.00	4.92	8.01	4.80	2.55	8.72	5.15	2.90	215.65	
SDMH 130	72.00	2.50	4.00	4.92	8.32	4.95	2.70	8.98	5.28	3.03	76.45	
SDMH 129	46.00	2.50	4.00	4.92	8.60	5.09	2.84	8.62	5.10	2.85	48.50	
SDMH 128	84.00	2.50	4.00	4.92	8.31	4.95	2.70	9.04	5.31	3.06	89.53	
SDMH 127	22.00	2.50	4.00	4.92	8.67	5.13	2.88	7.88	4.73	2.48	22.08	
SDIN 76	25.00	2.50	4.00	4.92	7.48	4.53	2.28	6.60	4.09	1.84	20.72	Sewer Too Shallow
SDIN 77	52.00	2.50	4.00	4.92	8.46	5.02	2.77	7.68	4.63	2.38	50.57	
SDIN 11	25.00	2.50	4.00	4.92	7.94	4.76	2.51	7.08	4.33	2.08	22.30	
SDIN 75	52.00	2.50	4.00	4.92	7.84	4.71	2.46	6.44	4.01	1.76	43.92	Sewer Too Shallow

Total earth volume for sewer trenches = 2011 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/16/2017 1:17:57 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A (Basin A-1) 100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6031.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond A-	6032.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1										
SDMH 28	6043.63	73.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 9	6047.67	73.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 135	6047.92	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 10	6047.70	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond A-1	0.00	0.00	0.00	0.00	0.00	6.21	11.75	0.42	73.00	
SDMH 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.00	Surface Water Present (Downstream)
SDIN 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.00	
SDMH 135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 28	258.00	6031.49	1.1	6034.33	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 9	156.00	6034.52	3.0	6039.20	0.013	0.94	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 135	28.00	6039.89	2.0	6040.45	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 10	6.00	6040.65	2.0	6040.77	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 28	70.14	9.92	36.00	10.33	36.00	10.33	0.00	Pressurized	73.00	258.00	
SDIN 9	115.84	16.39	32.35	10.91	20.73	17.32	2.56	Supercritical Jump	73.00	88.63	
SDMH	58.16	11.85	26.07	9.30	18.92	12.91	1.96	Supercritical	42.10	0.00	

135											
SDIN 10	58.16	11.85	26.07	9.30	18.92	12.91	1.96	Supercritical	42.10	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 28	73.00	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 9	73.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 135	42.10	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDIN 10	42.10	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6031.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 28	6031.49	6034.33	0.00	0.00	6034.49	6037.57	6036.15	3.07	6039.22
SDIN 9	6034.52	6039.20	1.56	0.00	6039.12	6041.90	6040.78	2.96	6043.74
SDMH 135	6039.89	6040.45	0.06	0.00	6041.95	6042.90	6044.05	0.00	6044.05
SDIN 10	6040.65	6040.77	0.06	0.00	6042.96	6043.67	6044.81	0.00	6044.81

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)

- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 28	258.00	4.00	6.00	6.67	0.00	1.62	0.00	16.60	10.13	5.97	492.27	Sewer Too Shallow
SDIN 9	156.00	4.00	6.00	6.67	16.22	9.94	5.78	14.94	9.30	5.14	486.03	
SDMH 135	28.00	3.50	6.00	6.08	14.06	8.57	4.99	13.44	8.26	4.68	68.36	
SDIN 10	6.00	3.50	6.00	6.08	13.04	8.06	4.48	12.36	7.72	4.14	13.11	

Total earth volume for sewer trenches = 1060 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/17/2017 10:47:50 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfooot Pond A_1 **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6016.10

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond A Outfall	6015.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A-2 2 Year										
MH 17 SWR 17 - 1	6030.00	22.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 7	6043.12	22.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 138	6043.43	19.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 4	6043.44	16.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 137	6043.94	4.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 5	6043.64	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 136	6046.73	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 74	6046.74	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 5	6045.30	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 139	6047.23	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 6	6048.13	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 7	6048.86	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 8	6051.46	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 9	6057.28	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 141	6058.25	7.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 10	6070.26	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 8	6069.90	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 71	6057.89	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 140	6059.95	5.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 72	6059.77	5.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 73	6042.94	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time**	**Gutter Time**	**Basin Tc**	**Intensity (in/hr)**	**Local Contrib**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc**	**Peak Flow**	**Comment**

	(min)	(min)	(min)		(cfs)			(min)	(cfs)	
Pond A Outfall A-2 2 Year	0.00	0.00	0.00	0.00	0.00	5.34	4.14	1.21	22.10	Surface Water Present (Upstream)
MH 17 SWR 17 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.10	Surface Water Present (Downstream)
SDIN 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.10	
SDMH 138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.26	
SDMH 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.64	
SDMH 137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.67	
SDIN 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.27	
SDMH 136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	
SDIN 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	
SDMH 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 139	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.21	
SDMH 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.77	
SDIN 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.77	
SDIN 71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.28	
SDMH 140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.01	
SDIN 72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.01	
SDIN 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
MH 17 SWR 17 - 1	227.00	6015.10	3.7	6023.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 7	136.00	6024.97	3.7	6030.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 138	10.00	6030.60	4.0	6031.00	0.013	0.20	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 4	25.00	6031.40	4.0	6032.40	0.013	1.61	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 137	54.00	6032.64	4.0	6034.80	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 5	26.00	6034.99	3.5	6035.90	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 136	218.00	6036.25	2.8	6042.35	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 74	52.00	6042.55	1.0	6043.07	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 5	123.00	6033.38	4.0	6038.30	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 139	66.00	6038.50	4.0	6041.14	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 6	50.00	6041.35	3.5	6043.10	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 7	65.00	6043.30	2.0	6044.60	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 8	93.00	6044.80	2.5	6047.12	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 9	116.00	6047.34	4.0	6051.98	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 141	57.00	6052.29	2.7	6053.83	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 10	278.00	6054.03	4.0	6065.15	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 8	18.00	6065.36	2.0	6065.72	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 71	18.00	6054.13	2.0	6054.49	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 140	50.00	6052.17	4.0	6054.17	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 72	25.00	6054.37	2.0	6054.87	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 73	28.00	6031.75	4.0	6032.87	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
MH 17 SWR 17 - 1	128.64	18.20	18.14	6.19	10.10	13.61	3.09	Supercritical	22.10	0.00	
SDIN 7	128.64	18.20	18.14	6.19	10.10	13.61	3.09	Supercritical	22.10	0.00	
SDMH 138	133.76	18.92	16.88	5.92	9.23	13.45	3.21	Supercritical	19.26	0.00	
SDMH 4	133.76	18.92	15.64	5.65	8.57	12.89	3.20	Supercritical	16.64	0.00	
SDMH 137	82.26	16.76	8.54	4.05	4.85	9.07	3.02	Supercritical	4.67	0.00	
SDIN 5	76.94	15.67	5.90	3.33	3.54	6.98	2.74	Supercritical	2.27	0.00	
SDMH 136	17.62	9.97	7.20	3.80	4.59	7.07	2.39	Supercritical	2.51	0.00	
SDIN 74	10.53	5.96	7.20	3.80	5.98	4.89	1.43	Supercritical	2.51	0.00	
SDMH 5	45.37	14.44	15.65	6.05	8.84	12.50	2.99	Supercritical	13.13	0.00	
SDMH 139	45.37	14.44	15.65	6.05	8.84	12.50	2.99	Supercritical	13.13	0.00	
SDMH 6	42.44	13.51	15.65	6.05	9.16	11.91	2.79	Supercritical	13.13	0.00	
SDMH 7	32.08	10.21	15.65	6.05	10.69	9.70	2.07	Supercritical	13.13	0.00	
SDMH 8	35.87	11.42	15.65	6.05	10.05	10.53	2.33	Supercritical	13.13	0.00	
SDMH 9	45.37	14.44	15.65	6.05	8.84	12.50	2.99	Supercritical	13.13	0.00	
SDMH 141	17.31	9.79	12.48	5.52	8.10	9.35	2.29	Supercritical	7.21	0.00	
SDMH 10	21.07	11.92	12.08	5.37	7.02	10.62	2.83	Supercritical	6.77	0.00	
SDIN 8	14.90	8.43	12.08	5.37	8.51	8.23	1.96	Supercritical	6.77	0.00	
SDIN 71	14.90	8.43	6.85	3.69	4.76	6.10	2.02	Supercritical	2.28	0.00	
SDMH 140	21.07	11.92	10.33	4.77	5.97	9.77	2.86	Supercritical	5.01	0.00	
SDIN 72	14.90	8.43	10.33	4.77	7.19	7.60	2.00	Supercritical	5.01	0.00	
SDIN 73	82.26	16.76	6.55	3.51	3.78	7.77	2.95	Supercritical	2.78	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
MH 17 SWR 17 - 1	22.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 7	22.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 138	19.26	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 4	16.64	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 137	4.67	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 5	2.27	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 136	2.51	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 74	2.51	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 5	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 139	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 6	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 7	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 8	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 9	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 141	7.21	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 10	6.77	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 8	6.77	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 71	2.28	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 140	5.01	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 72	5.01	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 73	2.78	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6016.10

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss**	**Lateral Loss**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss**	**Upstream (ft)**

			(ft)	(ft)				(ft)	
MH 17 SWR 17 - 1	6015.10	6023.50	0.00	0.00	6016.10	6025.01	6018.82	6.79	6025.61
SDIN 7	6024.97	6030.00	0.01	0.00	6025.81	6031.51	6028.69	3.42	6032.11
SDMH 138	6030.60	6031.00	0.02	0.00	6031.53	6034.06	6034.18	0.00	6034.18
SDMH 4	6031.40	6032.40	0.14	0.00	6034.20	6034.55	6034.70	0.00	6034.70
SDMH 137	6032.64	6034.80	0.00	0.00	6034.68	6035.51	6034.70	1.07	6035.77
SDIN 5	6034.99	6035.90	0.00	0.00	6035.52	6036.39	6036.04	0.52	6036.56
SDMH 136	6036.25	6042.35	0.00	0.00	6036.63	6042.95	6037.40	5.77	6043.17
SDIN 74	6042.55	6043.07	0.04	0.00	6043.05	6043.67	6043.42	0.47	6043.89
SDMH 5	6033.38	6038.30	0.36	0.00	6034.91	6039.60	6036.54	3.63	6040.17
SDMH 139	6038.50	6041.14	0.01	0.00	6039.62	6042.44	6041.66	1.35	6043.01
SDMH 6	6041.35	6043.10	0.01	0.00	6042.46	6044.40	6044.32	0.66	6044.97
SDMH 7	6043.30	6044.60	0.01	0.00	6044.42	6045.90	6045.65	0.82	6046.47
SDMH 8	6044.80	6047.12	0.01	0.00	6045.92	6048.42	6047.35	1.64	6048.99
SDMH 9	6047.34	6051.98	0.01	0.00	6048.44	6053.28	6050.50	3.35	6053.85
SDMH 141	6052.29	6053.83	0.34	0.00	6053.62	6054.87	6054.32	1.02	6055.34
SDMH 10	6054.03	6065.15	0.01	0.00	6054.88	6066.16	6056.37	10.24	6066.60
SDIN 8	6065.36	6065.72	0.30	0.00	6066.46	6066.73	6067.12	0.05	6067.17
SDIN 71	6054.13	6054.49	0.03	0.00	6055.34	6055.34	6055.38	0.04	6055.42
SDMH 140	6052.17	6054.17	0.01	0.00	6053.29	6055.03	6054.15	1.23	6055.38
SDIN 72	6054.37	6054.87	0.16	0.00	6055.20	6055.73	6055.87	0.22	6056.08
SDIN 73	6031.75	6032.87	0.00	0.00	6034.17	6034.17	6034.18	0.01	6034.19

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
MH 17 SWR 17 - 1	227.00	4.00	6.00	6.67	0.00	0.73	0.00	11.00	7.33	3.17	245.77	Sewer Too Shallow
SDIN 7	136.00	4.00	6.00	6.67	8.06	5.87	1.70	24.24	13.95	9.79	528.43	Sewer Too Shallow
SDMH 138	10.00	4.00	6.00	6.67	23.04	13.35	9.19	22.86	13.26	9.10	57.41	
SDMH 4	25.00	4.00	6.00	6.67	22.06	12.86	8.70	20.08	11.87	7.71	124.60	
SDMH 137	54.00	3.50	6.00	6.08	20.10	11.59	8.01	16.78	9.93	6.35	208.66	

SDIN 5	26.00	3.50	6.00	6.08	16.40	9.74	6.16	13.98	8.53	4.95	73.84	
SDMH 136	218.00	2.50	4.00	4.92	14.89	8.24	5.99	8.26	4.92	2.67	372.79	
SDIN 74	52.00	2.50	4.00	4.92	7.86	4.72	2.47	6.84	4.21	1.96	45.27	Sewer Too Shallow
SDMH 5	123.00	3.00	4.00	5.50	19.12	10.64	7.81	13.00	7.58	4.75	366.01	
SDMH 139	66.00	3.00	4.00	5.50	12.60	7.38	4.55	11.18	6.67	3.84	119.75	
SDMH 6	50.00	3.00	4.00	5.50	10.76	6.46	3.63	9.06	5.61	2.78	70.84	
SDMH 7	65.00	3.00	4.00	5.50	8.66	5.41	2.58	7.52	4.84	2.01	72.14	
SDMH 8	93.00	3.00	4.00	5.50	7.13	4.65	1.82	7.68	4.92	2.09	93.86	Sewer Too Shallow
SDMH 9	116.00	3.00	4.00	5.50	7.24	4.70	1.87	9.60	5.88	3.05	135.73	Sewer Too Shallow
SDMH 141	57.00	2.50	4.00	4.92	9.48	5.53	3.28	8.34	4.96	2.71	63.04	
SDMH 10	278.00	2.50	4.00	4.92	7.94	4.76	2.51	9.72	5.65	3.40	305.04	
SDIN 8	18.00	2.50	4.00	4.92	9.30	5.44	3.19	7.86	4.72	2.47	18.98	
SDIN 71	18.00	2.50	4.00	4.92	7.74	4.66	2.41	6.30	3.94	1.69	14.92	Sewer Too Shallow
SDMH 140	50.00	2.50	4.00	4.92	9.72	5.65	3.40	11.06	6.32	4.07	68.59	
SDIN 72	25.00	2.50	4.00	4.92	10.66	6.12	3.87	9.30	5.44	3.19	32.36	
SDIN 73	28.00	3.50	6.00	6.08	21.86	12.47	8.89	18.64	10.86	7.28	126.30	

Total earth volume for sewer trenches = 3144 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/16/2017 2:44:28 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A (BAsin A-2) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6015.10

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond A Outfall	6015.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A-2_100 Year										
SDMH 17	6030.00	94.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 7	6043.12	94.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 138	6043.43	82.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 4	6043.44	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 137	6043.94	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 5	6043.64	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 73	6042.94	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond A Outfall A-2_100 Year	0.00	0.00	0.00	0.00	0.00	7.93	11.86	0.28	94.13	Surface Water Present (Upstream)
SDMH 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.13	Surface Water Present (Downstream)
SDIN 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.13	
SDMH 138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.87	
SDMH 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDMH 137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 17	227.00	6015.10	3.7	6023.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 7	136.00	6024.97	3.7	6030.00	0.013	0.83	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 138	10.00	6030.60	4.0	6031.00	0.013	0.20	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 4	25.00	6031.40	4.0	6032.40	0.013	1.61	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 137	54.00	6032.64	4.0	6034.80	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 5	25.00	6035.03	3.5	6035.90	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in

SDIN 73	28.00	6031.75	4.0	6032.87	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 17	128.64	18.20	34.43	13.52	22.87	19.87	2.73	Supercritical	94.13	0.00	Velocity is Too High
SDIN 7	128.64	18.20	34.43	13.52	22.87	19.87	2.73	Supercritical Jump	94.13	44.95	Velocity is Too High
SDMH 138	133.76	18.92	33.54	12.08	20.51	19.93	2.97	Supercritical	82.87	0.00	Velocity is Too High
SDMH 4	133.76	18.92	25.36	7.91	13.87	16.76	3.18	Pressurized	42.10	25.00	
SDMH 137	82.26	16.76	26.07	9.30	15.21	16.85	2.97	Pressurized	42.10	54.00	
SDIN 5	76.94	15.67	26.07	9.30	15.83	16.03	2.75	Pressurized	42.10	25.00	
SDIN 73	82.26	16.76	26.07	9.30	15.21	16.85	2.97	Pressurized	42.10	28.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 17	94.13	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 7	94.13	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 138	82.87	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 4	42.10	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 137	42.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
SDIN 5	42.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
SDIN 73	42.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6015.10

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 17	6015.10	6023.50	0.00	0.00	6017.01	6026.37	6023.14	6.07	6029.21
SDIN 7	6024.97	6030.00	2.29	0.00	6028.74	6032.87	6031.49	4.21	6035.71
SDMH 138	6030.60	6031.00	0.43	0.00	6033.30	6036.34	6038.47	0.00	6038.47
SDMH 4	6031.40	6032.40	0.89	0.00	6038.81	6038.91	6039.36	0.10	6039.46
SDMH 137	6032.64	6034.80	0.06	0.00	6038.97	6039.53	6040.11	0.57	6040.67
SDIN 5	6035.03	6035.90	1.51	0.00	6041.04	6041.30	6042.18	0.26	6042.44
SDIN 73	6031.75	6032.87	0.06	0.00	6037.39	6037.68	6038.53	0.29	6038.82

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 17	227.00	4.00	6.00	6.67	0.00	0.73	0.00	11.00	7.33	3.17	245.77	Sewer Too Shallow
SDIN 7	136.00	4.00	6.00	6.67	8.06	5.87	1.70	24.24	13.95	9.79	528.43	Sewer Too Shallow
SDMH 138	10.00	4.00	6.00	6.67	23.04	13.35	9.19	22.86	13.26	9.10	57.41	
SDMH 4	25.00	4.00	6.00	6.67	22.06	12.86	8.70	20.08	11.87	7.71	124.60	
SDMH 137	54.00	3.50	6.00	6.08	20.10	11.59	8.01	16.78	9.93	6.35	208.66	
SDIN 5	25.00	3.50	6.00	6.08	16.33	9.71	6.12	13.98	8.53	4.95	70.74	
SDIN 73	28.00	3.50	6.00	6.08	21.86	12.47	8.89	18.64	10.86	7.28	126.30	

Total earth volume for sewer trenches = 1362 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.

- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/17/2017 11:04:35 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A_3 **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6007.41

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond A (A-3)	6009.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 16	6017.00	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 1	6024.71	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 1	6025.08	9.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 2	6033.08	9.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 3	6037.45	6.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 142	6043.65	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 70	6043.47	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 69	6037.27	3.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 3	6032.90	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond A (A-3)	0.00	0.00	0.00	0.00	0.00	2.66	4.21	0.95	11.20	
SDMH 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	
SDIN 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	
SDMH 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.74	
SDMH 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.74	
SDMH 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.71	
SDMH 142	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22	
SDIN 70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22	
SDIN 69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.69	
SDIN 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 16	130.00	6006.41	4.3	6012.00	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 1	128.00	6012.97	3.0	6016.81	0.013	0.94	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 1	9.00	6019.00	1.9	6019.17	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 2	162.00	6019.38	5.0	6027.48	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 3	87.00	6027.70	5.0	6032.05	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in

SDMH 142	124.00	6032.44	6.1	6040.00	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 70	25.00	6040.00	1.0	6040.25	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 69	25.00	6032.37	1.0	6032.62	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 3	25.00	6027.68	1.0	6027.93	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 16	85.28	17.37	13.45	5.25	7.34	12.03	3.22	Supercritical	11.20	0.00	
SDIN 1	71.24	14.51	13.45	5.25	8.04	10.58	2.70	Supercritical	11.20	0.00	
SDMH 1	14.52	8.22	14.45	6.41	10.79	8.81	1.79	Supercritical	9.74	0.00	
SDMH 2	23.55	13.33	14.45	6.41	8.07	12.70	3.12	Supercritical Jump	9.74	9.02	
SDMH 3	23.55	13.33	12.03	5.35	6.58	11.49	3.18	Supercritical	6.71	0.00	
SDMH 142	26.01	14.72	8.20	4.11	4.28	10.02	3.52	Supercritical	3.22	0.00	
SDIN 70	10.53	5.96	8.20	4.11	6.83	5.24	1.42	Supercritical	3.22	0.00	
SDIN 69	10.53	5.96	8.80	4.30	7.36	5.43	1.41	Supercritical	3.69	0.00	
SDIN 3	10.53	5.96	8.67	4.25	7.23	5.39	1.41	Supercritical Jump	3.58	18.28	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 16	11.20	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 1	11.20	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 1	9.74	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 2	9.74	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 3	6.71	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 142	3.22	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 70	3.22	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 69	3.69	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 3	3.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6007.41

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 16	6006.41	6012.00	0.00	0.00	6007.41	6013.12	6009.27	4.28	6013.55
SDIN 1	6012.97	6016.81	0.08	0.00	6013.64	6017.93	6015.38	2.98	6018.36
SDMH 1	6019.00	6019.17	0.05	0.00	6019.90	6020.62	6021.10	0.00	6021.10
SDMH 2	6019.38	6027.48	0.62	0.00	6021.25	6028.68	6021.73	7.60	6029.32
SDMH 3	6027.70	6032.05	0.01	0.00	6028.70	6033.05	6030.30	3.20	6033.50
SDMH 142	6032.44	6040.00	0.00	0.00	6033.05	6040.68	6034.35	6.60	6040.95
SDIN 70	6040.00	6040.25	0.07	0.00	6040.87	6040.93	6041.01	0.18	6041.20
SDIN 69	6032.37	6032.62	0.09	0.00	6033.48	6033.48	6033.59	0.09	6033.67
SDIN 3	6027.68	6027.93	0.08	0.00	6029.34	6029.36	6029.41	0.02	6029.43

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 16	130.00	3.50	6.00	6.08	0.00	3.88	0.30	8.50	5.79	2.21	140.81	Sewer Too Shallow
SDIN 1	128.00	3.50	6.00	6.08	6.56	4.82	1.24	14.30	8.69	5.11	235.00	Sewer Too Shallow
SDMH 1	9.00	2.50	4.00	4.92	10.92	6.25	4.00	11.32	6.45	4.20	13.62	
SDMH 2	162.00	2.50	4.00	4.92	10.90	6.24	3.99	10.70	6.14	3.89	234.59	
SDMH 3	87.00	2.50	4.00	4.92	10.26	5.92	3.67	10.30	5.94	3.69	117.15	

SDMH 142	124.00	2.50	4.00	4.92	9.53	5.56	3.31	6.80	4.19	1.94	124.29	Sewer Too Shallow
SDIN 70	25.00	2.50	4.00	4.92	6.80	4.19	1.94	5.94	3.76	1.51	18.64	Sewer Too Shallow
SDIN 69	25.00	2.50	4.00	4.92	9.66	5.62	3.37	8.80	5.19	2.94	28.96	
SDIN 3	25.00	2.50	4.00	4.92	10.30	5.94	3.69	9.44	5.51	3.26	31.79	

Total earth volume for sewer trenches = 945 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/16/2017 3:07:22 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A (Basin A-3)_100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6006.38

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond A (A-3)	6009.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 16	6017.00	49.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 1	6024.71	49.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond A (A-3)	0.00	0.00	0.00	0.00	0.00	4.17	11.93	0.21	49.80	
SDMH 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.80	
SDIN 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 16	130.00	6006.41	4.3	6012.00	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 1	128.00	6012.97	3.0	6016.81	0.013	0.94	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 16	85.28	17.37	27.56	10.55	16.47	18.04	3.02	Supercritical	49.80	0.00	Velocity is Too High
SDIN 1	71.24	14.51	27.56	10.55	18.48	15.70	2.42	Supercritical Jump	49.80	29.94	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

SDMH 16	49.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDIN 1	49.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6006.38

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 16	6006.41	6012.00	0.00	0.00	6007.78	6014.30	6012.84	3.19	6016.03
SDIN 1	6012.97	6016.81	1.50	0.00	6015.93	6019.11	6017.53	3.31	6020.84

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 16	130.00	3.50	6.00	6.08	0.00	3.88	0.30	8.50	5.79	2.21	140.81	Sewer Too Shallow
SDIN 1	128.00	3.50	6.00	6.08	6.56	4.82	1.24	14.30	8.69	5.11	235.00	Sewer Too Shallow

Total earth volume for sewer trenches = 376 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/17/2017 11:07:53 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A (Pond A-4)_100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6003.47

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	6003.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A_4										
SDIN 63	6008.84	7.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 62	6008.36	3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond A_4	0.00	0.00	0.00	0.00	0.00	0.65	11.69	0.48	7.60	Surface Water Present (Upstream)
SDIN 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60	Surface Water Present (Downstream)
SDIN 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 63	31.00	6003.74	0.5	6003.89	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 62	119.00	6004.10	0.5	6004.69	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 63	47.29	6.69	10.42	4.48	9.76	4.91	1.14	Supercritical	7.60	0.00	
SDIN 62	29.08	5.92	7.58	3.80	7.23	4.06	1.10	Supercritical	3.70	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

	(cfs)									
SDIN 63	7.60	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 62	3.70	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6003.47

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 63	6003.74	6003.89	0.00	0.00	6004.55	6004.76	6004.92	0.15	6005.07
SDIN 62	6004.10	6004.69	0.00	0.00	6004.98	6005.32	6005.07	0.48	6005.55

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 63	31.00	4.00	6.00	6.67	0.00	0.45	0.00	7.90	5.78	1.62	24.07	Sewer Too Shallow
SDIN 62	119.00	3.50	6.00	6.08	7.99	5.54	1.95	6.08	4.46	0.88	124.26	Sewer Too Shallow

Total earth volume for sewer trenches = 148 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/15/2017 7:19:05 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A (Pond A-4)_100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6003.47

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	6003.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A_4										
SDIN 63	6008.84	40.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 62	6008.36	23.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond A_4	0.00	0.00	0.00	0.00	0.00	3.36	12.04	0.09	40.45	Surface Water Present (Upstream)
SDIN 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.45	Surface Water Present (Downstream)
SDIN 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.96	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 63	31.00	6003.74	0.5	6003.89	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 62	119.00	6004.10	0.5	6004.69	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 63	47.29	6.69	24.85	7.77	25.62	7.52	0.94	Subcritical	40.45	0.00	
SDIN 62	29.08	5.92	20.00	6.89	20.75	6.62	0.93	Subcritical	23.96	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

	(cfs)									
SDIN 63	40.45	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDIN 62	23.96	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6003.47

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 63	6003.74	6003.89	0.00	0.00	6005.81	6006.04	6006.74	0.16	6006.90
SDIN 62	6004.10	6004.69	0.02	0.00	6006.55	6006.85	6006.92	0.37	6007.29

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 63	31.00	4.00	6.00	6.67	0.00	0.45	0.00	7.90	5.78	1.62	24.07	Sewer Too Shallow
SDIN 62	119.00	3.50	6.00	6.08	7.99	5.54	1.95	6.08	4.46	0.88	124.26	Sewer Too Shallow

Total earth volume for sewer trenches = 148 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/31/2017 12:20:57 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond B **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6035.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	6035.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

B_1										
SDMH 18	6044.50	31.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 19	6050.60	31.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 20	6056.97	31.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 21	6060.17	31.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 27	6060.88	31.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 16	6061.71	4.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 125	6063.23	19.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 124	6068.85	7.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 29	6071.44	7.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 20	6071.27	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 121	6080.32	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 120	6092.75	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 80	6092.18	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 14	6060.71	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 22	6062.64	13.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 23	6065.28	13.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 24	6080.45	13.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 25	6093.46	13.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 26	6102.93	13.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 119	6104.21	13.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 18	6103.96	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 118	6106.06	10.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 117	6108.22	10.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 116	6111.82	10.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 115	6122.01	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 81	6121.83	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 82	6111.63	5.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 12	6041.77	25.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 126	6042.14	24.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 13	6041.77	24.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 217	6041.70	24.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 216	6058.00	24.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 166	6072.01	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 165	6077.85	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 164	6076.95	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 163	6080.63	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 162	6082.43	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 161	6084.63	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 126	6087.46	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 30	6090.01	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 122	6105.99	13.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 31	6108.58	8.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 24	6108.41	8.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 114	6108.33	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 113	6112.90	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 112	6126.77	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 111	6134.72	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 84	6134.23	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH	6139.55	3.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

110										
SDIN 83	6139.37	3.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 22	6089.84	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 109	6094.45	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 108	6102.34	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 85	6101.89	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 215	6071.00	6.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 106	6074.72	6.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond B_1	0.00	0.00	0.00	0.00	0.00	13.31	4.31	0.63	57.40	
SDMH 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.80	
SDMH 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.80	
SDMH 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.80	
SDMH 21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.80	
SDMH 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.80	
SDIN 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.95	
SDMH 125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.80	
SDMH 124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.90	
SDMH 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.90	
SDIN 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDIN 80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDIN 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	
SDMH 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.15	
SDMH 23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.15	
SDMH 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.15	
SDMH 25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.15	
SDMH 26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.15	
SDMH 119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.15	
SDIN 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	
SDMH 118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.38	

SDMH 117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.38	
SDMH 116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.38	
SDMH 115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.86	
SDIN 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.60	
SDMH 126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.60	
SDIN 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.60	
SDMH 217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.20	
SDMH 216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.20	
SDMH 166	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 165	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 163	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 162	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 161	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.11	
SDMH 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.48	
SDIN 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.48	
SDMH 114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.15	
SDMH 113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.15	
SDMH 112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.15	
SDMH 111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDMH 110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.82	
SDIN 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.82	
SDIN 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDIN 85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.10	
SDIN 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 18	169.00	6033.14	2.0	6036.52	0.013	0.29	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 19	143.00	6038.21	3.0	6042.50	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in

SDMH 20	150.00	6042.75	3.7	6048.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 21	76.00	6048.59	3.7	6051.40	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 27	44.00	6051.70	2.5	6052.80	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 16	26.00	6053.54	1.0	6053.80	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 125	41.00	6055.35	3.5	6056.78	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 124	129.00	6056.95	4.5	6062.75	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 29	39.00	6062.92	5.5	6065.06	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 20	26.00	6065.35	2.0	6065.87	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 121	300.00	6063.05	4.0	6075.05	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 120	254.00	6075.21	5.0	6087.91	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 80	36.00	6088.11	2.0	6088.83	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 14	9.00	6053.00	1.0	6053.09	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 22	58.00	6053.50	4.0	6055.82	0.013	0.20	0.00	CIRCULAR	0.00 in	0.00 in
SDMH 23	61.00	6056.03	4.0	6058.47	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 24	350.00	6058.67	4.0	6072.67	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 25	300.00	6072.87	4.0	6084.87	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 26	226.00	6084.97	4.8	6095.82	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 119	50.00	6096.01	4.0	6098.01	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 18	41.00	6098.30	2.0	6099.12	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 118	48.00	6098.29	5.0	6100.69	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 117	53.00	6100.89	5.0	6103.54	0.013	0.20	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 116	93.00	6103.73	5.0	6108.38	0.013	0.20	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 115	275.00	6108.59	3.5	6118.21	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 81	18.00	6118.48	1.0	6118.66	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 82	25.00	6108.58	1.0	6108.83	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 12	23.00	6033.13	1.9	6033.57	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 126	43.00	6033.97	1.0	6034.40	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
SDIN 13	10.00	6034.60	2.0	6034.80	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 217	50.00	6035.00	2.5	6036.25	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 216	385.00	6037.07	3.1	6049.00	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 166	181.00	6053.69	4.0	6060.93	0.013	0.63	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 165	139.00	6061.13	3.0	6065.30	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 164	90.00	6065.56	1.0	6066.46	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 163	214.00	6066.56	1.0	6068.70	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 162	82.00	6068.93	1.0	6069.75	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 161	91.00	6071.02	3.5	6074.20	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 126	102.00	6075.37	4.0	6079.45	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 30	39.00	6079.62	6.0	6081.96	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 122	237.00	6082.13	6.0	6096.35	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 31	39.00	6096.52	6.0	6098.86	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 24	26.00	6099.05	2.0	6099.57	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 114	311.00	6096.65	2.0	6102.87	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 113	350.00	6103.07	1.5	6108.32	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in

SDMH 112	350.00	6108.62	3.5	6120.87	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 111	248.00	6121.68	3.5	6130.36	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 84	36.00	6130.56	1.0	6130.92	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 110	345.00	6121.08	3.5	6133.15	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 83	7.00	6133.35	1.0	6133.42	0.013	1.06	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 22	26.00	6082.25	2.0	6082.77	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 109	300.00	6079.75	3.5	6090.25	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 108	253.00	6090.46	3.0	6098.05	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 85	36.00	6098.25	1.0	6098.61	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 215	394.00	6049.30	3.7	6063.88	0.013	0.12	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 106	109.00	6064.07	4.0	6068.43	0.013	0.24	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 18	94.58	13.38	21.95	7.05	14.38	12.06	2.24	Supercritical	31.80	0.00	
SDMH 19	115.84	16.39	21.95	7.05	12.89	13.98	2.77	Supercritical	31.80	0.00	
SDMH 20	128.64	18.20	21.95	7.05	12.20	15.08	3.08	Supercritical	31.80	0.00	
SDMH 21	128.64	18.20	21.95	7.05	12.20	15.08	3.08	Supercritical	31.80	0.00	
SDMH 27	105.74	14.96	21.95	7.05	13.54	13.09	2.52	Supercritical	31.80	0.00	
SDIN 16	41.13	8.38	8.80	4.12	7.03	5.65	1.55	Supercritical	4.95	0.00	
SDMH 125	125.12	17.70	17.13	5.97	9.68	12.93	3.00	Supercritical	19.80	0.00	
SDMH 124	141.87	20.07	10.63	4.53	5.77	10.80	3.30	Supercritical	7.90	0.00	
SDMH 29	156.84	22.19	10.63	4.53	5.49	11.59	3.63	Supercritical	7.90	0.00	
SDIN 20	58.16	11.85	7.77	3.85	5.25	6.73	2.15	Supercritical	3.88	0.00	
SDMH 121	21.07	11.92	9.04	4.37	5.23	9.09	2.86	Supercritical	3.88	0.00	
SDMH 120	23.55	13.33	9.04	4.37	4.94	9.85	3.20	Supercritical	3.88	0.00	
SDIN 80	14.90	8.43	9.04	4.37	6.27	7.09	2.02	Supercritical	3.88	0.00	
SDIN 14	41.13	8.38	6.74	3.57	5.43	4.85	1.53	Supercritical	2.94	0.00	
SDMH 22	21.07	11.92	16.27	7.82	10.30	12.57	2.64	Supercritical	13.15	0.00	
SDMH 23	45.37	14.44	15.66	6.06	8.85	12.50	2.99	Supercritical	13.15	0.00	
SDMH 24	45.37	14.44	15.66	6.06	8.85	12.50	2.99	Supercritical	13.15	0.00	
SDMH 25	45.37	14.44	15.66	6.06	8.85	12.50	2.99	Supercritical	13.15	0.00	
SDMH 26	49.70	15.82	15.66	6.06	8.43	13.36	3.28	Supercritical	13.15	0.00	
SDMH 119	45.37	14.44	15.66	6.06	8.85	12.50	2.99	Supercritical	13.15	0.00	

SDIN 18	32.08	10.21	8.52	4.10	5.79	7.01	2.11	Supercritical	4.10	0.00	
SDMH 118	23.55	13.33	14.87	6.65	8.36	12.91	3.10	Supercritical	10.38	0.00	
SDMH 117	23.55	13.33	14.87	6.65	8.36	12.91	3.10	Supercritical	10.38	0.00	
SDMH 116	23.55	13.33	14.87	6.65	8.36	12.91	3.10	Supercritical	10.38	0.00	
SDMH 115	19.70	11.15	10.93	4.97	6.55	9.59	2.66	Supercritical	5.58	0.00	
SDIN 81	10.53	5.96	10.93	4.97	9.31	6.05	1.36	Supercritical	5.58	0.00	
SDIN 82	10.53	5.96	11.21	5.06	9.59	6.12	1.35	Pressurized	5.86	25.00	
SDIN 12	198.53	15.80	17.95	5.97	11.64	10.88	2.31	Supercritical	25.60	0.00	
SDMH 126	144.03	11.46	17.58	5.90	13.42	8.56	1.69	Supercritical	24.60	0.00	
SDIN 13	203.69	16.21	17.58	5.90	11.26	10.95	2.37	Supercritical	24.60	0.00	
SDMH 217	159.51	16.58	18.15	6.08	11.06	11.96	2.60	Supercritical	24.20	0.00	
SDMH 216	177.62	18.46	18.15	6.08	10.47	12.92	2.89	Supercritical	24.20	0.00	
SDMH 166	133.76	18.92	16.64	5.86	9.10	13.34	3.20	Supercritical	18.73	0.00	
SDMH 165	115.84	16.39	16.64	5.86	9.79	12.04	2.78	Supercritical	18.73	0.00	
SDMH 164	66.88	9.46	16.64	5.86	13.03	8.12	1.60	Supercritical	18.73	0.00	
SDMH 163	66.88	9.46	16.64	5.86	13.03	8.12	1.60	Supercritical	18.73	0.00	
SDMH 162	66.88	9.46	16.64	5.86	13.03	8.12	1.60	Supercritical	18.73	0.00	
SDMH 161	125.12	17.70	16.64	5.86	9.41	12.72	3.00	Supercritical	18.73	0.00	
SDMH 126	133.76	18.92	16.64	5.86	9.10	13.34	3.20	Supercritical	18.73	0.00	
SDMH 30	100.74	20.52	17.60	6.26	8.76	15.70	3.82	Supercritical	18.73	0.00	
SDMH 122	100.74	20.52	14.60	5.53	7.31	14.17	3.80	Supercritical	13.11	0.00	
SDMH 31	100.74	20.52	11.63	4.82	5.88	12.48	3.76	Supercritical	8.48	0.00	
SDIN 24	58.16	11.85	11.63	4.82	7.74	8.45	2.20	Supercritical	8.48	0.00	
SDMH 114	14.90	8.43	11.50	5.16	8.06	8.03	1.97	Supercritical	6.15	0.00	
SDMH 113	12.90	7.30	11.50	5.16	8.75	7.21	1.69	Supercritical	6.15	0.00	
SDMH 112	19.70	11.15	11.50	5.16	6.91	9.85	2.65	Supercritical	6.15	0.00	
SDMH 111	19.70	11.15	7.18	3.80	4.33	7.64	2.67	Supercritical	2.50	0.00	
SDIN 84	10.53	5.96	7.18	3.80	5.97	4.88	1.43	Supercritical	2.50	0.00	

SDMH 110	19.70	11.15	8.97	4.34	5.37	8.63	2.68	Supercritical	3.82	0.00	
SDIN 83	10.53	5.96	8.97	4.34	7.50	5.48	1.41	Supercritical	3.82	0.00	
SDIN 22	58.16	11.85	7.77	3.85	5.25	6.73	2.15	Supercritical	3.88	0.00	
SDMH 109	19.70	11.15	9.04	4.37	5.42	8.67	2.68	Supercritical Jump	3.88	4.29	
SDMH 108	18.24	10.32	9.04	4.37	5.64	8.20	2.48	Supercritical	3.88	0.00	
SDIN 85	10.53	5.96	9.04	4.37	7.56	5.51	1.41	Supercritical	3.88	0.00	
SDMH 215	43.63	13.89	10.48	4.63	6.06	9.79	2.88	Supercritical	6.10	0.00	
SDIN 106	45.37	14.44	10.48	4.63	5.94	10.06	2.99	Supercritical	6.10	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 18	31.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 19	31.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 20	31.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 21	31.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 27	31.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 16	4.95	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 125	19.80	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 124	7.90	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 29	7.90	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 20	3.88	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 121	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 120	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 80	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 14	2.94	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 22	13.15	CIRCULAR	0.00 in	0.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 23	13.15	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 24	13.15	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 25	13.15	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 26	13.15	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 119	13.15	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 18	4.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 118	10.38	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

SDMH 117	10.38	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 116	10.38	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 115	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 81	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 82	5.86	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 12	25.60	CIRCULAR	48.00 in	48.00 in	24.00 in	24.00 in	48.00 in	48.00 in	12.57	
SDMH 126	24.60	CIRCULAR	48.00 in	48.00 in	27.00 in	27.00 in	48.00 in	48.00 in	12.57	
SDIN 13	24.60	CIRCULAR	48.00 in	48.00 in	24.00 in	24.00 in	48.00 in	48.00 in	12.57	
SDMH 217	24.20	CIRCULAR	42.00 in	42.00 in	21.00 in	21.00 in	42.00 in	42.00 in	9.62	
SDMH 216	24.20	CIRCULAR	42.00 in	42.00 in	21.00 in	21.00 in	42.00 in	42.00 in	9.62	
SDMH 166	18.73	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 165	18.73	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 164	18.73	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 163	18.73	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 162	18.73	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 161	18.73	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 126	18.73	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 30	18.73	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 122	13.11	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 31	8.48	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 24	8.48	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 114	6.15	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 113	6.15	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 112	6.15	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 111	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 84	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 110	3.82	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 83	3.82	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 22	3.88	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 109	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 108	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 85	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 215	6.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 106	6.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6035.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 18	6033.14	6036.52	0.00	0.00	6035.00	6038.35	6036.60	2.52	6039.12
SDMH 19	6038.21	6042.50	0.02	0.00	6039.28	6044.33	6042.32	2.78	6045.10
SDMH 20	6042.75	6048.30	0.02	0.00	6044.34	6050.13	6047.30	3.60	6050.90
SDMH 21	6048.59	6051.40	0.02	0.00	6050.14	6053.23	6053.14	0.86	6054.00
SDMH 27	6051.70	6052.80	0.41	0.00	6053.64	6054.96	6055.49	0.00	6055.49
SDIN 16	6053.54	6053.80	0.02	0.00	6055.48	6055.48	6055.50	0.01	6055.51
SDMH 125	6055.35	6056.78	0.01	0.00	6056.15	6058.21	6058.75	0.01	6058.76
SDMH 124	6056.95	6062.75	0.00	0.00	6058.21	6063.64	6059.24	4.72	6063.95
SDMH 29	6062.92	6065.06	0.00	0.00	6063.64	6065.95	6065.46	0.81	6066.26
SDIN 20	6065.35	6065.87	0.01	0.00	6065.96	6066.52	6066.49	0.26	6066.75
SDMH 121	6063.05	6075.05	0.10	0.00	6063.73	6075.80	6064.77	11.33	6076.10
SDMH 120	6075.21	6087.91	0.00	0.00	6075.81	6088.66	6077.13	11.83	6088.96
SDIN 80	6088.11	6088.83	0.10	0.00	6088.76	6089.58	6089.41	0.47	6089.88
SDIN 14	6053.00	6053.09	0.01	0.00	6055.49	6055.49	6055.49	0.00	6055.49
SDMH 22	6053.50	6055.82	0.17	0.00	6054.36	6057.18	6056.81	1.31	6058.13
SDMH 23	6056.03	6058.47	0.01	0.00	6057.19	6059.77	6059.20	1.15	6060.34
SDMH 24	6058.67	6072.67	0.03	0.00	6059.80	6073.97	6061.84	12.71	6074.54
SDMH 25	6072.87	6084.87	0.01	0.00	6073.99	6086.17	6076.04	10.71	6086.74
SDMH 26	6084.97	6095.82	0.01	0.00	6086.19	6097.12	6088.45	9.25	6097.69
SDMH 119	6096.01	6098.01	0.36	0.00	6097.48	6099.31	6099.18	0.71	6099.88
SDIN 18	6098.30	6099.12	0.03	0.00	6099.88	6099.88	6099.92	0.18	6100.10
SDMH 118	6098.29	6100.69	0.03	0.00	6099.34	6101.93	6101.57	1.04	6102.62
SDMH 117	6100.89	6103.54	0.11	0.00	6102.04	6104.78	6104.17	1.29	6105.47
SDMH 116	6103.73	6108.38	0.11	0.00	6104.89	6109.62	6107.01	3.29	6110.31
SDMH 115	6108.59	6118.21	0.01	0.00	6109.63	6119.12	6110.56	8.94	6119.50
SDIN 81	6118.48	6118.66	0.20	0.00	6119.33	6119.57	6119.82	0.13	6119.95
SDIN 82	6108.58	6108.83	0.23	0.00	6110.36	6110.44	6110.53	0.08	6110.61
SDIN 12	6033.13	6033.57	0.00	0.00	6035.00	6035.73	6035.94	0.00	6035.94
SDMH 126	6033.97	6034.40	0.00	0.00	6035.73	6035.86	6036.23	0.18	6036.41
SDIN 13	6034.60	6034.80	0.00	0.00	6035.87	6037.26	6037.40	0.00	6037.40

SDMH 217	6035.00	6036.25	0.00	0.00	6037.26	6037.76	6038.14	0.19	6038.34
SDMH 216	6037.07	6049.00	0.00	0.00	6037.94	6050.51	6040.53	10.56	6051.09
SDMH 166	6053.69	6060.93	0.07	0.00	6054.45	6062.32	6057.21	5.64	6062.85
SDMH 165	6061.13	6065.30	0.01	0.00	6062.33	6066.69	6064.20	3.02	6067.22
SDMH 164	6065.56	6066.46	0.11	0.00	6066.80	6067.85	6067.67	0.71	6068.38
SDMH 163	6066.56	6068.70	0.11	0.00	6067.96	6070.09	6068.67	1.95	6070.62
SDMH 162	6068.93	6069.75	0.01	0.00	6070.10	6071.14	6071.04	0.63	6071.67
SDMH 161	6071.02	6074.20	0.01	0.00	6071.80	6075.59	6074.31	1.81	6076.12
SDMH 126	6075.37	6079.45	0.01	0.00	6076.13	6080.84	6078.89	2.48	6081.37
SDMH 30	6079.62	6081.96	0.01	0.00	6080.85	6083.82	6084.18	0.00	6084.18
SDMH 122	6082.13	6096.35	0.01	0.00	6083.83	6097.57	6085.86	12.19	6098.04
SDMH 31	6096.52	6098.86	0.00	0.00	6097.57	6099.83	6099.43	0.76	6100.19
SDIN 24	6099.05	6099.57	0.06	0.00	6099.89	6100.54	6100.80	0.10	6100.90
SDMH 114	6096.65	6102.87	0.25	0.00	6097.82	6103.83	6098.32	5.92	6104.24
SDMH 113	6103.07	6108.32	0.01	0.00	6103.84	6109.28	6104.61	5.08	6109.69
SDMH 112	6108.62	6120.87	0.01	0.00	6109.29	6121.83	6110.70	11.54	6122.24
SDMH 111	6121.68	6130.36	0.00	0.00	6122.04	6130.96	6122.95	8.24	6131.18
SDIN 84	6130.56	6130.92	0.04	0.00	6131.06	6131.52	6131.43	0.32	6131.74
SDMH 110	6121.08	6133.15	0.10	0.00	6121.92	6133.90	6122.68	11.51	6134.19
SDIN 83	6133.35	6133.42	0.08	0.00	6133.97	6134.17	6134.44	0.02	6134.46
SDIN 22	6082.25	6082.77	0.01	0.00	6084.17	6084.17	6084.19	0.01	6084.20
SDMH 109	6079.75	6090.25	0.10	0.00	6081.39	6091.00	6081.47	9.83	6091.30
SDMH 108	6090.46	6098.05	0.00	0.00	6091.01	6098.80	6091.97	7.13	6099.10
SDIN 85	6098.25	6098.61	0.10	0.00	6098.90	6099.36	6099.35	0.31	6099.66
SDMH 215	6049.30	6063.88	0.01	0.00	6050.52	6064.75	6051.30	13.79	6065.09
SDIN 106	6064.07	6068.43	0.01	0.00	6064.77	6069.30	6066.14	3.50	6069.64

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)

- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 18	169.00	4.00	6.00	6.67	0.00	3.24	0.00	13.96	8.81	4.65	293.17	Sewer Too Shallow
SDMH 19	143.00	4.00	6.00	6.67	10.58	7.12	2.96	14.20	8.93	4.77	331.18	
SDMH 20	150.00	4.00	6.00	6.67	13.70	8.68	4.52	15.34	9.50	5.34	423.38	
SDMH 21	76.00	4.00	6.00	6.67	14.76	9.22	5.05	15.54	9.60	5.44	227.34	
SDMH 27	44.00	4.00	6.00	6.67	14.94	9.30	5.14	14.16	8.91	4.75	124.34	
SDIN 16	26.00	3.50	6.00	6.08	13.18	8.13	4.55	14.32	8.70	5.12	63.53	
SDMH 125	41.00	4.00	6.00	6.67	9.07	6.37	2.20	10.90	7.28	3.12	73.60	
SDMH 124	129.00	4.00	6.00	6.67	10.57	7.12	2.95	10.20	6.93	2.77	240.34	
SDMH 29	39.00	4.00	6.00	6.67	9.87	6.77	2.60	10.76	7.21	3.05	72.20	
SDIN 20	26.00	3.50	6.00	6.08	10.68	6.88	3.30	9.30	6.19	2.61	42.08	
SDMH 121	300.00	2.50	4.00	4.92	11.10	6.34	4.09	10.04	5.81	3.56	421.52	
SDMH 120	254.00	2.50	4.00	4.92	9.72	5.65	3.40	9.18	5.38	3.13	303.67	
SDIN 80	36.00	2.50	4.00	4.92	8.78	5.18	2.93	6.20	3.89	1.64	32.50	Sewer Too Shallow
SDIN 14	9.00	3.50	6.00	6.08	14.26	8.67	5.09	13.74	8.41	4.83	22.55	
SDMH 22	58.00	2.50	4.00	4.92	12.84	7.21	4.96	13.14	7.36	5.11	111.98	
SDMH 23	61.00	3.00	4.00	5.50	12.22	7.19	4.36	12.62	7.39	4.56	117.70	
SDMH 24	350.00	3.00	4.00	5.50	12.22	7.19	4.36	14.56	8.36	5.53	760.75	
SDMH 25	300.00	3.00	4.00	5.50	14.16	8.16	5.33	16.18	9.17	6.34	792.31	
SDMH 26	226.00	3.00	4.00	5.50	15.98	9.07	6.24	13.22	7.69	4.86	563.08	
SDMH 119	50.00	3.00	4.00	5.50	12.84	7.50	4.67	11.40	6.78	3.95	93.29	
SDIN 18	41.00	3.00	4.00	5.50	10.82	6.49	3.66	8.68	5.42	2.59	57.05	
SDMH 118	48.00	2.50	4.00	4.92	11.34	6.46	4.21	10.24	5.91	3.66	69.54	
SDMH 117	53.00	2.50	4.00	4.92	9.84	5.71	3.46	8.86	5.22	2.97	62.52	
SDMH 116	93.00	2.50	4.00	4.92	8.48	5.03	2.78	6.38	3.98	1.73	82.71	Sewer Too Shallow

SDMH 115	275.00	2.50	4.00	4.92	5.97	3.78	1.53	7.10	4.34	2.09	210.75	Sewer Too Shallow
SDIN 81	18.00	2.50	4.00	4.92	6.56	4.07	1.82	5.84	3.71	1.46	13.05	Sewer Too Shallow
SDIN 82	25.00	2.50	4.00	4.92	5.98	3.78	1.53	5.10	3.34	1.09	16.35	Sewer Too Shallow
SDIN 12	23.00	5.00	6.00	7.83	0.00	3.33	0.00	13.40	9.12	3.78	44.84	Sewer Too Shallow
SDMH 126	43.00	5.00	6.00	7.83	12.60	8.72	3.38	12.48	8.66	3.32	117.19	
SDIN 13	10.00	5.00	6.00	7.83	12.08	8.46	3.12	10.94	7.89	2.55	24.99	
SDMH 217	50.00	4.50	6.00	7.25	11.04	7.65	2.90	8.40	6.33	1.58	97.41	Sewer Too Shallow
SDMH 216	385.00	4.50	6.00	7.25	0.00	5.51	0.76	15.50	9.88	5.13	877.28	Sewer Too Shallow
SDMH 166	181.00	4.00	6.00	6.67	0.00	5.14	0.98	20.16	11.91	7.75	511.89	Sewer Too Shallow
SDMH 165	139.00	4.00	6.00	6.67	19.76	11.71	7.55	23.10	13.38	9.22	714.78	
SDMH 164	90.00	4.00	6.00	6.67	22.58	13.12	8.96	18.98	11.32	7.16	440.32	
SDMH 163	214.00	4.00	6.00	6.67	18.78	11.22	7.06	21.86	12.76	8.60	1007.80	
SDMH 162	82.00	4.00	6.00	6.67	21.40	12.53	8.37	23.36	13.51	9.35	451.88	
SDMH 161	91.00	4.00	6.00	6.67	20.83	12.25	8.08	18.86	11.26	7.10	411.29	
SDMH 126	102.00	4.00	6.00	6.67	16.52	10.09	5.93	14.02	8.84	4.68	309.84	
SDMH 30	39.00	3.50	6.00	6.08	14.18	8.63	5.05	14.60	8.84	5.26	101.70	
SDMH 122	237.00	3.50	6.00	6.08	14.26	8.67	5.09	17.78	10.43	6.85	733.51	
SDMH 31	39.00	3.50	6.00	6.08	17.44	10.26	6.68	17.94	10.51	6.93	139.94	
SDIN 24	26.00	3.50	6.00	6.08	17.56	10.32	6.74	16.18	9.63	6.05	86.57	
SDMH 114	311.00	2.50	4.00	4.92	18.18	9.88	7.63	10.42	6.00	3.75	746.65	
SDMH 113	350.00	2.50	4.00	4.92	10.02	5.80	3.55	8.66	5.12	2.87	413.00	
SDMH 112	350.00	2.50	4.00	4.92	8.06	4.82	2.57	11.30	6.44	4.19	440.97	
SDMH 111	248.00	2.50	4.00	4.92	9.68	5.63	3.38	8.22	4.90	2.65	276.42	
SDIN 84	36.00	2.50	4.00	4.92	7.82	4.70	2.45	6.12	3.85	1.60	29.68	Sewer Too Shallow
SDMH 110	345.00	2.50	4.00	4.92	10.89	6.24	3.99	12.30	6.94	4.69	558.02	
SDIN 83	7.00	2.50	4.00	4.92	11.90	6.74	4.49	11.40	6.49	4.24	11.38	
SDIN 22	26.00	3.50	6.00	6.08	14.02	8.55	4.97	12.64	7.86	4.28	60.83	

SDMH 109	300.00	2.50	4.00	4.92	14.92	8.25	6.00	7.90	4.74	2.49	506.25	
SDMH 108	253.00	2.50	4.00	4.92	7.48	4.53	2.28	8.08	4.83	2.58	235.11	
SDIN 85	36.00	2.50	4.00	4.92	7.68	4.63	2.38	6.06	3.82	1.57	29.20	Sewer Too Shallow
SDMH 215	394.00	3.00	4.00	5.50	16.40	9.28	6.45	13.24	7.70	4.87	1007.42	
SDIN 106	109.00	3.00	4.00	5.50	12.86	7.51	4.68	11.58	6.87	4.04	205.71	

Total earth volume for sewer trenches = 16214 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/31/2017 12:18:04 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6034.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	6035.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

B_1										
SDMH 18	6044.50	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 19	6050.60	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 20	6056.97	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 21	6060.17	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 27	6060.88	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 16	6061.71	23.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 125	6063.23	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 124	6068.85	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 29	6071.44	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 20	6071.27	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 14	6060.71	35.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 12	6041.77	161.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 126	6042.14	155.70	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 13	6041.77	155.70	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 217	6041.70	112.30	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 216	6058.00	112.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 166	6072.01	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 165	6077.85	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 164	6076.95	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 163	6080.63	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 162	6082.43	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 161	6084.63	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 123	6087.46	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 30	6090.01	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDIN 22	6089.84	34.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 122	6105.99	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 31	6105.99	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 34	6108.41	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 215	6071.00	43.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 106	6074.72	42.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond B_1	0.00	0.00	0.00	0.00	0.00	20.64	11.91	0.23	245.80	
SDMH 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDIN 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.20	
SDMH 125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDMH 124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDMH 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDIN 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDIN 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.70	
SDIN 12	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	161.00	Surface Water Present (Downstream)
SDMH 126	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	155.70	
SDIN 13	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	155.70	
SDMH 217	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	112.30	
SDMH 216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	112.30	
SDMH 166	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 165	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 163	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 162	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 161	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	

SDMH 123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDIN 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.80	
SDMH 122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	
SDMH 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	
SDIN 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	
SDMH 215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.60	
SDIN 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.40	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 18	169.00	6033.14	2.0	6036.52	0.013	0.29	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 19	143.00	6038.21	3.0	6042.50	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 20	150.00	6042.75	3.7	6048.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 21	76.00	6048.59	3.7	6051.40	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 27	44.00	6051.70	2.5	6052.80	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 16	26.00	6053.54	1.0	6053.80	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 125	41.00	6055.35	3.5	6056.78	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 124	129.00	6056.95	4.5	6062.75	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 29	39.00	6062.92	5.5	6065.06	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 20	26.00	6065.35	2.0	6065.87	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 14	9.00	6053.00	1.0	6053.09	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 12	23.00	6033.13	1.9	6033.57	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 126	43.00	6033.97	1.0	6034.40	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
SDIN 13	10.00	6034.60	2.0	6034.80	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 217	50.00	6035.00	2.5	6036.25	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 216	385.00	6037.07	3.1	6049.00	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 166	181.00	6053.69	4.0	6060.93	0.013	0.63	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 165	139.00	6061.13	3.0	6065.30	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 164	90.00	6065.56	1.0	6066.46	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 163	214.00	6066.56	1.0	6068.70	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 162	82.00	6068.93	1.0	6069.75	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 161	91.00	6071.02	3.5	6074.20	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 123	102.00	6075.37	4.0	6079.45	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 30	39.00	6080.44	4.0	6082.00	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 22	26.00	6082.25	2.0	6082.77	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 122	237.00	6084.51	5.0	6096.36	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 31	39.00	6096.91	5.0	6098.86	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 34	26.00	6099.05	2.0	6099.57	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 215	394.00	6049.30	3.7	6063.88	0.013	0.12	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 106	109.00	6064.07	4.0	6068.43	0.013	0.24	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 18	94.58	13.38	33.73	12.32	26.62	15.14	1.83	Supercritical	84.80	0.00	
SDMH 19	115.84	16.39	33.73	12.32	22.88	17.90	2.46	Supercritical	84.80	0.00	
SDMH 20	128.64	18.20	33.73	12.32	21.33	19.44	2.82	Supercritical	84.80	0.00	Velocity is Too High
SDMH 21	128.64	18.20	33.73	12.32	21.33	19.44	2.82	Supercritical	84.80	0.00	Velocity is Too High
SDMH 27	105.74	14.96	33.73	12.32	24.40	16.63	2.17	Pressurized	84.80	44.00	
SDIN 16	41.13	8.38	19.67	6.80	16.12	8.63	1.46	Pressurized	23.20	26.00	
SDMH 125	76.94	15.67	22.07	7.52	12.79	14.58	2.86	Supercritical	29.10	0.00	
SDMH 124	87.24	17.77	22.07	7.52	11.93	15.99	3.27	Supercritical	29.10	0.00	
SDMH 29	96.45	19.65	22.07	7.52	11.30	17.20	3.63	Supercritical	29.10	0.00	
SDIN 20	58.16	11.85	22.07	7.52	15.01	11.85	2.11	Pressurized	29.10	26.00	
SDIN 14	41.13	8.38	24.33	8.37	21.60	9.43	1.28	Pressurized	35.70	9.00	
SDIN 12	198.53	15.80	44.08	13.33	32.80	17.60	1.98	Supercritical	161.00	0.00	
SDMH 126	144.03	11.46	48.00	12.39	48.00	12.39	0.00	Pressurized	155.70	43.00	
SDIN 13	203.69	16.21	43.65	12.97	31.43	17.86	2.08	Pressurized	155.70	10.00	
SDMH 217	159.51	16.58	38.28	12.20	25.99	17.96	2.33	Pressurized	112.30	50.00	
SDMH 216	177.62	18.46	38.28	12.20	24.23	19.53	2.67	Supercritical	112.30	0.00	Velocity is Too High
SDMH 166	133.76	18.92	32.81	11.30	19.50	19.55	3.01	Supercritical	76.40	0.00	Velocity is Too High
SDMH 165	115.84	16.39	32.81	11.30	21.34	17.50	2.53	Supercritical	76.40	0.00	
SDMH 164	66.88	9.46	36.00	10.81	36.00	10.81	0.00	Pressurized	76.40	90.00	
SDMH 163	66.88	9.46	36.00	10.81	36.00	10.81	0.00	Pressurized	76.40	214.00	
SDMH 162	66.88	9.46	36.00	10.81	36.00	10.81	0.00	Pressurized	76.40	82.00	

SDMH 161	125.12	17.70	32.81	11.30	20.32	18.58	2.78	Pressurized	76.40	91.00	Velocity is Too High
SDMH 123	133.76	18.92	32.81	11.30	19.50	19.55	3.01	Supercritical Jump	76.40	6.54	Velocity is Too High
SDMH 30	133.76	18.92	32.81	11.30	19.50	19.55	3.01	Supercritical Jump	76.40	26.98	Velocity is Too High
SDIN 22	58.16	11.85	24.04	8.25	16.72	12.38	2.05	Pressurized	34.80	26.00	
SDMH 122	50.72	16.15	23.72	15.31	18.61	18.37	2.59	Supercritical	48.00	0.00	Velocity is Too High
SDMH 31	50.72	16.15	23.72	15.31	18.61	18.37	2.59	Supercritical	48.00	0.00	Velocity is Too High
SDIN 34	32.08	10.21	24.00	15.28	24.00	15.28	0.00	Pressurized	48.00	26.00	
SDMH 215	43.63	13.89	23.59	13.93	19.65	15.83	2.09	Pressurized	43.60	394.00	
SDIN 106	45.37	14.44	23.54	13.56	18.39	16.41	2.34	Pressurized	42.40	109.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 18	84.80	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 19	84.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 20	84.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 21	84.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 27	84.80	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDIN 16	23.20	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDMH 125	29.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDMH 124	29.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDMH 29	29.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDIN 20	29.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
SDIN 14	35.70	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	

SDIN 12	161.00	CIRCULAR	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	12.57	
SDMH 126	155.70	CIRCULAR	48.00 in	48.00 in	54.00 in	54.00 in	48.00 in	48.00 in	12.57	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 13	155.70	CIRCULAR	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	12.57	
SDMH 217	112.30	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
SDMH 216	112.30	CIRCULAR	42.00 in	42.00 in	36.00 in	36.00 in	42.00 in	42.00 in	9.62	
SDMH 166	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 165	76.40	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 164	76.40	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 163	76.40	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 162	76.40	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 161	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 123	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 30	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDIN 22	34.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDMH 122	48.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 31	48.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

SDIN 34	48.00	CIRCULAR	24.00 in	24.00 in	30.00 in	30.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 215	43.60	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.
SDIN 106	42.40	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6034.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 18	6033.14	6036.52	0.00	0.00	6035.36	6039.33	6038.91	2.77	6041.69
SDMH 19	6038.21	6042.50	0.11	0.00	6040.12	6045.31	6045.09	2.58	6047.67
SDMH 20	6042.75	6048.30	0.11	0.00	6045.42	6051.11	6050.39	3.07	6053.47
SDMH 21	6048.59	6051.40	0.11	0.00	6051.22	6054.21	6056.23	0.34	6056.57
SDMH 27	6051.70	6052.80	2.23	0.00	6056.57	6057.28	6058.80	0.71	6059.51
SDIN 16	6053.54	6053.80	0.35	0.00	6059.51	6059.59	6059.86	0.08	6059.94
SDMH 125	6055.35	6056.78	0.03	0.00	6057.30	6059.14	6059.71	0.00	6059.71
SDMH 124	6056.95	6062.75	0.03	0.00	6059.17	6064.59	6061.91	3.56	6065.47
SDMH 29	6062.92	6065.06	0.03	0.00	6064.62	6067.91	6068.45	0.00	6068.45
SDIN 20	6065.35	6065.87	0.55	0.00	6068.45	6068.58	6069.00	0.13	6069.13
SDIN 14	6053.00	6053.09	0.82	0.00	6059.51	6059.58	6060.33	0.07	6060.40
SDIN 12	6033.13	6033.57	0.00	0.00	6035.87	6038.12	6040.67	0.00	6040.67
SDMH 126	6033.97	6034.40	0.12	0.00	6038.41	6038.91	6040.79	0.50	6041.30
SDIN 13	6034.60	6034.80	0.12	0.00	6039.03	6039.15	6041.41	0.12	6041.53
SDMH 217	6035.00	6036.25	0.11	0.00	6039.52	6040.14	6041.64	0.62	6042.26

SDMH 216	6037.07	6049.00	0.11	0.00	6040.25	6052.19	6045.01	9.49	6054.50
SDMH 166	6053.69	6060.93	1.14	0.00	6055.31	6063.66	6061.25	4.40	6065.65
SDMH 165	6061.13	6065.30	0.15	0.00	6063.81	6068.03	6067.67	2.35	6070.02
SDMH 164	6065.56	6066.46	1.81	0.00	6070.02	6071.19	6071.83	1.17	6073.01
SDMH 163	6066.56	6068.70	1.81	0.00	6073.01	6075.80	6074.82	2.79	6077.61
SDMH 162	6068.93	6069.75	0.16	0.00	6075.96	6077.03	6077.78	1.07	6078.85
SDMH 161	6071.02	6074.20	0.16	0.00	6077.20	6078.38	6079.01	1.19	6080.20
SDMH 123	6075.37	6079.45	0.16	0.00	6078.55	6082.18	6080.36	3.81	6084.17
SDMH 30	6080.44	6082.00	1.81	0.00	6084.17	6084.73	6085.98	0.74	6086.72
SDIN 22	6082.25	6082.77	0.78	0.00	6086.72	6086.90	6087.50	0.19	6087.68
SDMH 122	6084.51	6096.36	0.18	0.00	6086.06	6098.34	6091.30	10.68	6101.98
SDMH 31	6096.91	6098.86	0.18	0.00	6098.52	6100.84	6103.70	0.78	6104.48
SDIN 34	6099.05	6099.57	3.62	0.00	6104.48	6105.64	6108.10	1.16	6109.27
SDMH 215	6049.30	6063.88	0.36	0.00	6052.55	6067.11	6055.54	14.56	6070.10
SDIN 106	6064.07	6068.43	0.68	0.00	6067.95	6071.76	6070.78	3.81	6074.58

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 18	169.00	4.00	6.00	6.67	0.00	3.24	0.00	13.96	8.81	4.65	293.17	Sewer Too Shallow
SDMH 19	143.00	4.00	6.00	6.67	10.58	7.12	2.96	14.20	8.93	4.77	331.18	
SDMH 20	150.00	4.00	6.00	6.67	13.70	8.68	4.52	15.34	9.50	5.34	423.38	
SDMH 21	76.00	4.00	6.00	6.67	14.76	9.22	5.05	15.54	9.60	5.44	227.34	
SDMH 27	44.00	4.00	6.00	6.67	14.94	9.30	5.14	14.16	8.91	4.75	124.34	
SDIN 16	26.00	3.50	6.00	6.08	13.18	8.13	4.55	14.32	8.70	5.12	63.53	

SDMH 125	41.00	3.50	6.00	6.08	9.57	6.33	2.74	11.40	7.24	3.66	70.34	
SDMH 124	129.00	3.50	6.00	6.08	11.07	7.08	3.49	10.70	6.89	3.31	230.57	
SDMH 29	39.00	3.50	6.00	6.08	10.37	6.73	3.14	11.26	7.17	3.59	69.22	
SDIN 20	26.00	3.50	6.00	6.08	10.68	6.88	3.30	9.30	6.19	2.61	42.08	
SDIN 14	9.00	3.50	6.00	6.08	14.26	8.67	5.09	13.74	8.41	4.83	22.55	
SDIN 12	23.00	5.00	6.00	7.83	0.00	3.33	0.00	13.40	9.12	3.78	44.84	Sewer Too Shallow
SDMH 126	43.00	5.00	6.00	7.83	12.60	8.72	3.38	12.48	8.66	3.32	117.19	
SDIN 13	10.00	5.00	6.00	7.83	12.08	8.46	3.12	10.94	7.89	2.55	24.99	
SDMH 217	50.00	4.50	6.00	7.25	11.04	7.65	2.90	8.40	6.33	1.58	97.41	Sewer Too Shallow
SDMH 216	385.00	4.50	6.00	7.25	0.00	5.51	0.76	15.50	9.88	5.13	877.28	Sewer Too Shallow
SDMH 166	181.00	4.00	6.00	6.67	0.00	5.14	0.98	20.16	11.91	7.75	511.89	Sewer Too Shallow
SDMH 165	139.00	4.00	6.00	6.67	19.76	11.71	7.55	23.10	13.38	9.22	714.78	
SDMH 164	90.00	4.00	6.00	6.67	22.58	13.12	8.96	18.98	11.32	7.16	440.32	
SDMH 163	214.00	4.00	6.00	6.67	18.78	11.22	7.06	21.86	12.76	8.60	1007.80	
SDMH 162	82.00	4.00	6.00	6.67	21.40	12.53	8.37	23.36	13.51	9.35	451.88	
SDMH 161	91.00	4.00	6.00	6.67	20.83	12.25	8.08	18.86	11.26	7.10	411.29	
SDMH 123	102.00	4.00	6.00	6.67	16.52	10.09	5.93	14.02	8.84	4.68	309.84	
SDMH 30	39.00	4.00	6.00	6.67	12.04	7.85	3.69	14.02	8.84	4.68	95.37	
SDIN 22	26.00	3.50	6.00	6.08	14.02	8.55	4.97	12.64	7.86	4.28	60.83	
SDMH 122	237.00	3.00	4.00	5.50	10.00	6.08	3.25	18.26	10.21	7.38	594.25	
SDMH 31	39.00	3.00	4.00	5.50	17.16	9.66	6.83	13.26	7.71	4.88	104.44	
SDIN 34	26.00	3.00	4.00	5.50	12.88	7.52	4.69	16.68	9.42	6.59	66.48	
SDMH 215	394.00	3.00	4.00	5.50	16.40	9.28	6.45	13.24	7.70	4.87	1007.42	
SDIN 106	109.00	3.00	4.00	5.50	12.86	7.51	4.68	11.58	6.87	4.04	205.71	

Total earth volume for sewer trenches = 9042 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.

- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/24/2017 3:55:33 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond A Outfall **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5987.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond A Outall	5996.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Outlet Pipe 1	5997.87	177.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond A Outall	0.00	0.00	0.00	0.00	0.00	14.86	11.91	0.24	177.00	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	156.00	5986.68	1.7	5989.33	0.013	0.03	0.00	BOX	4.00 ft	4.00 ft

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	239.10	14.94	47.19	11.25	32.39	16.39	1.76	Supercritical	177.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Outlet Pipe 1	177.00	BOX	4.00 ft	4.00 ft	5.00 ft	5.00 ft	4.00 ft	4.00 ft	16.00	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5987.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Outlet Pipe 1	5986.68	5989.33	0.00	0.00	5989.38	5993.26	5993.55	1.68	5995.23

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
Outlet Pipe 1	156.00	5.00	6.00	7.83	15.64	10.24	4.91	14.08	9.46	4.12	517.94	

Total earth volume for sewer trenches = 518 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

POND B

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/17/2017 11:21:33 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond D_1 **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6096.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond B Outfall	6097.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(BAsin D-1)										
SDMH 159	6109.07	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 96	6126.88	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 39	6127.17	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 38	6127.62	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 37	6128.41	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 36	6129.15	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 35	6129.80	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 99	6130.33	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 34	6130.48	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 33	6129.43	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 32	6122.51	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 28	6123.80	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 98	6128.49	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 27	6145.65	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 97	6145.47	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 30	6126.90	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond B Outfall (BAsin D-1)	0.00	0.00	0.00	0.00	0.00	2.94	4.32	0.62	12.69	
SDMH 159	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.69	Surface Water Present (Downstream)
SDIN 96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.69	
SDMH 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.69	

SDMH 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDIN 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDMH 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 159	67.00	6097.00	3.8	6099.55	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 96	181.00	6100.82	4.0	6108.06	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 39	26.00	6108.25	3.0	6109.03	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 38	62.00	6109.20	4.0	6111.68	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 37	74.00	6111.72	2.6	6113.64	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 36	73.00	6113.82	0.5	6114.18	0.013	0.08	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 35	65.00	6114.38	0.5	6114.70	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 99	54.00	6115.40	0.5	6115.67	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 34	26.00	6115.83	0.8	6116.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 33	61.00	6116.16	0.8	6116.65	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 32	211.00	6116.77	0.8	6118.46	0.013	0.08	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 28	34.00	6118.70	1.3	6119.14	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 98	103.00	6109.25	5.1	6114.50	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 27	303.00	6114.67	6.3	6133.76	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 97	10.00	6133.95	2.0	6134.15	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 30	8.00	6109.23	1.0	6109.31	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length**	**Comment**

										(ft)	
SDMH 159	130.37	18.44	13.58	5.20	7.59	11.70	3.10	Supercritical	12.69	0.00	
SDIN 96	133.76	18.92	13.58	5.20	7.49	11.92	3.18	Supercritical	12.69	0.00	
SDMH 39	115.84	16.39	13.58	5.20	8.05	10.76	2.76	Supercritical	12.69	0.00	
SDMH 38	133.76	18.92	5.87	3.30	3.40	7.32	2.94	Supercritical	2.48	0.00	
SDMH 37	36.58	11.64	6.58	3.55	4.23	6.64	2.36	Supercritical	2.48	0.00	
SDMH 36	16.04	5.11	6.58	3.55	6.38	3.70	1.06	Supercritical	2.48	0.00	
SDMH 35	7.45	4.21	7.15	3.79	7.15	3.79	1.00	Supercritical	2.48	0.00	
SDMH 99	7.45	4.21	7.15	3.79	7.15	3.79	1.00	Supercritical	2.48	0.00	
SDMH 34	9.42	5.33	7.15	3.79	6.30	4.50	1.28	Supercritical	2.48	0.00	
SDMH 33	9.42	5.33	7.15	3.79	6.30	4.50	1.28	Supercritical	2.48	0.00	
SDMH 32	9.42	5.33	7.15	3.79	6.30	4.50	1.28	Supercritical	2.48	0.00	
SDIN 28	12.01	6.80	7.15	3.79	5.55	5.35	1.63	Supercritical	2.48	0.00	
SDMH 98	23.79	13.46	10.93	4.97	5.93	10.99	3.23	Supercritical	5.58	0.00	
SDMH 27	26.44	14.96	10.93	4.97	5.61	11.86	3.59	Supercritical	5.58	0.00	
SDIN 97	14.90	8.43	10.93	4.97	7.63	7.82	1.99	Supercritical	5.58	0.00	
SDIN 30	22.68	7.22	10.03	4.50	8.12	5.98	1.50	Supercritical	5.60	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 159	12.69	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 96	12.69	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 39	12.69	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 38	2.48	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 37	2.48	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 36	2.48	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 35	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 99	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 34	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 33	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 32	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 28	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 98	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 27	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 97	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

SDIN 30	5.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6096.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 159	6097.00	6099.55	0.00	0.00	6097.64	6100.68	6099.76	1.34	6101.10
SDIN 96	6100.82	6108.06	0.04	0.00	6101.44	6109.19	6103.65	5.96	6109.61
SDMH 39	6108.25	6109.03	0.00	0.00	6109.19	6110.51	6110.72	0.00	6110.72
SDMH 38	6109.20	6111.68	0.00	0.00	6110.71	6112.17	6110.72	1.62	6112.34
SDMH 37	6111.72	6113.64	0.00	0.00	6112.17	6114.19	6112.75	1.63	6114.38
SDMH 36	6113.82	6114.18	0.00	0.00	6114.35	6114.73	6114.56	0.36	6114.92
SDMH 35	6114.38	6114.70	0.00	0.00	6114.97	6115.30	6115.19	0.32	6115.52
SDMH 99	6115.40	6115.67	0.00	0.00	6116.00	6116.27	6116.22	0.27	6116.49
SDMH 34	6115.83	6116.04	0.00	0.00	6116.36	6116.64	6116.67	0.19	6116.86
SDMH 33	6116.16	6116.65	0.00	0.00	6116.69	6117.25	6117.00	0.47	6117.47
SDMH 32	6116.77	6118.46	0.00	0.00	6117.30	6119.06	6117.61	1.67	6119.28
SDIN 28	6118.70	6119.14	0.04	0.00	6119.16	6119.74	6119.61	0.35	6119.96
SDMH 98	6109.25	6114.50	0.02	0.00	6110.53	6115.41	6111.62	4.18	6115.79
SDMH 27	6114.67	6133.76	0.02	0.00	6115.43	6134.67	6117.32	17.73	6135.05
SDIN 97	6133.95	6134.15	0.20	0.00	6134.88	6135.31	6135.54	0.00	6135.54
SDIN 30	6109.23	6109.31	0.00	0.00	6110.63	6110.63	6110.72	0.01	6110.73

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				

Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 159	67.00	4.00	6.00	6.67	0.00	0.83	0.00	17.04	10.35	6.19	125.88	Sewer Too Shallow
SDIN 96	181.00	4.00	6.00	6.67	14.50	9.08	4.92	35.64	19.65	15.49	1396.99	
SDMH 39	26.00	4.00	6.00	6.67	35.26	19.46	15.30	34.28	18.97	14.81	313.57	
SDMH 38	62.00	4.00	6.00	6.67	33.94	18.80	14.64	29.88	16.77	12.61	640.50	
SDMH 37	74.00	3.00	4.00	5.50	30.81	16.49	13.65	28.54	15.35	12.52	641.28	
SDMH 36	73.00	3.00	4.00	5.50	28.19	15.18	12.35	28.94	15.55	12.72	588.18	
SDMH 35	65.00	2.50	4.00	4.92	29.05	15.32	13.07	29.70	15.64	13.39	543.32	
SDMH 99	54.00	2.50	4.00	4.92	28.30	14.94	12.69	28.82	15.20	12.95	427.74	
SDMH 34	26.00	2.50	4.00	4.92	28.50	15.04	12.79	28.38	14.98	12.73	204.26	
SDMH 33	61.00	2.50	4.00	4.92	28.14	14.86	12.61	25.06	13.32	11.07	423.36	
SDMH 32	211.00	2.50	4.00	4.92	24.82	13.20	10.95	7.60	4.59	2.34	735.65	
SDIN 28	34.00	2.50	4.00	4.92	7.12	4.35	2.10	8.82	5.20	2.95	32.75	
SDMH 98	103.00	2.50	4.00	4.92	35.35	18.46	16.21	27.48	14.53	12.28	993.75	
SDMH 27	303.00	2.50	4.00	4.92	27.14	14.36	12.11	23.28	12.43	10.18	1904.85	
SDIN 97	10.00	2.50	4.00	4.92	22.90	12.24	9.99	22.14	11.86	9.61	50.65	
SDIN 30	8.00	3.00	4.00	5.50	34.88	18.52	15.69	34.18	18.17	15.34	92.34	

Total earth volume for sewer trenches = 9115 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/15/2017 7:44:52 PM	# UDSewer Results Summary **Project Title:** Trails at Crowfoot Pond D_1 **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6097.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond B Outfall	6097.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(Basin D-1)										
SDMH 159	6109.07	80.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 96	6126.88	80.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 39	6127.17	56.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 38	6127.62	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 37	6128.41	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 36	6129.15	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 35	6129.80	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 99	6130.33	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 34	6130.48	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 33	6129.43	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 32	6122.51	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 28	6123.80	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 30	6126.90	45.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond B Outfall (Basin D-1)	0.00	0.00	0.00	0.00	0.00	6.72	12.04	0.10	80.90	
SDMH 159	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.90	Surface Water Present (Downstream)
SDIN 96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.90	
SDMH 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.80	
SDMH 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	

SDMH 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDIN 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDIN 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 159	67.00	6097.00	3.8	6099.55	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 96	181.00	6100.82	4.0	6108.06	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 39	26.00	6108.25	3.0	6109.03	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 38	62.00	6109.20	4.0	6111.68	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 37	74.00	6111.72	2.6	6113.64	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 36	73.00	6113.82	0.5	6114.18	0.013	0.08	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 35	65.00	6114.38	0.5	6114.70	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 99	54.00	6115.40	0.5	6115.67	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 34	26.00	6115.83	0.8	6116.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 33	61.00	6116.16	0.8	6116.65	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 32	211.00	6116.77	0.8	6118.46	0.013	0.08	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 28	34.00	6118.70	1.3	6119.14	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 30	8.00	6109.23	1.0	6109.31	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 159	130.37	18.44	33.34	11.84	20.53	19.43	2.89	Supercritical	80.90	0.00	Velocity is Too High
SDIN 96	133.76	18.92	33.34	11.84	20.20	19.82	2.98	Supercritical	80.90	0.00	Velocity is Too High
SDMH 39	115.84	16.39	29.30	9.22	17.80	16.31	2.67	Supercritical	56.80	0.00	
SDMH 38	133.76	18.92	13.08	5.09	7.23	11.66	3.17	Supercritical Jump	11.80	42.23	
SDMH 37	36.58	11.64	14.80	5.80	9.37	10.38	2.40	Supercritical Jump	11.80	7.35	
SDMH 36	16.04	5.11	14.80	5.80	15.30	5.58	0.94	Subcritical	11.80	0.00	
SDMH 35	7.45	4.21	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	65.00	

SDMH 99	7.45	4.21	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	54.00	
SDMH 34	9.42	5.33	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	26.00	
SDMH 33	9.42	5.33	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	61.00	
SDMH 32	9.42	5.33	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	211.00	
SDIN 28	12.01	6.80	15.67	7.23	14.48	7.75	1.21	Pressurized	11.80	34.00	
SDIN 30	22.68	7.22	24.00	14.55	24.00	14.55	0.00	Pressurized	45.70	8.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 159	80.90	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 96	80.90	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 39	56.80	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 38	11.80	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 37	11.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 36	11.80	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 35	11.80	CIRCULAR	18.00 in	18.00 in	24.00 in	24.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 99	11.80	CIRCULAR	18.00 in	18.00 in	24.00 in	24.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 34	11.80	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 33	11.80	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

SDMH 32	11.80	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 28	11.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 30	45.70	CIRCULAR	24.00 in	24.00 in	33.00 in	33.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6097.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 159	6097.00	6099.55	0.00	0.00	6098.97	6102.33	6103.18	1.32	6104.50
SDIN 96	6100.82	6108.06	1.48	0.00	6103.81	6110.84	6108.60	4.41	6113.01
SDMH 39	6108.25	6109.03	0.05	0.00	6110.89	6112.86	6113.86	0.00	6113.86
SDMH 38	6109.20	6111.68	0.06	0.00	6113.88	6113.88	6113.92	0.03	6113.95
SDMH 37	6111.72	6113.64	0.01	0.00	6113.89	6114.87	6114.11	1.29	6115.40
SDMH 36	6113.82	6114.18	0.02	0.00	6115.05	6115.48	6115.57	0.37	6115.94
SDMH 35	6114.38	6114.70	0.03	0.00	6115.88	6116.69	6116.57	0.82	6117.38
SDMH 99	6115.40	6115.67	0.03	0.00	6116.90	6117.58	6117.59	0.68	6118.27
SDMH 34	6115.83	6116.04	0.03	0.00	6117.61	6117.94	6118.30	0.33	6118.63
SDMH 33	6116.16	6116.65	0.03	0.00	6117.97	6118.74	6118.67	0.77	6119.43
SDMH 32	6116.77	6118.46	0.06	0.00	6118.79	6121.44	6119.49	2.65	6122.14
SDIN 28	6118.70	6119.14	0.91	0.00	6122.36	6122.78	6123.05	0.43	6123.48
SDIN 30	6109.23	6109.31	0.16	0.00	6113.02	6113.02	6114.52	1.79	6116.31

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 159	67.00	4.00	6.00	6.67	0.00	0.83	0.00	17.04	10.35	6.19	125.88	Sewer Too Shallow
SDIN 96	181.00	4.00	6.00	6.67	14.50	9.08	4.92	35.64	19.65	15.49	1396.99	
SDMH 39	26.00	4.00	6.00	6.67	35.26	19.46	15.30	34.28	18.97	14.81	313.57	
SDMH 38	62.00	4.00	6.00	6.67	33.94	18.80	14.64	29.88	16.77	12.61	640.50	
SDMH 37	74.00	3.00	4.00	5.50	30.81	16.49	13.65	28.54	15.35	12.52	641.28	
SDMH 36	73.00	3.00	4.00	5.50	28.19	15.18	12.35	28.94	15.55	12.72	588.18	
SDMH 35	65.00	2.50	4.00	4.92	29.05	15.32	13.07	29.70	15.64	13.39	543.32	
SDMH 99	54.00	2.50	4.00	4.92	28.30	14.94	12.69	28.82	15.20	12.95	427.74	
SDMH 34	26.00	2.50	4.00	4.92	28.50	15.04	12.79	28.38	14.98	12.73	204.26	
SDMH 33	61.00	2.50	4.00	4.92	28.14	14.86	12.61	25.06	13.32	11.07	423.36	
SDMH 32	211.00	2.50	4.00	4.92	24.82	13.20	10.95	7.60	4.59	2.34	735.65	
SDIN 28	34.00	2.50	4.00	4.92	7.12	4.35	2.10	8.82	5.20	2.95	32.75	
SDIN 30	8.00	3.00	4.00	5.50	34.88	18.52	15.69	34.18	18.17	15.34	92.34	

Total earth volume for sewer trenches = 6166 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 4/17/2017 11:23:24 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond B (Basin D-2)_100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6097.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	6090.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

D_2										
SDIN 98	6096.03	5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond D_2	0.00	0.00	0.00	0.00	0.00	0.45	11.49	0.71	5.20	Surface Water Present (Upstream)
SDIN 98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 98	71.00	6090.00	2.0	6091.42	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 98	32.08	10.21	9.65	4.40	6.53	7.51	2.12	Pressurized	5.20	71.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDIN 98	5.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6097.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDIN 98	6090.00	6091.42	0.00	0.00	6097.00	6097.04	6097.04	0.04	6097.08

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDIN 98	71.00	3.00	4.00	5.50	0.00	0.92	0.00	8.22	5.19	2.36	46.66	Sewer Too Shallow

Total earth volume for sewer trenches = 47 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/30/2017 5:49:11 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond B Outfall **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6088.34

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond B Outfall	6090.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Outlet Pipe 1	6091.79	30.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond B Outfall	0.00	0.00	0.00	0.00	0.00	2.56	11.92	0.22	30.56	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.56	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	82.00	6086.67	0.5	6087.08	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	29.08	5.92	30.00	6.23	30.00	6.23	0.00	Pressurized	30.56	82.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Outlet Pipe 1	30.56	CIRCULAR	30.00 in	30.00 in	33.00 in	33.00 in	30.00 in	30.00 in	4.91	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.

										Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6088.34

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Outlet Pipe 1	6086.67	6087.08	0.00	0.00	6089.17	6089.62	6089.77	0.45	6090.22

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
Outlet Pipe 1	82.00	3.50	6.00	6.08	6.74	4.91	1.33	7.92	5.50	1.92	97.64	Sewer Too Shallow

Total earth volume for sewer trenches = 98 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

POND C

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 11/1/2017 11:25:52 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C(Basin E) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5977.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E_1										
SDMH 51	5985.25	40.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 52	5987.60	35.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 53	5988.26	35.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 54	5993.21	32.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 55	6002.90	32.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 56	6008.45	32.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 43	6008.29	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 57	6008.48	28.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 86	6008.34	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 58	6016.70	28.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 160	6018.22	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 87	6018.05	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 59	6016.97	28.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 44	6016.80	3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 60	6028.21	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 45	6028.03	4.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 62	6034.14	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 63	6039.11	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 152	6047.43	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 64	6051.09	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 65	6049.38	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 89	6048.72	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 151	6048.08	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 66	6047.43	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 150	6046.71	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 67	6046.02	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 68	6045.80	15.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 144	6046.43	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 145	6048.27	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 105	6048.13	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 146	6049.85	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 147	6053.06	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 148	6055.17	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 149	6056.83	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 67	6056.65	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 47	6045.63	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 46	6045.63	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 90	6028.63	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 104	6028.45	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 42	5988.16	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 40	5985.07	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	9.19	4.36	0.48	40.10	Surface Water Present (Upstream)
SDMH 51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.10	Surface Water Present (Downstream)
SDMH 52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.30	
SDMH 53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.30	
SDMH 54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.80	

SDMH 55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.80	
SDMH 56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.80	
SDIN 43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	
SDMH 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.30	
SDIN 86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60	
SDMH 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.30	
SDMH 160	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	
SDIN 87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	
SDMH 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.30	
SDIN 44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60	
SDMH 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.00	
SDIN 45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.80	
SDMH 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 152	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	
SDMH 144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.70	
SDMH 145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.70	
SDIN 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDMH 146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
SDMH 147	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
SDMH 148	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
SDMH 149	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
SDIN 67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	
SDIN 47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	
SDIN 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	
SDMH 90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDIN 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDIN 42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.90	
SDIN 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length**	**Downstream Invert**	**Slope (%)**	**Upstream Invert**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**

	(ft)	(ft)		(ft)						
SDMH 51	92.00	5975.95	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 52	237.00	5977.07	2.0	5981.81	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 53	38.00	5982.01	2.5	5982.96	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 54	146.00	5983.14	3.5	5988.25	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 55	281.00	5988.47	3.5	5998.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 56	169.00	5998.49	2.5	6002.71	0.013	0.23	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 43	9.00	6003.01	2.6	6003.24	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 57	38.00	6002.91	2.0	6003.67	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 86	7.00	6003.87	1.0	6003.94	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 58	263.00	6003.86	2.0	6009.12	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 160	36.00	6009.29	5.0	6011.09	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 87	8.00	6011.28	3.0	6011.52	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 59	38.00	6009.31	5.0	6011.21	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 44	9.00	6011.39	3.0	6011.66	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 60	298.00	6011.34	3.7	6022.37	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 45	9.00	6022.66	2.1	6022.85	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 62	258.00	6022.45	2.3	6028.38	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 63	99.00	6028.53	2.5	6031.00	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 152	139.00	6031.10	1.6	6033.32	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 64	63.00	6033.47	1.0	6034.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 65	81.00	6034.29	1.0	6035.10	0.013	1.19	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 89	51.00	6035.29	1.0	6035.80	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 151	50.00	6035.90	1.0	6036.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 66	51.00	6036.59	1.0	6037.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 150	56.00	6037.24	1.0	6037.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 67	55.00	6037.95	1.0	6038.50	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 68	40.00	6038.60	1.0	6039.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 144	74.00	6041.69	1.5	6042.80	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 145	72.00	6043.00	1.5	6044.08	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 105	8.00	6044.28	1.0	6044.36	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 146	43.00	6044.28	3.5	6045.78	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 147	84.00	6045.97	3.5	6048.91	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 148	56.00	6049.10	3.5	6051.06	0.013	0.15	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 149	42.00	6051.24	3.5	6052.71	0.013	0.15	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 67	9.00	6052.91	1.0	6053.00	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 47	9.00	6039.16	0.5	6039.20	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 46	26.00	6039.17	0.5	6039.30	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 90	97.00	6022.67	1.0	6023.64	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 104	9.00	6023.84	1.0	6023.93	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 42	9.00	5983.41	1.0	5983.50	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 40	9.00	5977.17	1.6	5977.31	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 51	144.03	11.46	22.68	6.86	17.32	9.82	1.68	Supercritical	40.10	0.00	
SDMH 52	94.58	13.38	23.17	7.34	15.23	12.41	2.23	Supercritical	35.30	0.00	
SDMH 53	105.74	14.96	23.17	7.34	14.33	13.46	2.51	Supercritical	35.30	0.00	
SDMH 54	125.12	17.70	22.30	7.13	12.58	14.91	3.00	Supercritical	32.80	0.00	
SDMH 55	125.12	17.70	22.30	7.13	12.58	14.91	3.00	Supercritical	32.80	0.00	
SDMH 56	105.74	14.96	22.30	7.13	13.77	13.20	2.52	Supercritical	32.80	0.00	
SDIN 43	16.98	9.61	8.04	4.06	5.21	7.31	2.31	Pressurized	3.10	9.00	
SDMH 57	94.58	13.38	20.65	6.75	13.50	11.69	2.26	Supercritical	28.30	0.00	
SDIN 86	10.53	5.96	7.33	3.84	6.09	4.94	1.43	Pressurized	2.60	7.00	
SDMH 58	94.58	13.38	20.65	6.75	13.50	11.69	2.26	Supercritical	28.30	0.00	
SDMH 160	23.55	13.33	8.04	4.06	4.41	9.23	3.19	Supercritical Jump	3.10	14.50	
SDIN 87	18.24	10.32	8.04	4.06	5.02	7.70	2.48	Supercritical	3.10	0.00	
SDMH 59	149.54	21.16	20.65	6.75	10.61	16.26	3.59	Supercritical	28.30	0.00	
SDIN 44	18.24	10.32	8.69	4.26	5.42	8.03	2.48	Pressurized	3.60	9.00	
SDMH 60	128.64	18.20	18.53	6.27	10.31	13.76	3.09	Supercritical	23.00	0.00	
SDIN 45	15.26	8.64	10.10	4.70	6.93	7.65	2.06	Pressurized	4.80	9.00	
SDMH 62	101.43	14.35	14.87	5.48	9.39	10.30	2.43	Supercritical	15.10	0.00	
SDMH 63	105.74	14.96	14.87	5.48	9.19	10.61	2.53	Supercritical	15.10	0.00	
SDMH 152	84.59	11.97	14.87	5.48	10.30	9.05	2.03	Supercritical	15.10	0.00	
SDMH 64	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 65	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 89	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 151	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 66	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 150	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 67	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 68	66.88	9.46	14.87	5.48	11.63	7.64	1.61	Supercritical	15.10	0.00	
SDMH 144	12.90	7.30	13.70	6.03	10.83	7.84	1.59	Supercritical	8.70	0.00	
SDMH 145	12.90	7.30	13.70	6.03	10.83	7.84	1.59	Supercritical	8.70	0.00	
SDIN 105	10.53	5.96	9.88	4.63	8.32	5.76	1.39	Supercritical Jump	4.60	4.90	
SDMH	19.70	11.15	9.42	4.49	5.64	8.86	2.68	Supercritical	4.20	0.00	

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SDMH 147	19.70	11.15	9.42	4.49	5.64	8.86	2.68	Supercritical	4.20	0.00	
SDMH 148	19.70	11.15	9.42	4.49	5.64	8.86	2.68	Supercritical	4.20	0.00	
SDMH 149	19.70	11.15	9.42	4.49	5.64	8.86	2.68	Supercritical	4.20	0.00	
SDIN 67	10.53	5.96	9.42	4.49	7.90	5.62	1.40	Supercritical	4.20	0.00	
SDIN 47	29.08	5.92	7.37	3.74	7.03	4.00	1.10	Supercritical	3.50	0.00	
SDIN 46	29.08	5.92	7.37	3.74	7.03	4.00	1.10	Supercritical	3.50	0.00	
SDMH 90	22.68	7.22	9.05	4.24	7.33	5.66	1.50	Supercritical	4.60	0.00	
SDIN 104	10.53	5.96	9.88	4.63	8.32	5.76	1.39	Supercritical	4.60	0.00	
SDIN 42	41.13	8.38	7.79	3.86	6.24	5.27	1.54	Pressurized	3.90	9.00	
SDIN 40	84.59	11.97	9.38	4.23	6.60	6.99	1.99	Supercritical	6.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 51	40.10	CIRCULAR	48.00 in	48.00 in	30.00 in	30.00 in	48.00 in	48.00 in	12.57	
SDMH 52	35.30	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 53	35.30	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 54	32.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 55	32.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 56	32.80	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 43	3.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 57	28.30	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 86	2.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 58	28.30	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 160	3.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 87	3.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 59	28.30	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 44	3.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 60	23.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 45	4.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 62	15.10	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 63	15.10	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 152	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	

SDMH 64	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 65	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 89	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 151	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 66	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 150	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 67	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 68	15.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 144	8.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 145	8.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 105	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 146	4.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 147	4.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 148	4.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 149	4.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 67	4.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 47	3.50	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 46	3.50	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 90	4.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 104	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 42	3.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 40	6.20	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5977.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 51	5975.95	5976.87	0.00	0.00	5977.39	5978.76	5978.89	0.60	5979.49
SDMH 52	5977.07	5981.81	0.28	0.00	5979.04	5983.74	5980.73	3.85	5984.58
SDMH 53	5982.01	5982.96	0.51	0.00	5984.25	5985.56	5986.02	0.00	5986.02
SDMH 54	5983.14	5988.25	0.02	0.00	5985.58	5990.11	5987.64	3.26	5990.90
SDMH 55	5988.47	5998.30	0.02	0.00	5990.13	6000.16	5992.96	7.98	6000.95
SDMH 56	5998.49	6002.71	0.08	0.00	6000.24	6004.57	6002.34	3.02	6005.36
SDIN 43	6003.01	6003.24	0.00	0.00	6005.31	6005.32	6005.36	0.01	6005.37

SDMH 57	6002.91	6003.67	0.33	0.00	6004.90	6005.65	6006.16	0.00	6006.16
SDIN 86	6003.87	6003.94	0.04	0.00	6006.17	6006.17	6006.20	0.00	6006.20
SDMH 58	6003.86	6009.12	0.01	0.00	6005.66	6010.84	6007.11	4.44	6011.55
SDMH 160	6009.29	6011.09	0.00	0.00	6011.50	6011.76	6011.55	0.47	6012.02
SDIN 87	6011.28	6011.52	0.06	0.00	6011.82	6012.52	6012.62	0.00	6012.62
SDMH 59	6009.31	6011.21	0.33	0.00	6011.17	6014.04	6014.30	0.00	6014.30
SDIN 44	6011.39	6011.66	0.09	0.00	6014.32	6014.33	6014.39	0.01	6014.40
SDMH 60	6011.34	6022.37	0.01	0.00	6014.05	6023.91	6015.14	9.38	6024.53
SDIN 45	6022.66	6022.85	0.01	0.00	6024.42	6024.43	6024.53	0.02	6024.55
SDMH 62	6022.45	6028.38	0.09	0.00	6024.01	6029.62	6024.87	5.21	6030.09
SDMH 63	6028.53	6031.00	0.01	0.00	6029.63	6032.24	6031.04	1.67	6032.71
SDMH 152	6031.10	6033.32	0.01	0.00	6032.24	6034.56	6033.23	1.80	6035.03
SDMH 64	6033.47	6034.10	0.01	0.00	6034.57	6035.34	6035.35	0.46	6035.81
SDMH 65	6034.29	6035.10	0.08	0.00	6035.42	6036.34	6036.17	0.64	6036.81
SDMH 89	6035.29	6035.80	0.00	0.00	6036.34	6037.04	6037.17	0.34	6037.51
SDMH 151	6035.90	6036.40	0.01	0.00	6037.05	6037.64	6037.78	0.33	6038.11
SDMH 66	6036.59	6037.10	0.01	0.00	6037.65	6038.34	6038.47	0.34	6038.81
SDMH 150	6037.24	6037.80	0.01	0.00	6038.35	6039.04	6039.12	0.39	6039.51
SDMH 67	6037.95	6038.50	0.01	0.00	6039.05	6039.74	6039.83	0.38	6040.21
SDMH 68	6038.60	6039.00	0.00	0.00	6039.74	6040.24	6040.48	0.23	6040.71
SDMH 144	6041.69	6042.80	0.02	0.00	6042.59	6043.94	6043.55	0.96	6044.51
SDMH 145	6043.00	6044.08	0.02	0.00	6043.96	6045.22	6044.86	0.93	6045.79
SDIN 105	6044.28	6044.36	0.14	0.00	6045.82	6045.83	6045.92	0.01	6045.93
SDMH 146	6044.28	6045.78	0.00	0.00	6045.23	6046.57	6045.97	0.91	6046.88
SDMH 147	6045.97	6048.91	0.01	0.00	6046.57	6049.70	6047.66	2.35	6050.01
SDMH 148	6049.10	6051.06	0.01	0.00	6049.71	6051.85	6050.79	1.37	6052.16
SDMH 149	6051.24	6052.71	0.01	0.00	6051.86	6053.50	6052.93	0.88	6053.81
SDIN 67	6052.91	6053.00	0.12	0.00	6053.61	6053.79	6054.06	0.04	6054.10
SDIN 47	6039.16	6039.20	0.01	0.00	6040.70	6040.70	6040.72	0.00	6040.72
SDIN 46	6039.17	6039.30	0.01	0.00	6040.70	6040.70	6040.72	0.00	6040.72
SDMH 90	6022.67	6023.64	0.04	0.00	6024.53	6024.53	6024.57	0.14	6024.71
SDIN 104	6023.84	6023.93	0.14	0.00	6024.67	6024.75	6025.05	0.04	6025.09
SDIN 42	5983.41	5983.50	0.01	0.00	5986.02	5986.02	5986.03	0.00	5986.03
SDIN 40	5977.17	5977.31	0.02	0.00	5979.49	5979.49	5979.51	0.00	5979.51

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 51	92.00	5.00	6.00	7.83	0.00	0.00	0.00	13.76	9.30	3.96	139.03	Sewer Too Shallow
SDMH 52	237.00	4.00	6.00	6.67	14.36	9.01	4.85	9.58	6.62	2.46	531.77	
SDMH 53	38.00	4.00	6.00	6.67	9.18	6.42	2.26	8.60	6.13	1.97	60.68	Sewer Too Shallow
SDMH 54	146.00	4.00	6.00	6.67	8.24	5.95	1.79	7.92	5.79	1.63	214.46	Sewer Too Shallow
SDMH 55	281.00	4.00	6.00	6.67	7.49	5.58	1.41	7.20	5.43	1.27	383.26	Sewer Too Shallow
SDMH 56	169.00	4.00	6.00	6.67	6.83	5.25	1.08	9.48	6.57	2.41	252.86	Sewer Too Shallow
SDIN 43	9.00	2.50	4.00	4.92	10.39	5.99	3.74	9.60	5.59	3.34	11.65	
SDMH 57	38.00	4.00	6.00	6.67	9.08	6.37	2.21	7.62	5.64	1.48	57.56	Sewer Too Shallow
SDIN 86	7.00	2.50	4.00	4.92	8.72	5.15	2.90	8.30	4.94	2.69	7.27	
SDMH 58	263.00	4.00	6.00	6.67	7.24	5.45	1.29	13.16	8.41	4.25	501.98	Sewer Too Shallow
SDMH 160	36.00	2.50	4.00	4.92	14.32	7.95	5.70	13.76	7.67	5.42	78.98	
SDIN 87	8.00	2.50	4.00	4.92	13.38	7.48	5.23	12.56	7.07	4.82	15.42	
SDMH 59	38.00	4.00	6.00	6.67	12.78	8.22	4.06	9.52	6.59	2.43	77.52	
SDIN 44	9.00	2.50	4.00	4.92	10.66	6.12	3.87	9.78	5.68	3.43	12.03	
SDMH 60	298.00	4.00	6.00	6.67	9.25	6.46	2.29	9.68	6.67	2.51	504.90	
SDIN 45	9.00	2.50	4.00	4.92	10.60	6.09	3.84	9.86	5.72	3.47	12.04	
SDMH 62	258.00	4.00	6.00	6.67	9.53	6.60	2.43	9.52	6.59	2.43	439.65	
SDMH 63	99.00	4.00	6.00	6.67	9.23	6.45	2.28	14.22	8.94	4.78	217.28	
SDMH 152	139.00	4.00	6.00	6.67	14.03	8.85	4.68	26.22	14.94	10.78	689.17	
SDMH 64	63.00	4.00	6.00	6.67	25.92	14.79	10.63	31.98	17.82	13.66	548.69	
SDMH 65	81.00	4.00	6.00	6.67	31.60	17.63	13.47	26.56	15.11	10.95	709.00	
SDMH 89	51.00	4.00	6.00	6.67	26.18	14.92	10.76	23.84	13.75	9.59	340.10	
SDMH	50.00	4.00	6.00	6.67	23.64	13.65	9.49	21.36	12.51	8.35	278.19	

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SDMH 66	51.00	4.00	6.00	6.67	20.98	12.32	8.16	18.66	11.16	7.00	230.21	
SDMH 150	56.00	4.00	6.00	6.67	18.38	11.02	6.86	15.82	9.74	5.58	200.86	
SDMH 67	55.00	4.00	6.00	6.67	15.52	9.59	5.43	13.04	8.35	4.19	152.16	
SDMH 68	40.00	4.00	6.00	6.67	12.84	8.25	4.09	11.60	7.63	3.47	90.02	
SDMH 144	74.00	2.50	4.00	4.92	7.72	4.65	2.40	6.76	4.17	1.92	63.30	Sewer Too Shallow
SDMH 145	72.00	2.50	4.00	4.92	6.36	3.97	1.72	7.88	4.73	2.48	60.68	Sewer Too Shallow
SDIN 105	8.00	2.50	4.00	4.92	7.48	4.53	2.28	7.04	4.31	2.06	6.85	
SDMH 146	43.00	2.50	4.00	4.92	7.49	4.54	2.29	7.64	4.61	2.36	38.61	
SDMH 147	84.00	2.50	4.00	4.92	7.26	4.42	2.17	7.80	4.69	2.44	75.07	
SDMH 148	56.00	2.50	4.00	4.92	7.42	4.50	2.25	7.72	4.65	2.40	50.33	
SDMH 149	42.00	2.50	4.00	4.92	7.36	4.47	2.22	7.74	4.66	2.41	37.64	
SDIN 67	9.00	2.50	4.00	4.92	7.34	4.46	2.21	6.80	4.19	1.94	7.48	Sewer Too Shallow
SDIN 47	9.00	3.50	6.00	6.08	11.79	7.44	3.85	11.36	7.22	3.64	17.38	
SDIN 46	26.00	3.50	6.00	6.08	11.76	7.42	3.84	11.16	7.12	3.54	49.58	
SDMH 90	97.00	3.00	4.00	5.50	10.08	6.12	3.29	8.98	5.57	2.74	130.42	
SDIN 104	9.00	2.50	4.00	4.92	9.08	5.33	3.08	8.54	5.06	2.81	9.79	
SDIN 42	9.00	3.50	6.00	6.08	8.20	5.64	2.06	7.82	5.45	1.87	11.56	Sewer Too Shallow
SDIN 40	9.00	4.00	6.00	6.67	14.17	8.92	4.75	13.52	8.59	4.43	23.76	

Total earth volume for sewer trenches = 7339 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/4/2017 11:20:49 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C(Basin E) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5979.06

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E_1										
SDMH 51	5985.25	146.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 52	5987.60	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 53	5988.26	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 54	5993.21	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 55	6002.90	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 56	6008.45	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 57	6008.48	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 58	6016.70	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 59	6016.97	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 60	6028.21	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 62	6034.14	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 63	6039.11	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 152	6047.43	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 64	6051.09	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 65	6049.38	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 89	6048.72	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 151	6048.08	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 66	6047.43	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 150	6046.71	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 67	6046.02	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 68	6045.80	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 47	6045.63	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 46	6045.63	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 40	5985.07	86.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	12.17	12.00	0.13	146.10	Surface Water Present (Upstream)
SDMH 51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	146.10	Surface Water Present (Downstream)
SDMH 52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 152	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDMH 68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	
SDIN 47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
SDIN 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
SDIN 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 51	92.00	5975.95	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 52	237.00	5977.07	2.0	5981.81	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in

SDMH 53	38.00	5982.01	2.5	5982.96	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 54	146.00	5983.14	3.5	5988.25	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 55	281.00	5988.47	3.5	5998.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 56	169.00	5998.49	2.5	6002.71	0.013	0.23	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 57	38.00	6002.91	2.0	6003.67	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 58	263.00	6003.86	2.0	6009.12	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 59	38.00	6009.31	5.0	6011.21	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 60	298.00	6011.34	3.7	6022.37	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 62	258.00	6022.45	2.3	6028.38	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 63	99.00	6028.53	2.5	6031.00	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 152	139.00	6031.10	1.6	6033.32	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 64	63.00	6033.47	1.0	6034.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 65	81.00	6034.29	1.0	6035.10	0.013	1.19	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 89	51.00	6035.29	1.0	6035.80	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 151	50.00	6035.90	1.0	6036.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 66	51.00	6036.59	1.0	6037.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 150	56.00	6037.24	1.0	6037.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 67	55.00	6037.95	1.0	6038.50	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 68	40.00	6038.60	1.0	6039.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 47	9.00	6039.16	0.5	6039.20	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 46	26.00	6039.17	0.5	6039.30	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 40	9.00	5977.17	1.6	5977.31	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 51	144.03	11.46	48.00	11.63	48.00	11.63	0.00	Pressurized	146.10	92.00	
SDMH 52	94.58	13.38	29.80	9.43	20.59	14.11	2.10	Supercritical Jump	59.00	215.56	
SDMH 53	105.74	14.96	29.80	9.43	19.22	15.37	2.39	Pressurized	59.00	38.00	
SDMH 54	125.12	17.70	29.80	9.43	17.39	17.44	2.89	Supercritical Jump	59.00	8.46	
SDMH 55	125.12	17.70	29.80	9.43	17.39	17.44	2.89	Supercritical	59.00	0.00	
SDMH 56	105.74	14.96	29.80	9.43	19.22	15.37	2.39	Supercritical	59.00	0.00	
SDMH 57	94.58	13.38	29.80	9.43	20.59	14.11	2.10	Pressurized	59.00	38.00	
SDMH	94.58	13.38	29.80	9.43	20.59	14.11	2.10	Supercritical	59.00	33.57	

58								Jump			
SDMH 59	149.54	21.16	29.80	9.43	15.71	19.91	3.51	Supercritical Jump	59.00	24.17	Velocity is Too High
SDMH 60	128.64	18.20	29.80	9.43	17.12	17.81	2.98	Supercritical	59.00	0.00	
SDMH 62	101.43	14.35	29.80	9.43	19.72	14.89	2.28	Supercritical Jump	59.00	74.54	
SDMH 63	105.74	14.96	29.80	9.43	19.22	15.37	2.39	Supercritical	59.00	0.00	
SDMH 152	84.59	11.97	29.80	9.43	22.14	12.94	1.82	Supercritical	59.00	0.00	
SDMH 64	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Supercritical	59.00	0.00	
SDMH 65	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Pressurized	59.00	81.00	
SDMH 89	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Pressurized	59.00	51.00	
SDMH 151	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Pressurized	59.00	50.00	
SDMH 66	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Pressurized	59.00	51.00	
SDMH 150	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Pressurized	59.00	56.00	
SDMH 67	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Supercritical	59.00	0.00	
SDMH 68	66.88	9.46	29.80	9.43	26.26	10.68	1.31	Supercritical	59.00	0.00	
SDIN 47	29.08	5.92	30.00	6.01	30.00	6.01	0.00	Pressurized	29.50	9.00	
SDIN 46	29.08	5.92	30.00	6.01	30.00	6.01	0.00	Pressurized	29.50	26.00	
SDIN 40	84.59	11.97	36.00	12.18	36.00	12.18	0.00	Pressurized	86.10	9.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 51	146.10	CIRCULAR	48.00 in	48.00 in	54.00 in	54.00 in	48.00 in	48.00 in	12.57	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

SDMH 52	59.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 53	59.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 54	59.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 55	59.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 56	59.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 57	59.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 58	59.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 59	59.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 60	59.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 62	59.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 63	59.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 152	59.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 64	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 65	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 89	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 151	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 66	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 150	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 67	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 68	59.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDIN 47	29.50	CIRCULAR	30.00 in	30.00 in	33.00 in	33.00 in	30.00 in	30.00 in	4.91	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 46	29.50	CIRCULAR	30.00 in	30.00 in	33.00 in	33.00 in	30.00 in	30.00 in	4.91	Existing height is smaller than the suggested height.

										Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 40	86.10	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5979.06

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 51	5975.95	5976.87	0.00	0.00	5979.95	5980.90	5982.05	0.95	5983.00
SDMH 52	5977.07	5981.81	0.79	0.00	5982.70	5984.29	5983.79	1.89	5985.67
SDMH 53	5982.01	5982.96	1.43	0.00	5986.02	5986.32	5987.10	0.30	5987.40
SDMH 54	5983.14	5988.25	0.05	0.00	5986.37	5990.73	5987.45	4.66	5992.11
SDMH 55	5988.47	5998.30	0.05	0.00	5990.79	6000.78	5994.64	7.53	6002.16
SDMH 56	5998.49	6002.71	0.25	0.00	6001.03	6005.19	6003.75	2.82	6006.57
SDMH 57	6002.91	6003.67	1.43	0.00	6006.92	6007.22	6008.00	0.30	6008.30
SDMH 58	6003.86	6009.12	0.05	0.00	6007.27	6011.60	6008.35	4.63	6012.98
SDMH 59	6009.31	6011.21	1.43	0.00	6013.33	6013.69	6014.41	0.66	6015.07
SDMH 60	6011.34	6022.37	0.05	0.00	6013.75	6024.85	6017.69	8.54	6026.23
SDMH 62	6022.45	6028.38	1.43	0.00	6026.58	6030.86	6027.66	4.58	6032.24
SDMH 63	6028.53	6031.00	0.12	0.00	6030.98	6033.48	6033.79	1.07	6034.86
SDMH 152	6031.10	6033.32	0.09	0.00	6033.57	6035.80	6035.54	1.64	6037.18
SDMH 64	6033.47	6034.10	0.12	0.00	6035.92	6036.58	6037.43	0.53	6037.96
SDMH 65	6034.29	6035.10	1.29	0.00	6038.17	6038.80	6039.25	0.63	6039.88
SDMH 89	6035.29	6035.80	0.05	0.00	6038.85	6039.25	6039.94	0.40	6040.33
SDMH 151	6035.90	6036.40	0.12	0.00	6039.37	6039.76	6040.45	0.39	6040.84
SDMH 66	6036.59	6037.10	0.12	0.00	6039.88	6040.28	6040.96	0.40	6041.36
SDMH	6037.24	6037.80	0.12	0.00	6040.39	6040.83	6041.48	0.44	6041.91

150									
SDMH 67	6037.95	6038.50	0.12	0.00	6040.95	6040.98	6042.03	0.33	6042.36
SDMH 68	6038.60	6039.00	0.05	0.00	6041.04	6041.48	6042.56	0.30	6042.86
SDIN 47	6039.16	6039.20	0.74	0.00	6043.04	6043.09	6043.60	0.05	6043.65
SDIN 46	6039.17	6039.30	0.74	0.00	6043.04	6043.18	6043.60	0.13	6043.74
SDIN 40	5977.17	5977.31	3.04	0.00	5983.94	5984.09	5986.24	0.15	5986.39

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 51	92.00	5.00	6.00	7.83	0.00	0.00	0.00	13.76	9.30	3.96	139.03	Sewer Too Shallow
SDMH 52	237.00	4.00	6.00	6.67	14.36	9.01	4.85	9.58	6.62	2.46	531.77	
SDMH 53	38.00	4.00	6.00	6.67	9.18	6.42	2.26	8.60	6.13	1.97	60.68	Sewer Too Shallow
SDMH 54	146.00	4.00	6.00	6.67	8.24	5.95	1.79	7.92	5.79	1.63	214.46	Sewer Too Shallow
SDMH 55	281.00	4.00	6.00	6.67	7.49	5.58	1.41	7.20	5.43	1.27	383.26	Sewer Too Shallow
SDMH 56	169.00	4.00	6.00	6.67	6.83	5.25	1.08	9.48	6.57	2.41	252.86	Sewer Too Shallow
SDMH 57	38.00	4.00	6.00	6.67	9.08	6.37	2.21	7.62	5.64	1.48	57.56	Sewer Too Shallow
SDMH 58	263.00	4.00	6.00	6.67	7.24	5.45	1.29	13.16	8.41	4.25	501.98	Sewer Too Shallow
SDMH 59	38.00	4.00	6.00	6.67	12.78	8.22	4.06	9.52	6.59	2.43	77.52	
SDMH 60	298.00	4.00	6.00	6.67	9.25	6.46	2.29	9.68	6.67	2.51	504.90	
SDMH 62	258.00	4.00	6.00	6.67	9.53	6.60	2.43	9.52	6.59	2.43	439.65	
SDMH 63	99.00	4.00	6.00	6.67	9.23	6.45	2.28	14.22	8.94	4.78	217.28	
SDMH 152	139.00	4.00	6.00	6.67	14.03	8.85	4.68	26.22	14.94	10.78	689.17	
SDMH 64	63.00	4.00	6.00	6.67	25.92	14.79	10.63	31.98	17.82	13.66	548.69	
SDMH 65	81.00	4.00	6.00	6.67	31.60	17.63	13.47	26.56	15.11	10.95	709.00	
SDMH 89	51.00	4.00	6.00	6.67	26.18	14.92	10.76	23.84	13.75	9.59	340.10	
SDMH	50.00	4.00	6.00	6.67	23.64	13.65	9.49	21.36	12.51	8.35	278.19	

151												
SDMH 66	51.00	4.00	6.00	6.67	20.98	12.32	8.16	18.66	11.16	7.00	230.21	
SDMH 150	56.00	4.00	6.00	6.67	18.38	11.02	6.86	15.82	9.74	5.58	200.86	
SDMH 67	55.00	4.00	6.00	6.67	15.52	9.59	5.43	13.04	8.35	4.19	152.16	
SDMH 68	40.00	4.00	6.00	6.67	12.84	8.25	4.09	11.60	7.63	3.47	90.02	
SDIN 47	9.00	3.50	6.00	6.08	11.79	7.44	3.85	11.36	7.22	3.64	17.38	
SDIN 46	26.00	3.50	6.00	6.08	11.76	7.42	3.84	11.16	7.12	3.54	49.58	
SDIN 40	9.00	4.00	6.00	6.67	14.17	8.92	4.75	13.52	8.59	4.43	23.76	

Total earth volume for sewer trenches = 6710 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/31/2017 11:45:10 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond E **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5978.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E_1										
SDMH 49	5985.24	23.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 48	5986.93	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 47	5987.92	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 46	5988.63	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 157	5990.48	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 45	5989.97	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 158	5990.68	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 44	5991.38	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 43	5993.65	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 42	6001.13	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 64	6000.95	3.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 41	6018.88	18.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 40	6031.08	14.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 34	6030.90	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 35	6030.90	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 156	6031.76	9.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 155	6035.77	9.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 65	6035.58	5.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 154	6044.01	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 153	6045.71	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 66	6045.58	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 36	6018.70	5.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 38	5985.06	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	5.38	4.37	0.45	23.50	Surface Water Present (Upstream)
SDMH 49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.50	Surface Water Present (Downstream)
SDMH 48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 157	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 158	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDIN 64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.78	
SDMH 41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.85	
SDMH 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.28	
SDIN 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDMH 156	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.80	
SDMH 155	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.80	
SDIN 65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.39	
SDMH 154	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81	
SDMH 153	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81	
SDIN 66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81	
SDIN 36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.64	
SDIN 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.09	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 49	90.00	5975.97	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 48	172.00	5977.07	2.0	5980.51	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 47	97.00	5980.71	1.5	5982.16	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 46	69.00	5982.37	1.5	5983.40	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 157	67.00	5983.60	1.5	5984.60	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 45	64.00	5984.79	1.5	5985.75	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 158	70.00	5985.77	1.5	5986.82	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 44	60.00	5986.82	1.5	5987.72	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 43	97.00	5987.93	1.5	5989.38	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 42	178.00	5989.57	3.5	5995.80	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 64	9.00	5996.41	1.0	5996.50	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 41	366.00	5995.98	5.0	6014.28	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 40	500.00	6014.22	2.4	6026.22	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 34	25.00	6026.52	2.0	6027.02	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 35	9.00	6026.52	2.0	6026.70	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 156	54.00	6026.42	2.0	6027.50	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 155	151.00	6027.62	3.3	6032.60	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 65	9.00	6032.81	0.5	6032.85	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 154	164.00	6032.80	4.0	6039.36	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 153	56.00	6039.58	5.0	6042.38	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 66	7.00	6042.58	1.0	6042.65	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 36	9.00	6014.58	1.0	6014.67	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 38	9.00	5977.17	1.6	5977.31	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 49	66.88	9.46	18.74	6.32	14.73	8.63	1.58	Supercritical	23.50	0.00	
SDMH 48	32.08	10.21	20.06	7.81	14.55	10.99	1.92	Supercritical	21.89	0.00	
SDMH 47	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 46	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 157	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 45	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 158	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 44	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 43	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 42	42.44	13.51	20.06	7.81	12.22	13.61	2.68	Supercritical	21.89	0.00	
SDIN 64	22.68	7.22	8.17	4.00	6.63	5.35	1.50	Supercritical Jump	3.78	1.50	
SDMH 41	50.72	16.15	18.75	7.16	10.13	14.95	3.30	Supercritical	18.85	0.00	
SDMH 40	35.14	11.19	16.34	6.27	10.65	10.61	2.27	Supercritical	14.28	0.00	
SDIN 34	14.90	8.43	7.18	3.80	4.99	6.26	2.02	Supercritical Jump	2.50	9.35	

SDIN 35	14.90	8.43	7.18	3.80	4.99	6.26	2.02	Pressurized	2.50	9.00	
SDMH 156	32.08	10.21	13.43	5.42	9.10	8.97	2.11	Supercritical	9.80	0.00	
SDMH 155	41.21	13.12	13.43	5.42	7.97	10.75	2.72	Supercritical	9.80	0.00	
SDIN 65	7.45	4.21	10.74	4.90	11.35	4.59	0.90	Subcritical	5.39	0.00	
SDMH 154	21.07	11.92	10.12	4.70	5.85	9.66	2.86	Supercritical	4.81	0.00	
SDMH 153	23.55	13.33	10.12	4.70	5.52	10.47	3.20	Supercritical	4.81	0.00	
SDIN 66	10.53	5.96	10.12	4.70	8.54	5.83	1.38	Supercritical	4.81	0.00	
SDIN 36	22.68	7.22	10.06	4.51	8.16	5.99	1.50	Supercritical Jump	5.64	7.91	
SDIN 38	28.69	9.13	7.36	3.78	5.32	5.97	1.88	Supercritical	3.09	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 49	23.50	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 48	21.89	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDMH 47	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 46	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 157	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 45	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 158	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 44	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 43	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 42	21.89	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDIN 64	3.78	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 41	18.85	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 40	14.28	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 34	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 35	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 156	9.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 155	9.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 65	5.39	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 154	4.81	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 153	4.81	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

SDIN 66	4.81	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 36	5.64	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 38	3.09	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5978.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 49	5975.97	5976.87	0.00	0.00	5978.00	5978.43	5978.35	0.70	5979.05
SDMH 48	5977.07	5980.51	0.04	0.00	5978.47	5982.18	5980.16	2.97	5983.13
SDMH 47	5980.71	5982.16	0.08	0.00	5982.26	5983.83	5983.53	1.24	5984.78
SDMH 46	5982.37	5983.40	0.08	0.00	5983.91	5985.07	5985.19	0.82	5986.02
SDMH 157	5983.60	5984.60	0.08	0.00	5985.15	5986.27	5986.42	0.79	5987.22
SDMH 45	5984.79	5985.75	0.08	0.00	5986.35	5987.42	5987.62	0.75	5988.37
SDMH 158	5985.77	5986.82	0.08	0.00	5987.50	5988.49	5988.60	0.84	5989.44
SDMH 44	5986.82	5987.72	0.08	0.00	5988.57	5989.39	5989.65	0.69	5990.34
SDMH 43	5987.93	5989.38	0.08	0.00	5989.47	5991.05	5990.75	1.24	5992.00
SDMH 42	5989.57	5995.80	0.08	0.00	5991.13	5997.47	5993.47	4.95	5998.42
SDIN 64	5996.41	5996.50	0.03	0.00	5998.42	5998.42	5998.45	0.00	5998.45
SDMH 41	5995.98	6014.28	0.03	0.00	5997.50	6015.84	6000.30	16.34	6016.64
SDMH 40	6014.22	6026.22	0.02	0.00	6015.86	6027.58	6016.85	11.34	6028.19
SDIN 34	6026.52	6027.02	0.04	0.00	6028.20	6028.20	6028.23	0.01	6028.25
SDIN 35	6026.52	6026.70	0.04	0.00	6028.20	6028.21	6028.23	0.01	6028.24
SDMH 156	6026.42	6027.50	0.20	0.00	6027.78	6028.62	6028.43	0.65	6029.08
SDMH 155	6027.62	6032.60	0.20	0.00	6028.82	6033.72	6030.08	4.10	6034.18
SDIN 65	6032.81	6032.85	0.19	0.00	6034.21	6034.23	6034.37	0.02	6034.39
SDMH 154	6032.80	6039.36	0.01	0.00	6033.73	6040.20	6034.74	5.81	6040.55
SDMH 153	6039.58	6042.38	0.01	0.00	6040.21	6043.22	6041.74	1.83	6043.57
SDIN 66	6042.58	6042.65	0.15	0.00	6043.37	6043.49	6043.82	0.02	6043.84

SDIN 36	6014.58	6014.67	0.07	0.00	6016.65	6016.66	6016.70	0.00	6016.71
SDIN 38	5977.17	5977.31	0.01	0.00	5979.04	5979.04	5979.06	0.00	5979.06

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 49	90.00	4.00	6.00	6.67	0.00	0.00	0.00	14.74	9.20	5.04	129.42	Sewer Too Shallow
SDMH 48	172.00	3.00	4.00	5.50	15.34	8.75	5.92	11.84	7.00	4.17	385.14	
SDMH 47	97.00	3.00	4.00	5.50	11.45	6.81	3.98	10.52	6.34	3.51	157.15	
SDMH 46	69.00	3.00	4.00	5.50	10.11	6.14	3.31	9.46	5.81	2.98	95.79	
SDMH 157	67.00	3.00	4.00	5.50	9.07	5.62	2.79	10.76	6.46	3.63	94.98	
SDMH 45	64.00	3.00	4.00	5.50	10.38	6.27	3.44	7.44	4.80	1.97	80.37	Sewer Too Shallow
SDMH 158	70.00	3.00	4.00	5.50	7.40	4.78	1.95	6.72	4.44	1.61	67.43	Sewer Too Shallow
SDMH 44	60.00	3.00	4.00	5.50	6.72	4.44	1.61	6.32	4.24	1.41	53.69	Sewer Too Shallow
SDMH 43	97.00	3.00	4.00	5.50	5.91	4.04	1.21	7.54	4.85	2.02	89.79	Sewer Too Shallow
SDMH 42	178.00	3.00	4.00	5.50	7.16	4.66	1.83	9.66	5.91	3.08	208.28	Sewer Too Shallow
SDIN 64	9.00	3.00	4.00	5.50	8.44	5.30	2.47	7.90	5.03	2.20	10.08	
SDMH 41	366.00	3.00	4.00	5.50	9.30	5.73	2.90	8.20	5.18	2.35	443.77	
SDMH 40	500.00	3.00	4.00	5.50	8.32	5.24	2.41	8.72	5.44	2.61	586.64	
SDIN 34	25.00	2.50	4.00	4.92	8.62	5.10	2.85	7.26	4.42	2.17	23.90	
SDIN 35	9.00	2.50	4.00	4.92	8.62	5.10	2.85	7.90	4.74	2.49	9.01	
SDMH 156	54.00	3.00	4.00	5.50	8.32	5.24	2.41	7.52	4.84	2.01	58.48	
SDMH 155	151.00	3.00	4.00	5.50	7.29	4.73	1.89	5.50	3.75	0.92	118.49	Sewer Too Shallow
SDIN 65	9.00	2.50	4.00	4.92	5.43	3.51	1.26	4.96	3.27	1.02	5.57	Sewer Too Shallow
SDMH 154	164.00	2.50	4.00	4.92	5.44	3.51	1.26	8.80	5.19	2.94	141.62	Sewer Too Shallow

SDMH 153	56.00	2.50	4.00	4.92	8.36	4.97	2.72	6.16	3.87	1.62	48.56	Sewer Too Shallow
SDIN 66	7.00	2.50	4.00	4.92	5.76	3.67	1.42	5.36	3.47	1.22	4.58	Sewer Too Shallow
SDIN 36	9.00	3.00	4.00	5.50	7.60	4.88	2.05	7.06	4.61	1.78	8.99	Sewer Too Shallow
SDIN 38	9.00	3.00	4.00	5.50	15.15	8.66	5.82	14.50	8.33	5.50	22.83	

Total earth volume for sewer trenches = 2845 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/4/2017 2:29:14 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C (Basin E-2) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5979.06

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond C Outfall	5974.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 49	5985.24	83.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 38	5985.06	83.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond C Outfall	0.00	0.00	0.00	0.00	0.00	6.94	12.02	0.12	83.40	Surface Water Present (Upstream)
SDMH 49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.40	Surface Water Present (Downstream)
SDIN 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.40	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 49	85.00	5676.45	0.5	5676.87	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 38	9.00	5977.17	1.6	5977.31	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 49	47.29	6.69	36.00	11.80	36.00	11.80	0.00	Pressurized	83.40	85.00	
SDIN 38	84.59	11.97	33.59	12.15	29.06	13.64	1.50	Pressurized	83.40	9.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

SDMH 49	83.40	CIRCULAR	36.00 in	36.00 in	48.00 in	48.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 38	83.40	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5979.06

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 49	5676.45	5676.87	0.00	0.00	5979.06	5980.38	5981.22	1.32	5982.54
SDIN 38	5977.17	5977.31	0.82	0.00	5981.20	5981.34	5983.36	0.14	5983.50

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 49	85.00	4.00	6.00	6.67	593.11	298.39	294.22	614.74	309.20	305.04	287217.91	
SDIN 38	9.00	4.00	6.00	6.67	14.15	8.91	4.74	13.50	8.58	4.42	23.71	

Total earth volume for sewer trenches = 287242 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches

- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/5/2017 8:24:58 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond E **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5976.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E_1										
SDIN 39	5984.90	9.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 50	5985.08	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 143	5986.08	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 68	5985.74	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 95	5992.44	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 94	5995.66	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 93	5998.30	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 92	6001.45	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 91	6005.56	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 103	6006.38	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	2.18	4.41	0.33	9.60	Surface Water Present (Upstream)
SDIN 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.60	Surface Water Present (Downstream)
SDMH 50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.90	
SDMH 143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.90	
SDIN 68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40	
SDMH 95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDIN 103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
	Sewer	**Downstream**		**Upstream**						

Element Name	Length (ft)	Invert (ft)	Slope (%)	Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 39	60.00	5976.00	1.0	5976.60	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 50	25.00	5976.83	0.5	5976.95	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 143	36.00	5977.17	0.5	5977.35	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 68	17.00	5977.56	2.0	5977.90	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 95	161.00	5977.97	4.6	5985.38	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 94	68.00	5985.58	5.0	5988.98	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 93	54.00	5989.20	5.0	5991.90	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 92	64.00	5992.12	5.0	5995.32	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 91	144.00	5995.50	5.0	6002.70	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 103	9.00	6002.90	1.0	6002.99	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 39	22.68	7.22	13.29	5.38	10.90	6.92	1.46	Supercritical	9.60	0.00	
SDMH 50	7.45	4.21	10.21	4.73	10.65	4.50	0.92	Subcritical	4.90	0.00	
SDMH 143	7.45	4.21	10.21	4.73	10.65	4.50	0.92	Subcritical	4.90	0.00	
SDIN 68	14.90	8.43	8.44	4.18	5.85	6.83	2.02	Supercritical	3.40	0.00	
SDMH 95	22.59	12.78	6.53	3.59	3.69	7.98	3.03	Supercritical	2.08	0.00	
SDMH 94	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDMH 93	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDMH 92	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDMH 91	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDIN 103	10.53	5.96	6.53	3.59	5.42	4.64	1.43	Supercritical	2.08	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDIN 39	9.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 50	4.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 143	4.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

SDIN 68	3.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 95	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 94	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 93	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 92	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 91	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 103	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5976.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDIN 39	5976.00	5976.60	0.00	0.00	5976.91	5977.71	5977.65	0.50	5978.16
SDMH 50	5976.83	5976.95	0.01	0.00	5977.99	5978.03	5978.16	0.07	5978.23
SDMH 143	5977.17	5977.35	0.01	0.00	5978.03	5978.25	5978.37	0.18	5978.55
SDIN 68	5977.56	5977.90	0.08	0.00	5978.33	5978.60	5978.77	0.10	5978.87
SDMH 95	5977.97	5985.38	0.00	0.00	5978.28	5985.92	5979.27	6.85	5986.12
SDMH 94	5985.58	5988.98	0.00	0.00	5985.93	5989.52	5986.93	2.79	5989.72
SDMH 93	5989.20	5991.90	0.00	0.00	5989.53	5992.44	5990.55	2.09	5992.64
SDMH 92	5992.12	5995.32	0.00	0.00	5992.45	5995.86	5993.47	2.59	5996.06
SDMH 91	5995.50	6002.70	0.00	0.00	5995.87	6003.24	5996.85	6.59	6003.44
SDIN 103	6002.90	6002.99	0.03	0.00	6003.35	6003.53	6003.69	0.05	6003.73

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

	Downstream	Upstream	

Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 39	60.00	3.00	4.00	5.50	0.00	0.00	0.00	15.60	8.88	6.05	82.62	Sewer Too Shallow
SDMH 50	25.00	2.50	4.00	4.92	15.65	8.62	6.37	15.76	8.67	6.42	66.29	
SDMH 143	36.00	2.50	4.00	4.92	15.32	8.45	6.20	16.96	9.27	7.02	100.31	
SDIN 68	17.00	2.50	4.00	4.92	16.54	9.06	6.81	15.18	8.38	6.13	45.92	
SDMH 95	161.00	2.50	4.00	4.92	15.71	8.65	6.40	13.62	7.60	5.35	381.52	
SDMH 94	68.00	2.50	4.00	4.92	13.22	7.40	5.15	12.86	7.22	4.97	132.11	
SDMH 93	54.00	2.50	4.00	4.92	12.42	7.00	4.75	12.30	6.94	4.69	96.26	
SDMH 92	64.00	2.50	4.00	4.92	11.86	6.72	4.47	11.76	6.67	4.42	106.21	
SDMH 91	144.00	2.50	4.00	4.92	11.40	6.49	4.24	5.22	3.40	1.15	157.80	Sewer Too Shallow
SDIN 103	9.00	2.50	4.00	4.92	0.00	3.20	0.95	6.28	3.93	1.68	5.14	Sewer Too Shallow

Total earth volume for sewer trenches = 1174 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/4/2017 4:43:40 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C (Basin E-3) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5979.06

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond C (Basin	5974.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E) Outfall										
SDIN 39	5984.90	40.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond C (Basin E) Outfall	0.00	0.00	0.00	0.00	0.00	3.38	12.06	0.08	40.80	Surface Water Present (Upstream)
SDIN 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.80	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDIN 39	60.00	5976.20	3.0	5978.00	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDIN 39	39.29	12.51	24.00	12.99	24.00	12.99	0.00	Pressurized	40.80	60.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDIN 39	40.80	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height.

										Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5979.06

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDIN 39	5976.20	5978.00	0.00	0.00	5979.06	5981.00	5981.68	1.94	5983.62

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDIN 39	60.00	3.00	4.00	5.50	0.00	0.00	0.00	12.80	7.48	4.65	60.53	Sewer Too Shallow

Total earth volume for sewer trenches = 61 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/7/2017 11:22:13 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C (Basin F-2a) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6020.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond F	6020.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 105	6028.02	5.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 106	6027.26	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 89	6027.03	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 88	6027.85	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond F	0.00	0.00	0.00	0.00	0.00	1.27	4.24	0.87	5.40	
SDMH 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40	Surface Water Present (Downstream)
SDMH 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	
SDIN 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	
SDIN 88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 105	90.00	6020.01	1.6	6021.45	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 106	100.00	6021.67	1.2	6022.87	0.013	0.46	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 89	11.00	6023.07	1.0	6023.18	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 88	9.00	6022.64	3.1	6022.92	0.013	0.83	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 105	28.69	9.13	9.84	4.45	7.05	7.01	1.90	Supercritical	5.40	0.00	
SDMH 106	24.85	7.91	7.00	3.67	5.44	5.24	1.63	Supercritical	2.80	0.00	

SDIN 89	22.68	7.22	7.00	3.67	5.69	4.91	1.49	Supercritical	2.80	0.00	
SDIN 88	18.54	10.49	7.33	3.84	4.55	7.40	2.51	Supercritical	2.60	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 105	5.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 106	2.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 89	2.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 88	2.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6020.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 105	6020.01	6021.45	0.00	0.00	6020.60	6022.27	6021.36	1.22	6022.58
SDMH 106	6021.67	6022.87	0.01	0.00	6022.50	6023.45	6022.58	1.08	6023.66
SDIN 89	6023.07	6023.18	0.01	0.00	6023.54	6023.76	6023.92	0.05	6023.97
SDIN 88	6022.64	6022.92	0.03	0.00	6023.02	6023.77	6023.87	0.00	6023.87

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 105	90.00	3.00	4.00	5.50	0.00	0.57	0.00	12.14	7.15	4.32	89.20	Sewer Too Shallow
SDMH 106	100.00	3.00	4.00	5.50	11.70	6.93	4.10	7.78	4.97	2.14	141.47	
SDIN 89	11.00	3.00	4.00	5.50	7.38	4.77	1.94	6.70	4.43	1.60	10.57	Sewer Too Shallow
SDIN 88	9.00	2.50	4.00	4.92	10.26	5.92	3.67	9.36	5.47	3.22	11.35	

Total earth volume for sewer trenches = 253 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/7/2017 11:24:11 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C (Basin F-2a) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6020.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond F	6020.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 105	6028.02	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 106	6027.26	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 89	6027.03	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond F	0.00	0.00	0.00	0.00	0.00	2.01	11.94	0.20	24.00	
SDMH 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	Surface Water Present (Downstream)
SDMH 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	
SDIN 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 105	90.00	6020.01	1.6	6021.45	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 106	100.00	6021.67	1.2	6022.87	0.013	0.46	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 89	11.00	6023.07	1.0	6023.18	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 105	28.69	9.13	20.82	8.29	16.79	10.23	1.59	Supercritical	24.00	0.00	
SDMH 106	24.85	7.91	20.82	8.29	18.97	9.01	1.24	Pressurized	24.00	100.00	
SDIN 89	22.68	7.22	24.00	7.64	24.00	7.64	0.00	Pressurized	24.00	11.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
SDMH 105	24.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 106	24.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDIN 89	24.00	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6020.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDMH 105	6020.01	6021.45	0.00	0.00	6021.41	6023.18	6023.03	1.22	6024.25
SDMH 106	6021.67	6022.87	0.42	0.00	6023.76	6024.88	6024.67	1.12	6025.79
SDIN 89	6023.07	6023.18	0.96	0.00	6025.84	6025.97	6026.75	0.12	6026.87

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 105	90.00	3.00	4.00	5.50	0.00	0.57	0.00	12.14	7.15	4.32	89.20	Sewer Too Shallow
SDMH 106	100.00	3.00	4.00	5.50	11.70	6.93	4.10	7.78	4.97	2.14	141.47	
SDIN 89	11.00	3.00	4.00	5.50	7.38	4.77	1.94	6.70	4.43	1.60	10.57	Sewer Too Shallow

Total earth volume for sewer trenches = 241 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/7/2017 12:21:36 PM	**UDSewer Results Summary** **Project Title:** Pond C (Basin F-2B) 2 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6004.05

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
SDFES 21	6006.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDFES 20	6010.85	5.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
SDFES 21	0.00	0.00	0.00	0.00	0.00	1.22	4.18	1.05	5.10	
SDFES 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDFES 20	102.00	6004.30	4.1	6008.48	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDFES 20	45.93	14.62	9.55	4.38	5.40	9.64	3.02	Supercritical	5.10	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDFES 20	5.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6004.05

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDFES 20	6004.30	6008.48	0.00	0.00	6004.75	6009.28	6006.19	3.38	6009.57

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDFES 20	102.00	3.00	4.00	5.50	0.00	2.96	0.12	5.50	2.95	0.12	58.87	Sewer Too Shallow

Total earth volume for sewer trenches = 59 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/7/2017 12:19:55 PM	**UDSewer Results Summary** **Project Title:** Pond C (Basin F-2B) 100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6004.05

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
SDFES 21	6006.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDFES 20	6010.85	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
SDFES 21	0.00	0.00	0.00	0.00	0.00	2.01	11.92	0.22	24.00	
SDFES 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDFES 20	102.00	6004.30	4.1	6008.48	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDFES 20	45.93	14.62	20.82	8.29	12.32	14.78	2.89	Supercritical	24.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDFES 20	24.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6004.05

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDFES 20	6004.30	6008.48	0.00	0.00	6005.32	6010.21	6008.72	2.57	6011.28

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDFES 20	102.00	3.00	4.00	5.50	0.00	2.96	0.12	5.50	2.95	0.12	58.87	Sewer Too Shallow

Total earth volume for sewer trenches = 59 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/7/2017 12:13:06 PM	**UDSewer Results Summary** **Project Title:** Pond C (Basin F_2c) 100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5975.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond F	5975.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDIN 58	5997.61	13.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 57	5997.60	10.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond F	0.00	0.00	0.00	0.00	0.00	1.26	10.91	1.44	13.70	
SDIN 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.70	Surface Water Present (Downstream)
SDIN 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDIN 58	241.00	5975.01	4.6	5986.10	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 57	34.00	5987.55	6.0	5989.59	0.013	0.20	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDIN 58	88.21	17.97	14.94	5.61	7.99	13.05	3.34	Supercritical	13.70	0.00	
SDIN 57	55.56	17.69	13.65	5.48	6.93	13.44	3.68	Supercritical	10.10	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**

SDIN 58	13.70	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 57	10.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5975.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
SDIN 58	5975.01	5986.10	0.00	0.00	5975.68	5987.35	5978.33	9.51	5987.83
SDIN 57	5987.55	5989.59	0.03	0.00	5988.13	5990.73	5990.93	0.26	5991.19

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDIN 58	241.00	3.50	6.00	6.08	0.00	0.78	0.00	21.52	12.30	8.72	620.97	Sewer Too Shallow
SDIN 57	34.00	3.00	4.00	5.50	19.12	10.64	7.81	15.02	8.59	5.76	110.08	

Total earth volume for sewer trenches = 731 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.

- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/7/2017 12:11:33 PM	**UDSewer Results Summary** **Project Title:** Pond C (Basin F_2c) 100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5975.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall Pond F	5975.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDIN 58	5997.61	69.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 57	5997.60	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall Pond F	0.00	0.00	0.00	0.00	0.00	5.83	11.86	0.28	69.20	
SDIN 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.20	Surface Water Present (Downstream)
SDIN 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDIN 58	241.00	5975.01	4.6	5986.10	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 57	34.00	5987.55	6.0	5989.59	0.013	0.20	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDIN 58	88.21	17.97	29.25	14.19	20.01	19.89	2.89	Supercritical	69.20	0.00	Velocity is Too High
SDIN 57	55.56	17.69	23.53	13.46	15.62	19.45	3.22	Supercritical	42.10	0.00	Velocity is Too High

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			

Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDIN 58	69.20	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	
SDIN 57	42.10	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5975.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 58	5975.01	5986.10	0.00	0.00	5976.68	5988.54	5982.83	8.84	5991.66
SDIN 57	5987.55	5989.59	0.56	0.00	5989.10	5991.94	5994.73	0.00	5994.73

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 58	241.00	3.50	6.00	6.08	0.00	0.78	0.00	21.52	12.30	8.72	620.97	Sewer Too Shallow
SDIN 57	34.00	3.00	4.00	5.50	19.12	10.64	7.81	15.02	8.59	5.76	110.08	

Total earth volume for sewer trenches = 731 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches

- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/23/2017 5:30:49 PM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond C Outfall **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5961.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond C Outfall	5965.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Outlet Pipe 1	5979.33	107.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond C Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	107.73	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	107.73	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Outlet Pipe 1	47.00	5968.33	2.5	5969.50	0.013	0.03	0.00	CIRCULAR	42.00 in	42.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Outlet Pipe 1	159.51	16.58	37.79	11.82	25.29	17.80	2.36	Supercritical	107.73	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Outlet Pipe 1	107.73	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.

- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5961.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Outlet Pipe 1	5968.33	5969.50	0.00	0.00	5970.81	5972.65	5974.19	0.63	5974.82

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
Outlet Pipe 1	47.00	4.50	6.00	7.25	0.00	0.00	0.00	17.16	10.71	5.96	88.92	Sewer Too Shallow

Total earth volume for sewer trenches = 89 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

POND D

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/31/2017 11:38:47 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond D (Pond F-1) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5993.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	5988.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH	6006.86	41.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

84										
SDMH 83	6017.46	41.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 82	6026.89	41.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 102	6030.61	41.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 81	6032.85	41.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 80	6037.91	9.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 79	6038.44	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 54	6038.24	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 100	6040.84	8.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 95	6040.65	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 101	6046.30	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 94	6046.11	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 78	6033.64	34.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 93	6033.43	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 76	6041.85	32.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 75	6049.80	32.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 74	6057.40	32.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 103	6064.52	32.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 73	6066.22	32.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 72	6067.73	21.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 52	6067.41	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 53	6067.41	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 96	6070.85	17.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 71	6075.57	12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 102	6075.25	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 70	6079.46	8.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 100	6079.14	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 101	6070.53	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 12	6074.01	21.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 104	6079.25	21.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 69	6081.25	16.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 48	6081.31	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 90	6081.91	13.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 92	6078.84	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	9.57	4.31	0.65	41.20	Surface Water Present (Upstream)
SDMH 84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.20	Surface Water Present (Downstream)
SDMH 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.20	
SDMH 82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.20	
SDMH 102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.20	
SDMH 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.20	
SDMH 80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	
SDMH 79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	
SDIN 54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	
SDMH 100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.80	
SDIN 95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	
SDMH 101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDIN 94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	

SDMH 78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.40	
SDIN 93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50	
SDMH 76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50	
SDMH 75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50	
SDMH 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50	
SDMH 103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50	
SDMH 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50	
SDMH 72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.40	
SDIN 52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	
SDIN 53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	
SDMH 96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.20	
SDMH 71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20	
SDIN 102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	
SDMH 70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.30	
SDIN 100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	
SDIN 101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.30	
SDMH 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.10	
SDMH 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.10	
SDMH 69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.90	
SDIN 48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	
SDIN 90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.60	
SDIN 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDMH 84	227.00	5989.92	4.0	5999.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 83	183.00	5999.88	4.0	6007.20	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in

SDMH 82	179.00	6008.24	4.0	6015.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 102	147.00	6016.21	3.8	6021.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 81	153.00	6022.55	1.6	6025.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 80	201.00	6026.10	3.5	6033.13	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 79	44.00	6033.31	3.0	6034.63	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 54	10.00	6034.83	1.0	6034.93	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 100	92.00	6033.35	4.0	6037.03	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 95	10.00	6037.22	1.0	6037.32	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 101	138.00	6037.23	4.0	6042.75	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 94	9.00	6042.95	1.0	6043.04	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 78	49.00	6025.53	1.7	6026.36	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 93	11.00	6027.04	2.0	6027.26	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 76	382.00	6027.36	2.0	6035.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 75	184.00	6036.02	2.0	6039.70	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 74	174.00	6040.84	4.0	6047.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 103	168.00	6048.08	4.0	6054.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 73	50.00	6055.00	4.0	6057.00	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 72	53.00	6057.88	4.0	6060.00	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 52	16.00	6060.84	1.0	6061.00	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 53	18.00	6060.82	1.0	6061.00	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 96	127.00	6060.62	4.0	6065.70	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 71	191.00	6065.90	2.5	6070.67	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 102	16.00	6070.87	1.0	6071.03	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 70	158.00	6070.85	3.1	6075.75	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 100	16.00	6075.99	1.0	6076.15	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 101	16.00	6065.90	1.0	6066.06	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 12	187.00	6057.22	4.0	6064.70	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 104	175.00	6064.95	3.0	6070.20	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 69	170.00	6070.39	1.3	6072.60	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 48	120.00	6073.78	1.2	6075.22	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 90	83.00	6073.87	1.4	6075.03	0.013	0.83	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 92	64.00	6072.58	1.0	6073.22	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 84	133.76	18.92	25.08	7.84	13.71	16.66	3.19	Supercritical Jump	41.20	16.02	
SDMH 83	133.76	18.92	25.08	7.84	13.71	16.66	3.19	Supercritical	41.20	0.00	

SDMH 82	133.76	18.92	25.08	7.84	13.71	16.66	3.19	Supercritical	41.20	0.00	
SDMH 102	130.37	18.44	25.08	7.84	13.91	16.35	3.10	Supercritical	41.20	0.00	
SDMH 81	84.59	11.97	25.08	7.84	17.72	11.89	1.95	Supercritical	41.20	0.00	
SDMH 80	42.44	13.51	13.22	5.36	7.72	10.89	2.81	Supercritical	9.50	0.00	
SDMH 79	18.24	10.32	5.51	3.27	3.49	6.23	2.44	Supercritical	1.50	0.00	
SDIN 54	10.53	5.96	5.51	3.27	4.59	4.22	1.43	Supercritical	1.50	0.00	
SDMH 100	21.07	11.92	13.78	6.06	8.11	11.39	2.79	Supercritical	8.80	0.00	
SDIN 95	10.53	5.96	9.65	4.56	8.11	5.69	1.39	Supercritical Jump	4.40	7.24	
SDMH 101	21.07	11.92	9.88	4.63	5.71	9.54	2.86	Supercritical	4.60	0.00	
SDIN 94	10.53	5.96	9.88	4.63	8.32	5.76	1.39	Supercritical	4.60	0.00	
SDMH 78	87.20	12.34	22.86	7.27	15.71	11.61	2.05	Supercritical	34.40	0.00	
SDIN 93	14.90	8.43	9.77	4.59	6.79	7.38	2.01	Pressurized	4.50	11.00	
SDMH 76	94.58	13.38	22.20	7.11	14.55	12.13	2.24	Supercritical	32.50	0.00	
SDMH 75	94.58	13.38	22.20	7.11	14.55	12.13	2.24	Supercritical	32.50	0.00	
SDMH 74	133.76	18.92	22.20	7.11	12.09	15.61	3.21	Supercritical	32.50	0.00	
SDMH 103	133.76	18.92	22.20	7.11	12.09	15.61	3.21	Supercritical	32.50	0.00	
SDMH 73	133.76	18.92	22.20	7.11	12.09	15.61	3.21	Supercritical	32.50	0.00	
SDMH 72	45.37	14.44	19.86	7.70	11.60	14.23	2.89	Supercritical Jump	21.40	12.12	
SDIN 52	22.68	7.22	6.33	3.48	5.16	4.64	1.49	Supercritical	2.30	0.00	
SDIN 53	22.68	7.22	6.33	3.48	5.16	4.64	1.49	Supercritical	2.30	0.00	
SDMH 96	45.37	14.44	17.94	6.83	10.24	13.44	2.95	Supercritical	17.20	0.00	
SDMH 71	16.65	9.42	15.86	7.40	11.44	10.29	2.00	Supercritical	12.20	0.00	
SDIN 102	22.68	7.22	8.52	4.10	6.91	5.48	1.50	Supercritical	4.10	0.00	
SDMH 70	18.54	10.49	13.39	5.89	8.44	10.20	2.44	Supercritical	8.30	0.00	
SDIN 100	10.53	5.96	10.32	4.77	8.73	5.88	1.38	Supercritical	5.00	0.00	
SDIN 101	22.68	7.22	9.74	4.43	7.89	5.89	1.50	Supercritical Jump	5.30	3.52	
SDMH 12	133.76	18.92	17.71	6.10	9.67	13.81	3.21	Supercritical	21.10	0.00	
SDMH 104	115.84	16.39	17.71	6.10	10.40	12.46	2.78	Supercritical	21.10	0.00	
SDMH 69	76.25	10.79	15.77	5.68	11.52	8.67	1.83	Supercritical	16.90	0.00	
SDIN 48	24.85	7.91	8.74	4.16	6.76	5.93	1.64	Supercritical	4.30	0.00	
SDIN 90	79.13	11.19	14.08	5.31	10.10	8.37	1.90	Supercritical	13.60	0.00	
SDIN 92	22.68	7.22	10.57	4.65	8.57	6.15	1.50	Supercritical	6.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 84	41.20	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 83	41.20	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 82	41.20	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 102	41.20	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 81	41.20	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 80	9.50	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 79	1.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 54	1.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 100	8.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 95	4.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 101	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 94	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 78	34.40	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDIN 93	4.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 76	32.50	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 75	32.50	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 74	32.50	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 103	32.50	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 73	32.50	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 72	21.40	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDIN 52	2.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 53	2.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 96	17.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 71	12.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 102	4.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 70	8.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 100	5.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 101	5.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 12	21.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 104	21.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 69	16.90	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 48	4.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 90	13.60	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 92	6.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5993.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 84	5989.92	5999.00	0.00	0.00	5993.50	6001.09	5994.03	8.02	6002.04
SDMH 83	5999.88	6007.20	0.20	0.00	6001.29	6009.29	6005.33	4.91	6010.24
SDMH 82	6008.24	6015.40	0.06	0.00	6009.38	6017.49	6013.69	4.75	6018.44
SDMH 102	6016.21	6021.80	0.06	0.00	6017.55	6023.89	6021.52	3.32	6024.84
SDMH 81	6022.55	6025.00	0.03	0.00	6024.03	6027.09	6026.22	1.82	6028.04
SDMH 80	6026.10	6033.13	0.19	0.00	6027.28	6034.23	6028.58	6.10	6034.68
SDMH 79	6033.31	6034.63	0.00	0.00	6034.67	6035.09	6034.68	0.58	6035.26
SDIN 54	6034.83	6034.93	0.01	0.00	6035.21	6035.39	6035.49	0.07	6035.56
SDMH 100	6033.35	6037.03	0.51	0.00	6034.74	6038.18	6036.04	2.71	6038.75
SDIN 95	6037.22	6037.32	0.13	0.00	6038.78	6038.79	6038.88	0.01	6038.89
SDMH 101	6037.23	6042.75	0.01	0.00	6038.18	6043.57	6039.12	4.79	6043.91
SDIN 94	6042.95	6043.04	0.14	0.00	6043.71	6043.86	6044.16	0.04	6044.20
SDMH 78	6025.53	6026.36	0.02	0.00	6027.11	6028.27	6028.93	0.16	6029.08
SDIN 93	6027.04	6027.26	0.13	0.00	6029.12	6029.14	6029.22	0.02	6029.24
SDMH 76	6027.36	6035.00	0.02	0.00	6028.57	6036.85	6030.86	6.77	6037.63
SDMH 75	6036.02	6039.70	0.03	0.00	6037.23	6041.55	6039.52	2.81	6042.33
SDMH 74	6040.84	6047.80	0.04	0.00	6041.85	6049.65	6045.63	4.81	6050.43
SDMH 103	6048.08	6054.80	0.04	0.00	6049.69	6056.65	6052.87	4.57	6057.43
SDMH 73	6055.00	6057.00	0.03	0.00	6056.68	6059.31	6059.79	0.00	6059.79
SDMH 72	6057.88	6060.00	0.95	0.00	6060.26	6061.66	6060.98	1.60	6062.58
SDIN 52	6060.84	6061.00	0.01	0.00	6062.58	6062.58	6062.59	0.00	6062.59
SDIN 53	6060.82	6061.00	0.01	0.00	6062.58	6062.58	6062.59	0.00	6062.59
SDMH 96	6060.62	6065.70	0.02	0.00	6061.68	6067.19	6064.28	3.64	6067.92
SDMH 71	6065.90	6070.67	0.04	0.00	6067.23	6071.99	6068.49	4.35	6072.84
SDIN 102	6070.87	6071.03	0.03	0.00	6072.85	6072.85	6072.88	0.00	6072.88
SDMH 70	6070.85	6075.75	0.02	0.00	6072.01	6076.87	6073.17	4.23	6077.40
SDIN 100	6075.99	6076.15	0.16	0.00	6077.44	6077.44	6077.57	0.02	6077.59
SDIN 101	6065.90	6066.06	0.06	0.00	6067.93	6067.93	6067.98	0.00	6067.98
SDMH 12	6057.22	6064.70	0.01	0.00	6059.31	6066.18	6060.99	5.77	6066.75

SDMH 104	6064.95	6070.20	0.01	0.00	6066.18	6071.68	6068.23	4.02	6072.25
SDMH 69	6070.39	6072.60	0.00	0.00	6071.68	6073.91	6072.52	1.90	6074.41
SDIN 48	6073.78	6075.22	0.02	0.00	6074.34	6075.95	6074.89	1.33	6076.22
SDIN 90	6073.87	6075.03	0.05	0.00	6074.71	6076.20	6075.80	0.84	6076.64
SDIN 92	6072.58	6073.22	0.05	0.00	6073.29	6074.10	6073.88	0.55	6074.44

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 84	227.00	4.00	6.00	6.67	0.00	0.00	0.00	13.72	8.69	4.53	295.91	Sewer Too Shallow
SDMH 83	183.00	4.00	6.00	6.67	11.96	7.81	3.65	18.52	11.09	6.93	569.93	
SDMH 82	179.00	4.00	6.00	6.67	16.44	10.05	5.89	20.98	12.32	8.16	743.43	
SDMH 102	147.00	4.00	6.00	6.67	19.35	11.51	7.34	15.62	9.64	5.48	547.95	
SDMH 81	153.00	4.00	6.00	6.67	14.12	8.89	4.72	13.70	8.68	4.52	406.31	
SDMH 80	201.00	3.00	4.00	5.50	12.51	7.34	4.51	8.56	5.36	2.53	314.47	
SDMH 79	44.00	2.50	4.00	4.92	8.70	5.14	2.89	7.12	4.35	2.10	41.94	
SDIN 54	10.00	2.50	4.00	4.92	6.72	4.15	1.90	6.12	3.85	1.60	7.50	Sewer Too Shallow
SDMH 100	92.00	2.50	4.00	4.92	8.62	5.10	2.85	7.12	4.35	2.10	87.10	
SDIN 95	10.00	2.50	4.00	4.92	6.74	4.16	1.91	6.16	3.87	1.62	7.54	Sewer Too Shallow
SDMH 101	138.00	2.50	4.00	4.92	6.72	4.15	1.90	6.60	4.09	1.84	107.46	Sewer Too Shallow
SDIN 94	9.00	2.50	4.00	4.92	6.20	3.89	1.64	5.64	3.61	1.36	6.24	Sewer Too Shallow
SDMH 78	49.00	4.00	6.00	6.67	12.65	8.16	3.99	12.56	8.11	3.95	114.41	
SDIN 93	11.00	2.50	4.00	4.92	12.70	7.14	4.89	11.84	6.71	4.46	19.40	
SDMH 76	382.00	4.00	6.00	6.67	10.56	7.11	2.95	11.70	7.68	3.52	769.43	
SDMH 75	184.00	4.00	6.00	6.67	9.66	6.66	2.50	18.20	10.93	6.77	520.67	
SDMH 74	174.00	4.00	6.00	6.67	15.92	9.79	5.63	17.20	10.43	6.27	592.85	

SDMH 103	168.00	4.00	6.00	6.67	16.64	10.15	5.99	17.44	10.55	6.39	597.11	
SDMH 73	50.00	4.00	6.00	6.67	17.04	10.35	6.19	16.44	10.05	5.89	172.99	
SDMH 72	53.00	3.00	4.00	5.50	15.68	8.92	6.09	14.46	8.31	5.48	138.17	
SDIN 52	16.00	3.00	4.00	5.50	12.78	7.47	4.64	11.82	6.99	4.16	30.46	
SDIN 53	18.00	3.00	4.00	5.50	12.82	7.49	4.66	11.82	6.99	4.16	34.35	
SDMH 96	127.00	3.00	4.00	5.50	13.22	7.69	4.86	9.30	5.73	2.90	217.21	
SDMH 71	191.00	2.50	4.00	4.92	9.41	5.50	3.25	9.30	5.44	3.19	225.07	
SDIN 102	16.00	3.00	4.00	5.50	8.40	5.28	2.45	7.44	4.80	1.97	17.34	Sewer Too Shallow
SDMH 70	158.00	2.50	4.00	4.92	8.94	5.26	3.01	6.92	4.25	2.00	151.58	
SDIN 100	16.00	2.50	4.00	4.92	6.44	4.01	1.76	5.48	3.53	1.28	11.18	Sewer Too Shallow
SDIN 101	16.00	3.00	4.00	5.50	8.90	5.53	2.70	7.94	5.05	2.22	18.55	
SDMH 12	187.00	4.00	6.00	6.67	16.00	9.83	5.67	16.62	10.14	5.98	622.37	
SDMH 104	175.00	4.00	6.00	6.67	16.12	9.89	5.73	16.10	9.88	5.72	571.77	
SDMH 69	170.00	4.00	6.00	6.67	15.72	9.69	5.53	15.30	9.48	5.32	525.64	
SDIN 48	120.00	3.00	4.00	5.50	13.94	8.05	5.22	11.18	6.67	3.84	237.49	
SDIN 90	83.00	4.00	6.00	6.67	12.76	8.22	4.05	11.76	7.71	3.55	187.47	
SDIN 92	64.00	3.00	4.00	5.50	12.34	7.25	4.42	10.24	6.20	3.37	108.24	

Total earth volume for sewer trenches = 9020 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/5/2017 11:38:29 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond D (Pond F-1) **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5993.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Outfall	5988.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH	6006.86	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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SDMH 83	6017.46	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 82	6026.89	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 102	6030.61	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 81	6032.85	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 78	6033.64	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 76	6041.85	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 75	6049.80	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 74	6057.40	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 103	6064.52	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 73	6066.22	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 12	6074.01	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 104	6079.25	82.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 92	6078.84	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 69	6081.25	69.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 48	6081.31	19.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 90	6081.91	54.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Outfall	0.00	0.00	0.00	0.00	0.00	6.99	11.83	0.32	82.70	Surface Water Present (Upstream)
SDMH 84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	Surface Water Present (Downstream)
SDMH 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	

SDMH 102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDMH 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.70	
SDIN 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	
SDMH 69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.50	
SDIN 48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.60	
SDIN 90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 84	227.00	5989.92	4.0	5999.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 83	183.00	5999.88	4.0	6007.20	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 82	179.00	6008.24	4.0	6015.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 102	147.00	6016.21	3.8	6021.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 81	153.00	6022.55	1.6	6025.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 78	49.00	6025.53	1.7	6026.36	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 76	382.00	6027.36	2.0	6035.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 75	184.00	6036.02	2.0	6039.70	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 74	174.00	6040.84	4.0	6047.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 103	168.00	6048.08	4.0	6054.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 73	50.00	6055.00	4.0	6057.00	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 12	187.00	6057.22	4.0	6064.70	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 104	175.00	6064.95	3.0	6070.20	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 92	64.00	6072.58	1.0	6073.22	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 69	170.00	6070.39	1.3	6072.60	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 48	120.00	6073.78	1.2	6075.22	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 90	83.00	6073.87	1.4	6075.03	0.013	0.83	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDMH 84	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical Jump	82.70	23.47	Velocity is Too High
SDMH 83	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical	82.70	0.00	Velocity is Too High
SDMH 82	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical	82.70	0.00	Velocity is Too High
SDMH 102	130.37	18.44	33.53	12.06	20.82	19.53	2.88	Supercritical	82.70	0.00	Velocity is Too High
SDMH 81	84.59	11.97	33.53	12.06	28.80	13.64	1.51	Supercritical	82.70	0.00	
SDMH 78	87.20	12.34	33.53	12.06	27.97	14.04	1.61	Supercritical	82.70	0.00	
SDMH 76	94.58	13.38	33.53	12.06	26.07	15.08	1.86	Supercritical	82.70	0.00	
SDMH 75	94.58	13.38	33.53	12.06	26.07	15.08	1.86	Supercritical	82.70	0.00	
SDMH 74	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical	82.70	0.00	Velocity is Too High
SDMH 103	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical	82.70	0.00	Velocity is Too High
SDMH 73	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical	82.70	0.00	Velocity is Too High
SDMH 12	133.76	18.92	33.53	12.06	20.48	19.92	2.97	Supercritical Jump	82.70	25.38	Velocity is Too High
SDMH 104	115.84	16.39	33.53	12.06	22.49	17.80	2.48	Supercritical	82.70	0.00	
SDIN 92	22.68	7.22	18.82	7.19	16.81	8.09	1.26	Supercritical	19.00	0.00	
SDMH 69	76.25	10.79	31.81	10.52	26.99	12.23	1.46	Pressurized	69.50	170.00	
SDIN 48	24.85	7.91	19.09	7.31	16.07	8.76	1.42	Pressurized	19.60	120.00	
SDIN 90	79.13	11.19	28.76	9.00	21.96	12.07	1.71	Supercritical	54.50	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element	**Peak**	**Cross**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area**	**Comment**

Name	Flow (cfs)	Section							(ft^2)	
SDMH 84	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 83	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 82	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 102	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 81	82.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 78	82.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 76	82.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 75	82.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 74	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 103	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 73	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 12	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 104	82.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 92	19.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 69	69.50	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDIN 48	19.60	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDIN 90	54.50	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5993.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 84	5989.92	5999.00	0.00	0.00	5993.50	6001.79	5995.63	8.43	6004.05
SDMH 83	5999.88	6007.20	0.81	0.00	6002.60	6009.99	6007.75	4.51	6012.25
SDMH 82	6008.24	6015.40	0.23	0.00	6010.23	6018.19	6016.11	4.35	6020.45
SDMH 102	6016.21	6021.80	0.23	0.00	6018.43	6024.59	6023.87	2.98	6026.85
SDMH 81	6022.55	6025.00	0.11	0.00	6024.95	6027.79	6027.84	2.21	6030.05
SDMH 78	6025.53	6026.36	0.11	0.00	6027.90	6029.15	6030.92	0.50	6031.41
SDMH 76	6027.36	6035.00	0.11	0.00	6029.53	6037.79	6033.07	6.99	6040.05
SDMH 75	6036.02	6039.70	0.17	0.00	6038.19	6042.49	6041.73	3.03	6044.75
SDMH 74	6040.84	6047.80	0.23	0.00	6042.73	6050.59	6048.71	4.15	6052.85

SDMH 103	6048.08	6054.80	0.23	0.00	6050.83	6057.59	6055.95	3.91	6059.85
SDMH 73	6055.00	6057.00	0.17	0.00	6057.76	6060.74	6062.87	0.00	6062.87
SDMH 12	6057.22	6064.70	0.11	0.00	6060.85	6067.49	6062.97	6.78	6069.75
SDMH 104	6064.95	6070.20	0.11	0.00	6067.60	6072.99	6071.75	3.51	6075.25
SDIN 92	6072.58	6073.22	0.47	0.00	6073.99	6074.79	6074.99	0.60	6075.59
SDMH 69	6070.39	6072.60	0.08	0.00	6073.83	6075.66	6075.33	1.84	6077.16
SDIN 48	6073.78	6075.22	0.50	0.00	6077.06	6077.96	6077.67	0.90	6078.56
SDIN 90	6073.87	6075.03	0.77	0.00	6076.43	6077.43	6077.96	0.73	6078.69

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
SDMH 84	227.00	4.00	6.00	6.67	0.00	0.00	0.00	13.72	8.69	4.53	295.91	Sewer Too Shallow
SDMH 83	183.00	4.00	6.00	6.67	11.96	7.81	3.65	18.52	11.09	6.93	569.93	
SDMH 82	179.00	4.00	6.00	6.67	16.44	10.05	5.89	20.98	12.32	8.16	743.43	
SDMH 102	147.00	4.00	6.00	6.67	19.35	11.51	7.34	15.62	9.64	5.48	547.95	
SDMH 81	153.00	4.00	6.00	6.67	14.12	8.89	4.72	13.70	8.68	4.52	406.31	
SDMH 78	49.00	4.00	6.00	6.67	12.65	8.16	3.99	12.56	8.11	3.95	114.41	
SDMH 76	382.00	4.00	6.00	6.67	10.56	7.11	2.95	11.70	7.68	3.52	769.43	
SDMH 75	184.00	4.00	6.00	6.67	9.66	6.66	2.50	18.20	10.93	6.77	520.67	
SDMH 74	174.00	4.00	6.00	6.67	15.92	9.79	5.63	17.20	10.43	6.27	592.85	
SDMH 103	168.00	4.00	6.00	6.67	16.64	10.15	5.99	17.44	10.55	6.39	597.11	
SDMH 73	50.00	4.00	6.00	6.67	17.04	10.35	6.19	16.44	10.05	5.89	172.99	
SDMH 12	187.00	4.00	6.00	6.67	16.00	9.83	5.67	16.62	10.14	5.98	622.37	
SDMH 104	175.00	4.00	6.00	6.67	16.12	9.89	5.73	16.10	9.88	5.72	571.77	
SDIN 92	64.00	3.00	4.00	5.50	12.34	7.25	4.42	10.24	6.20	3.37	108.24	
SDMH 69	170.00	4.00	6.00	6.67	15.72	9.69	5.53	15.30	9.48	5.32	525.64	
SDIN 48	120.00	3.00	4.00	5.50	13.94	8.05	5.22	11.18	6.67	3.84	237.49	

SDIN 90	83.00	4.00	6.00	6.67	12.76	8.22	4.05	11.76	7.71	3.55	187.47	

Total earth volume for sewer trenches = 7584 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/8/2017 3:38:42 PM	**UDSewer Results Summary** **Project Title:** Pond D (Basin F3a) 2 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5991.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond D (Basin	5991.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

F3) 100 Year										
SDIN 60	5994.85	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 59	5994.81	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond D (Basin F3) 100 Year	0.00	0.00	0.00	0.00	0.00	0.96	3.55	3.60	3.40	
SDIN 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40	
SDIN 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDIN 60	104.00	5988.54	1.4	5990.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 59	53.00	5990.27	1.0	5990.80	0.013	0.29	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDIN 60	79.13	11.19	6.90	3.59	5.09	5.58	1.82	Supercritical	3.40	0.00	
SDIN 59	41.13	8.38	5.24	3.13	4.28	4.20	1.49	Supercritical	1.80	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**

	(cfs)									
SDIN 60	3.40	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 59	1.80	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5991.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 60	5988.54	5990.00	0.00	0.00	5991.00	5991.00	5991.00	0.04	5991.04
SDIN 59	5990.27	5990.80	0.00	0.00	5991.01	5991.24	5991.04	0.35	5991.39

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 60	104.00	4.00	6.00	6.67	0.00	3.90	0.00	7.70	5.68	1.52	123.55	Sewer Too Shallow
SDIN 59	53.00	3.50	6.00	6.08	7.66	5.37	1.79	6.52	4.80	1.22	61.40	Sewer Too Shallow

Total earth volume for sewer trenches = 185 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/8/2017 3:36:33 PM	**UDSewer Results Summary** **Project Title:** Pond D (Basin F3) 100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5991.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond D (Basin	5991.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

F3) 100 Year										
SDIN 60	5994.85	36.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 59	5994.81	22.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond D (Basin F3) 100 Year	0.00	0.00	0.00	0.00	0.00	3.08	11.82	0.34	36.40	
SDIN 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.40	
SDIN 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDIN 60	104.00	5988.54	1.4	5990.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 59	53.00	5990.27	1.0	5990.80	0.013	0.29	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDIN 60	79.13	11.19	23.54	7.43	17.15	10.96	1.83	Supercritical	36.40	0.00	
SDIN 59	41.13	8.38	19.23	6.68	15.70	8.54	1.47	Supercritical	22.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**

	(cfs)									
SDIN 60	36.40	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDIN 59	22.20	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5991.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 60	5988.54	5990.00	0.00	0.00	5991.00	5991.96	5991.84	0.98	5992.82
SDIN 59	5990.27	5990.80	0.09	0.00	5992.57	5992.57	5992.91	0.21	5993.12

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 60	104.00	4.00	6.00	6.67	0.00	3.90	0.00	7.70	5.68	1.52	123.55	Sewer Too Shallow
SDIN 59	53.00	3.50	6.00	6.08	7.66	5.37	1.79	6.52	4.80	1.22	61.40	Sewer Too Shallow

Total earth volume for sewer trenches = 185 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 5/8/2017 2:51:34 PM	**UDSewer Results Summary** **Project Title:** Pond D (Basin F3b) 100 Year **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5993.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond D (Basin	5991.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

F3) 100 Year										
SDIN 83	5997.00	78.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 81	5997.00	39.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
Pond D (Basin F3) 100 Year	0.00	0.00	0.00	0.00	0.00	6.61	11.87	0.28	78.50	Surface Water Present (Upstream)
SDIN 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.50	Surface Water Present (Downstream)
SDIN 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.25	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
SDIN 83	104.00	5988.54	1.4	5990.00	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDIN 81	53.00	5990.47	2.0	5991.53	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
SDIN 83	170.42	13.56	32.19	8.76	22.88	13.28	1.92	Supercritical Jump	78.50	86.68	
SDIN 81	94.58	13.38	24.47	7.67	16.17	12.76	2.21	Supercritical Jump	39.25	28.23	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDIN 83	78.50	CIRCULAR	48.00 in	48.00 in	36.00 in	36.00 in	48.00 in	48.00 in	12.57	
SDIN 81	39.25	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5993.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 83	5988.54	5990.00	0.00	0.00	5993.50	5993.72	5994.11	0.26	5994.36
SDIN 81	5990.47	5991.53	0.05	0.00	5993.94	5993.94	5994.42	0.17	5994.58

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 83	104.00	5.00	6.00	7.83	0.00	3.98	0.00	11.00	7.92	2.58	184.35	Sewer Too Shallow
SDIN 81	53.00	4.00	6.00	6.67	11.06	7.36	3.20	8.94	6.30	2.14	95.43	

Total earth volume for sewer trenches = 280 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/24/2017 10:22:35 AM	**UDSewer Results Summary** **Project Title:** Trails at Crowfoot Pond D Outfall **Project Description:** Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5985.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	**Ground Elevation (ft)**	**Total Known Flow (cfs)**	**Local Contribution (cfs)**	**Drainage Area (Ac.)**	**Runoff Coefficient**	**5yr Coefficient**	**Overland Length (ft)**	**Overland Slope (%)**	**Gutter Length (ft)**	**Gutter Velocity (fps)**
Pond D Outfall	5985.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Outlet Pipe 1	5988.70	58.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond D Outfall	0.00	0.00	0.00	0.00	0.00	4.86	12.02	0.12	58.42	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.42	Surface Water Present (Upstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	59.00	5983.51	3.8	5985.75	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	130.37	18.44	29.67	9.37	16.89	17.94	3.03	Supercritical	58.42	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Outlet Pipe 1	58.42	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.

- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5985.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Outlet Pipe 1	5983.51	5985.75	0.00	0.00	5985.00	5988.85	5989.91	0.00	5989.91

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
Outlet Pipe 1	59.00	4.00	6.00	6.67	0.00	3.08	0.00	6.67	3.78	0.00	49.96	Sewer Too Shallow

Total earth volume for sewer trenches = 50 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

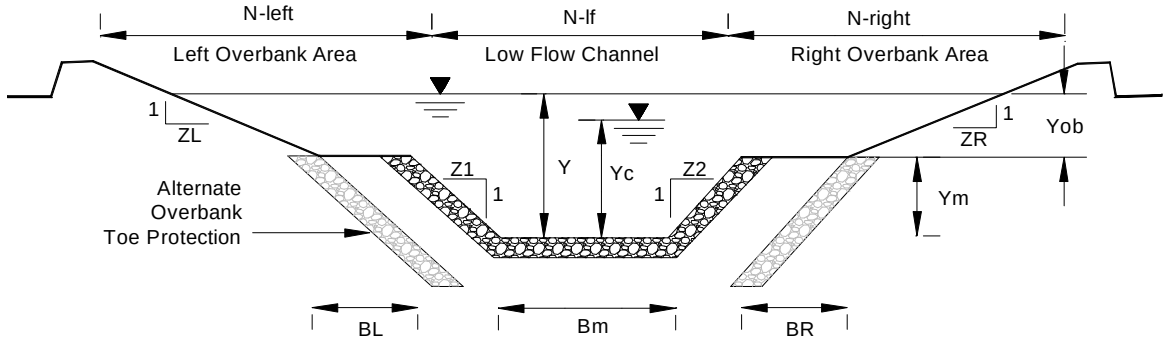
III. Hydraulic Computations

4. UD Channel
5. UD Culvert

Capacity Analysis of Composite Channel

Project: Trails at Crowfoot

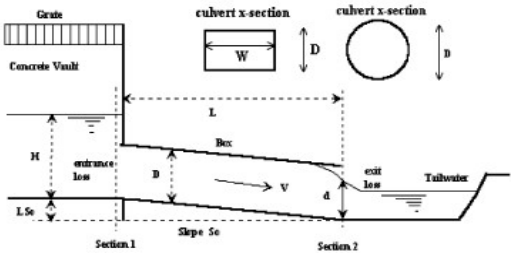
Channel ID: West Channel (100-YR 268 CFS/70% of 2-YR 39 CFS)



Design Information (Input)					
Channel Invert Slope	So =	0.00200 ft/ft	Left Overbank Bottom Width	BL =	8.00 ft
			Left Overbank Side Slope	ZL =	4.00 ft/ft
Low Flow Channel Bottom Width	Bm =	10.00 ft	Left Overbank Manning's n	n-left =	0.0400
Low Flow Channel Left Side Slope	Z1 =	4.00 ft/ft	Right Overbank Bottom Width	BR =	8.00 ft
Low Flow Channel Right Side Slope	Z2 =	4.00 ft/ft	Right Overbank Side Slope	ZR =	4.00 ft/ft
Low Flow Channel Manning's Nn for Qd	n-lf =	0.0250	Right Overbank Manning's n	n-right =	0.0400
Low Flow Channel Manning's Nn for Q100	n-m-Q100 =	0.0250			
(See USDCM Vol. II, n vs. Depth Graph)					
Low Flow Channel Bank-full depth	**Ym =**	**1.15 ft**	**Overbank Flow Depth Yob (Y - Ym)**	**Yob =**	**1.50 ft**
Low Flow Channel Condition for Qd			**Low Flow Channel Flow Condition for Q100**		
Top width	Tlf =	19.2 ft	Top width	Tm =	19.2 ft
Flow area	Alf =	16.8 sq ft	Flow area	Am =	45.6 sq ft
Wetted perimeter	Plf =	19.5 ft	Wetted perimeter	Pm =	19.5 ft
Discharge (Calculated)	**Qlf =**	**40.5 cfs**	**Discharge**	**Qm =**	**214.2 cfs**
Velocity	**Vlf=**	**2.4 fps**	**Velocity**	**Vm =**	**4.7 fps**
Froude number	**Fr-lf =**	**0.45**	**Froude number**	**Frm =**	**0.54**
Qd Critical Velocity	Vlfc =	4.36 fps	100-Yr. Critical Velocity	Vmc =	7.1 fps
Qd Critical Depth	Ylfc =	0.72 ft	100-Yr. Critical Depth	Ymc =	1.8 ft
Left Overbank Flow Condition for Q100			**Right Overbank Flow Condition for Q100**		
Top width	TL =	14.0 ft	Top width	TR =	14.0 ft
Flow area	AL =	16.5000 sq ft	Flow area	AR =	16.5000 sq ft
Wetted perimeter	PL =	14.1800 ft	Wetted perimeter	PR =	14.1800 ft
Discharge	**QL =**	**30.4 cfs**	**Discharge**	**QR =**	**30.4 cfs**
Velocity	**VL =**	**1.8 fps**	**Velocity**	**VR =**	**1.8 fps**
Froude number	**FrL =**	**0.30**	**Froude number**	**FrR =**	**0.30**
100-Yr. Critical Velocity	VLc =	4.5 fps	100-Yr. Critical Velocity	VRc =	4.5 fps
100-Yr. Critical Depth in Overbanks	YLc =	0.7 ft	100-Yr. Critical Depth in Overbanks	YRc =	0.7 ft
Composite Cross-Section Flow Condition for Q100					
Top width	**T =**	**47.2 ft**	**Discharge**	**Q =**	**275.0 cfs**
Channel Depth Y	**Y =**	**2.65 ft**	**Velocity**	**V =**	**3.5 fps**
Flow area	A =	78.6 sq ft	**Froude number**	**Fr =**	**0.48**
Wetted perimeter	P =	47.9 ft	100-Yr. Critical Velocity	Vc =	6.0 fps
Cross-Sectional Manning's n (Calculated)	n =	0.0265	100-Yr. Critical Depth in Overbanks	Yc =	0.76 ft

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfooot
Basin ID: 6'x6' RCB (Q_{100} = 268 CFS)
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =		inches
	Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =	6.00	ft.
	Barrel Width (Span) in Feet	Width (Span) =	6.00	ft.
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Bevel w/ 90 Deg. Headwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	6001	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	5998	ft. elev.
	Culvert Length in Feet	L =	329	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.94
Sum of All Loss Coefficients	K_s =	2.14
Orifice Inlet Condition Coefficient	C_d =	1.03
Minimum Energy Condition Coefficient	KE_{low} =	0.0401

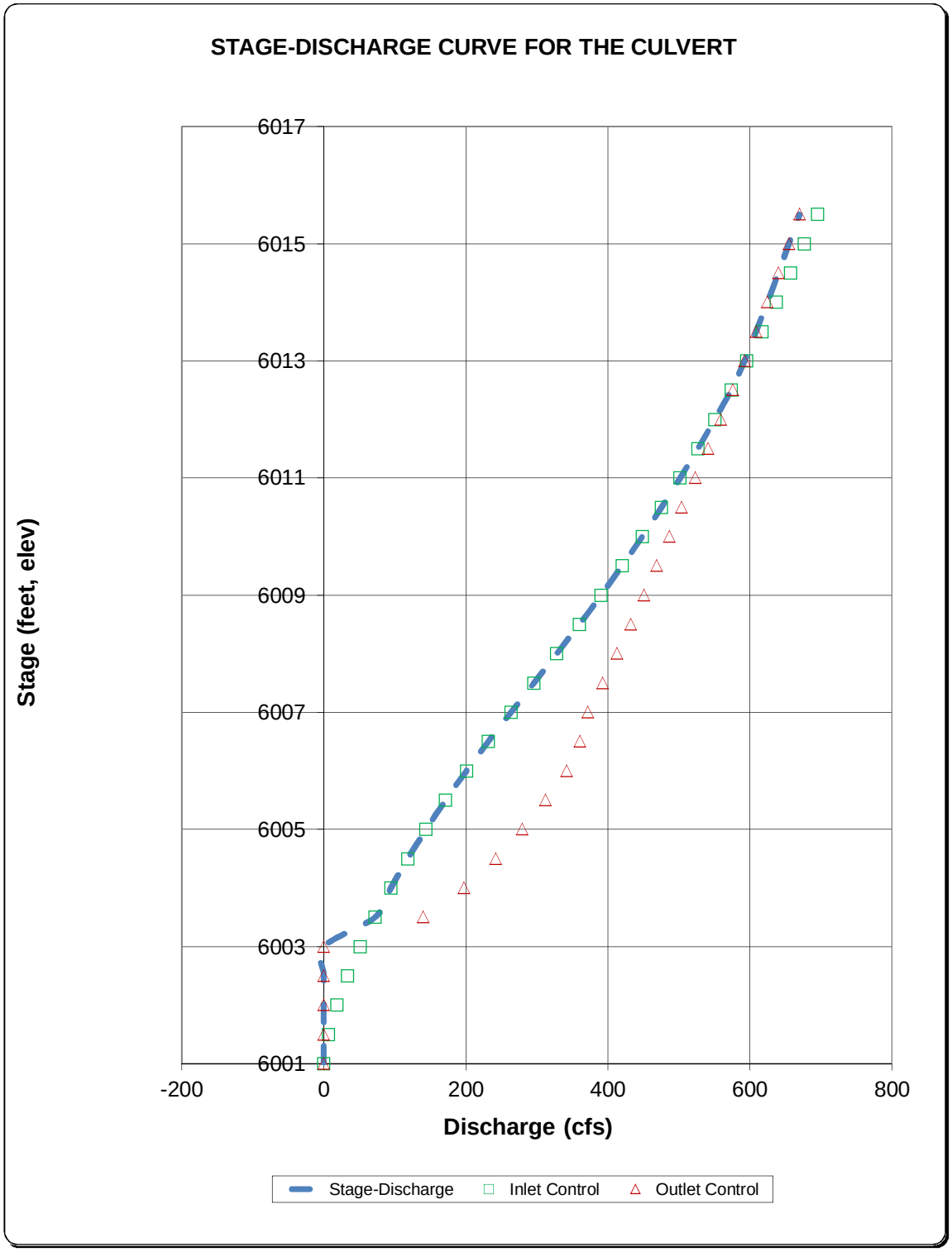
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
6001.00	6003.00	0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
6001.50	6003.00	6.50	0.00	**0.00**	Min. Energy. Eqn.	N/A
6002.00	6003.00	18.20	0.00	**0.00**	Min. Energy. Eqn.	N/A
6002.50	6003.00	33.40	0.00	**0.00**	Min. Energy. Eqn.	N/A
6003.00	6003.00	51.40	0.00	**0.00**	Min. Energy. Eqn.	N/A
6003.50	6003.00	71.90	139.70	**71.90**	Min. Energy. Eqn.	INLET
6004.00	6003.00	94.50	197.55	**94.50**	Min. Energy. Eqn.	INLET
6004.50	6003.00	118.20	241.96	**118.20**	Regression Eqn.	INLET
6005.00	6003.00	143.90	279.37	**143.90**	Regression Eqn.	INLET
6005.50	6003.00	171.50	312.35	**171.50**	Regression Eqn.	INLET
6006.00	6003.00	200.80	342.16	**200.80**	Regression Eqn.	INLET
6006.50	6003.00	231.60	360.88	**231.60**	Regression Eqn.	INLET
6007.00	6003.00	263.50	371.67	**263.50**	Regression Eqn.	INLET
6007.50	6003.00	295.80	392.54	**295.80**	Regression Eqn.	INLET
6008.00	6003.00	328.00	412.60	**328.00**	Regression Eqn.	INLET
6008.50	6003.00	359.60	431.91	**359.60**	Regression Eqn.	INLET
6009.00	6003.00	390.40	450.58	**390.40**	Regression Eqn.	INLET
6009.50	6003.00	420.00	468.65	**420.00**	Regression Eqn.	INLET
6010.00	6003.00	448.40	486.18	**448.40**	Regression Eqn.	INLET
6010.50	6003.00	475.60	503.64	**475.60**	Regression Eqn.	INLET
6011.00	6003.00	501.60	522.66	**501.60**	Regression Eqn.	INLET
6011.50	6003.00	526.60	540.99	**526.60**	Regression Eqn.	INLET
6012.00	6003.00	550.40	558.73	**550.40**	Regression Eqn.	INLET
6012.50	6003.00	573.40	575.93	**573.40**	Regression Eqn.	INLET
6013.00	6003.00	595.50	592.64	**592.64**	Regression Eqn.	OUTLET
6013.50	6003.00	616.80	608.86	**608.86**	Regression Eqn.	OUTLET
6014.00	6003.00	637.30	624.69	**624.69**	Regression Eqn.	OUTLET
6014.50	6003.00	657.30	640.12	**640.12**	Regression Eqn.	OUTLET
6015.00	6003.00	676.60	655.18	**655.18**	Regression Eqn.	OUTLET
6015.50	6003.00	695.30	669.90	**669.90**	Regression Eqn.	OUTLET

Processing Time: 04.71 Seconds

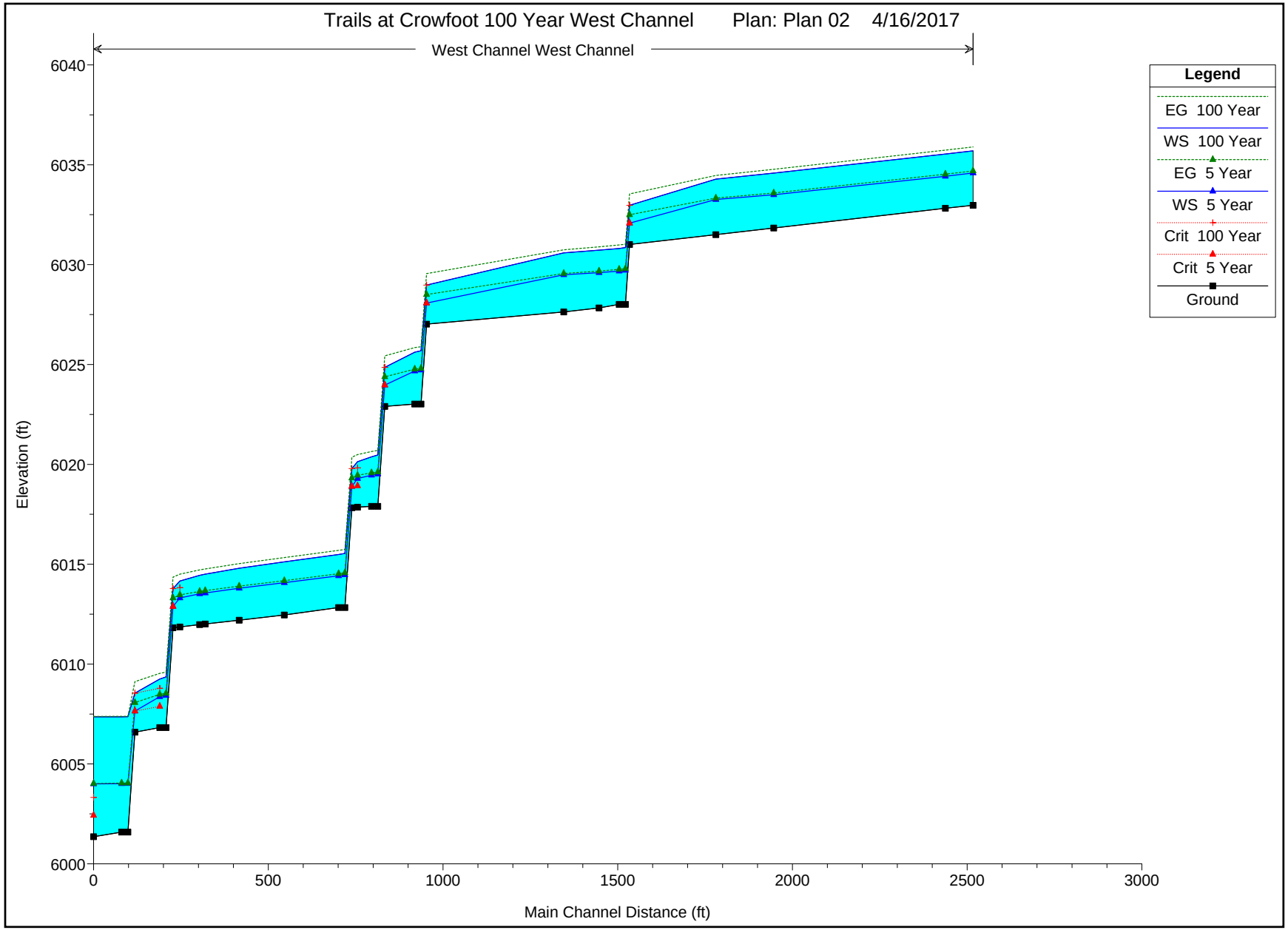
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfooot
Basin ID: 6'x6' RCB (Q100 = 268 CFS)



III. Hydraulic Computations

. HECRAS Analysis


Trails at Crowfoot 100 Year West Channel Plan: Plan 02 4/16/2017
West Channel West Channel
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EG 5 Year
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Crit 100 Year
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Ground
Elevation (ft)
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6010
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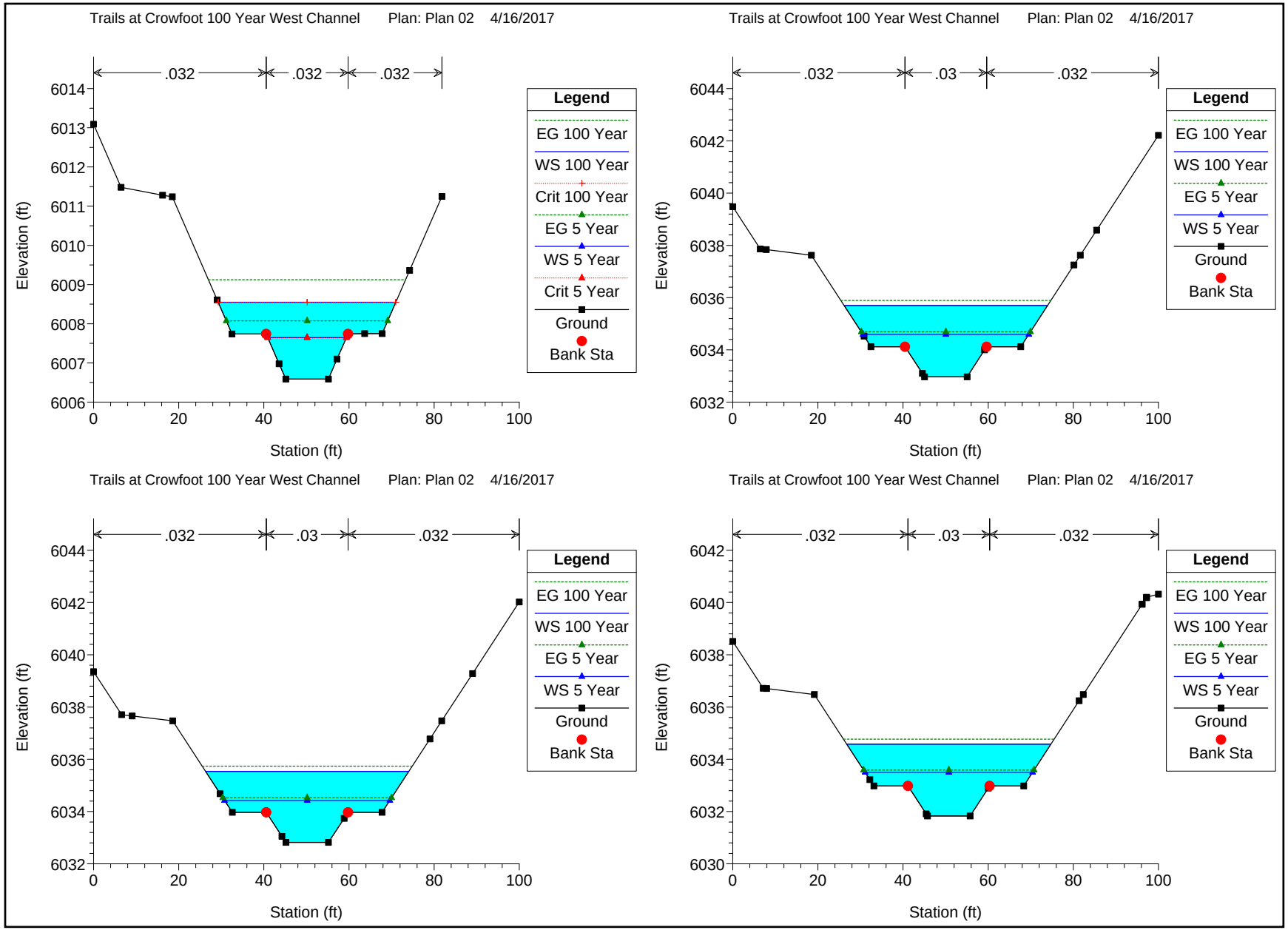
Main Channel Distance (ft)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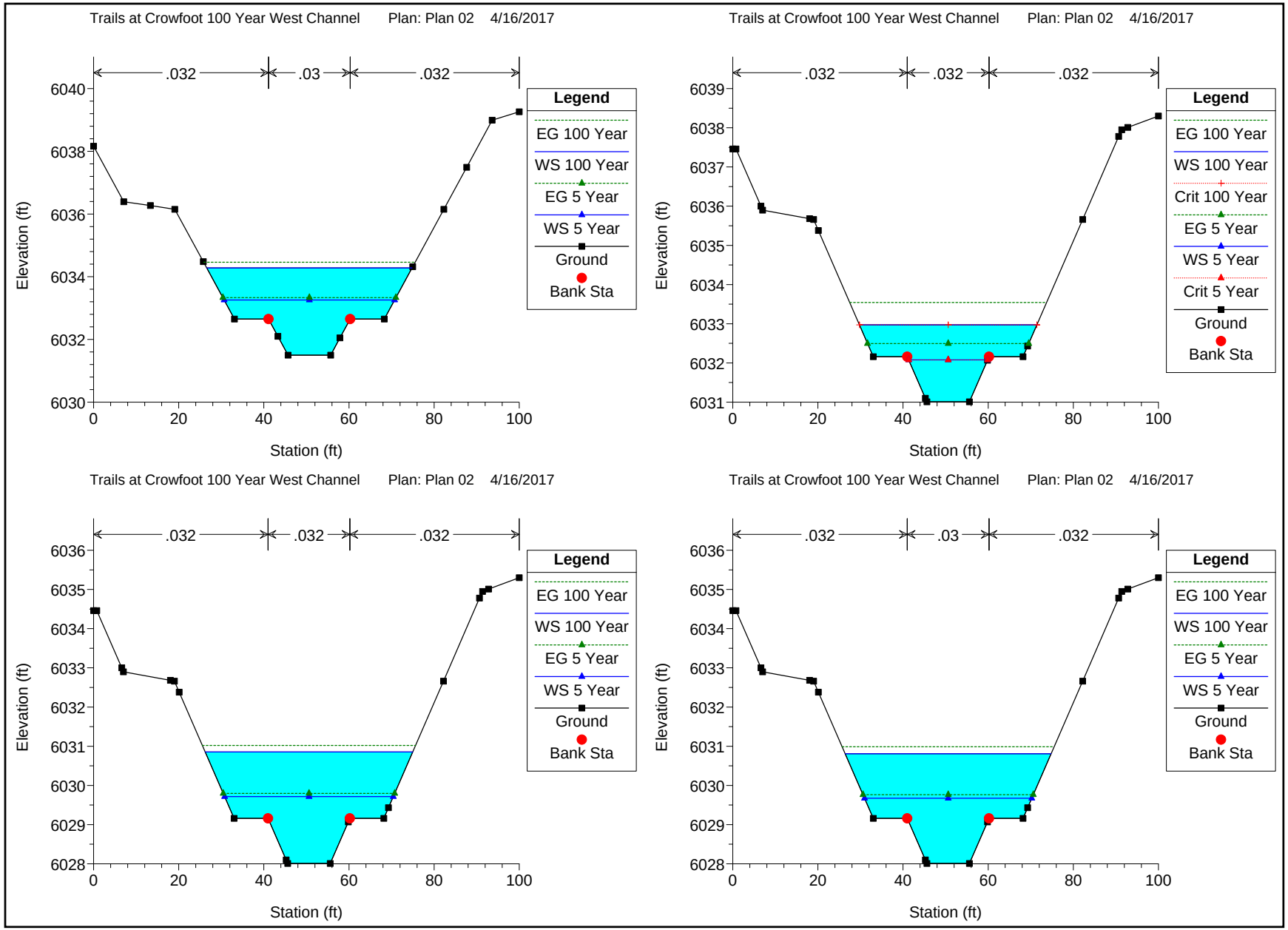
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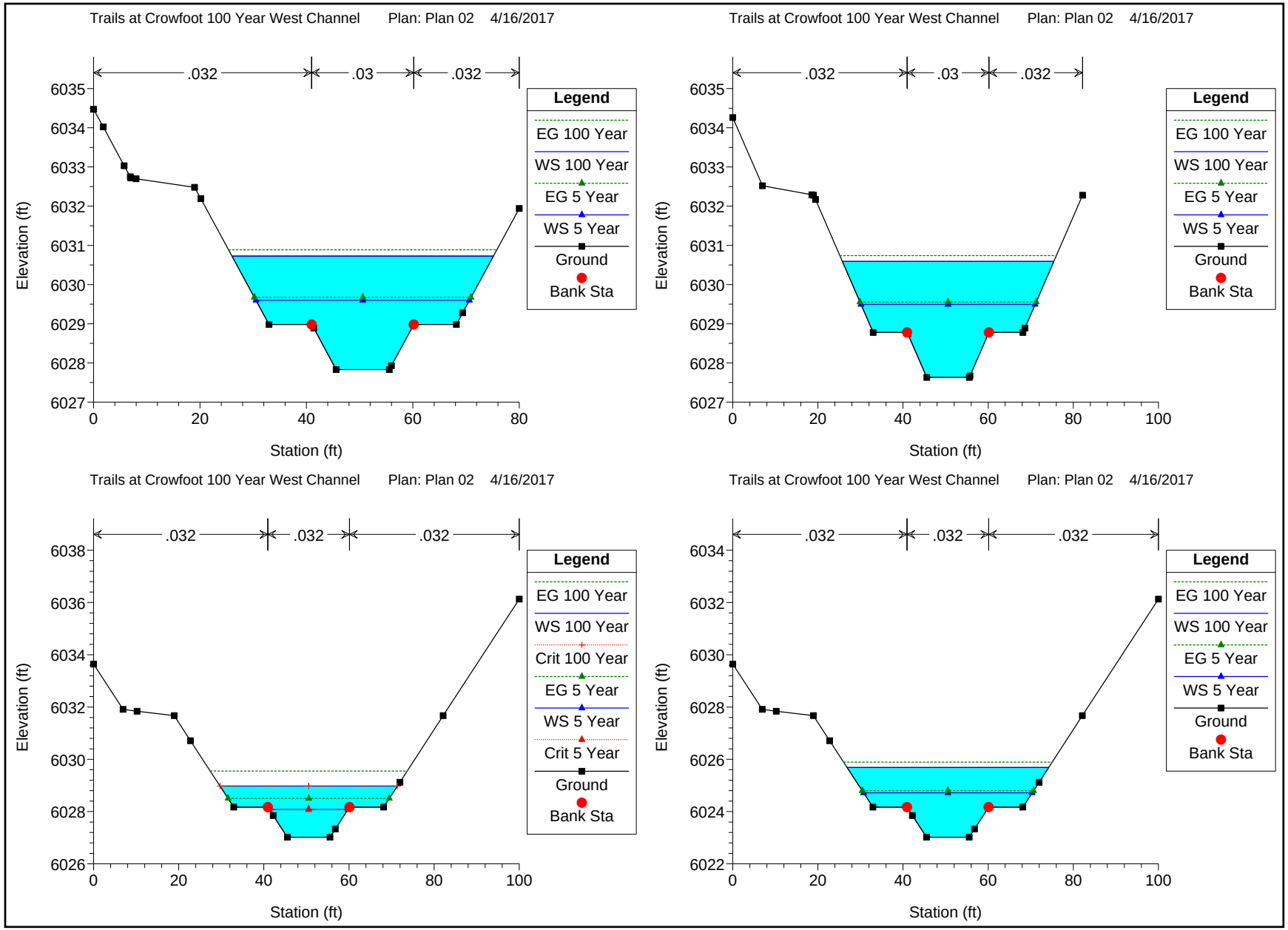
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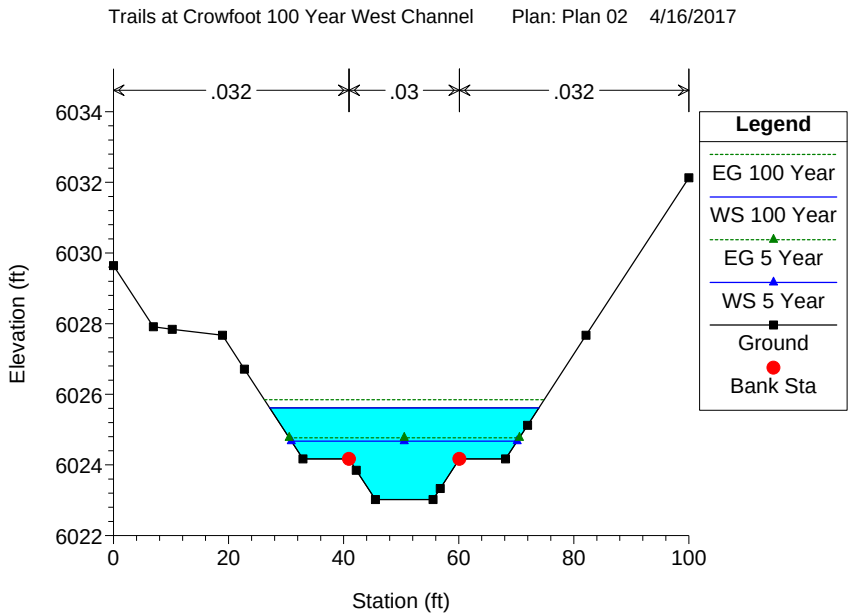
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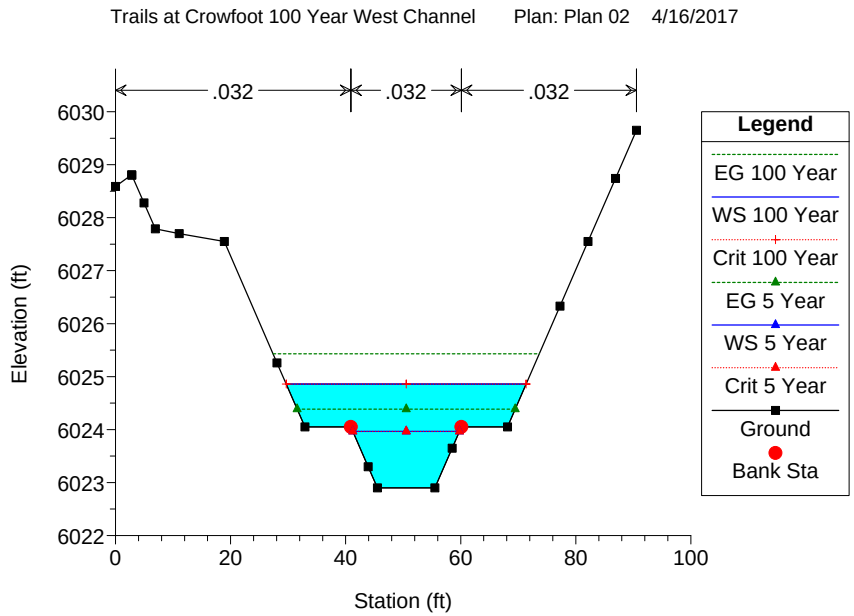
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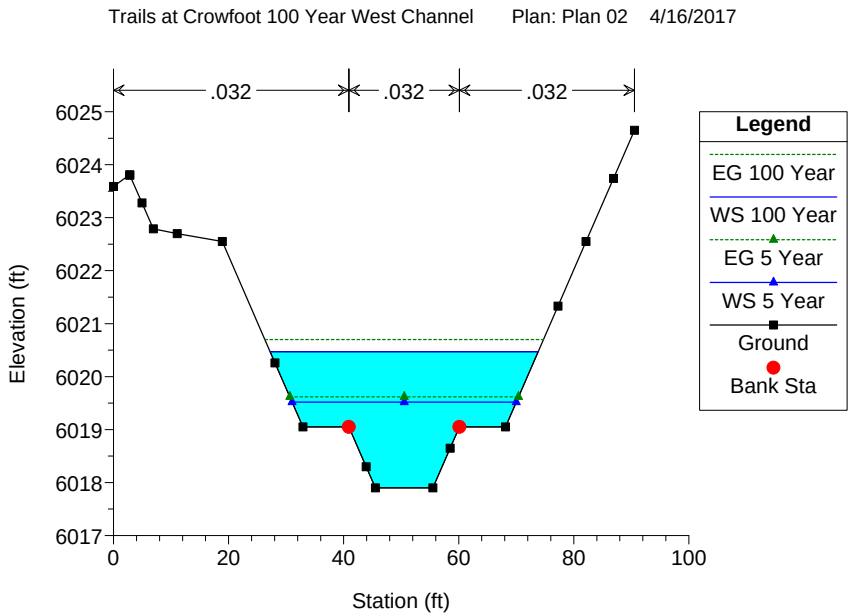
Trails at Crowfoot 100 Year West Channel Plan: Plan 02 4/16/2017
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Elevation (ft)
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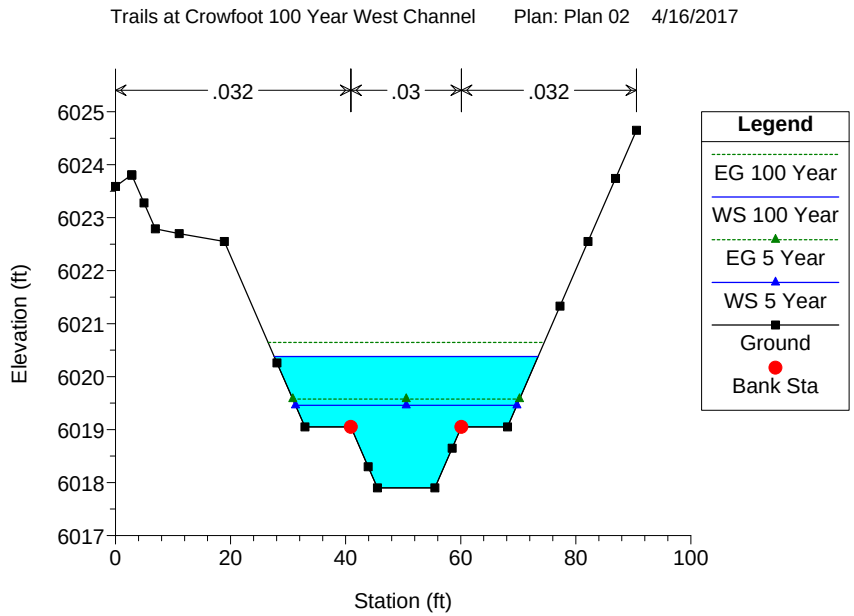
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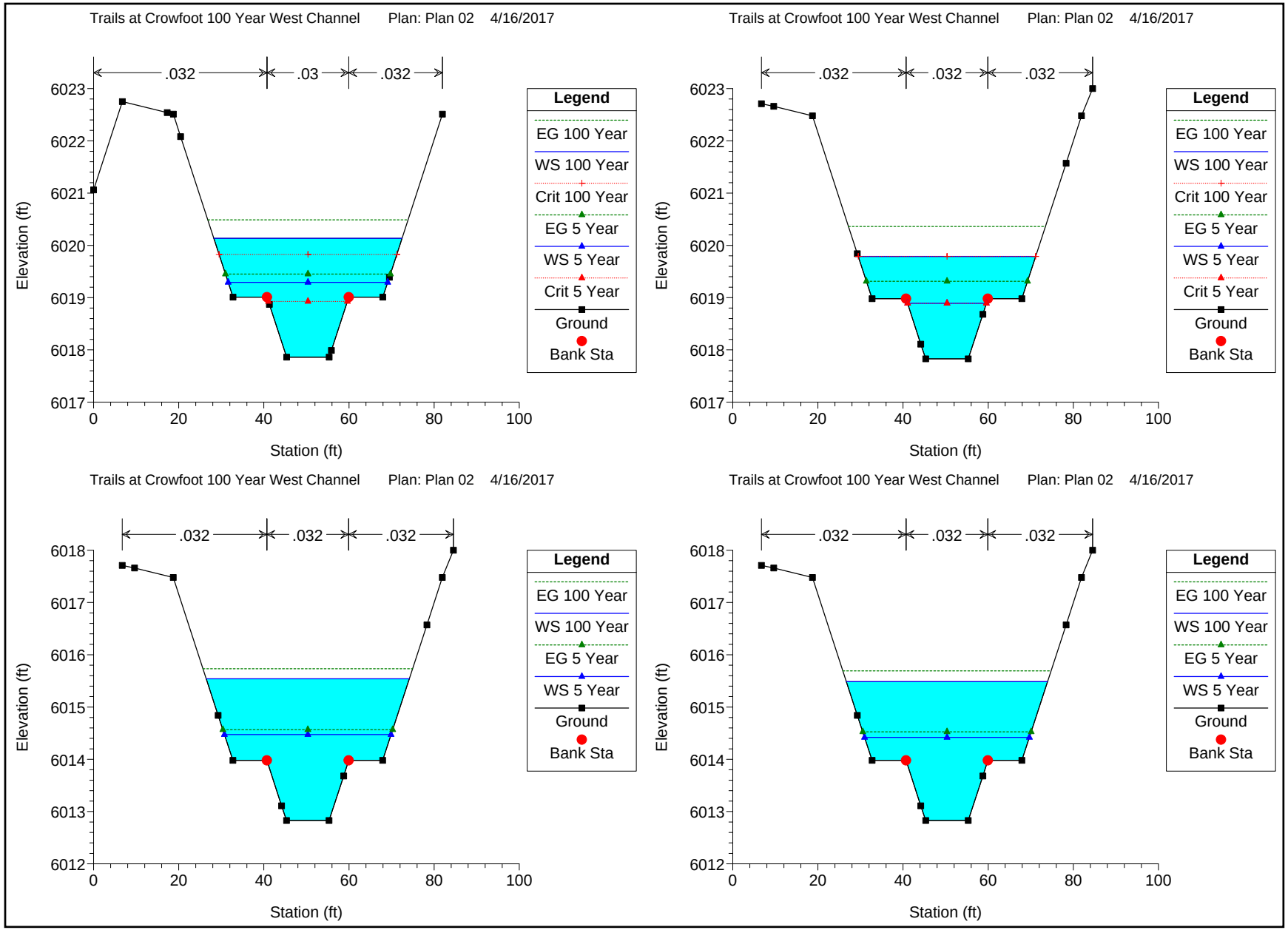
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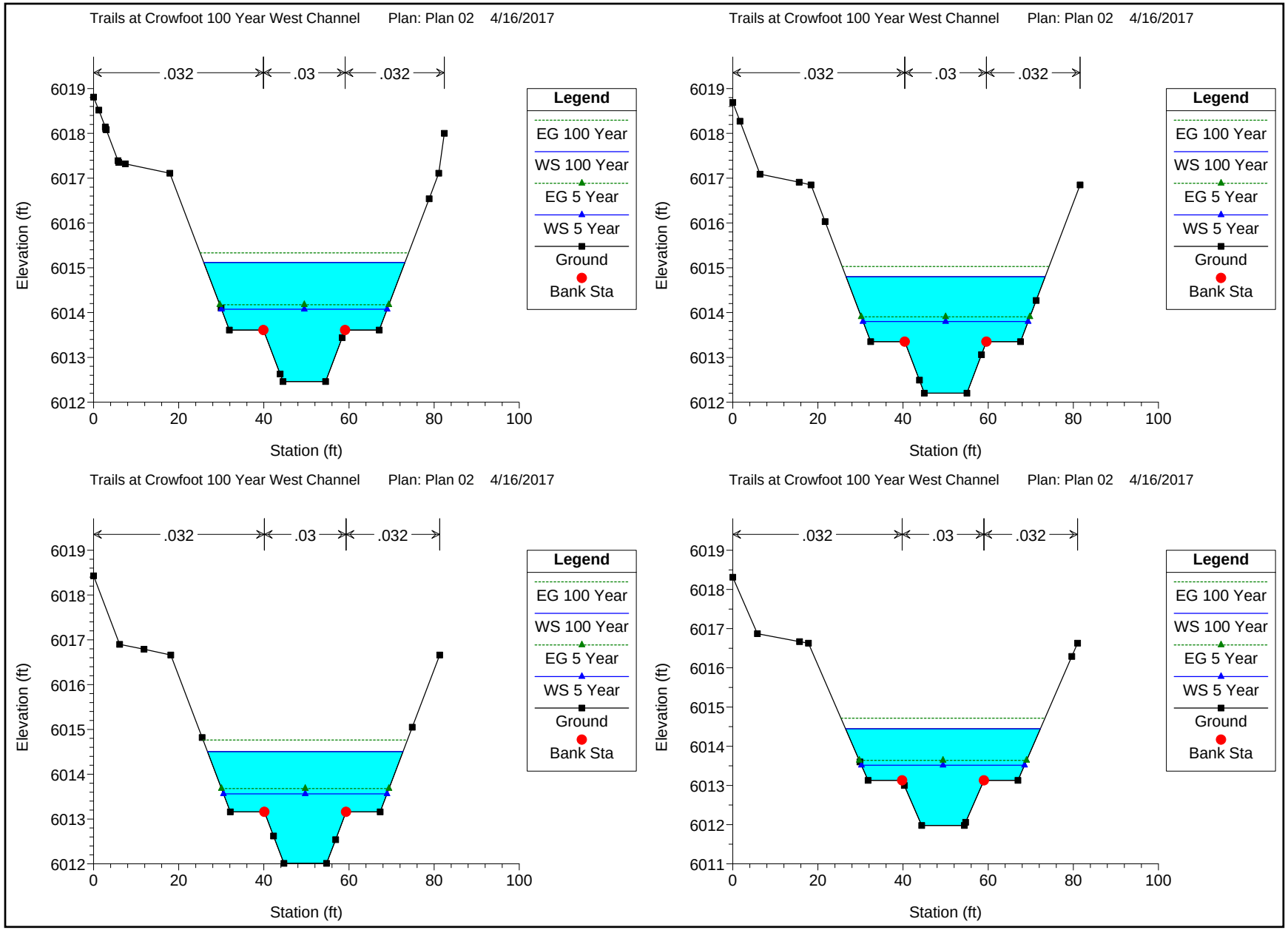
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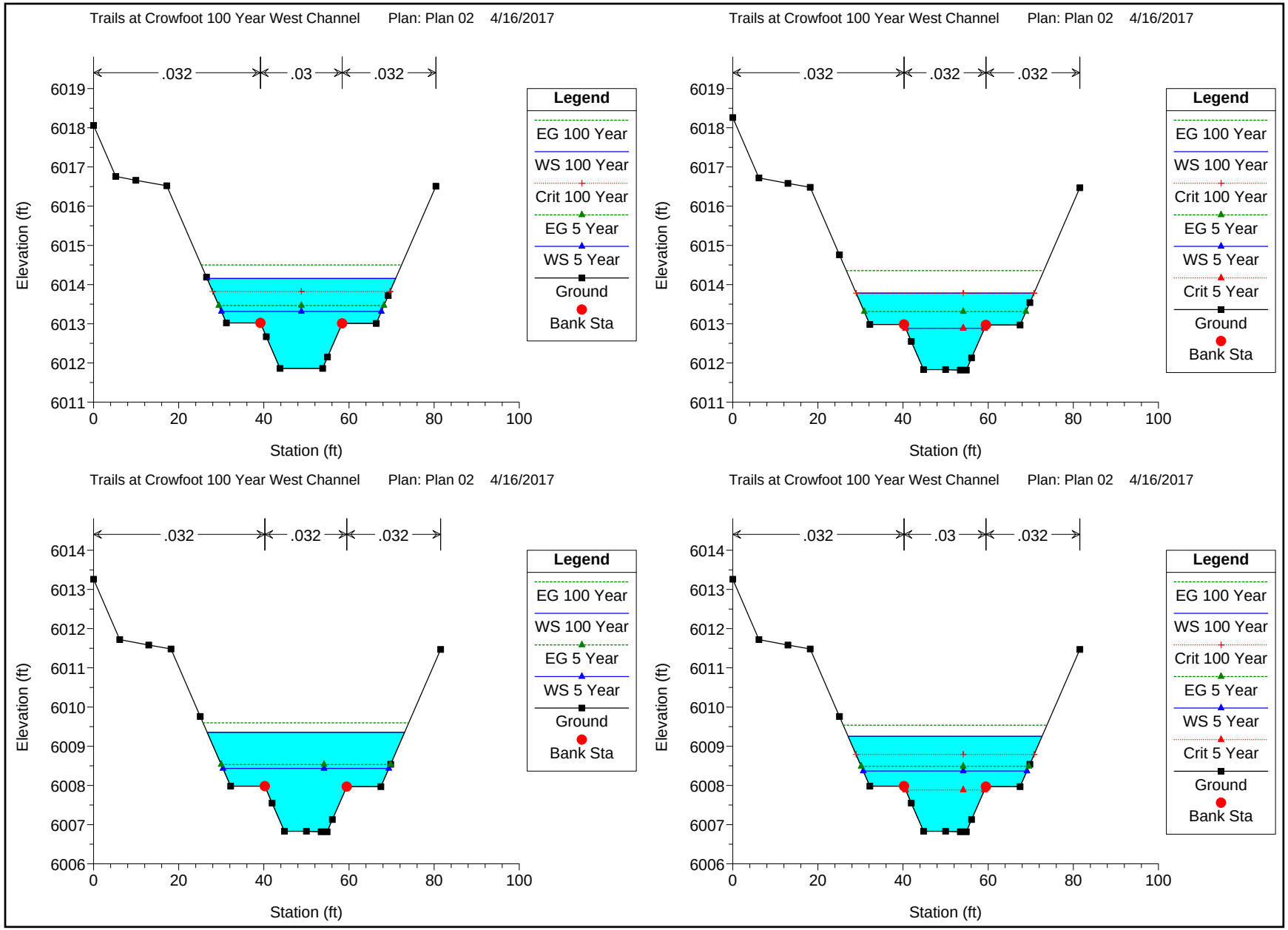
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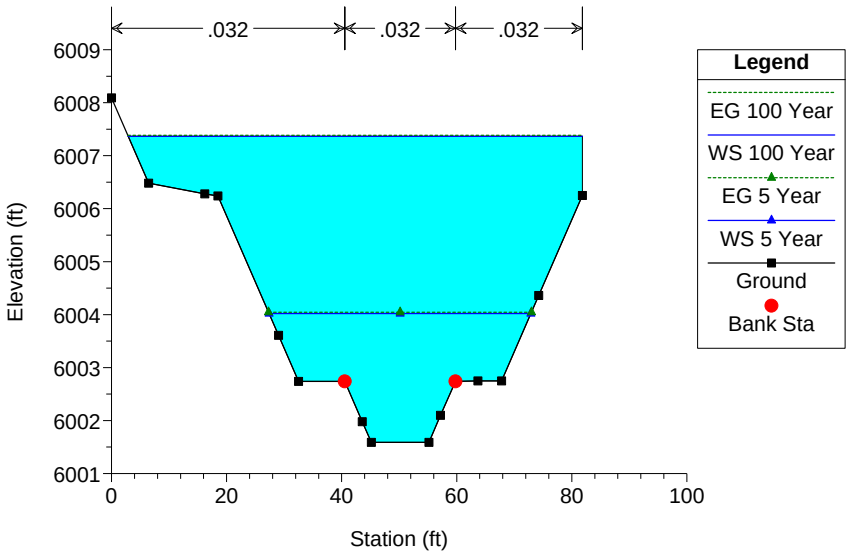
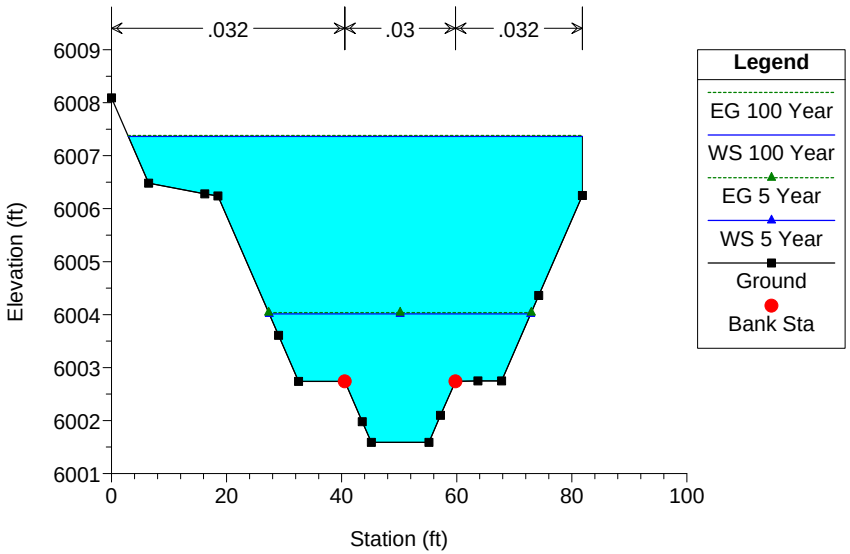
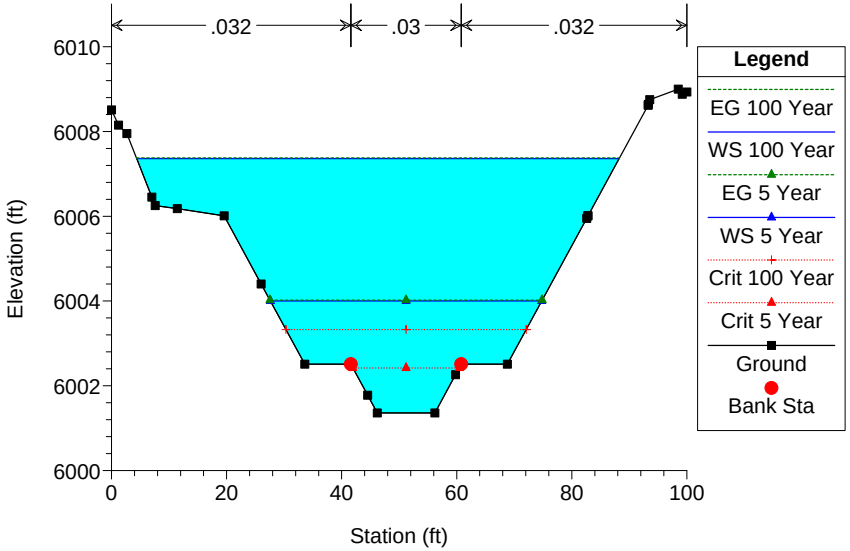
Trails at Crowfoot 100 Year West Channel Plan: Plan 02 4/16/2017



Trails at Crowfoot 100 Year West Channel Plan: Plan 02 4/16/2017



Trails at Crowfoot 100 Year West Channel Plan: Plan 02 4/16/2017



HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
West Channel	2426.78	100 Year	269.00	6032.97	6035.70		6035.89	0.001978	3.96	82.17	47.78	0.45
West Channel	2426.78	5 Year	79.00	6032.97	6034.59		6034.69	0.002007	2.68	34.24	38.94	0.41
West Channel	2347.67	100 Year	269.00	6032.82	6035.54		6035.74	0.002002	3.98	81.85	47.76	0.45
West Channel	2347.67	5 Year	79.00	6032.82	6034.42		6034.53	0.002108	2.72	33.61	38.85	0.42
West Channel	1856.34	100 Year	269.00	6031.83	6034.58		6034.77	0.001895	3.91	83.42	48.00	0.44
West Channel	1856.34	5 Year	79.00	6031.83	6033.50		6033.59	0.001732	2.55	36.15	39.34	0.38
West Channel	1690.88	100 Year	269.00	6031.50	6034.28		6034.46	0.001809	3.85	84.78	48.22	0.43
West Channel	1690.88	5 Year	79.00	6031.50	6033.26		6033.33	0.001340	2.33	39.68	40.06	0.34
West Channel	1443.96	100 Year	269.00	6031.01	6032.97	6032.97	6033.54	0.010117	6.55	47.99	41.69	0.89
West Channel	1443.96	5 Year	79.00	6031.01	6032.08	6032.08	6032.50	0.016526	5.19	15.23	18.54	1.01
West Channel	1431.96	100 Year	269.00	6028.01	6030.85		6031.02	0.001782	3.64	87.89	48.76	0.40
West Channel	1431.96	5 Year	79.00	6028.01	6029.72		6029.80	0.001736	2.43	37.59	39.64	0.36
West Channel	1413.96	100 Year	269.00	6028.01	6030.81		6030.99	0.001760	3.81	85.62	48.38	0.42
West Channel	1413.96	5 Year	79.00	6028.01	6029.67		6029.77	0.001757	2.56	35.95	39.31	0.38
West Channel	1356.5	100 Year	269.00	6027.83	6030.73		6030.89	0.001505	3.62	90.44	49.15	0.39
West Channel	1356.5	5 Year	79.00	6027.83	6029.60		6029.67	0.001298	2.31	40.14	40.14	0.33
West Channel	1255.33	100 Year	269.00	6027.63	6030.59		6030.74	0.001365	3.50	93.61	49.67	0.38
West Channel	1255.33	5 Year	79.00	6027.63	6029.49		6029.55	0.001007	2.12	43.98	40.92	0.30
West Channel	948.39	100 Year	269.00	6027.02	6028.98	6028.98	6029.55	0.010199	6.57	47.86	41.69	0.89
West Channel	948.39	5 Year	79.00	6027.02	6028.08	6028.08	6028.50	0.016990	5.24	15.08	18.47	1.02
West Channel	932.39	100 Year	269.00	6023.02	6025.69		6025.89	0.002374	4.01	79.55	47.39	0.46
West Channel	932.39	5 Year	79.00	6023.02	6024.72		6024.80	0.001770	2.45	37.32	39.61	0.36
West Channel	914.39	100 Year	269.00	6023.02	6025.62		6025.84	0.002466	4.27	76.08	46.80	0.49
West Channel	914.39	5 Year	79.00	6023.02	6024.68		6024.77	0.001803	2.58	35.61	39.26	0.39
West Channel	849.13	100 Year	269.00	6022.90	6024.86	6024.86	6025.43	0.010169	6.56	47.91	41.69	0.89
West Channel	849.13	5 Year	79.00	6022.90	6023.97	6023.97	6024.39	0.016550	5.19	15.22	18.54	1.01
West Channel	829.13	100 Year	269.00	6017.90	6020.47		6020.70	0.002831	4.26	74.83	46.58	0.50
West Channel	829.13	5 Year	79.00	6017.90	6019.52		6019.62	0.002258	2.66	34.17	38.96	0.40
West Channel	811.13	100 Year	269.00	6017.90	6020.38		6020.65	0.003046	4.58	70.65	45.85	0.54
West Channel	811.13	5 Year	79.00	6017.90	6019.46		6019.58	0.002434	2.86	31.86	38.48	0.44
West Channel	764.52	100 Year	269.00	6017.86	6020.14	6019.83	6020.49	0.004527	5.24	61.48	44.22	0.65
West Channel	764.52	5 Year	79.00	6017.86	6019.29	6018.93	6019.45	0.003724	3.30	27.07	37.48	0.54
West Channel	748.18	100 Year	269.00	6017.83	6019.79	6019.79	6020.36	0.010184	6.57	47.88	41.69	0.89
West Channel	748.18	5 Year	79.00	6017.83	6018.89	6018.89	6019.31	0.016701	5.21	15.17	18.51	1.01
West Channel	728.18	100 Year	269.00	6012.83	6015.54		6015.73	0.002211	3.92	81.53	47.71	0.44
West Channel	728.18	5 Year	79.00	6012.83	6014.47		6014.57	0.002088	2.59	35.15	39.16	0.39
West Channel	710.18	100 Year	269.00	6012.83	6015.49		6015.69	0.002427	4.04	78.94	47.27	0.46
West Channel	710.18	5 Year	79.00	6012.83	6014.42		6014.52	0.002469	2.74	33.05	38.73	0.42
West Channel	567.15	100 Year	269.00	6012.46	6015.12		6015.33	0.002214	4.12	79.01	47.28	0.47
West Channel	567.15	5 Year	79.00	6012.46	6014.07		6014.18	0.002052	2.70	33.96	38.91	0.41
West Channel	438.04	100 Year	269.00	6012.20	6014.80		6015.03	0.002448	4.26	76.27	46.80	0.49
West Channel	438.04	5 Year	79.00	6012.20	6013.80		6013.91	0.002145	2.74	33.41	38.80	0.42
West Channel	340.94	100 Year	269.00	6012.01	6014.50		6014.77	0.002959	4.54	71.34	45.93	0.54
West Channel	340.94	5 Year	79.00	6012.01	6013.56		6013.68	0.002477	2.88	31.64	38.42	0.45
West Channel	324.8	100 Year	269.00	6011.98	6014.44		6014.72	0.003124	4.62	70.03	45.75	0.55
West Channel	324.8	5 Year	79.00	6011.98	6013.52		6013.64	0.002617	2.93	31.01	38.32	0.46
West Channel	268.32	100 Year	269.00	6011.86	6014.16	6013.83	6014.50	0.004353	5.17	62.29	44.32	0.64
West Channel	268.32	5 Year	79.00	6011.86	6013.31		6013.47	0.003476	3.23	27.78	37.59	0.52
West Channel	248.78	100 Year	269.00	6011.82	6013.78	6013.78	6014.35	0.010192	6.56	47.91	41.78	0.89
West Channel	248.78	5 Year	79.00	6011.82	6012.89	6012.89	6013.31	0.016916	5.23	15.12	18.52	1.02
West Channel	238.61	100 Year	269.00	6006.82	6009.36		6009.60	0.003023	4.35	73.20	46.38	0.51
West Channel	238.61	5 Year	79.00	6006.82	6008.43		6008.53	0.002331	2.69	33.80	38.97	0.41
West Channel	210.78	100 Year	269.00	6006.82	6009.25	6008.79	6009.54	0.003342	4.73	68.45	45.55	0.57
West Channel	210.78	5 Year	79.00	6006.82	6008.37	6007.89	6008.49	0.002556	2.90	31.30	38.45	0.45

HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
West Channel	149.42	100 Year	269.00	6006.59	6008.55	6008.55	6009.12	0.010199	6.57	47.87	41.73	0.89
West Channel	149.42	5 Year	79.00	6006.59	6007.65	6007.65	6008.08	0.017131	5.25	15.05	18.49	1.03
West Channel	129.42	100 Year	269.00	6001.59	6007.37		6007.38	0.000077	1.26	274.19	78.92	0.09
West Channel	129.42	5 Year	79.00	6001.59	6004.02		6004.05	0.000316	1.36	68.46	45.51	0.16
West Channel	111.42	100 Year	269.00	6001.59	6007.36		6007.38	0.000072	1.30	274.04	78.92	0.10
West Channel	111.42	5 Year	79.00	6001.59	6004.02		6004.04	0.000291	1.39	68.19	45.46	0.17
West Channel	33.71	100 Year	269.00	6001.36	6007.36	6003.33	6007.38	0.000061	1.23	294.61	83.84	0.09
West Channel	33.71	5 Year	79.00	6001.36	6004.00	6002.42	6004.02	0.000197	1.22	78.16	47.16	0.14

Design Parameter	Design Value
Maximum 100-year depth outside of bankfull channel	5 ft
Roughness values	Per Table 8-5
Maximum 5-year velocity, main channel (within bankfull channel width) (ft/s)	5 ft/s
Maximum 100-year velocity, main channel (within bankfull channel width) (ft/s)	7 ft/s
Froude No., 5-year, main channel (within bankfull channel width)	0.7
Froude No., 100-year, main channel (within bankfull channel width)	0.8
Maximum shear stress, 100-year, main channel (within bankfull channel width)	1.2 lb/sf

HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel Profile: 5 Year

Reach	River Sta	Profile	Q Total	Vel Left	Vel Chnl	Vel Right	Shear LOB	Shear Chan	Shear ROB	Froude # Chl	Specif Force
			(cfs)	(ft/s)	(ft/s)	(ft/s)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)		(cu ft)
West Channel	2426.78	5 Year	79.00	1.17	2.68	1.17	0.05	0.17	0.05	0.41	26.69
West Channel	2347.67	5 Year	79.00	1.18	2.72	1.18	0.05	0.17	0.05	0.42	26.26
West Channel	1856.34	5 Year	79.00	1.16	2.55	1.16	0.05	0.15	0.05	0.38	28.07
West Channel	1690.88	5 Year	79.00	1.12	2.33	1.12	0.04	0.12	0.04	0.34	30.92
West Channel	1443.96	5 Year	79.00		5.19			0.84		1.01	20.05
West Channel	1431.96	5 Year	79.00	1.21	2.43	1.21	0.05	0.15	0.05	0.36	29.15
West Channel	1413.96	5 Year	79.00	1.16	2.56	1.16	0.05	0.15	0.05	0.38	27.93
West Channel	1356.5	5 Year	79.00	1.11	2.31	1.11	0.04	0.12	0.04	0.33	31.32
West Channel	1255.33	5 Year	79.00	1.07	2.12	1.07	0.04	0.10	0.04	0.30	34.83
West Channel	948.39	5 Year	79.00		5.24			0.85		1.02	20.05
West Channel	932.39	5 Year	79.00	1.21	2.45	1.21	0.05	0.16	0.05	0.36	28.93
West Channel	914.39	5 Year	79.00	1.16	2.58	1.16	0.05	0.15	0.05	0.39	27.67
West Channel	849.13	5 Year	79.00		5.19			0.84		1.01	20.05
West Channel	829.13	5 Year	79.00	1.24	2.66	1.24	0.06	0.19	0.06	0.40	26.59
West Channel	811.13	5 Year	79.00	1.19	2.86	1.19	0.06	0.19	0.06	0.44	25.12
West Channel	764.52	5 Year	79.00	1.17	3.30	1.17	0.06	0.27	0.06	0.54	22.56
West Channel	748.18	5 Year	79.00		5.21			0.84		1.01	20.04
West Channel	728.18	5 Year	79.00	1.23	2.59	1.23	0.06	0.18	0.06	0.39	27.29
West Channel	710.18	5 Year	79.00	1.25	2.74	1.25	0.06	0.20	0.06	0.42	25.84
West Channel	567.15	5 Year	79.00	1.18	2.70	1.18	0.05	0.17	0.05	0.41	26.49
West Channel	438.04	5 Year	79.00	1.18	2.74	1.18	0.05	0.17	0.05	0.42	26.12
West Channel	340.94	5 Year	79.00	1.19	2.88	1.19	0.06	0.19	0.06	0.45	24.99
West Channel	324.8	5 Year	79.00	1.19	2.93	1.19	0.06	0.20	0.06	0.46	24.60
West Channel	268.32	5 Year	79.00	1.16	3.23	1.18	0.06	0.25	0.06	0.52	22.92
West Channel	248.78	5 Year	79.00		5.23			0.85		1.02	20.04
West Channel	238.61	5 Year	79.00	1.23	2.69	1.25	0.06	0.19	0.06	0.41	26.30
West Channel	210.78	5 Year	79.00	1.18	2.90	1.19	0.06	0.20	0.06	0.45	24.75
West Channel	149.42	5 Year	79.00		5.25			0.86		1.03	20.06
West Channel	129.42	5 Year	79.00	1.24	2.67	1.23	0.06	0.19	0.06	0.41	26.52
West Channel	111.42	5 Year	79.00	1.19	2.87	1.17	0.06	0.19	0.06	0.45	25.07
West Channel	33.71	5 Year	79.00	1.17	2.68	1.17	0.05	0.17	0.05	0.41	26.70

HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel Profile: 100 Year

Reach	River Sta	Profile	Q Total	Vel Left	Vel Chnl	Vel Right	Shear LOB	Shear Chan	Shear ROB	Froude # Chl	Specif Force
			(cfs)	(ft/s)	(ft/s)	(ft/s)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)		(cu ft)
West Channel	2426.78	100 Year	269.00	2.35	3.96	2.35	0.15	0.30	0.15	0.45	113.03
West Channel	2347.67	100 Year	269.00	2.36	3.98	2.36	0.15	0.30	0.15	0.45	112.53
West Channel	1856.34	100 Year	269.00	2.32	3.91	2.32	0.15	0.29	0.15	0.44	114.73
West Channel	1690.88	100 Year	269.00	2.29	3.85	2.29	0.14	0.28	0.14	0.43	116.65
West Channel	1443.96	100 Year	269.00	3.64	6.55	3.64	0.43	1.05	0.43	0.89	84.22
West Channel	1431.96	100 Year	269.00	2.32	3.64	2.32	0.14	0.28	0.14	0.40	120.83
West Channel	1413.96	100 Year	269.00	2.27	3.81	2.27	0.14	0.27	0.14	0.42	117.83
West Channel	1356.5	100 Year	269.00	2.17	3.62	2.17	0.12	0.24	0.12	0.39	125.04
West Channel	1255.33	100 Year	269.00	2.11	3.50	2.11	0.12	0.23	0.12	0.38	130.02
West Channel	948.39	100 Year	269.00	3.64	6.57	3.64	0.44	1.06	0.44	0.89	84.20
West Channel	932.39	100 Year	269.00	2.52	4.01	2.52	0.17	0.35	0.17	0.46	109.11
West Channel	914.39	100 Year	269.00	2.50	4.27	2.50	0.17	0.35	0.17	0.49	105.12
West Channel	849.13	100 Year	269.00	3.64	6.56	3.64	0.44	1.05	0.44	0.89	84.20
West Channel	829.13	100 Year	269.00	2.65	4.26	2.65	0.20	0.40	0.20	0.50	103.26
West Channel	811.13	100 Year	269.00	2.65	4.58	2.65	0.20	0.41	0.20	0.54	98.99
West Channel	764.52	100 Year	269.00	2.94	5.24	2.94	0.26	0.56	0.26	0.65	90.67
West Channel	748.18	100 Year	269.00	3.64	6.57	3.64	0.44	1.06	0.44	0.89	84.21
West Channel	728.18	100 Year	269.00	2.47	3.92	2.47	0.17	0.33	0.17	0.44	111.75
West Channel	710.18	100 Year	269.00	2.54	4.04	2.54	0.18	0.36	0.18	0.46	108.33
West Channel	567.15	100 Year	269.00	2.42	4.12	2.42	0.16	0.32	0.16	0.47	108.80
West Channel	438.04	100 Year	269.00	2.50	4.26	2.49	0.17	0.35	0.17	0.49	105.38
West Channel	340.94	100 Year	269.00	2.63	4.54	2.63	0.20	0.40	0.20	0.54	99.77
West Channel	324.8	100 Year	269.00	2.67	4.62	2.67	0.20	0.42	0.20	0.55	98.31
West Channel	268.32	100 Year	269.00	2.90	5.17	2.91	0.25	0.54	0.25	0.64	91.38
West Channel	248.78	100 Year	269.00	3.63	6.56	3.66	0.43	1.05	0.44	0.89	84.14
West Channel	238.61	100 Year	269.00	2.69	4.35	2.70	0.20	0.42	0.21	0.51	101.25
West Channel	210.78	100 Year	269.00	2.71	4.73	2.72	0.21	0.44	0.21	0.57	96.62
West Channel	149.42	100 Year	269.00	3.65	6.57	3.63	0.44	1.06	0.43	0.89	84.21
West Channel	129.42	100 Year	269.00	2.47	3.92	2.47	0.17	0.33	0.17	0.44	111.51
West Channel	111.42	100 Year	269.00	2.44	4.15	2.43	0.16	0.33	0.16	0.47	108.03
West Channel	33.71	100 Year	269.00	2.35	3.98	2.35	0.15	0.30	0.15	0.45	112.53

IV. Copies of graphs, tables, and nomographs used

A. FIRM
B. Soils
C. 1-Hour Rainfall Data
D. Excerpts from adjacent Studies

NOTES TO USERS

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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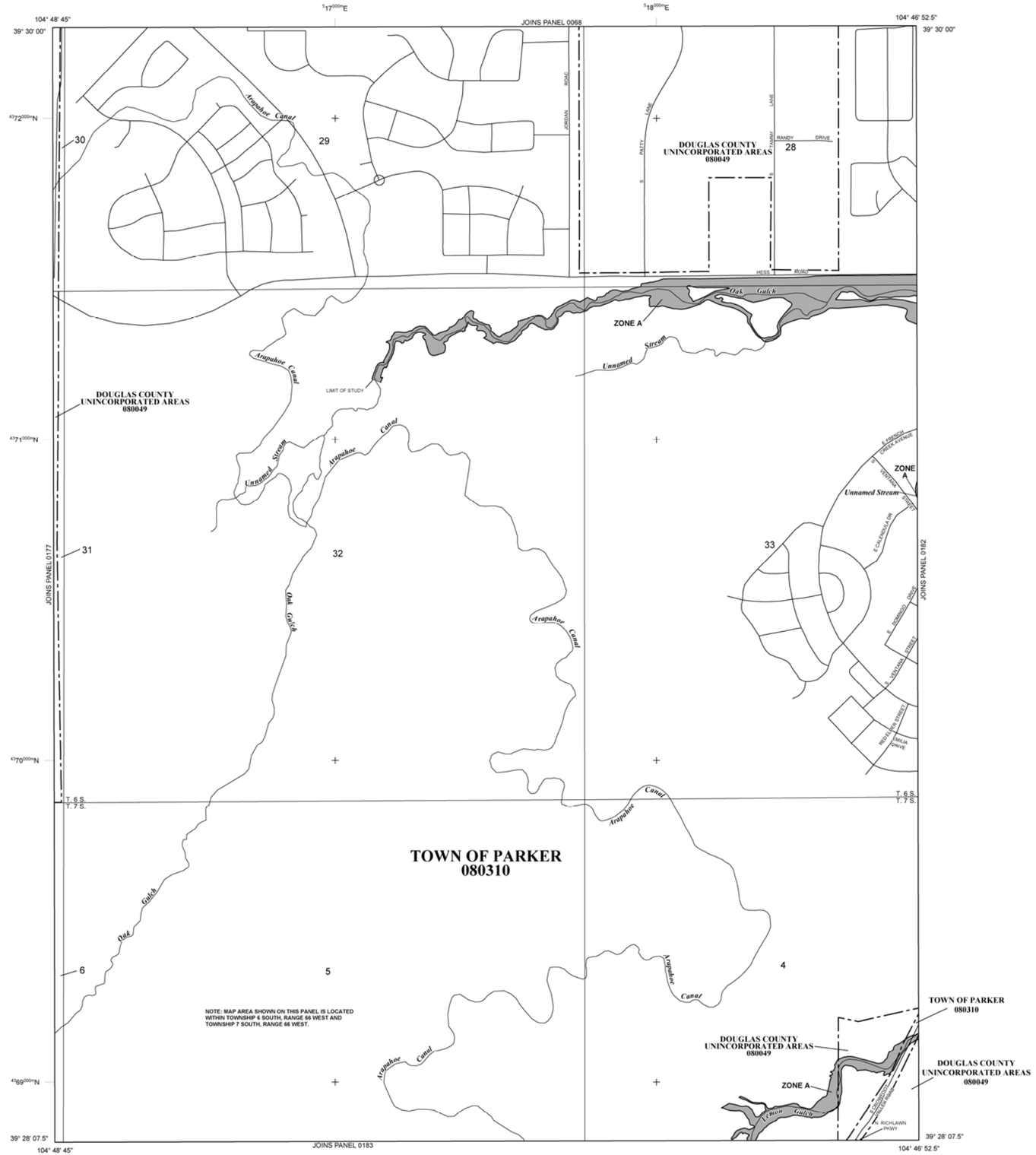

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - - 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4989000m N	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0181G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 181 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0181	G
PARKER, TOWN OF	080310	0181	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0181G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

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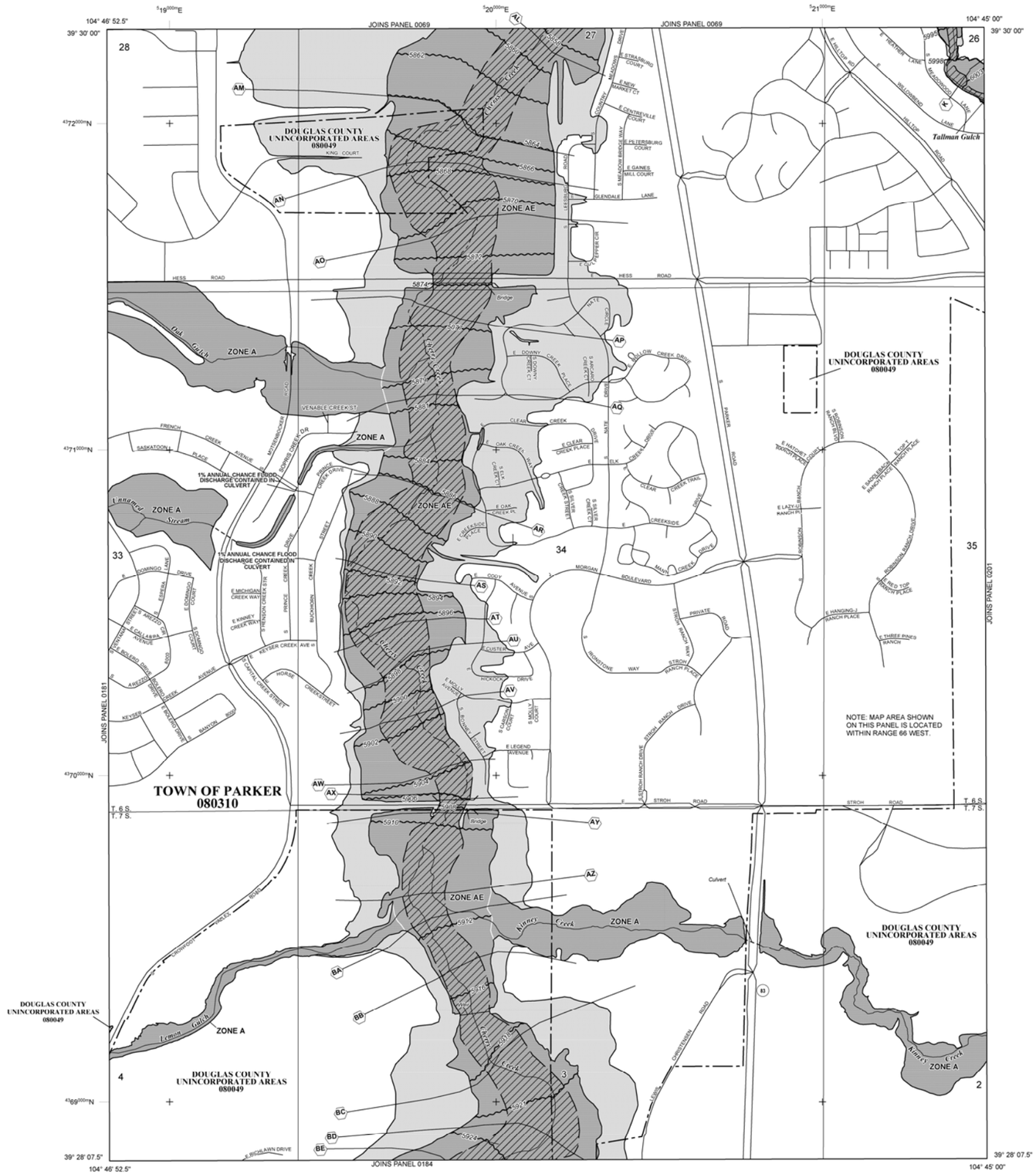

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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ZONE AE	Base Flood Elevations determined.
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ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
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FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

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ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4199000m N	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0182G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 182 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0182	G
PARKER, TOWN OF	080310	0182	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0182G

MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

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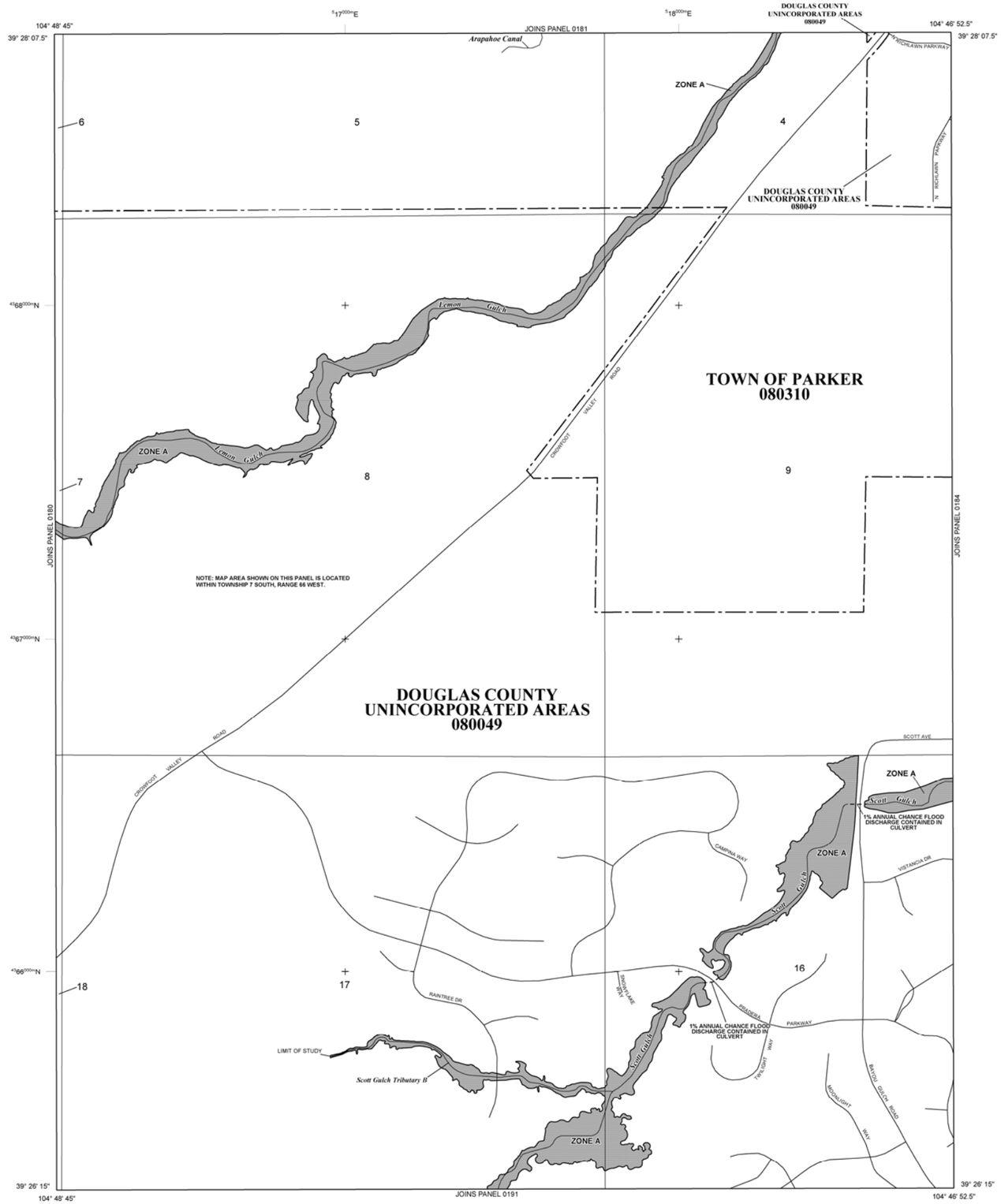

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% Annual Chance Floodplain Boundary
	0.2% Annual Chance Floodplain Boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

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A — A	Cross section line
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45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

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EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0183G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 183 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0183	G
PARKER, TOWN OF	080310	0183	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0183G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

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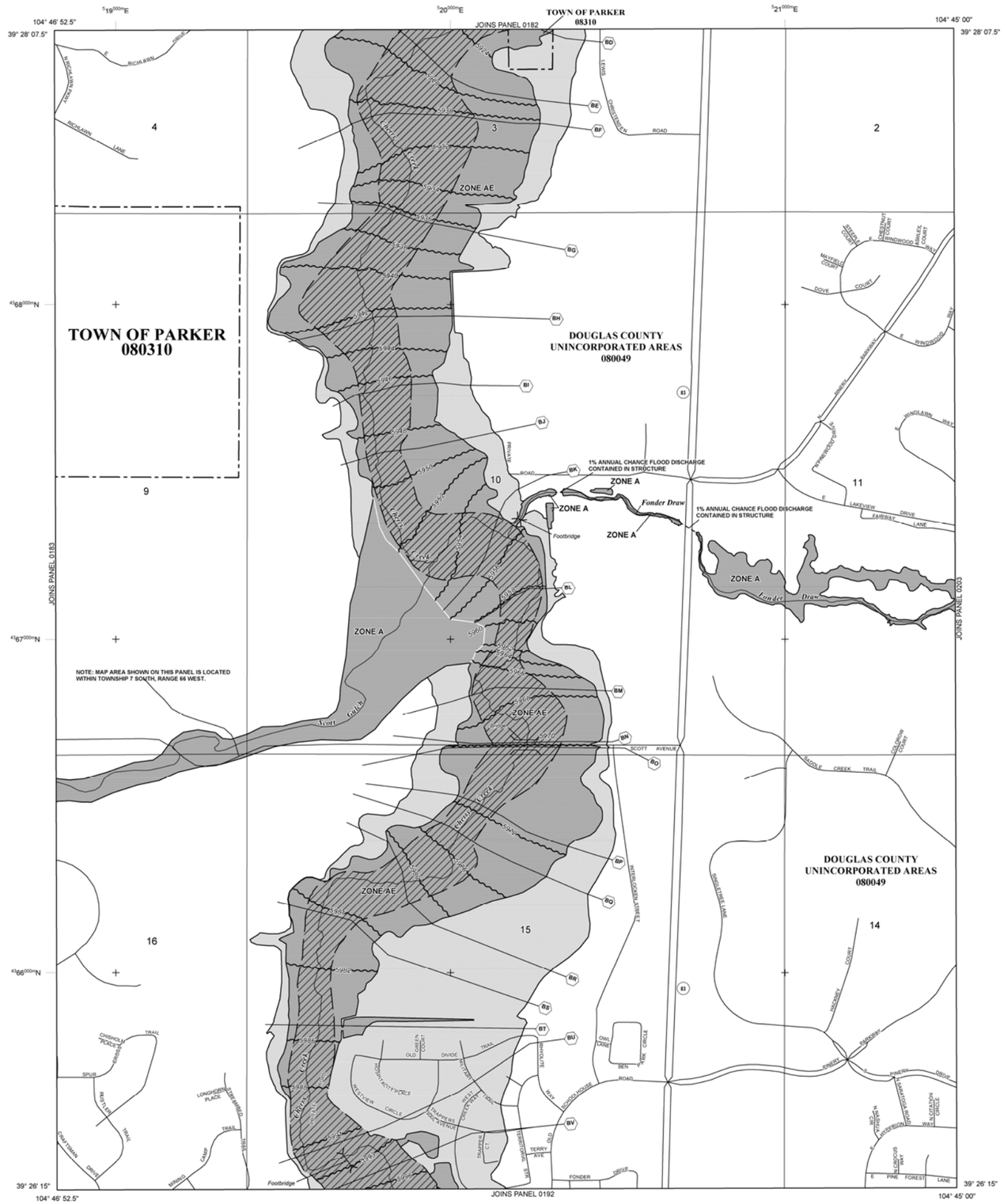

LEGEND

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ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

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FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

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250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0184G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 184 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0184	G
PARKER, TOWN OF	080310	0184	G

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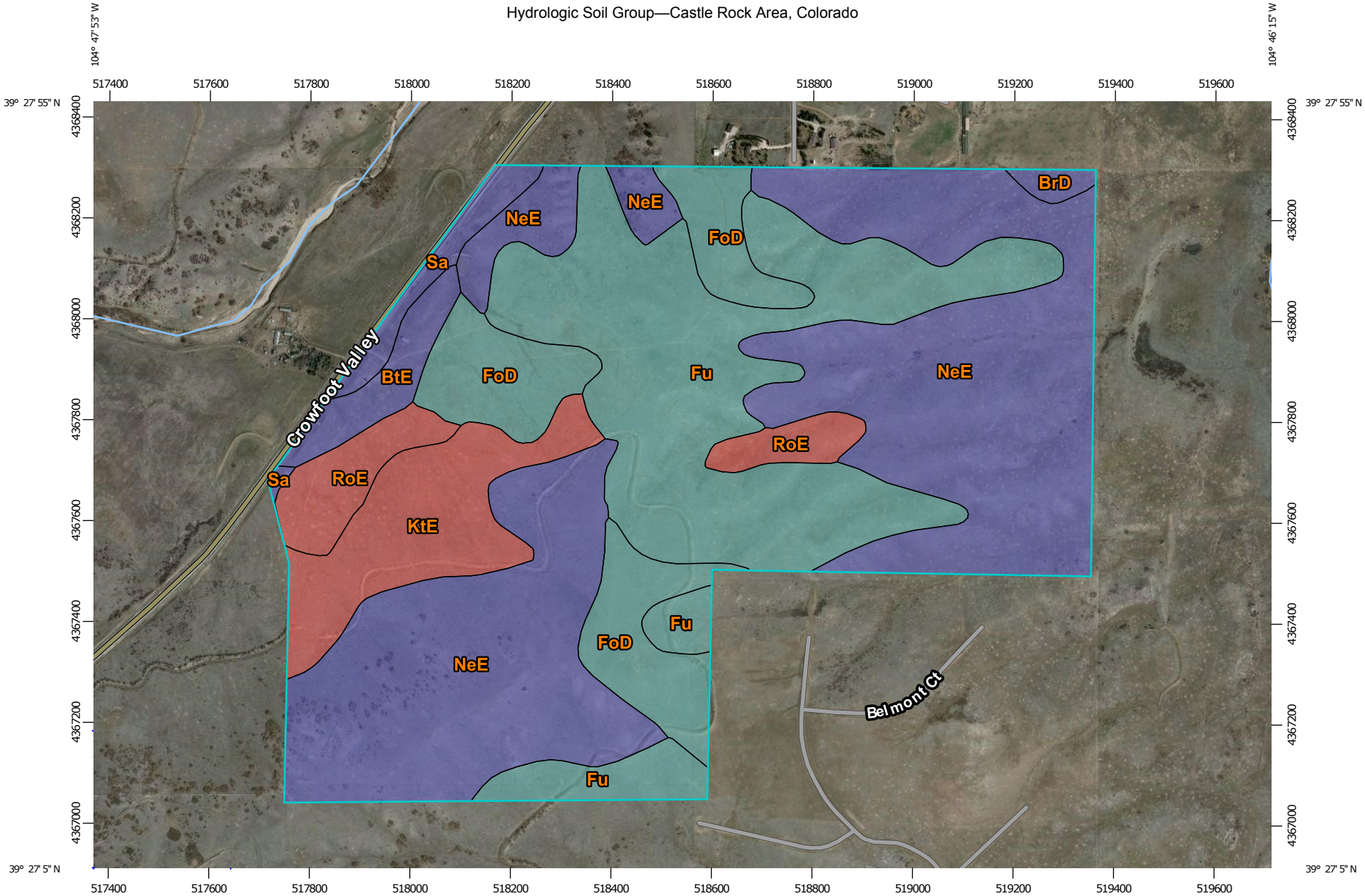
MAP NUMBER
08035C0184G

MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

Hydrologic Soil Group—Castle Rock Area, Colorado



Map Scale: 1:10,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 8, Sep 23, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 16, 2012—Apr 13, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BrD	Bresser sandy loam, 3 to 9 percent slopes	B	2.1	0.5%
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	9.1	2.4%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	41.3	10.7%
Fu	Fondis-Kutch association	C	105.5	27.3%
KtE	Kutch sandy loam, 5 to 20 percent slopes	D	30.5	7.9%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	174.1	45.0%
RoE	Renohill sandy loam, reddish variant, 5 to 20 percent slopes	D	16.5	4.3%
Sa	Sampson loam	B	7.5	1.9%
Totals for Area of Interest			**386.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

TABLE 5.1
ONE-HOUR POINT RAINFALL

Frequency of Design Event (yr)	One-hour Point Rainfall, P_1 (in)
2	0.99
5	1.39
10	1.64
25	1.98
50	2.31
100	2.60

5.3 FLOOD HYDROLOGY OVERVIEW

Various methods exist to determine appropriate flood peaks or hydrographs for storm drainage planning and design. Methods for determining flood peaks or hydrographs are the Rational Method, the Colorado Urban Hydrograph Procedure (CUHP), and Urban Drainage Stormwater Management (UDSWM) model. The Town of Parker discourages the use of computer models other than CUHP and UDSWM since these programs are preferred, if not required, by UDFCD for studies involving major drainageways where UDFCD approval is sought or where maintenance eligibility is requested.

The three methods are briefly described in this section, and a discussion of their applicability to the Town of Parker is discussed. UDSWM is mostly used to combine and route the hydrographs generated using CUHP.

In general, the Rational Method is the most widely used and accepted technique for determining peak flows in urban areas for small basins. Within the constraints outlined in the MANUAL, use of the Rational Method provides a relatively simple but effective way to analyze storm runoff.

CUHP is somewhat more complicated than the Rational Method. It allows a manual computation of a runoff hydrograph which may be used for further hydraulic routing through channels and/or detention ponds. Historically, CUHP is best used in urban areas for which runoff coefficients have been derived. However, recent improvements by UDFCD include consideration for different soil types, thus CUHP is now more applicable to rural areas. The reader is referred to UDFCD for the latest version of CUHP.

UDSWM is a computer model that generates runoff hydrographs and routes and combines these hydrographs. UDSWM is a modified version of the Runoff Block of the Environmental Protection Agency's Storm Water Management Model (SWMM). It has been modified to be used in conjunction with CUHP. Table 5.2 herein provides guidance on selecting the appropriate method for a given project.

Conceptual Drainage Report

Hess Ranch Development
Parker, Colorado

CODE: SRD01

Prepared For:
SDI Inc.
5105 DTC Parkway, Suite 240
Greenwood Village, Colorado 80111
Contact: Gary Hunter
720-482-7707

Prepared By:

Manhard CONSULTING

7442 South Tucson Way, Suite 190-A
Centennial, Colorado 80112
Contact: Russell Burrows, P.E.
303-708-0500

Initially Submitted: November 25, 2014
Revised: February 15, 2015
Updated: June 1, 2015

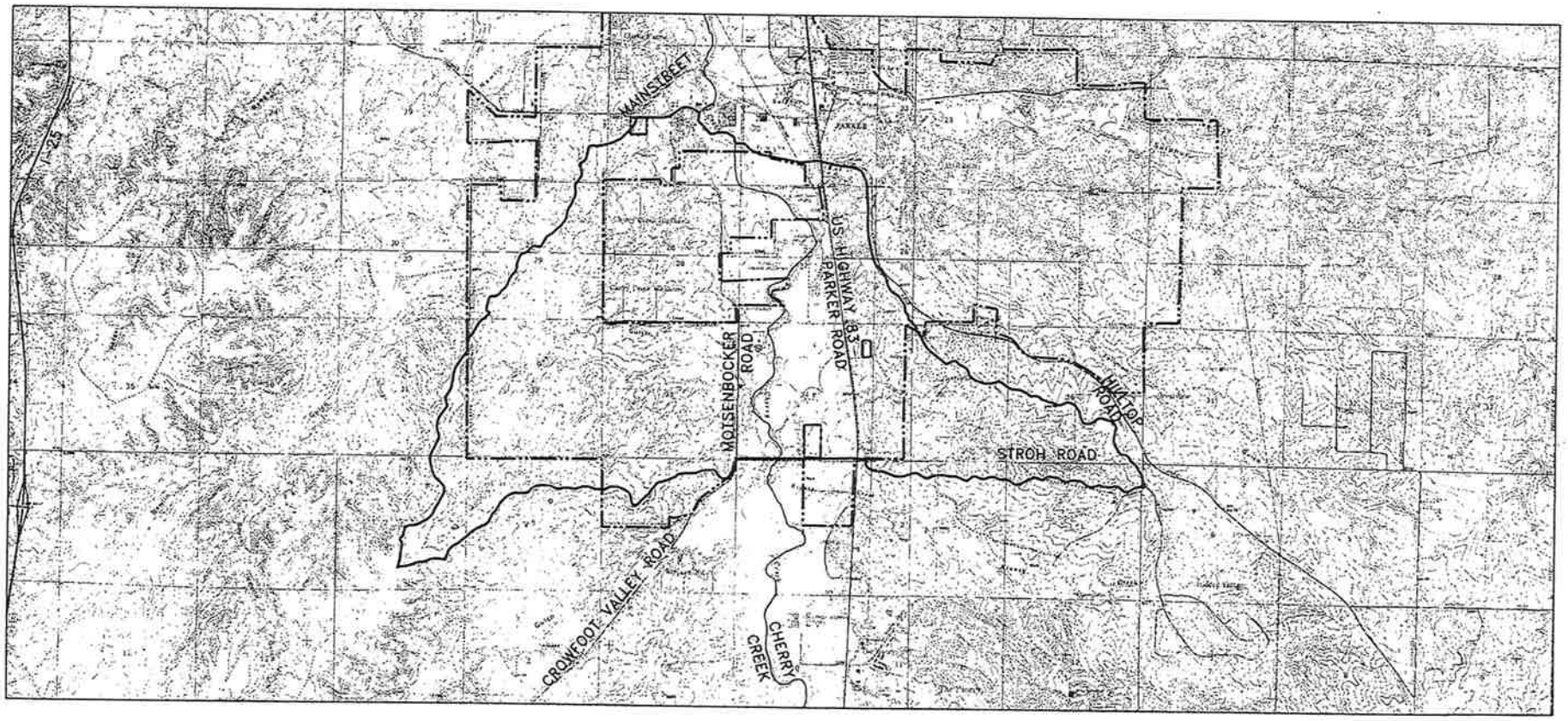
RECEIVED
JUN 23 2015
BY:

APPENDIX D

Excerpts from Oak Gulch & Stroh Ranch Area Outfall Systems Planning

OAK GULCH AND STROH RANCH AREA OUTFALL SYSTEMS PLANNING

PRELIMINARY DESIGN REPORT



TOWN OF PARKER DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
FEBRUARY 2003

Prepared by:
Knight Piésold CONSULTING
1050 17th Street, Suite 500
Denver, Colorado 80265-0500

II. STUDY AREA DESCRIPTION

A. General

The Oak Gulch and Stroh Ranch study area is located in Douglas County and partially within the southern portion of the Town of Parker. It encompasses the tributary areas on both the east and west sides of Cherry Creek between Main street on the north and Stroh Road on the south. The area contains several major drainageways, including Oak Gulch, smaller unnamed drainageways, and direct flow areas that discharge along a 3.6-mile reach of Cherry Creek. Cherry Creek flows from south to north through the study area. Figures II-1 and II-2 show the general location of the study area and existing facilities in the study area, respectively.

Presently, a portion of the 7.7-mi^2 (4 955-acre) study area lies within the corporate limits of the Town of Parker; those areas that are not within the corporate limits are under the jurisdiction of Douglas County. It should be noted that in the future much of the study area might eventually be annexed into the Town of Parker.

At the time of this study, the area comprised a mixture of residential, commercial, and open areas. The residential areas range from low-density with several acres per residence to high-density with as many as six units per acre. The open areas include native open space, undeveloped land, parks, greenbelts, sod farms (agricultural), and the Cherry Creek floodplain. There are also many areas that are presently being developed for various residential densities and commercial sites and several more areas have already been proposed for development.

The major arterial roads through the study area include Parker Road (State Highway 83), Motsenbocker Road, and Stroh Road. Several other collector and local roads, both paved and unpaved, are also within the study area.

B. Topography

The study area generally slopes toward Cherry Creek from both the east and west sides. West of Cherry Creek, slopes typically range from 2 to 4 percent in the upper reaches of the catchments, from 1 to 2 percent in the middle reaches, and are generally less than 1 percent in the lower reaches near the Cherry Creek floodplain. East of Cherry Creek, slopes are typically 3 to 6 percent in the upper reaches, 1 to 3 percent in the middle reaches, and less than 1 percent in the lower reaches. The topography, represented by 25-foot contour intervals, is shown on Figure II-3.

C. Soil Characteristics

Soil classifications throughout the study area were determined from the Soil Survey of Castle Rock Area, Colorado (Reference 1). Areas with common hydrologic soil properties were delineated based on their Hydrologic Soils Group classifications; these areas are shown on Figure II-4. The study area contains all four Hydrologic Soils Group classifications but primarily comprises Type B (moderately high infiltration and moderately low runoff potential) and Type C (moderately low infiltration and moderately high runoff potential) soils. There are, however, small areas of Type A (high infiltration and low runoff potential) and Type D (low infiltration and high runoff potential) soils. In general, those areas west of Cherry Creek have predominantly Type C soils while those areas east of Cherry Creek have predominantly Type B soils.

D. Catchment Imperviousness

The study area was divided into regions of similar hydrologic response based on the existing and proposed future imperviousness. For purposes of this study, four categories of imperviousness were used to generalize the entire study area. Areas with similar imperviousness under existing conditions were outlined from aerial photography of the project area; these areas are shown on Figure II-5. Areas with similar imperviousness for the proposed future conditions were outlined based on information from submitted drainage reports for various developments as well as from discussions with representatives of Parker and the County; these areas are shown on Figure II-6. The imperviousness values used to represent the four distinct areas were developed from Table RO-3 and Figures RO-3 through RO-5 of the Manual. The following values were used:

- 95 percent impervious for areas with many structures, buildings, large paved areas such as parking lots, or other impervious structures; typical for commercial or industrial-type developments
- 45 percent impervious for areas intermixed with pervious and impervious features; typical for residential or business areas with open space, lawns, or greenbelts situated among buildings, houses, or other structures
- 40 percent for the West Stroh and North Crowfoot Valley catchments, due to Town of Parker accepted plans in this area
- 18 percent impervious for areas with fewer structures and more open space, typical for rural residential areas with large lots, few houses, roadways or other structures
- 2 percent impervious for generally open areas; typical for open space, parks, or undeveloped land with only an occasional roadway, rock outcropping, or other impervious feature.

E. Sub-Catchment Descriptions

The study area was divided into eight major catchments, which were further divided into 91 sub-catchments. The catchment and sub-catchment boundaries are shown on Figures II-3 through II-6. These boundaries were developed based on topography, existing drainage facilities, aerial photography, and field observations. The sub-catchment delineation of Oak Gulch and the two unnamed tributaries immediately south of Oak Gulch were obtained from the Flood Hazard Area Delineation (FHAD) for Oak Gulch and Lemon Gulch (Reference 7). Since Oak Gulch is the only previously named tributary in the study area, the major catchments were assigned convenient names for identification in this report.

Oak Gulch Catchment

The Oak Gulch Catchment is located on the west side of Cherry Creek in the southwest portion of the study area. The 1.8-mi^2 (1,142-acre) tributary area comprises 16 sub-catchments. Presently, this area is in a relatively native condition and generally undeveloped. However, the Master Drainage Plan for Stroh Ranch provides extensive development plans that primarily include residential developments, a golf course, and some commercial sites (Reference 8 and 43). This master drainage plan calls for six detention basins and channel improvements. Runoff generated from this catchment culminates at an 11-foot-wide by 8-foot-high reinforced concrete box (RCB) culvert that passes under Motsenbocker Road. From Motsenbocker Road to the outfall into Cherry Creek, there is an improved drainageway with existing check structures and an on-site retention pond.

West Stroh Catchment

The West Stroh Catchment is located on the west side of Cherry Creek immediately south of Oak Gulch. The 1.0-mi^2 (664-acre) tributary area comprises 13 sub-catchments. This area is presently in a relatively native condition and undeveloped. However, development plans for the portion between Motsenbocker Road and Cherry Creek have been prepared through Stroh Ranch Filing No. 9 (Reference 9). Additionally, development plans for the area west of Motsenbocker Road have been prepared through Stroh Ranch Filing No. 12 (Reference 10), Stroh Ranch Filing No. 13 (Reference 11), and Stroh Ranch Filing Nos. 17, 18, and 19 (Reference 12). An existing regional detention basin is located adjacent to Motsenbocker Road. This pond has a maximum storage capacity of 80.90 acre-feet, which includes 11.48 acre-feet for water quality and discharges at a peak rate of 516 cfs for the 100-year storm event (References 13 and 14). The discharge from the detention basin passes under Motsenbocker Road through a 48-inch reinforced concrete pipe (RCP) culvert that carries the frequent low flows and a 10-foot by 10-foot RCB culvert for additional flows. The RCB culvert is also intended to be used as a pedestrian crossing. Although not constructed at the time of this report, improvements to the drainageway between Motsenbocker Road and Cherry Creek have been designed through Stroh Ranch Filing No. 9.

North Crowfoot Valley Catchment

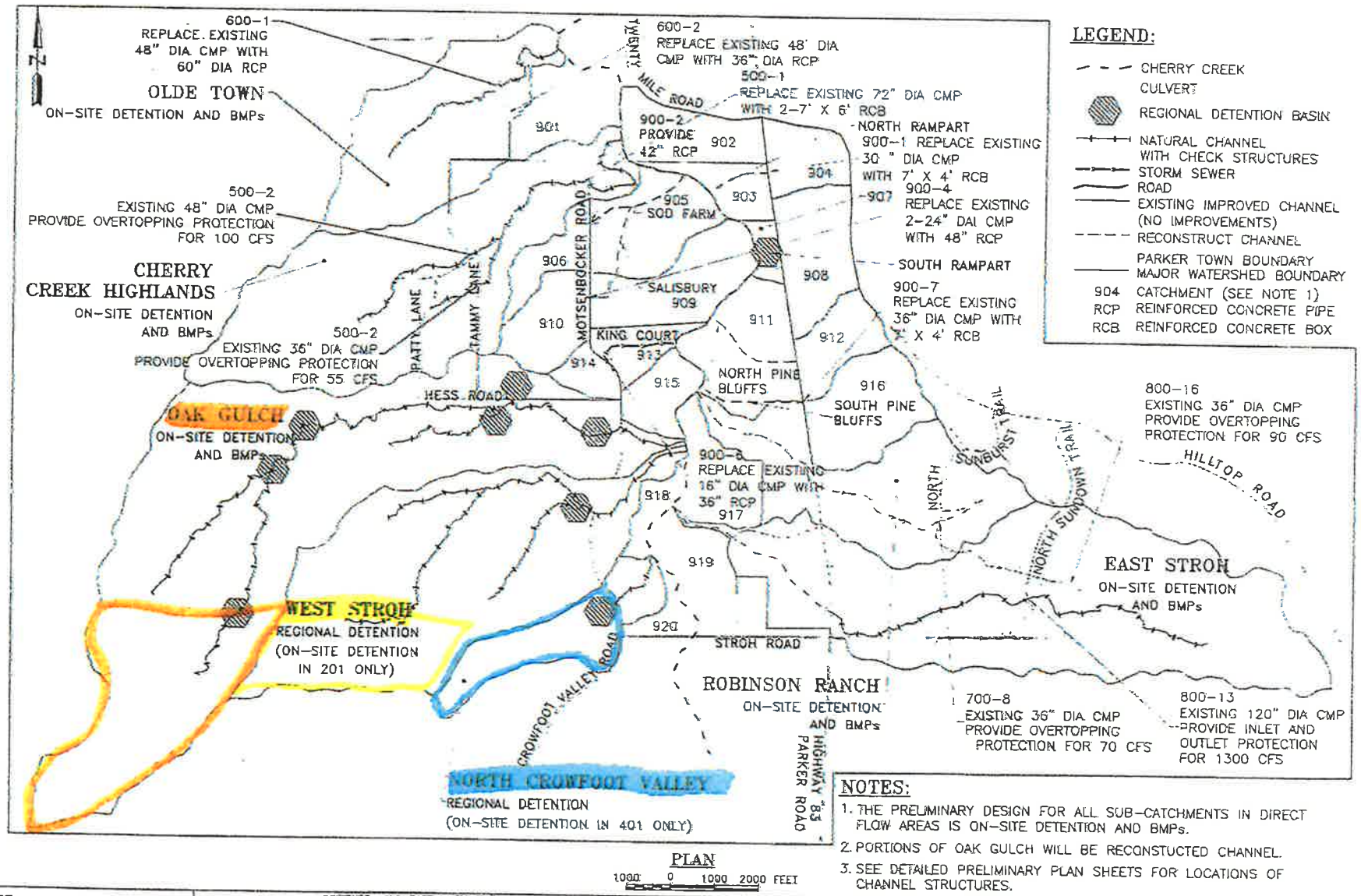
The North Crowfoot Valley Catchment is located on the west side of Cherry Creek immediately south of the West Stroh Catchment. The 0.2-mi^2 (132-acre) tributary area comprises two sub-catchments. This area is presently in a relatively native condition and undeveloped. However, development plans for the portion between Motsenbocker Road and Cherry Creek have been prepared through Stroh Ranch Filing No. 9 (Reference 9). Additionally, development plans for the area west of Motsenbocker Road have been prepared through Stroh Ranch Filing No. 13 (Reference 11) and Stroh Ranch Filing Nos. 17, 18, and 19 (Reference 12). An existing regional detention basin is located immediately adjacent to Motsenbocker Road. This pond has a maximum storage capacity of 12.15 acre-feet, which includes 1.54 acre-feet for water quality, and discharges at a rate 72 cfs for the 100-year storm event (References 13 and 14). The discharge from the detention basin passes under Motsenbocker Road through a 30-inch RCP culvert. Although not constructed at the time of this report, improvements to the drainageway between Motsenbocker Road and Cherry Creek have been designed through Stroh Ranch Filing No. 9.

Cherry Creek Highlands Catchment

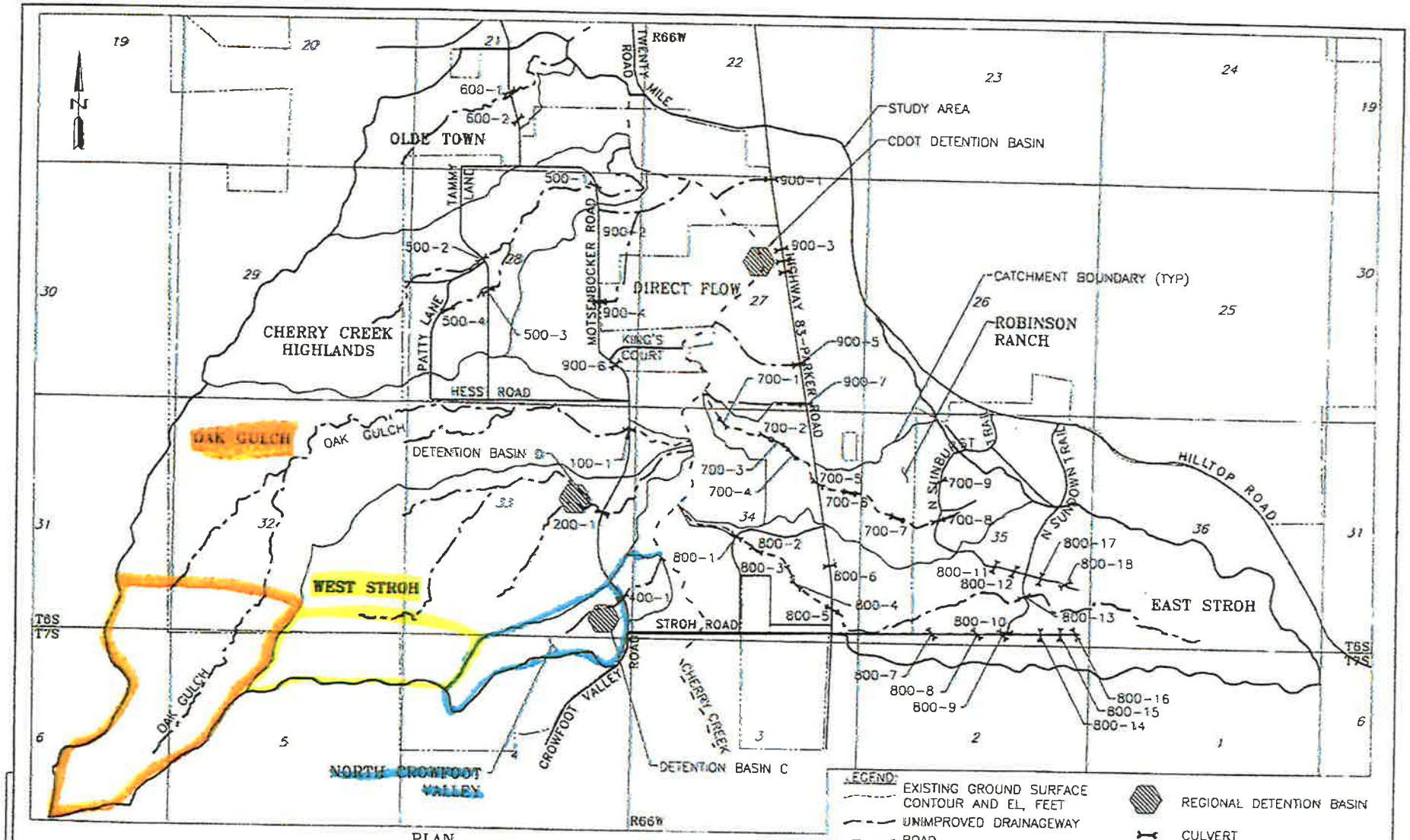
The Cherry Creek Highlands Catchment is located on the west side of Cherry Creek immediately north of Oak Gulch. The 0.9-mi^2 (601-acre) tributary area comprises 11 sub-catchments. A portion of this area comprises the Cherry Creek Highlands development, which is an existing residential neighborhood in which each residence occupies several acres of land. The remaining portion is primarily in a native condition and undeveloped. At the time of this study, no further development plans existed. However, development is expected to continue in a manner similar to the Cherry Creek Highlands development for the upper portion of the catchment and may include a small area of commercial or light industrial development adjacent to Motsenbocker Road. Two distinct drainageways convey runoff from the upper reaches of the catchment. Runoff from the south reach passes under Patty Lane through a 36-inch corrugated metal pipe (CMP) culvert and then under Tammy Lane through another 36-inch CMP culvert. Runoff from the north reach passes under Tammy Lane through a 48-inch CMP culvert. Discharge from these two reaches merges into a single drainageway that passes under Motsenbocker Road through a 72-inch CMP culvert and finally discharges into Cherry Creek.

Olde Town Catchment

The Olde Town Catchment is located on the west side of Cherry Creek immediately north of the Cherry Creek Highlands Catchment. The 0.5-mi^2 (306-acre) tributary comprises four sub-catchments. A small portion of this catchment comprises the Cherry Creek Highlands neighborhood. The remaining area is primarily in a native condition and undeveloped. MMcEngineering, Inc. has prepared drainage plans for the portion west of Motsenbocker Road (Reference 15). This portion of the catchment includes high-density residential neighborhoods. Two distinct drainageways convey runoff from the upper portions of the catchment. Runoff from these areas passes under Motsenbocker Road separately through two 48-inch CMP



Knight Piésold CONSULTING	DESIGNED: JAJ DATE: 11/00/00 DRAWN: JAJ DATE: 11/00/00 CHECKED: JRK DATE: 11/00/00 REVISED: DJA DATE: 9/23/03	TOWN OF PARKER • DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	RECOMMENDED PRELIMINARY PLAN	FIGURE ES-2



PLAN

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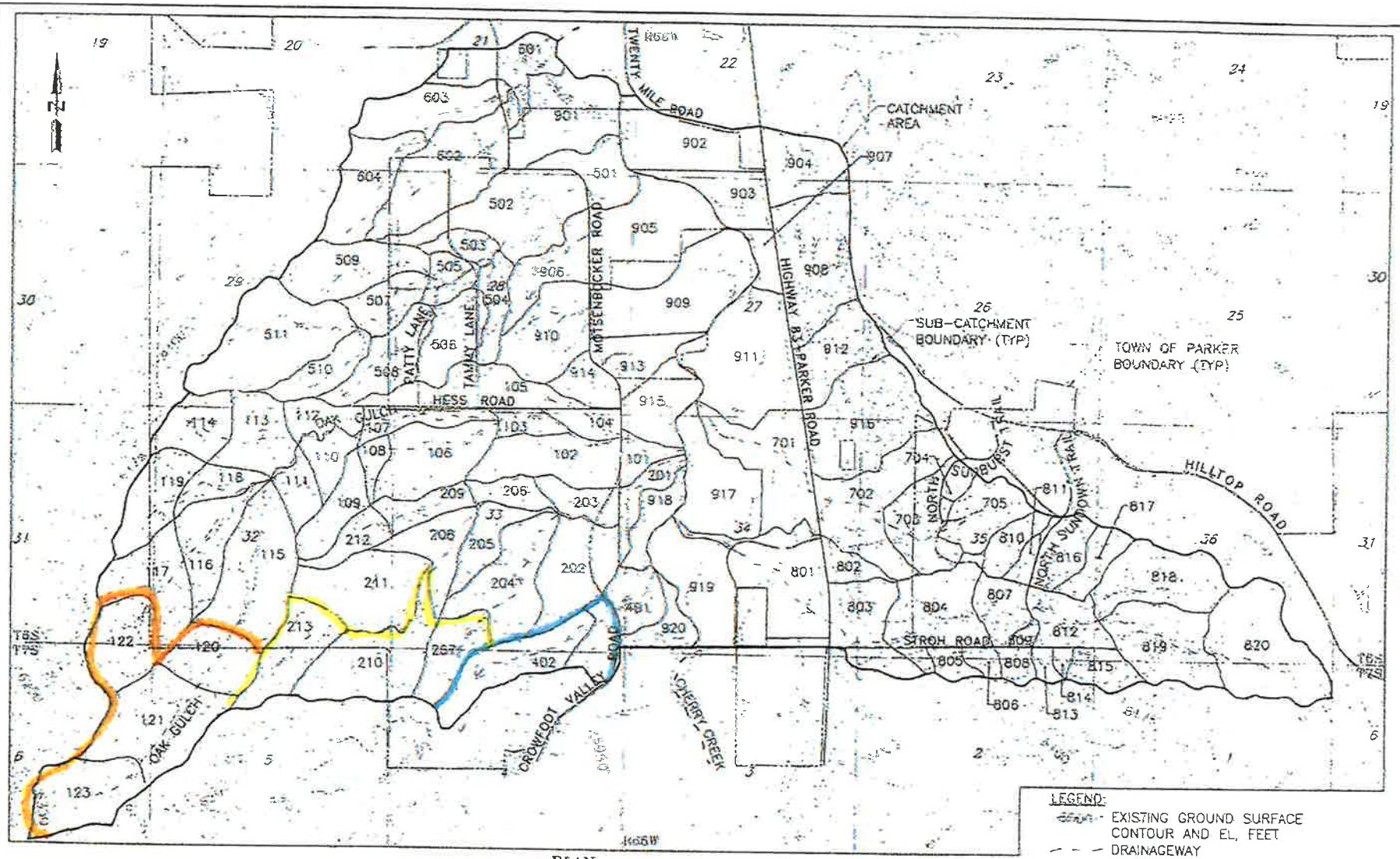
REVISED: DJA DATE: 5/27/03

TOWN OF PARKER * DOUGLAS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OAK GULCH AND STROH RANCH
OUTFALL SYSTEMS PLANNING

EXISTING FACILITIES MAP

FIGURE
II-2



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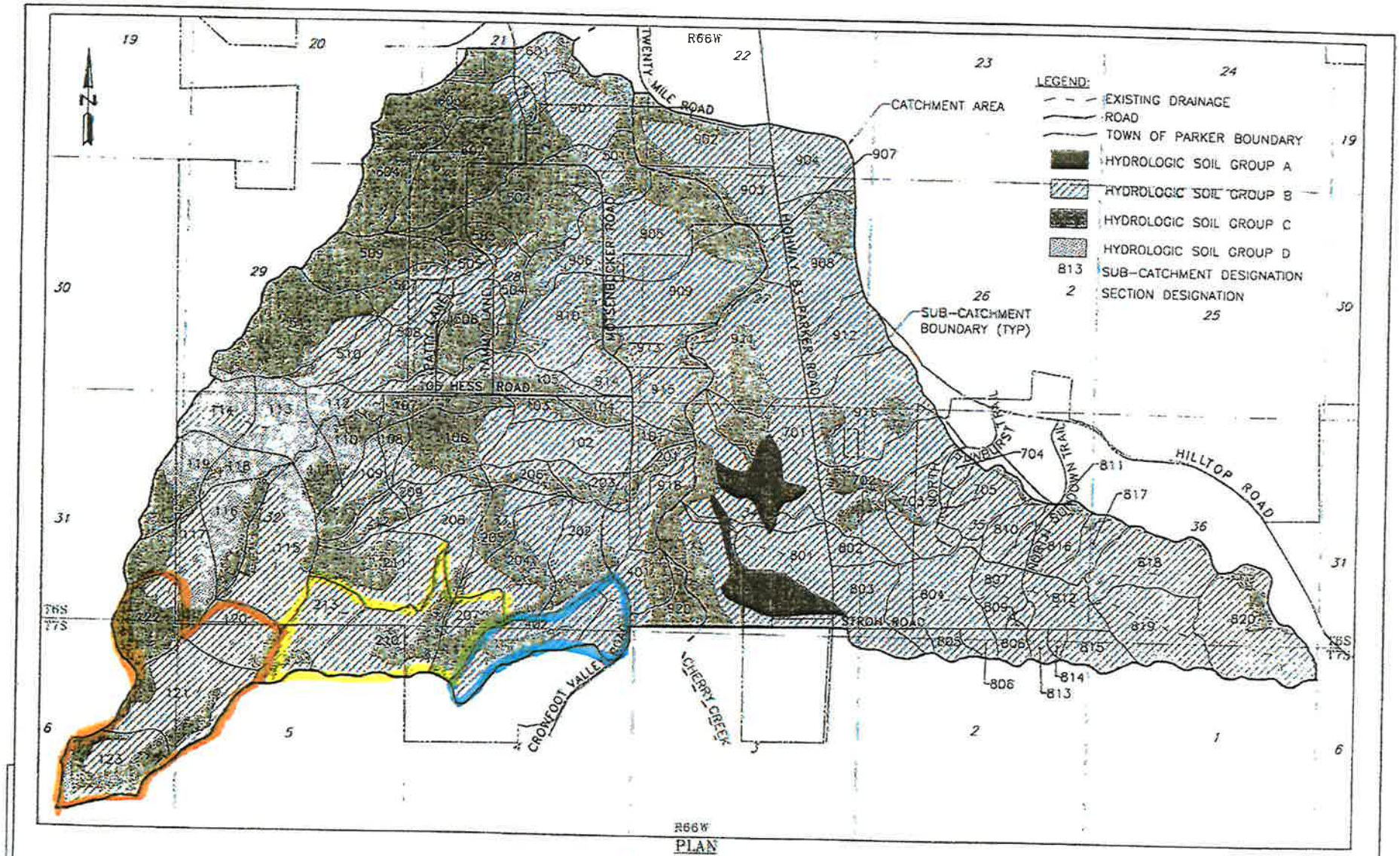

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REFERENCE
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE "SOIL SURVEY OF CASTLEROCK AREA, COLORADO" 1974

Knight Piésold CONSULTING

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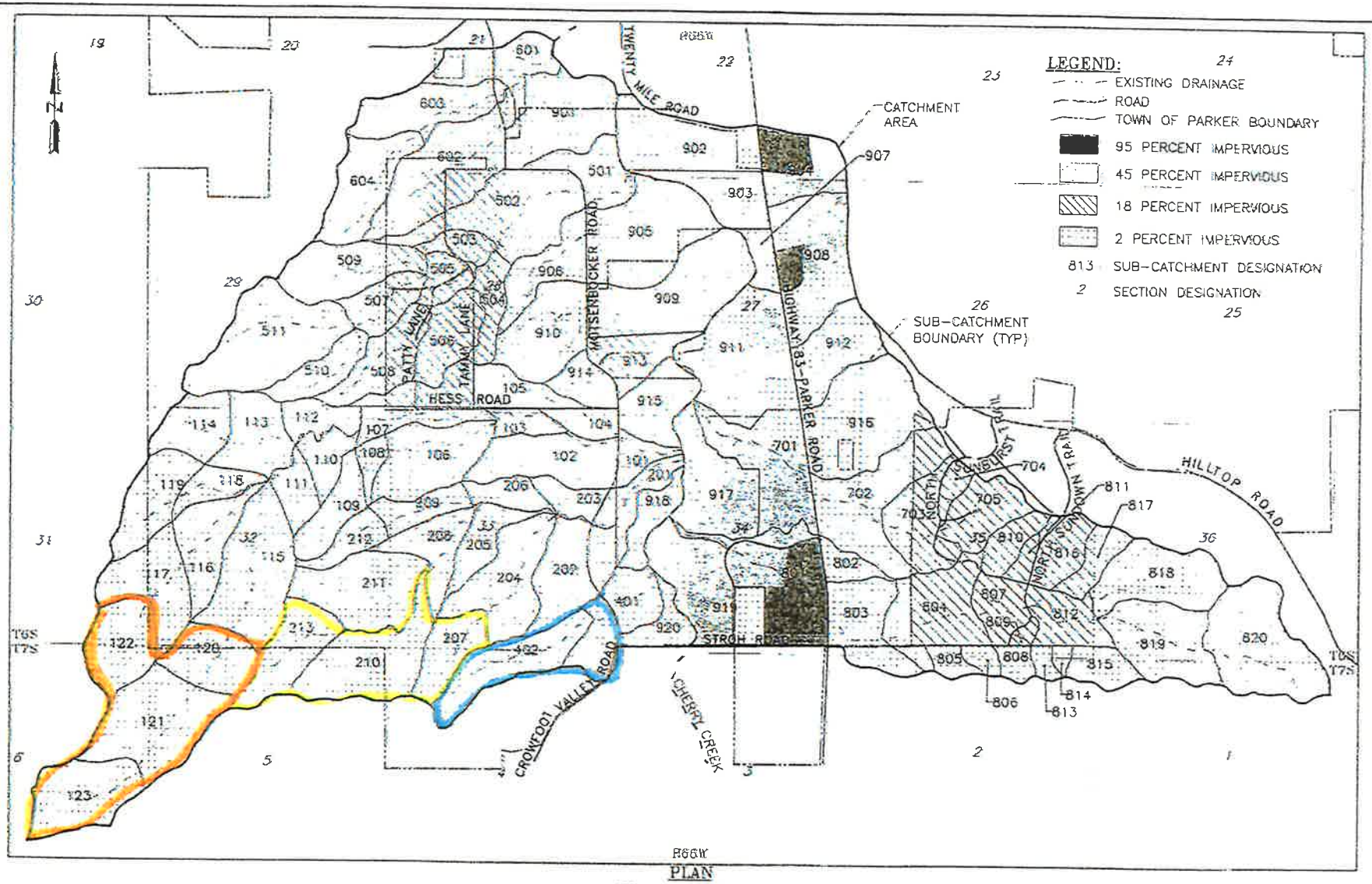
REVISED: DJA DATE: 2/27/03

TOWN OF PARKER & DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING

HYDROLOGIC SOILS GROUP

FIGURE II-4



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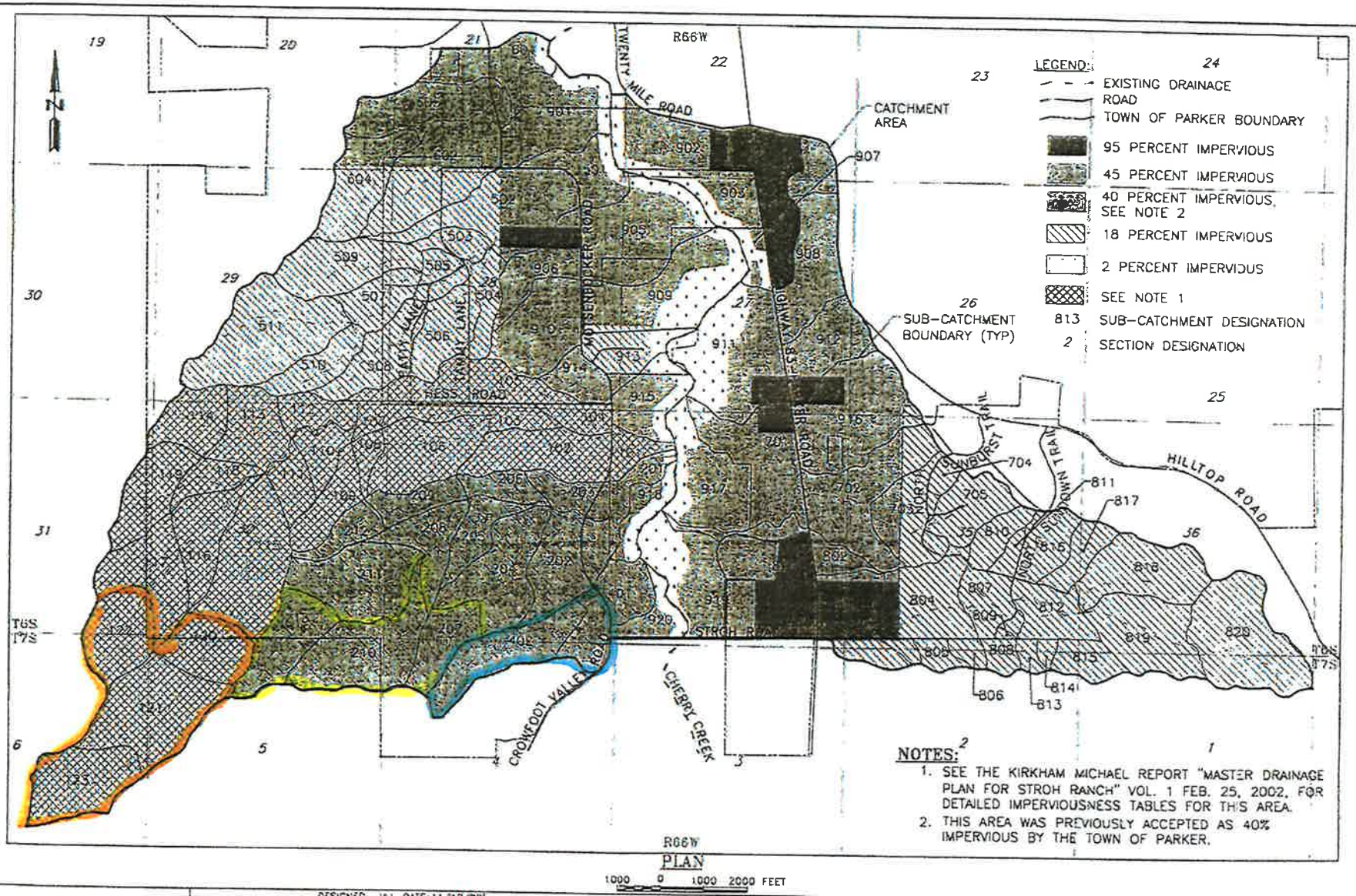
Knight Piésold CONSULTING DESIGNED: JAJ DATE: 11/12/02 DRAWN: JAJ DATE: 11/12/02 CHECKED: JRR DATE: 11/12/03 REVISED: DJA DATE: 2/27/03	TOWN OF PARKER * DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	EXISTING IMPERVIOUSNESS	FIGURE II-5



NOTES:

1. SEE THE KIRKHAM MICHAEL REPORT "MASTER DRAINAGE PLAN FOR STROH RANCH" VOL. 1 FEB. 25, 2002, FOR DETAILED IMPERVIOUSNESS TABLES FOR THIS AREA.
2. THIS AREA WAS PREVIOUSLY ACCEPTED AS 40% IMPERVIOUS BY THE TOWN OF PARKER.

PLAN

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Knight Piésold CONSULTING	DESIGNED: JAJ DATE: 11/12/02 DRAWN: JAJ DATE: 11/13/02 CHECKED: JRK DATE: 11/12/02 REVISED: DJA DATE: 2/27/03	TOWN OF PARKER - DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	FUTURE IMPERVIOUSNESS	FIGURE II-6

TABLE III-1

CUHP SUB-CATCHMENT PARAMETERS
EXISTING IMPERVIOUS CONDITIONS

Catchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
[illegible] (parameters from Stroh Master Plan, see Reference 43, except existing imperviousness)												
101	16.1	0.0252	NOTE 1	NOTE 1	2.0	NOTE 1	18.70	0.35	0.05	4.06	0.0018	0.57
102	72.4	0.1131	NOTE 1	NOTE 1	2.0	NOTE 1	31.70	0.35	0.05	4.26	0.0018	0.58
103	19.0	0.0297	NOTE 1	NOTE 1	2.0	NOTE 1	23.00	0.35	0.05	3.41	0.0018	0.53
104	17.2	0.0269	NOTE 1	NOTE 1	2.0	NOTE 1	16.50	0.35	0.05	4.05	0.0018	0.57
105	73.7	0.1152	NOTE 1	NOTE 1	17.8	NOTE 1	31.80	0.35	0.05	4.05	0.0018	0.57
106	72.2	0.1128	NOTE 1	NOTE 1	2.0	NOTE 1	32.30	0.35	0.05	3.26	0.0018	0.52
107	34.3	0.0536	NOTE 1	NOTE 1	2.0	NOTE 1	35.20	0.35	0.05	3.36	0.0018	0.52
108	13.0	0.0203	NOTE 1	NOTE 1	2.0	NOTE 1	18.00	0.35	0.05	3.60	0.0018	0.54
109	37.6	0.0588	NOTE 1	NOTE 1	2.0	NOTE 1	24.20	0.35	0.05	3.60	0.0018	0.54
110	28.0	0.0438	NOTE 1	NOTE 1	2.0	NOTE 1	21.60	0.35	0.05	3.03	0.0018	0.50
111	26.0	0.0406	NOTE 1	NOTE 1	2.0	NOTE 1	21.40	0.35	0.05	3.03	0.0018	0.50
112	24.6	0.0384	NOTE 1	NOTE 1	2.0	NOTE 1	25.60	0.35	0.05	3.15	0.0018	0.51
113	57.3	0.0895	NOTE 1	NOTE 1	2.0	NOTE 1	21.40	0.35	0.05	3.15	0.0018	0.51
114	42.7	0.0667	NOTE 1	NOTE 1	2.0	NOTE 1	20.40	0.35	0.05	3.15	0.0018	0.51
115	108.5	0.1695	0.650	0.350	2.0	0.024	33.90	0.35	0.05	3.64	0.0018	0.54
116	58.6	0.0916	NOTE 1	NOTE 1	2.0	NOTE 1	34.20	0.35	0.05	3.39	0.0018	0.53
117	77.7	0.1214	NOTE 1	NOTE 1	2.0	NOTE 1	23.70	0.35	0.05	3.39	0.0018	0.53
118	21.9	0.0342	NOTE 1	NOTE 1	2.0	NOTE 1	21.30	0.35	0.05	3.00	0.0018	0.50
119	57.5	0.0898	NOTE 1	NOTE 1	2.0	NOTE 1	22.30	0.35	0.05	3.00	0.0018	0.50
[illegible]	56.3	0.0880	NOTE 1	NOTE 1	2.0	NOTE 1	20.80	0.35	0.05	4.22	0.0018	0.58
[illegible]	109.1	0.1705	0.69	0.28	2.0	0.029	28.30	0.35	0.05	3.96	0.0018	0.56
[illegible]	51.4	0.0803	NOTE 1	NOTE 1	2.0	NOTE 1	221.10	0.35	0.05	3.30	0.0018	0.52
[illegible]	68.4	0.1069	NOTE 1	NOTE 1	2.0	NOTE 1	51.70	0.35	0.05	3.54	0.0018	0.54
WEST STROH												
201	25.0	0.0390	0.626	0.304	2.0	0.017	112.16	0.40	0.05	3.86	0.0018	0.56
202	72.4	0.1131	0.623	0.284	2.0	0.030	75.33	0.40	0.05	3.99	0.0018	0.57
203	32.2	0.0503	0.424	0.202	2.0	0.022	46.65	0.40	0.05	3.99	0.0018	0.57
204	84.8	0.1325	0.740	0.352	2.0	0.028	92.40	0.40	0.05	3.86	0.0018	0.56
205	36.0	0.0562	0.693	0.384	2.0	0.029	88.25	0.40	0.05	3.66	0.0018	0.54
206	23.3	0.0364	0.426	0.202	2.0	0.015	73.34	0.40	0.05	3.89	0.0018	0.56
207	44.0	0.0687	0.472	0.227	2.0	0.048	56.46	0.40	0.05	3.67	0.0018	0.54
208	47.2	0.0738	0.514	0.241	2.0	0.040	61.46	0.40	0.05	4.31	0.0018	0.59
209	29.8	0.0466	0.472	0.237	2.0	0.042	54.49	0.40	0.05	3.99	0.0018	0.57
210	93.8	0.1466	0.920	0.460	2.0	0.032	N/A	0.40	0.05	4.11	0.0018	0.57
211	89.6	0.1400	0.663	0.349	2.0	0.044	75.16	0.40	0.05	3.72	0.0018	0.55
212	23.5	0.0367	0.380	0.146	2.0	0.046	47.88	0.40	0.05	3.69	0.0018	0.55
213	62.1	0.0971	0.586	0.252	2.0	0.039	67.39	0.40	0.05	4.23	0.0018	0.58

NOTE 1 This information was not supplied with the Kirkham Micheal Report. Runoff was calculated by CUHP using the rational method for these areas, so this information is not strictly necessary

TABLE III-1 (CONTINUED)

CUHP SUB-CATCHMENT PARAMETERS
EXISTING IMPERVIOUS CONDITIONS

Catchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
NORTH CROWFOOT VALLEY												
[illegible]	59.5	0.0929	0.544	0.271	2.0	0.038	50.79	0.40	0.05	4.07	0.0018	0.57
[illegible]	72.9	0.1139	0.838	0.402	2.0	0.039	53.72	0.40	0.05	3.85	0.0018	0.56
CHERRY CREEK HIGHLANDS												
501	44.6	0.0698	0.426	0.123	2.0	0.032	56.14	0.40	0.05	3.53	0.0018	0.54
502	105.4	0.1646	0.778	0.309	8.4	0.028	N/A	0.40	0.05	3.15	0.0018	0.51
503	20.0	0.0312	0.337	0.134	18.0	0.040	41.61	0.40	0.05	3.15	0.0018	0.51
504	30.4	0.0475	0.477	0.248	18.0	0.032	61.73	0.40	0.05	3.45	0.0018	0.53
505	23.9	0.0374	0.284	0.136	18.0	0.050	33.18	0.40	0.05	4.05	0.0018	0.57
506	48.9	0.0780	0.466	0.239	18.0	0.039	57.36	0.40	0.05	3.60	0.0018	0.54
507	37.4	0.0584	0.398	0.206	10.0	0.044	48.85	0.40	0.05	3.90	0.0018	0.56
508	56.1	0.0877	0.581	0.252	10.0	0.036	68.59	0.40	0.05	4.05	0.0018	0.57
509	71.3	0.1114	0.855	0.383	6.8	0.061	59.70	0.40	0.05	3.00	0.0018	0.50
510	37.4	0.0585	0.536	0.258	2.0	0.048	57.53	0.40	0.05	4.20	0.0018	0.58
511	124.4	0.1944	0.803	0.339	2.0	0.044	N/A	0.40	0.05	3.15	0.0018	0.51
OLDE TOWN												
601	57.5	0.0899	0.555	0.208	2.0	0.040	69.91	0.40	0.05	3.60	0.0018	0.54
602	113.9	0.1779	0.869	0.388	6.8	0.028	N/A	0.40	0.05	3.08	0.0018	0.51
603	66.5	0.1039	0.689	0.341	2.0	0.025	93.45	0.40	0.05	3.15	0.0018	0.51
604	68.2	0.1066	0.606	0.290	2.0	0.041	67.94	0.40	0.05	3.00	0.0018	0.50
ROBINSON RANCH												
701	95.0	0.1485	0.754	0.458	36.4	0.021	N/A	0.36	0.05	4.30	0.00158	0.66
702	102.3	0.1599	0.672	0.259	5.2	0.054	N/A	0.40	0.05	4.13	0.0018	0.58
703	59.6	0.0931	0.443	0.150	13.2	0.071	43.26	0.40	0.05	4.35	0.0018	0.59
704	10.1	0.0157	0.163	0.078	18.0	0.056	24.39	0.40	0.05	4.50	0.0018	0.60

TABLE III-2

CUHP SUB-CATCHMENT PARAMETERS
FUTURE IMPERVIOUS CONDITIONS

Catchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
[illegible] (parameters from Stroh Master Plan, see Reference 43)												
101	16.1	0.0252	NOTE 1	Note 1	21.0	NOTE 1	18.70	0.35	0.05	4.06	0.0018	0.57
102	72.4	0.1131	NOTE 1	Note 1	20.7	NOTE 1	31.70	0.35	0.05	4.26	0.0018	0.58
103	18.0	0.0287	NOTE 1	Note 1	2.0	NOTE 1	23.00	0.35	0.05	3.41	0.0018	0.53
104	17.2	0.0269	NOTE 1	Note 1	55.0	NOTE 1	16.50	0.35	0.05	4.05	0.0018	0.57
105	73.7	0.1152	NOTE 1	Note 1	29.2	NOTE 1	31.80	0.35	0.05	4.05	0.0018	0.57
106	72.2	0.1128	NOTE 1	Note 1	24.5	NOTE 1	32.30	0.35	0.05	3.28	0.0018	0.52
107	34.3	0.0536	NOTE 1	Note 1	9.1	NOTE 1	35.20	0.35	0.05	3.36	0.0018	0.52
108	13.0	0.0203	NOTE 1	Note 1	20.6	NOTE 1	16.00	0.35	0.05	3.60	0.0018	0.54
109	37.6	0.0588	NOTE 1	Note 1	24.2	NOTE 1	24.20	0.35	0.05	3.60	0.0018	0.54
110	28.0	0.0438	NOTE 1	Note 1	26.3	NOTE 1	21.60	0.35	0.05	3.03	0.0018	0.50
111	26.0	0.0406	NOTE 1	Note 1	27.0	NOTE 1	21.40	0.35	0.05	3.03	0.0018	0.50
112	24.6	0.0384	NOTE 1	Note 1	30.0	NOTE 1	25.60	0.35	0.05	3.15	0.0018	0.51
113	57.3	0.0895	NOTE 1	Note 1	40.7	NOTE 1	21.40	0.35	0.05	3.15	0.0018	0.51
114	42.7	0.0667	NOTE 1	Note 1	30.0	NOTE 1	20.40	0.35	0.05	3.15	0.0018	0.51
115	108.5	0.1695	0.650	0.350	27.3	0.024	33.90	0.35	0.05	3.64	0.0018	0.54
116	58.6	0.0916	NOTE 1	Note 1	19.3	NOTE 1	34.20	0.35	0.05	3.39	0.0018	0.53
117	77.7	0.1214	NOTE 1	Note 1	24.8	NOTE 1	23.70	0.35	0.05	3.39	0.0018	0.53
118	21.9	0.0342	NOTE 1	Note 1	32.7	NOTE 1	21.30	0.35	0.05	3.00	0.0018	0.50
119	57.5	0.0898	NOTE 1	Note 1	24.9	NOTE 1	22.30	0.35	0.05	3.00	0.0018	0.50
[illegible]	56.3	0.0880	NOTE 1	Note 1	32.	NOTE 1	20.80	0.35	0.05	4.22	0.0018	0.58
[illegible]	109.1	0.1705	0.69	0.28	24.5	0.029	26.30	0.35	0.05	3.96	0.0018	0.56
[illegible]	51.4	0.0803	NOTE 1	Note 1	21.5	NOTE 1	221.10	0.35	0.05	3.30	0.0018	0.52
[illegible]	68.4	0.1069	NOTE 1	Note 1	19.5	NOTE 1	51.70	0.35	0.05	3.45	0.0018	0.54
WEST STROH												
201	25.0	0.0390	0.626	0.304	40.0*	0.017	28.40	0.35	0.05	3.86	0.0018	0.56
202	72.4	0.1131	0.623	0.284	40.0	0.030	28.30	0.35	0.05	3.99	0.0018	0.57
203	32.2	0.0503	0.424	0.202	40.0	0.022	22.40	0.35	0.05	3.99	0.0018	0.57
204	84.8	0.1325	0.740	0.362	40.0	0.028	31.70	0.35	0.05	3.88	0.0018	0.56
205	36.0	0.0562	0.693	0.384	40.0	0.029	30.30	0.35	0.05	3.66	0.0018	0.54
206	23.3	0.0364	0.426	0.202	40.0	0.015	22.50	0.35	0.05	3.89	0.0018	0.56
207	44.0	0.0687	0.472	0.227	40.0	0.048	23.80	0.35	0.05	3.67	0.0018	0.54
208	47.2	0.0738	0.514	0.241	40.0	0.040	25.10	0.35	0.05	4.31	0.0018	0.59
209	29.8	0.0466	0.472	0.237	40.0	0.042	23.90	0.35	0.05	3.99	0.0018	0.57
210	93.8	0.1466	0.920	0.460	40.0	0.032	N/A	0.35	0.05	4.11	0.0018	0.57
211	89.6	0.1400	0.663	0.349	40.0	0.044	29.40	0.35	0.05	3.72	0.0018	0.55
212	23.5	0.0367	0.380	0.148	40.0	0.046	21.20	0.35	0.05	3.69	0.0018	0.55
213	62.1	0.0971	0.586	0.252	40.0	0.039	27.20	0.35	0.05	4.23	0.0018	0.58

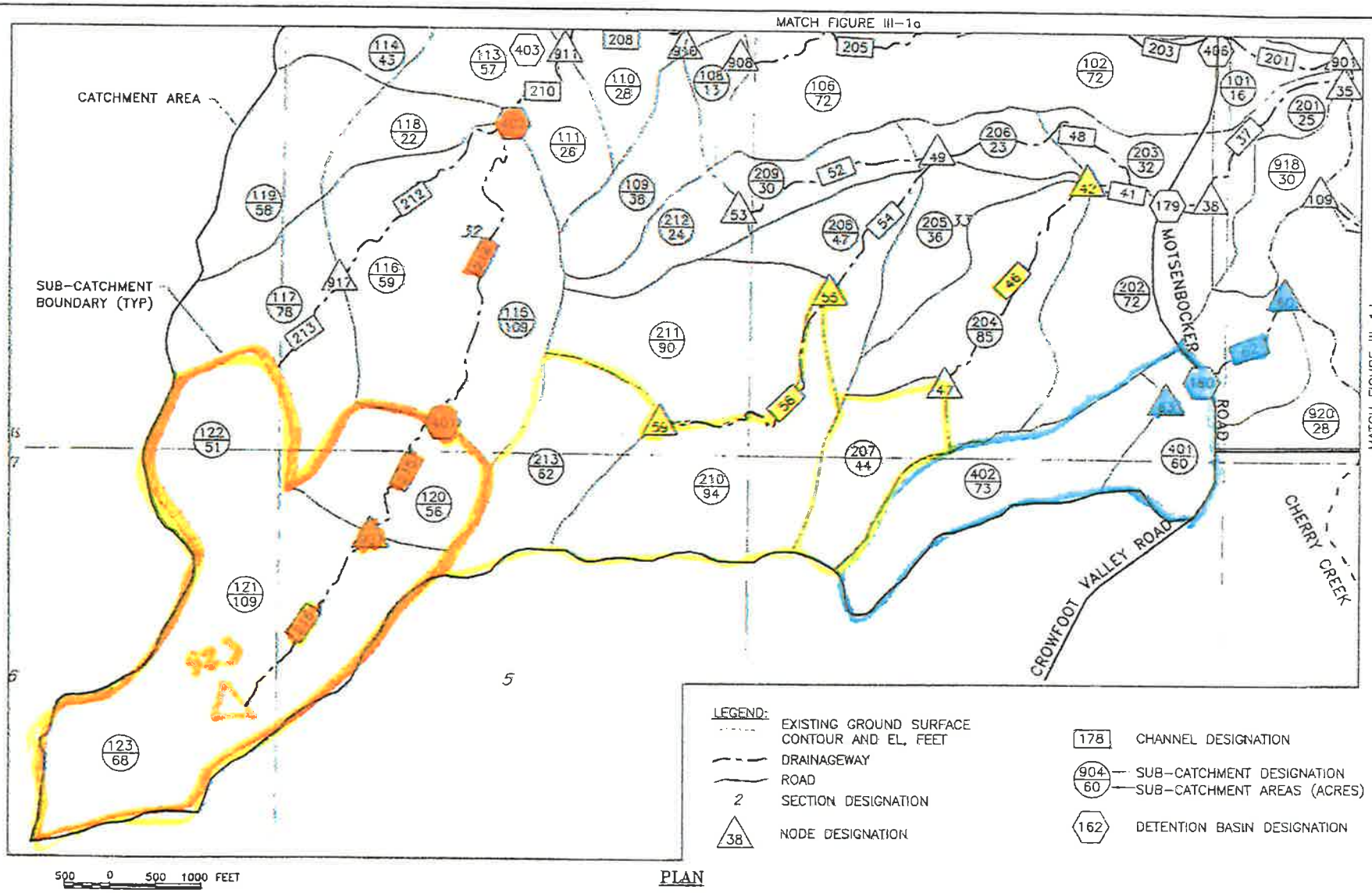
NOTE 1 This information was not supplied with the Kirkham Micheal Report. Runoff was calculated by CUHP using the rational method for these areas, so this information is not strictly necessary.

TABLE III-2 (CONTINUED)

CUHP SUB-CATCHMENT PARAMETERS
FUTURE IMPERVIOUS CONDITIONS

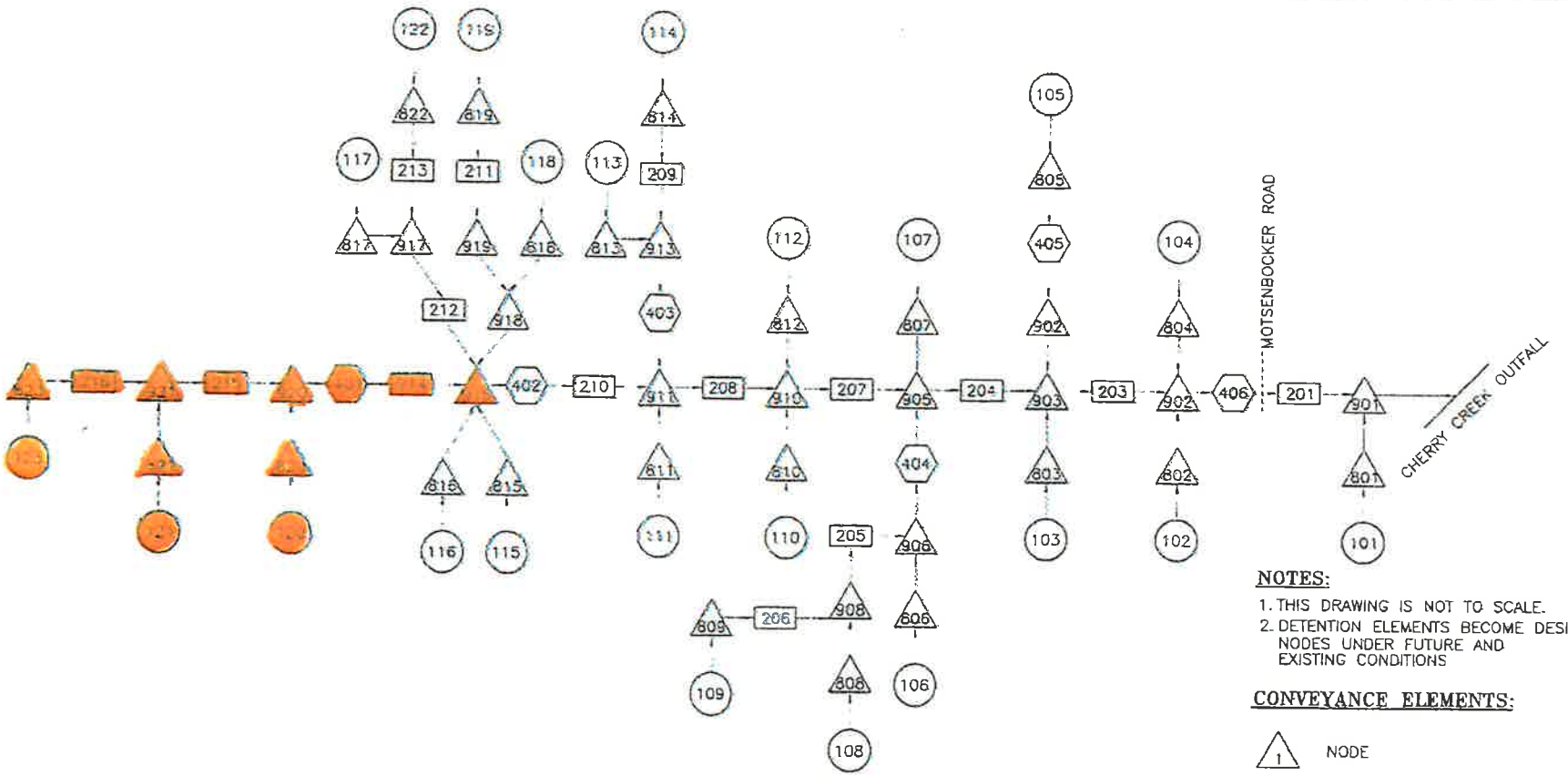
Catchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
NORTH CROWFOOT VALLEY												
[illegible]	59.5	0.0929	0.544	0.271	40.0*	0.038	25.90	0.35	0.05	4.07	0.0018	0.57
[illegible]	72.9	0.1139	0.838	0.402	40.0	0.039	34.60	0.35	0.05	3.85	0.0018	0.56
CHERRY CREEK HIGHLANDS												
501	44.6	0.0696	0.426	0.123	36.4	0.032	22.50	0.36	0.05	3.53	0.0018	0.54
502	105.4	0.1646	0.778	0.309	44.2	0.028	N/A	0.37	0.06	3.15	0.0018	0.51
503	20.0	0.0312	0.337	0.134	18.0	0.040	28.83	0.40	0.05	3.15	0.0018	0.51
504	30.4	0.0475	0.477	0.248	18.0	0.032	39.27	0.40	0.05	3.45	0.0018	0.53
505	23.9	0.0374	0.284	0.136	18.0	0.050	24.27	0.40	0.05	4.05	0.0018	0.57
506	49.9	0.0780	0.466	0.239	18.0	0.039	37.47	0.40	0.05	3.60	0.0018	0.54
507	37.4	0.0584	0.398	0.206	18.0	0.044	32.60	0.40	0.05	3.90	0.0018	0.56
508	56.1	0.0877	0.581	0.252	18.0	0.036	40.57	0.40	0.06	4.05	0.0018	0.57
509	71.3	0.1114	0.655	0.383	18.0	0.061	34.72	0.40	0.05	3.00	0.0018	0.50
510	37.4	0.0585	0.536	0.258	18.0	0.048	34.36	0.40	0.05	4.20	0.0018	0.58
511	124.4	0.1944	0.803	0.339	18.0	0.044	N/A	0.40	0.05	3.15	0.0018	0.51
OLDE TOWN												
601	57.5	0.0899	0.555	0.208	36.4	0.040	26.28	0.36	0.05	3.60	0.0018	0.54
602	113.9	0.1779	0.869	0.388	31.5	0.028	N/A	0.38	0.05	3.08	0.0018	0.51
603	66.5	0.1039	0.689	0.341	45.0	0.025	30.22	0.35	0.05	3.15	0.0018	0.51
604	68.2	0.1066	0.636	0.290	28.8	0.041	35.61	0.38	0.05	3.00	0.0018	0.50
ROBINSON RANCH												
701	95.0	0.1485	0.754	0.458	45.7	0.021	N/A	0.36	0.06	4.30	0.00158	0.66
702	102.3	0.1599	0.672	0.259	39.6	0.054	N/A	0.36	0.05	4.13	0.0018	0.58
703	59.6	0.0931	0.443	0.150	26.1	0.071	26.72	0.39	0.05	4.35	0.0018	0.59
704	10.1	0.0157	0.153	0.078	18.0	0.056	20.77	0.40	0.05	4.50	0.0018	0.60
705	47.8	0.0747	0.409	0.186	18.0	0.060	28.70	0.40	0.05	4.35	0.0018	0.59

* 40.0% imperviousness used for West Stroh and North Crowfoot Valley catchments per previously platted and accepted drainage designs



PLAN

Knight Piésold CONSULTING — DESIGNED: JAJ DATE: 11/05/02; DRAWN: JAJ DATE: 11/05/02; CHECKED: JRK DATE: 11/05/02; REVISED: DJA DATE: 2/27/03	TOWN OF PARKER * DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	UDSWM CONVEYANCE MAP SHEET 3 OF 4	FIGURE III-1c



OAK GULCH

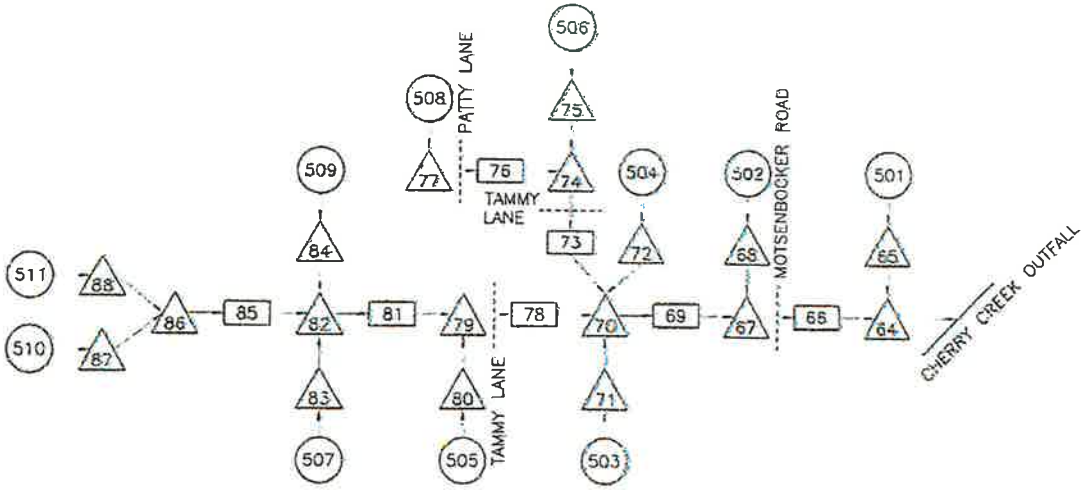
NOTES:

1. THIS DRAWING IS NOT TO SCALE.
2. DETENTION ELEMENTS BECOME DESIGN NODES UNDER FUTURE AND EXISTING CONDITIONS

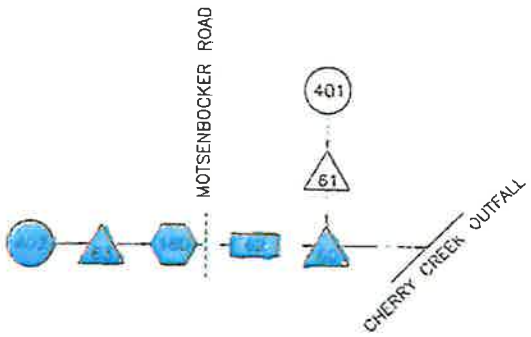
CONVEYANCE ELEMENTS:

- 1 — NODE
- 107 — SUB-CATCHMENT
- 3 — CHANNEL
- 162 — DETENTION
- CHERRY CREEK OUTFALL
- ROAD CROSSING

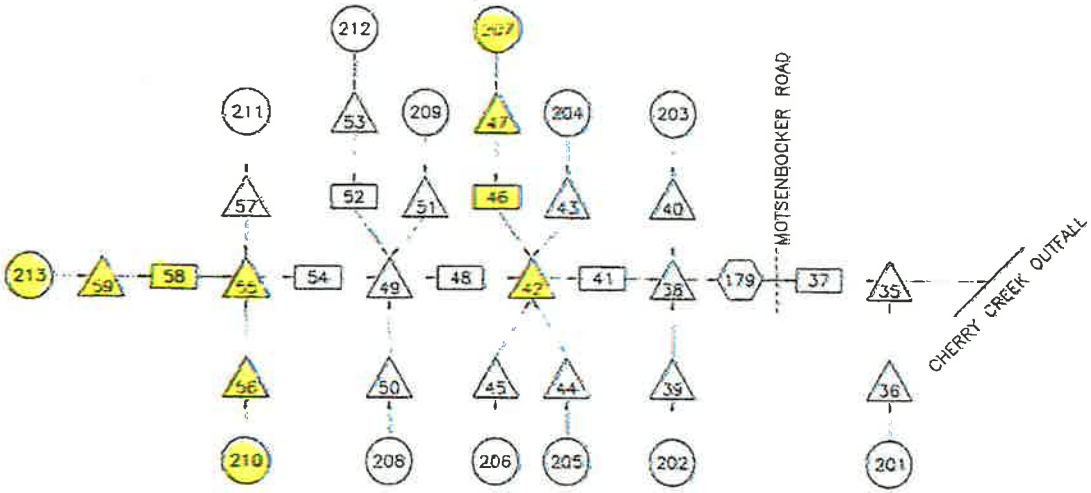
Knight Piésold CONSULTING DESIGNED: JAJ DATE: 11/12/02 DRAWN: JAJ DATE: 11/12/02 CHECKED: JRK DATE: 11/12/02 REVISED: DJA DATE: 2/27/03	TOWN OF PARKER * DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	CONNECTIVITY SHEET 1 OF 4	FIGURE III-2a



CHERRY CREEK HIGHLANDS



NORTH CROWFOOT VALLEY



WEST STROH

NOTES:

1. SUB-CATCHMENTS 901, 915, 918 AND 920 ARE DIRECT FLOW CATCHMENTS ADJACENT TO CHERRY CREEK. CONNECTIVITY DIAGRAMS AND UDSWM MODELING ARE NOT APPROPRIATE FOR THESE SUB-CATCHMENTS.
2. THIS DRAWING IS NOT TO SCALE.

CONVEYANCE ELEMENTS:

- 1 — NODE
- 107 — SUB-CATCHMENT
- 3 — CHANNEL
- 162 — DETENTION
- CHERRY CREEK OUTFALL
- ROAD CROSSING

Knight Piésold CONSULTING — DESIGNED: JAJ DATE: 11/12/02; DRAWN: JAJ DATE: 11/12/02; CHECKED: JRK DATE: 11/12/02; REVISED: DJA DATE: 2/27/03	TOWN OF PARKER • DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	CONNECTIVITY SHEET 2 OF 4	FIGURE III-2b

FIGURE III-3a

PEAK FLOW PROFILES
4616 OAK GULCH

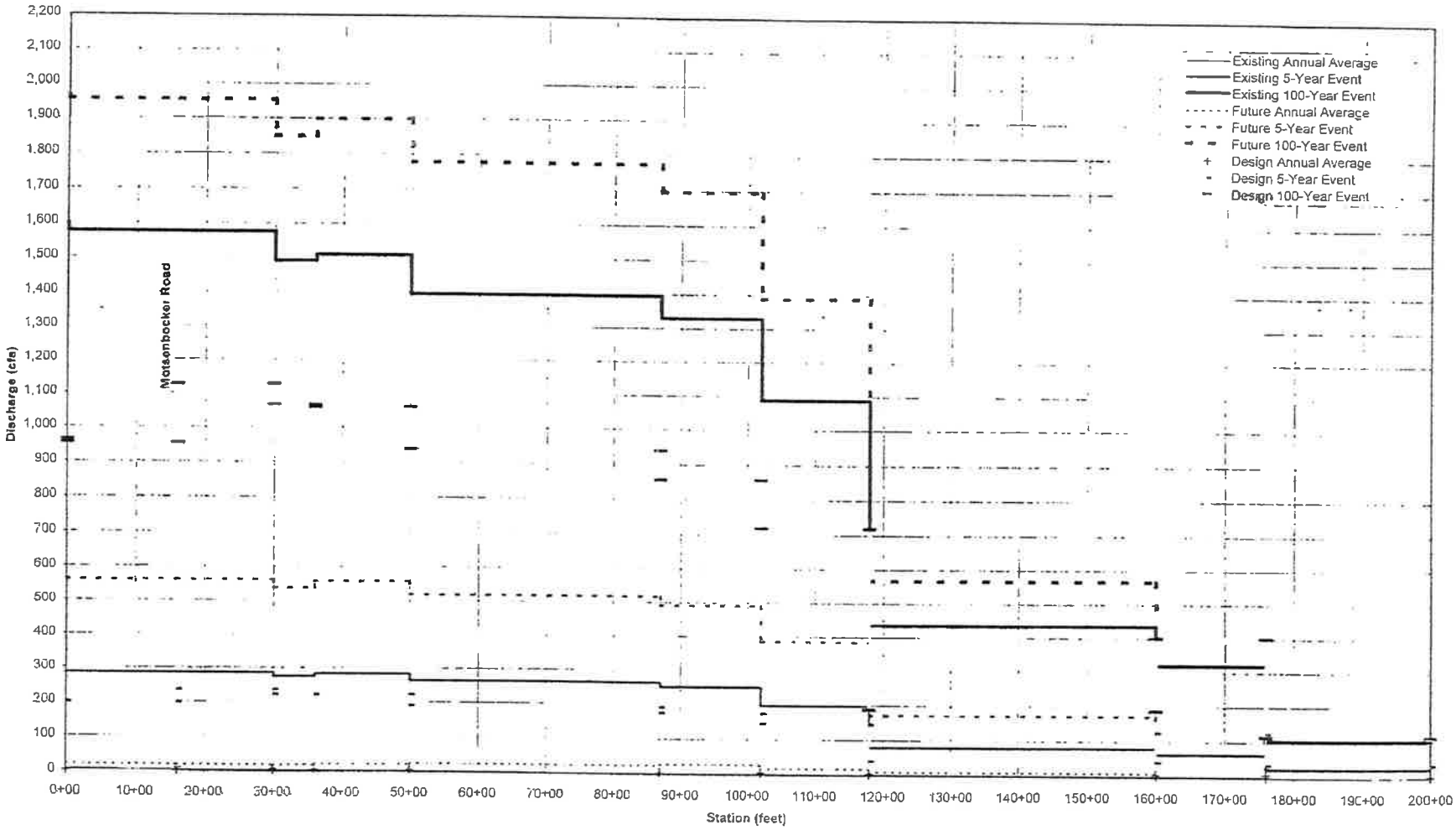


FIGURE III-3b

PEAK FLOW PROFILES
4616.1 WEST STROH

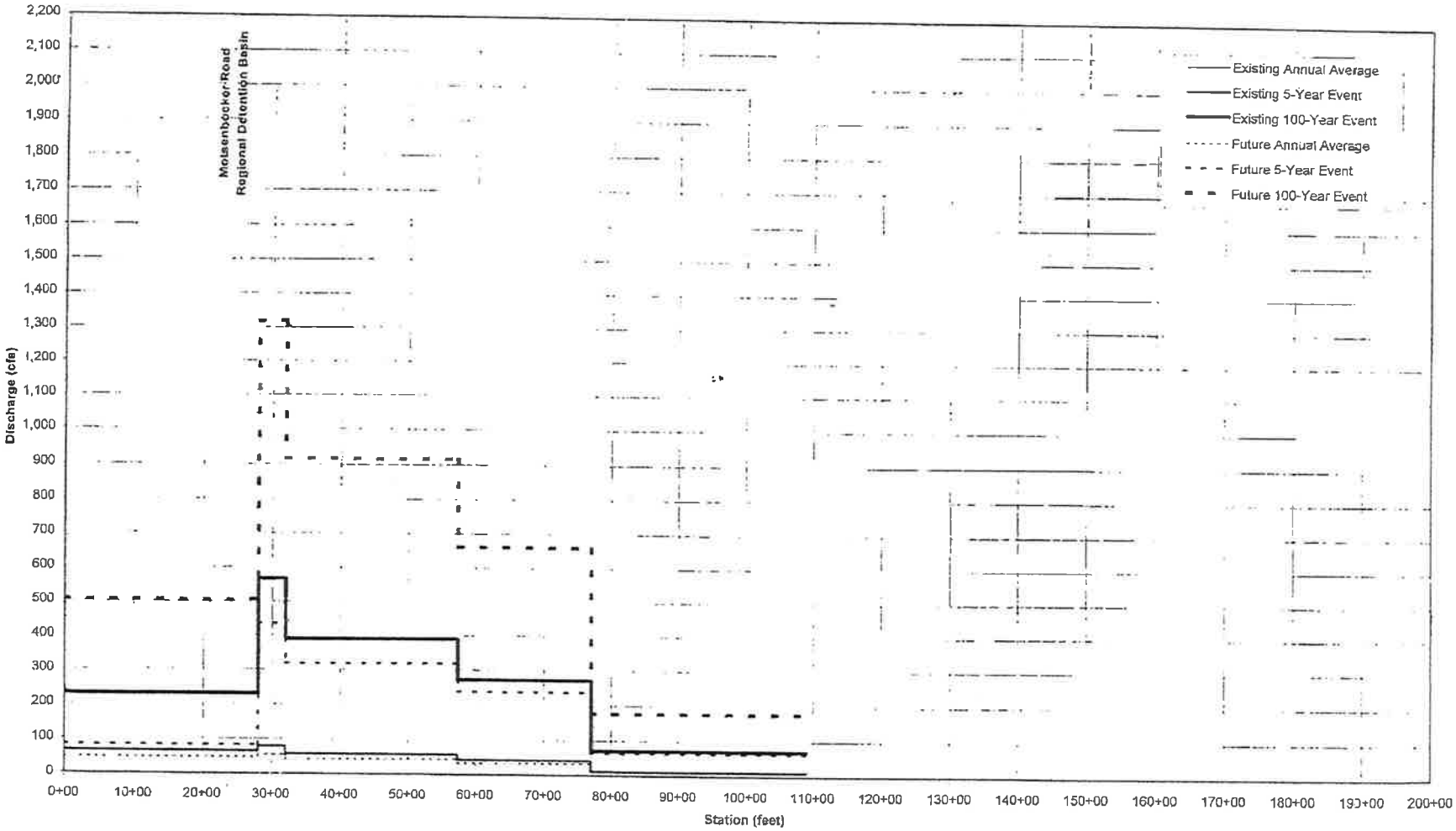


FIGURE III-3c

PEAK FLOW PROFILES
4600-11.3 NORTH CROWFOOT VALLEY

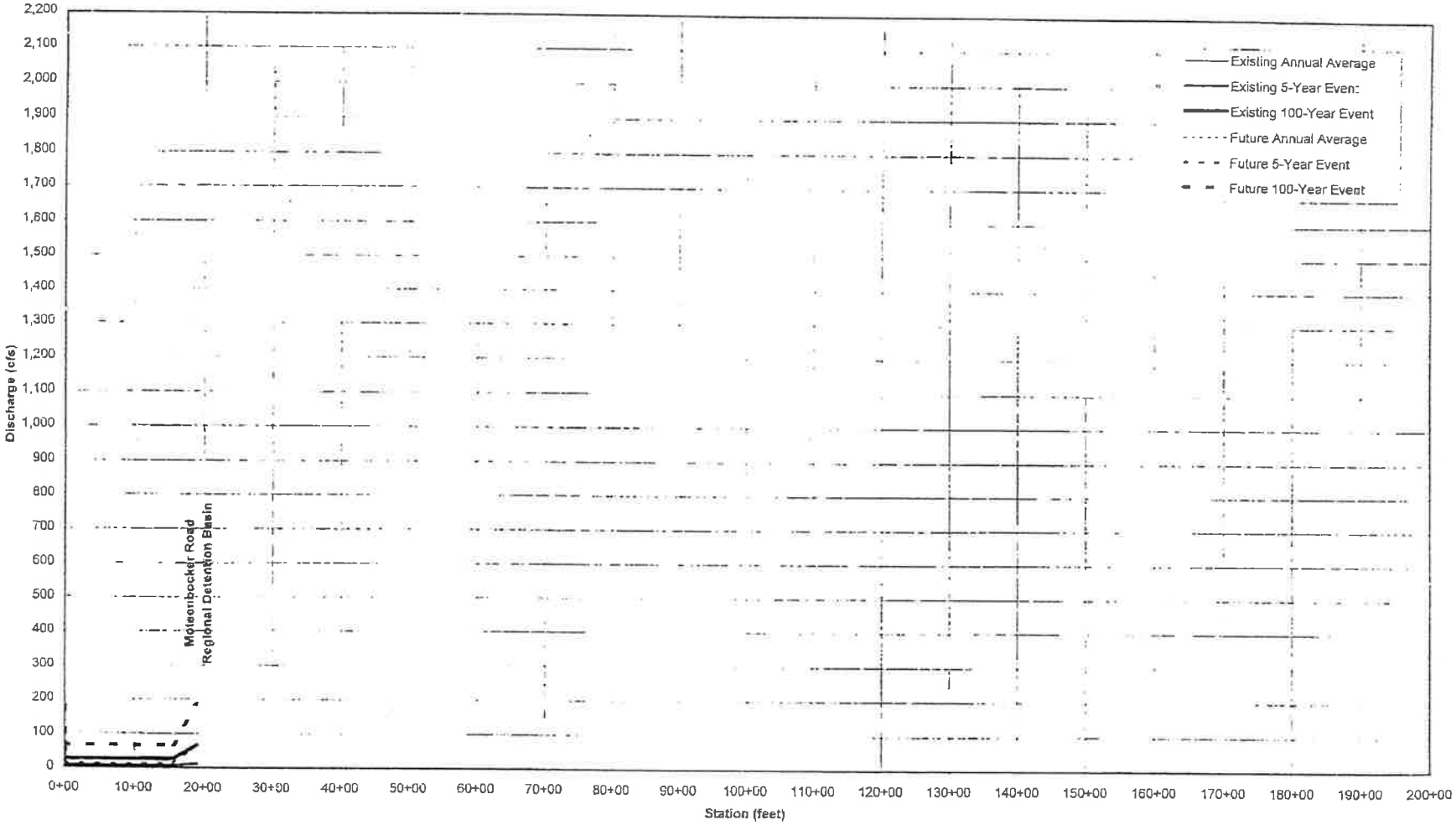


FIGURE III-4a

RUNOFF HYDROGRAPH DRAINAGEWAY 4616
UDSWM ELEMENT NO. 406
[illegible] GULCH AT MOTSENBOCKER ROAD

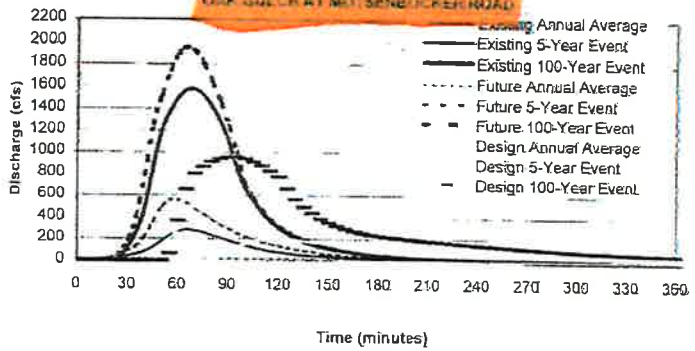


FIGURE III-4b

RUNOFF HYDROGRAPH DRAINAGEWAY 4616.1
UDSWM ELEMENT NO. 38
W. STROH AT INLET TO EXG. REG. DETENTION

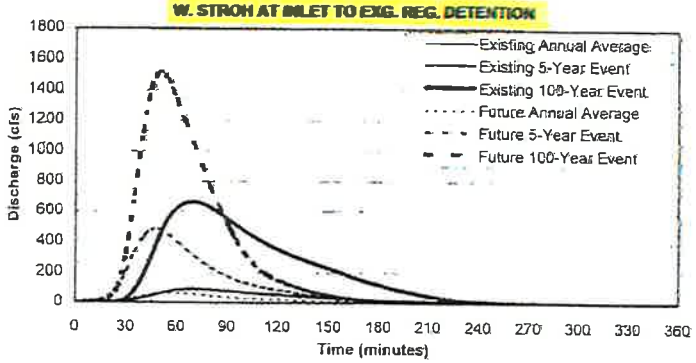


FIGURE III-4c

RUNOFF HYDROGRAPH DRAINAGEWAY 4600-11.3
UDSWM ELEMENT NO. 63
N. CROWFOOT VALLEY AT INLET TO EXG. REG. DETENTION

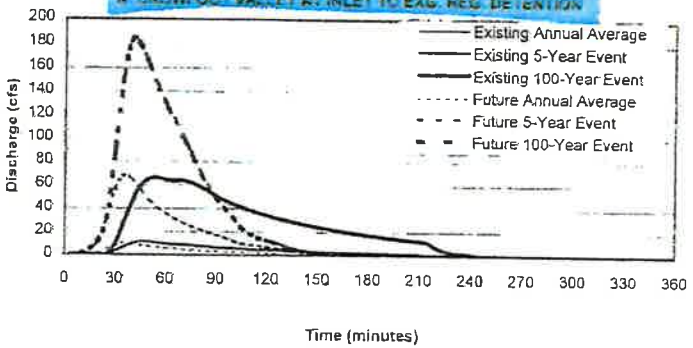
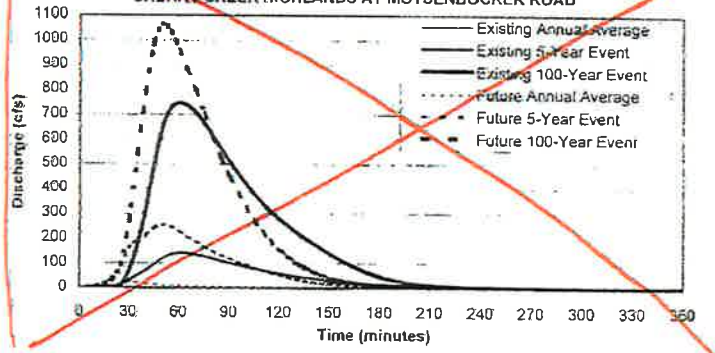


FIGURE III-4d

RUNOFF HYDROGRAPH DRAINAGEWAY 4600-10.4
UDSWM ELEMENT NO. 67
CHERRY CREEK HIGHLANDS AT MOTSENBOCKER ROAD

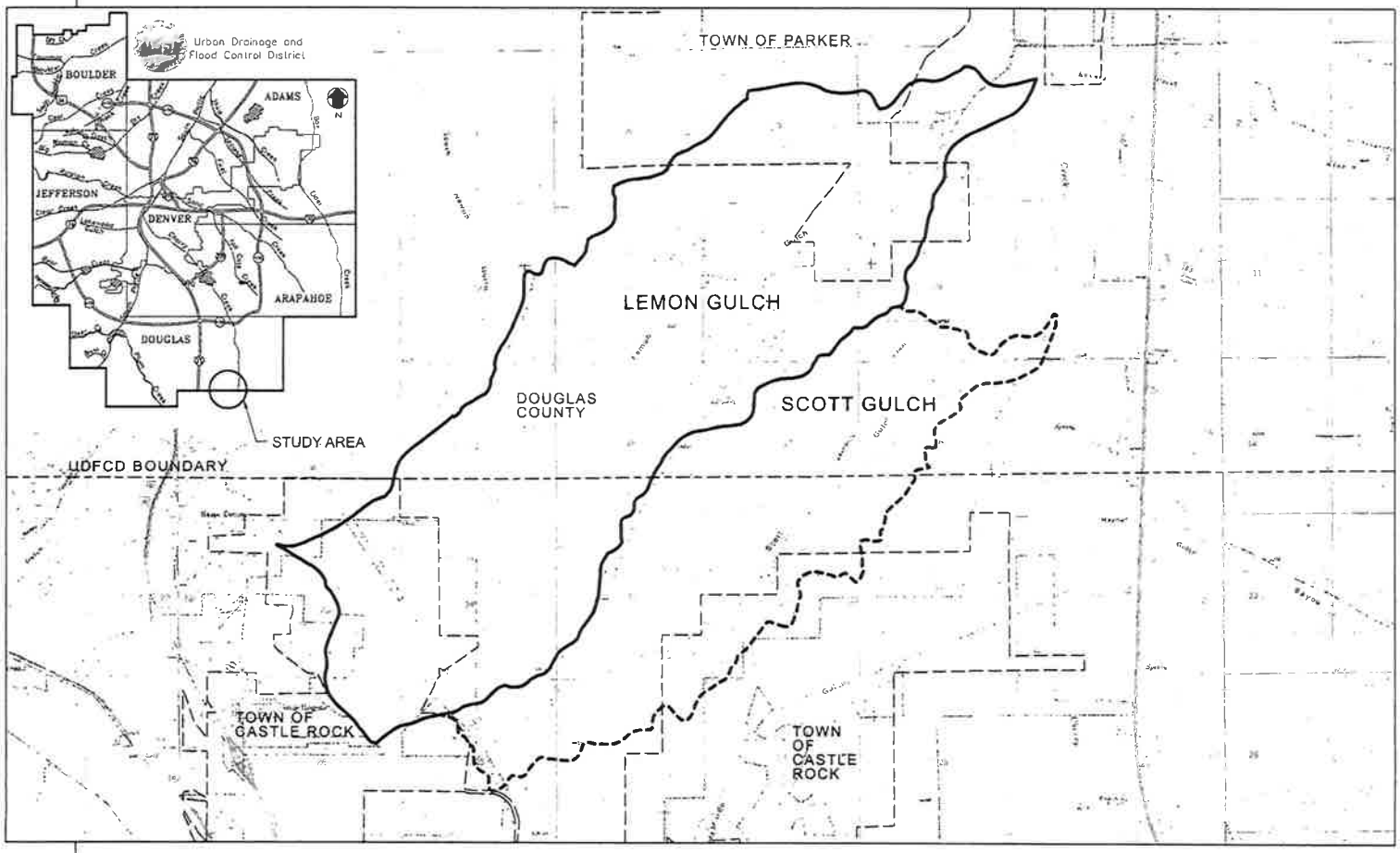


APPENDIX E

Excerpts from Scott & Lemon Gulch Watersheds Outfall Systems Planning

OUTFALL SYSTEMS PLANNING-PRELIMINARY DESIGN REPORT

SCOTT AND LEMON GULCH WATERSHEDS



PREPARED FOR:

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DOUGLAS COUNTY

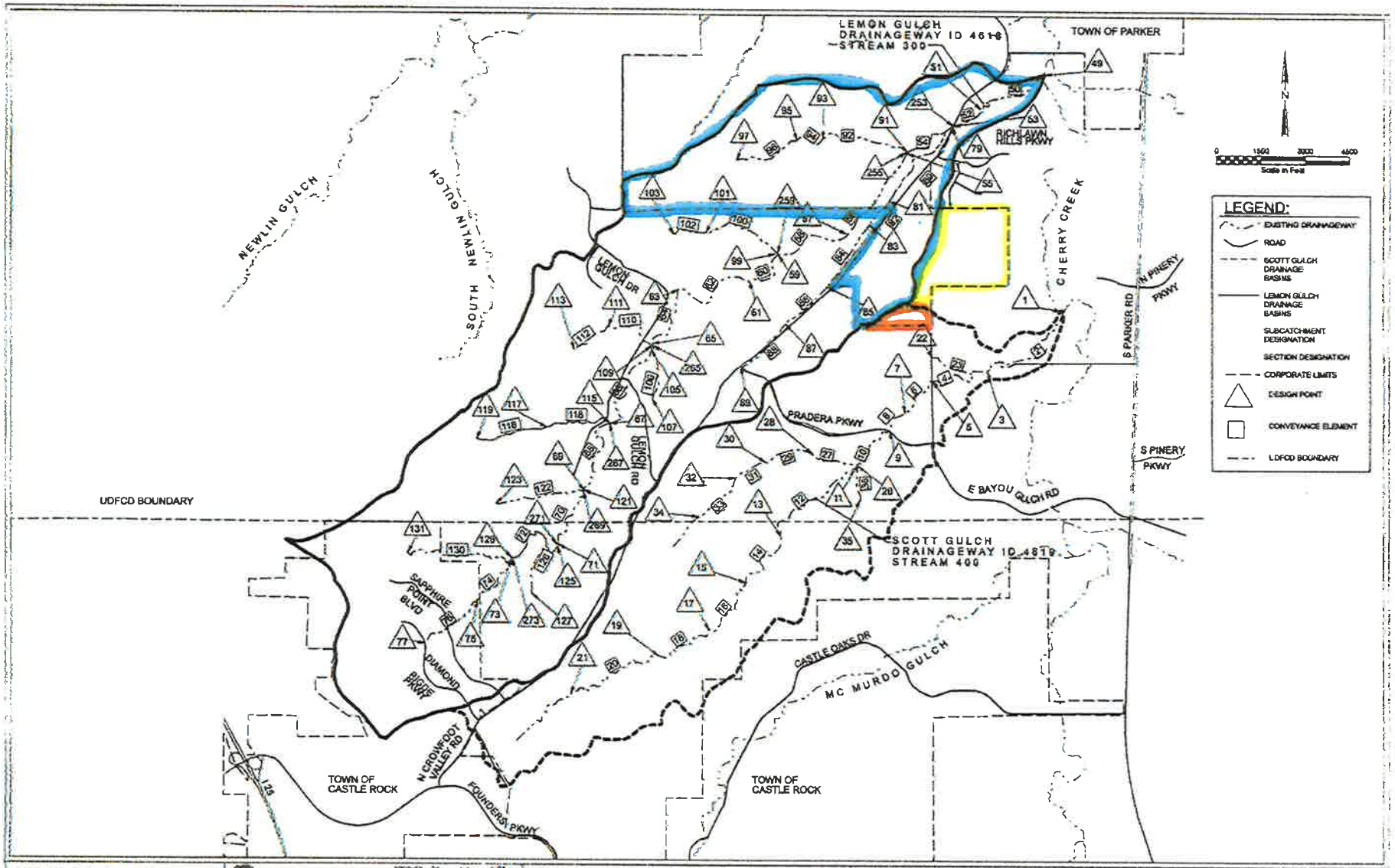
PREPARED BY

CH2MHILL

DENVER, CO

JULY 2006

lgfigcv.dlv



MAPPING PRODUCED BY DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

CH2M HILL
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

DESIGNED DATE
DRAWN DATE
CHECKED DATE
REVISED DATE

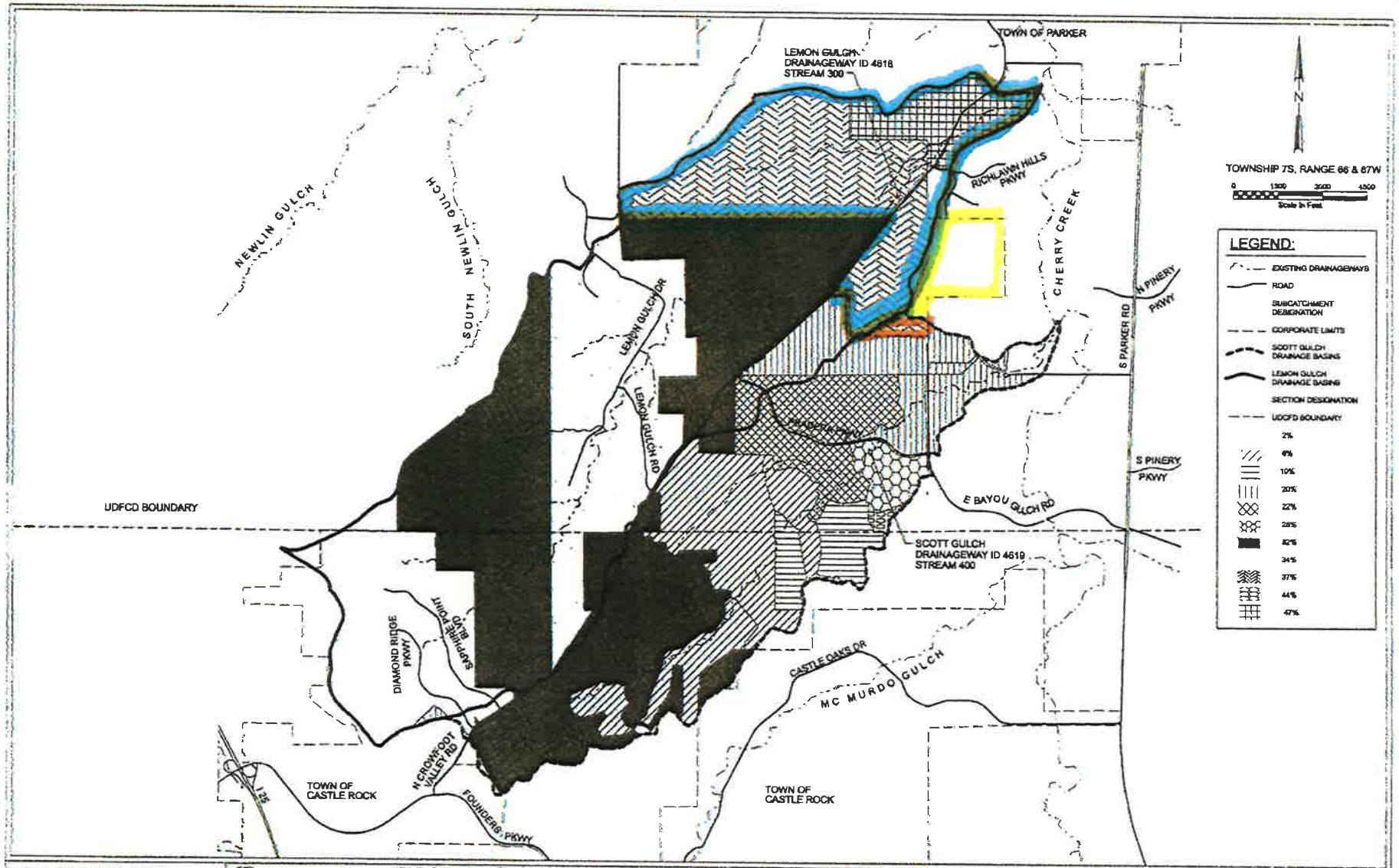
DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE ES-2
SCOTT GULCH AND LEMON GULCH
HYDROLOGIC SUMMARY MAP

course, and a single family community averaging just over one dwelling unit per acre. Much of the infrastructure planned for Pradera development has been constructed including a regional detention facility and stream stabilization measures.

The Canyons development is planned for the upper portion of the watershed and is not yet under construction. Density for the development will consist of one home per acre. The lower portion of the watershed is zoned as a Community Separator Area and open space. The Douglas County Master Plan indicates that there is potential for development in the community separator area, however, the allowed density will be restricted.



MAPPING PRODUCED BY:DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

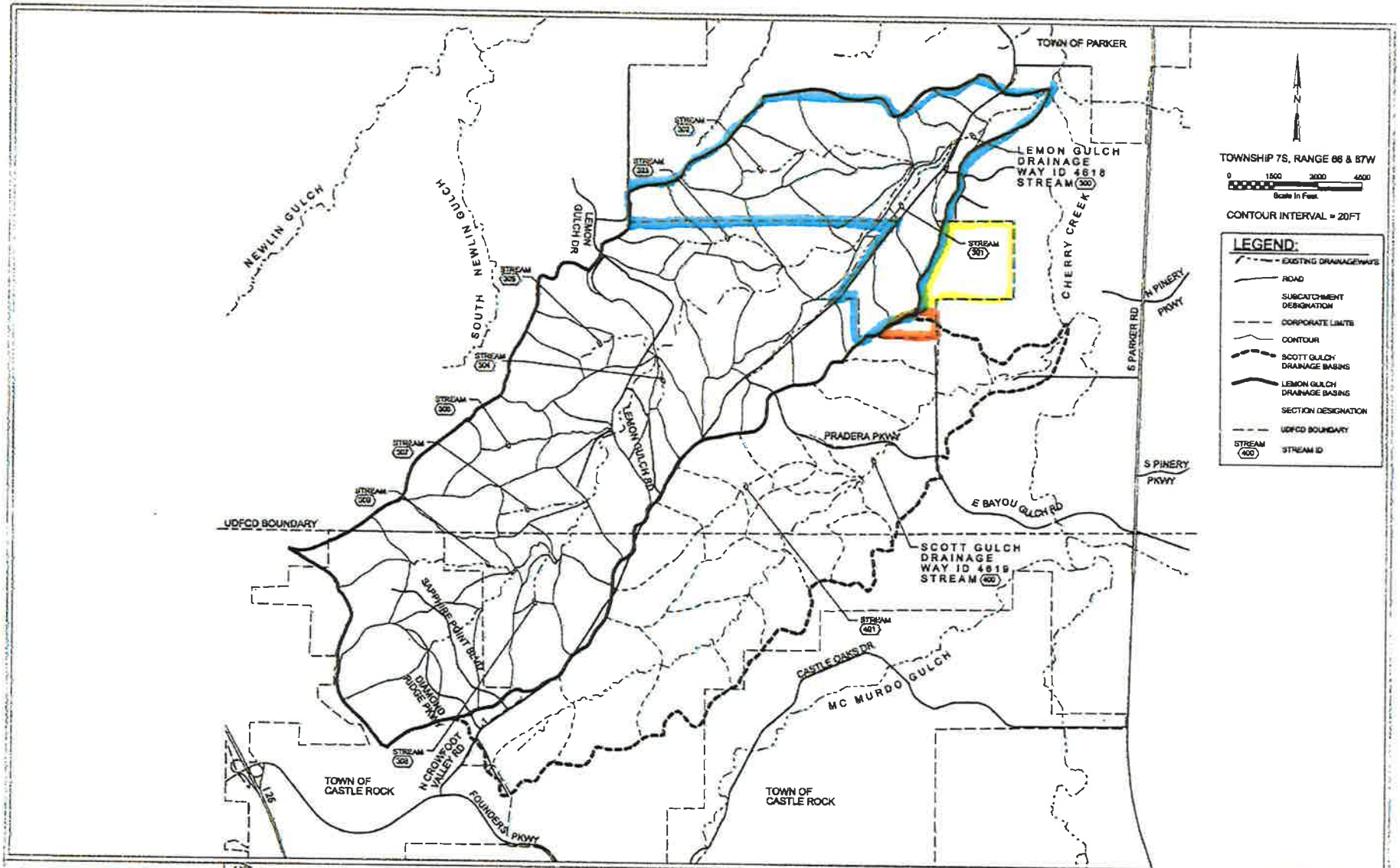
ORIGIN HLC
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

DESIGNED CK DATE 4/06
DRAWN JKE DATE 4/06
CHECKED DC DATE 4/06
REVISED JKE DATE 3/08

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE 2-3
SCOTT GULCH AND LEMON GULCH
FUTURE IMPERVIOUSNESS



MAPPING PRODUCED BY DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

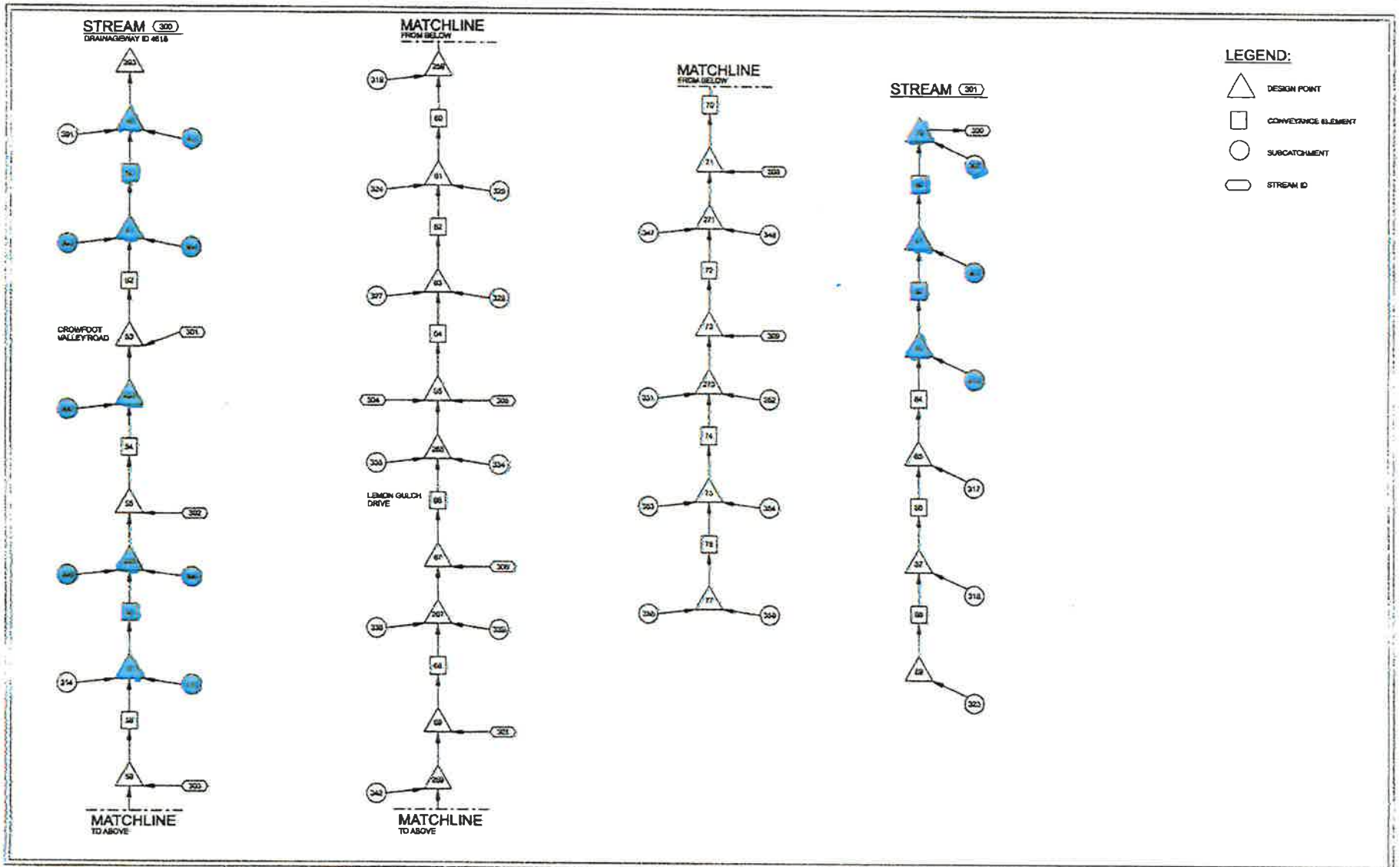
CROM HILL
8182 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

DESIGNED	CH	DATE	4/06
DRAWN	BW	DATE	4/06
CHECKED	JC	DATE	4/06
REVISED	BM	DATE	5/06

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE 3-1
SCOTT GULCH AND LEMON GULCH DRAINAGE BASIN DELINEATION



MAPPING PRODUCED BY:DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

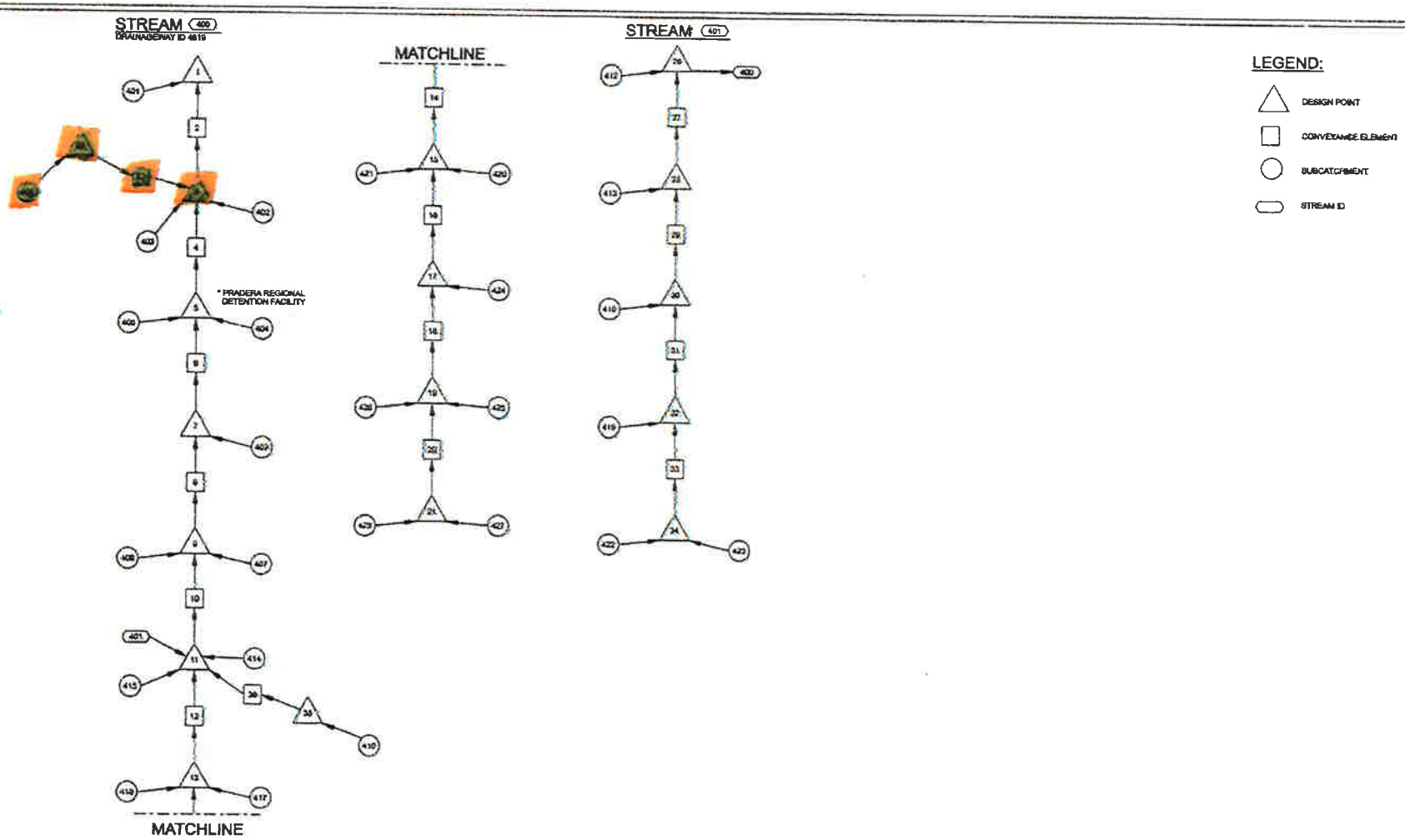
CH2M HILL
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

DESIGNED	CH	DATE	4/06
DRAWN	[illegible]	DATE	4/06
CHECKED	[illegible]	DATE	4/06
REVISED	[illegible]	DATE	4/06

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE 3-3
LEMON GULCH
UDSWM MODEL CONNECTIVITY



MAPPING PRODUCED BY: DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

GROM HILL
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

DESIGNED	CH	DATE	4/06
DRAWN	MB	DATE	4/06
CHECKED	RE	DATE	4/06
REVISED	MB	DATE	6/06

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE 3-5
SCOTT GULCH
UDSWM MODEL CONNECTIVITY

TABLE A-2

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

[1]Subcatchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
LEMON GULCH (DRAINAGEWAY ID 4618)												
301	33	0.051	0.61	0.32	30.4%	0.015	27.8	0.35	0.05	4.41	0.0018	0.59
[illegible]	59	0.092	0.81	0.43	43.0%	0.035	29.0	0.35	0.05	4.30	0.0018	0.59
[illegible]	39	0.061	0.73	0.37	19.1%	0.031	70.3	0.40	0.05	4.31	0.0018	0.59
[illegible]	49	0.077	0.53	0.32	45.0%	0.049	18.3	0.35	0.05	4.29	0.0018	0.59
[illegible]	101	0.158	1.04	0.43	36.1%	0.020		0.35	0.05	4.03	0.0016	0.62
[illegible]	53	0.082	0.65	0.46	41.9%	0.025	28.9	0.35	0.05	4.39	0.0018	0.59
[illegible]	98	0.153	0.78	0.46	34.0%	0.033		0.35	0.05	3.88	0.0017	0.59
[illegible]	43	0.067	0.81	0.42	37.0%	0.016	33.8	0.35	0.05	4.58	0.0016	0.69
[illegible]	105	0.166	0.84	0.47	37.0%	0.031		0.35	0.05	3.62	0.0018	0.54
[illegible]	163	0.255	0.94	0.50	41.0%	0.038		0.35	0.05	4.34	0.0018	0.59
[illegible]	30	0.047	0.41	0.07	37.0%	0.045	22.0	0.35	0.05	3.51	0.0018	0.53
[illegible]	72	0.112	0.62	0.35	37.0%	0.040	21.9	0.35	0.05	4.42	0.0018	0.59
[illegible]	97	0.152	0.82	0.49	28.9%	0.029		0.35	0.05	3.90	0.0018	0.57
314	57	0.088	0.53	0.29	37.0%	0.012	25.5	0.35	0.05	4.29	0.0018	0.59
[illegible]	124	0.194	0.83	0.48	37.0%	0.026		0.35	0.05	3.96	0.0018	0.56
[illegible]	88	0.137	0.62	0.32	37.0%	0.036	28.5	0.35	0.05	4.38	0.0018	0.59
317	98	0.153	0.62	0.30	20.3%	0.044		0.35	0.05	3.95	0.0018	0.56
318	67	0.138	0.78	0.36	8.7%	0.037	68.5	0.40	0.05	3.15	0.0018	0.51
319	121	0.189	0.75	0.38	25.9%	0.031		0.35	0.05	4.06	0.0018	0.57
320	37	0.057	0.56	0.24	35.7%	0.032	26.5	0.35	0.05	3.09	0.0018	0.51
[illegible]	91	0.142	0.95	0.56	28.4%	0.039		0.35	0.05	4.32	0.0018	0.59
[illegible]	54	0.084	0.41	0.18	29.6%	0.049	22.0	0.35	0.05	3.88	0.0018	0.56
323	67	0.105	0.49	0.22	19.6%	0.046	45.7	0.40	0.05	3.00	0.0018	0.50
324	84	0.131	0.75	0.40	18.4%	0.049	58.8	0.40	0.05	3.81	0.0018	0.55
325	73	0.114	0.60	0.41	18.1%	0.030	62.3	0.40	0.05	3.99	0.0018	0.57
[illegible]	107	0.168	0.68	0.37	17.3%	0.043		0.40	0.05	3.48	0.0018	0.53
327	74	0.116	1.04	0.57	7.6%	0.016	124.4	0.40	0.05	3.09	0.0018	0.51
328	116	0.181	0.71	0.32	2.0%	0.050		0.40	0.05	3.51	0.0018	0.53
329	51	0.080	0.51	0.24	10.0%	0.051	45.0	0.40	0.05	3.00	0.0018	0.50
330	67	0.105	0.64	0.38	5.0%	0.044	55.1	0.40	0.05	3.00	0.0018	0.50
331	30	0.047	0.38	0.19	2.0%	0.056	36.1	0.40	0.05	3.64	0.0018	0.54
332	124	0.195	1.01	0.63	7.5%	0.031		0.40	0.05	3.08	0.0018	0.51
333	65	0.102	0.61	0.30	2.6%	0.046	53.1	0.40	0.05	3.00	0.0018	0.50
334	49	0.076	0.80	0.37	2.0%	0.014	107.0	0.40	0.05	3.23	0.0018	0.52
335	89	0.139	0.88	0.55	2.2%	0.027	86.9	0.40	0.05	3.40	0.0018	0.53
336	19	0.030	0.36	0.19	2.0%	0.041	40.0	0.40	0.05	3.00	0.0018	0.50
337	60	0.094	0.60	0.35	13.8%	0.043	53.7	0.40	0.05	3.00	0.0018	0.50
338	116	0.182	0.98	0.61	4.3%	0.021		0.40	0.05	3.03	0.0018	0.50

TABLE A-2 (CONTINUED)

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

[1]Subcatchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
LEMON GULCH (CONTINUED)												
339	44	0.069	0.70	0.37	2.1%	0.022	79.9	0.40	0.05	3.04	0.0018	0.50
340	63	0.099	0.66	0.33	13.3%	0.030	66.9	0.40	0.05	3.01	0.0018	0.50
341	106	0.166	0.59	0.30	25.9%	0.043		0.35	0.05	3.00	0.0018	0.50
342	99	0.155	0.64	0.31	12.7%	0.039		0.40	0.05	3.00	0.0018	0.50
343	95	0.149	0.62	0.35	27.0%	0.035		0.35	0.05	3.00	0.0018	0.50
344	82	0.128	0.83	0.46	32.0%	0.030	34.3	0.35	0.05	3.00	0.0018	0.50
345	76	0.119	0.62	0.38	32.0%	0.038	23.7	0.35	0.05	3.00	0.0018	0.50
346	85	0.132	0.60	0.26	31.8%	0.041	27.7	0.35	0.05	3.00	0.0018	0.50
347	102	0.159	0.61	0.33	9.4%	0.038		0.40	0.05	3.00	0.0018	0.50
348	41	0.064	0.58	0.33	31.7%	0.048	20.7	0.35	0.05	3.00	0.0018	0.50
349	45	0.071	0.58	0.38	31.8%	0.040	22.9	0.35	0.05	3.00	0.0018	0.50
350	108	0.169	0.66	0.30	30.7%	0.033		0.35	0.05	3.00	0.0018	0.50
351	109	0.170	1.04	0.61	30.7%	0.028		0.35	0.05	3.00	0.0018	0.50
352	28	0.043	0.49	0.34	32.6%	0.039	18.6	0.35	0.05	3.00	0.0018	0.50
353	92	0.143	0.85	0.47	33.4%	0.036		0.35	0.05	3.00	0.0018	0.50
354	55	0.086	0.68	0.47	34.0%	0.039	32.2	0.35	0.05	3.00	0.0018	0.50
355	91	0.143	1.01	0.65	33.1%	0.027		0.35	0.05	3.00	0.0018	0.50
356	123	0.192	1.16	0.74	27.7%	0.025		0.35	0.05	3.00	0.0018	0.50
357	86	0.134	0.61	0.23	32.0%	0.040	28.0	0.35	0.05	3.00	0.0018	0.50
358	125	0.196	0.69	0.39	33.7%	0.040		0.35	0.05	3.00	0.0018	0.50
359	110	0.173	0.67	0.36	34.0%	0.046		0.35	0.05	3.00	0.0018	0.50
360	96	0.150	0.93	0.50	34.0%	0.037		0.35	0.05	3.00	0.0018	0.50
361	94	0.146	0.86	0.46	35.0%	0.035		0.35	0.05	3.00	0.0018	0.50
SCOTT GULCH (DRAINAGEWAY ID 4618)												
401	70	0.110	0.82	0.52	9.9%	0.016	25.9	0.40	0.05	4.59	0.0014	0.73
402	47	0.074	0.63	0.33	20.1%	0.030	21.2	0.35	0.05	4.29	0.0016	0.65
403	70	0.110	0.62	0.25	20.0%	0.035	24.2	0.35	0.05	4.16	0.0016	0.63
404	44	0.069	0.53	0.26	20.2%	0.021	23.9	0.35	0.05	3.83	0.0017	0.59
405	134	0.210	0.97	0.53	21.0%	0.047		0.35	0.05	4.04	0.0018	0.58
406	90	0.140	0.67	0.27	24.9%	0.046	23.3	0.35	0.05	3.87	0.0018	0.56
407	102	0.160	0.68	0.32	28.7%	0.040		0.35	0.05	3.70	0.0018	0.55
408	31	0.048	0.52	0.31	24.6%	0.057	21.2	0.35	0.05	3.79	0.0018	0.55
409	134	0.210	1.10	0.63	21.9%	0.045		0.35	0.05	3.61	0.0018	0.55
410	90	0.140	0.57	0.28	11.9%	0.045	20.7	0.40	0.05	3.86	0.0018	0.56
412	51	0.079	0.58	0.26	18.4%	0.039	22.0	0.40	0.05	3.32	0.0018	0.52
413	90	0.141	0.55	0.29	18.0%	0.049		0.40	0.05	3.44	0.0018	0.53
414	102	0.160	0.99	0.49	10.7%	0.036		0.40	0.05	3.82	0.0018	0.55

Italicized Subcatchment IDs indicate all values were adopted from the FHAD. The values for depression storage, initial and final infiltration, and decay rate were adopted from the FHAD for all subcatchments.

FIGURE A-4

PEAK FLOW PROFILES
LEMON GULCH
STREAM 300
(DRAINAGEWAY ID 4618)

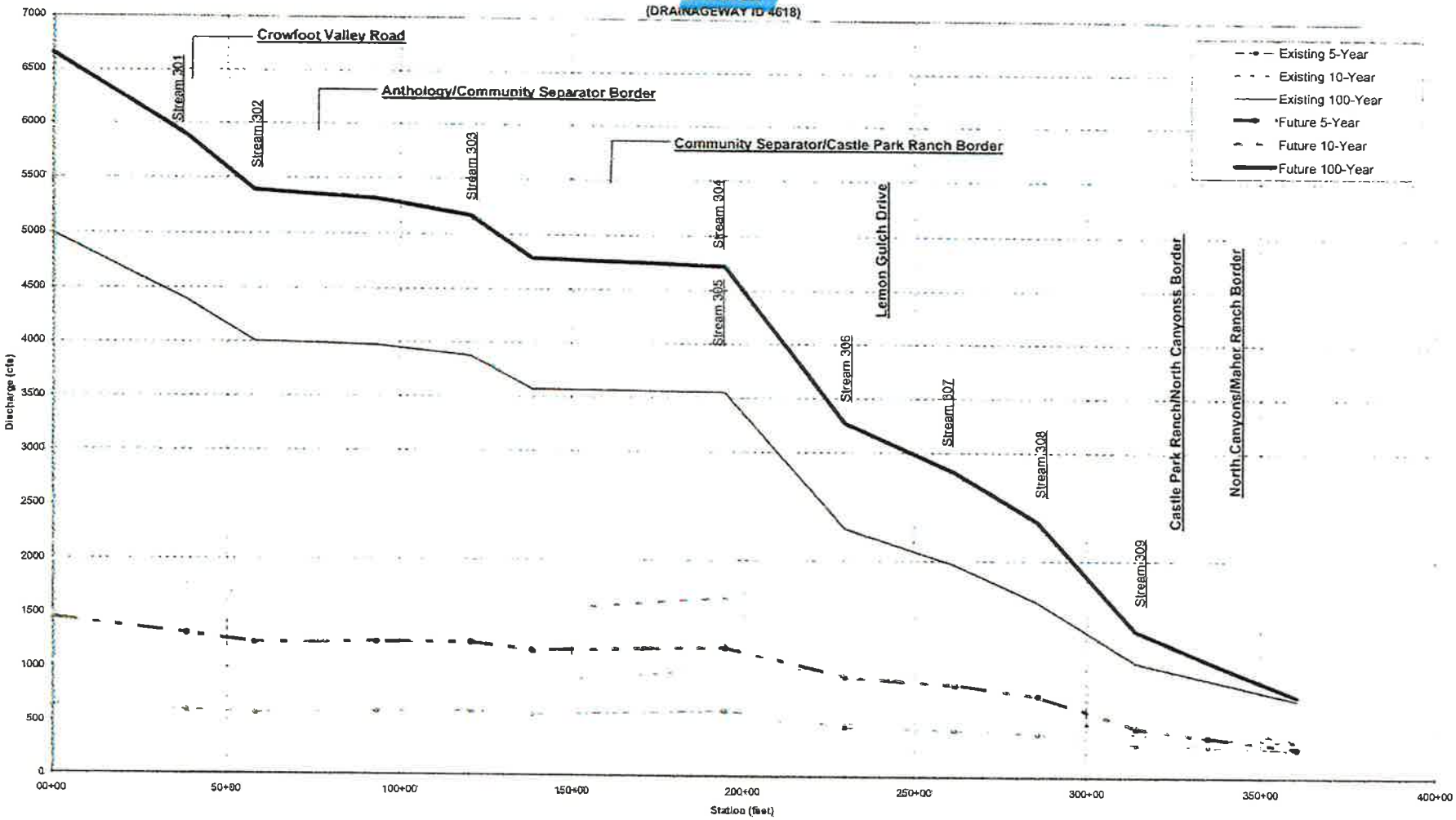
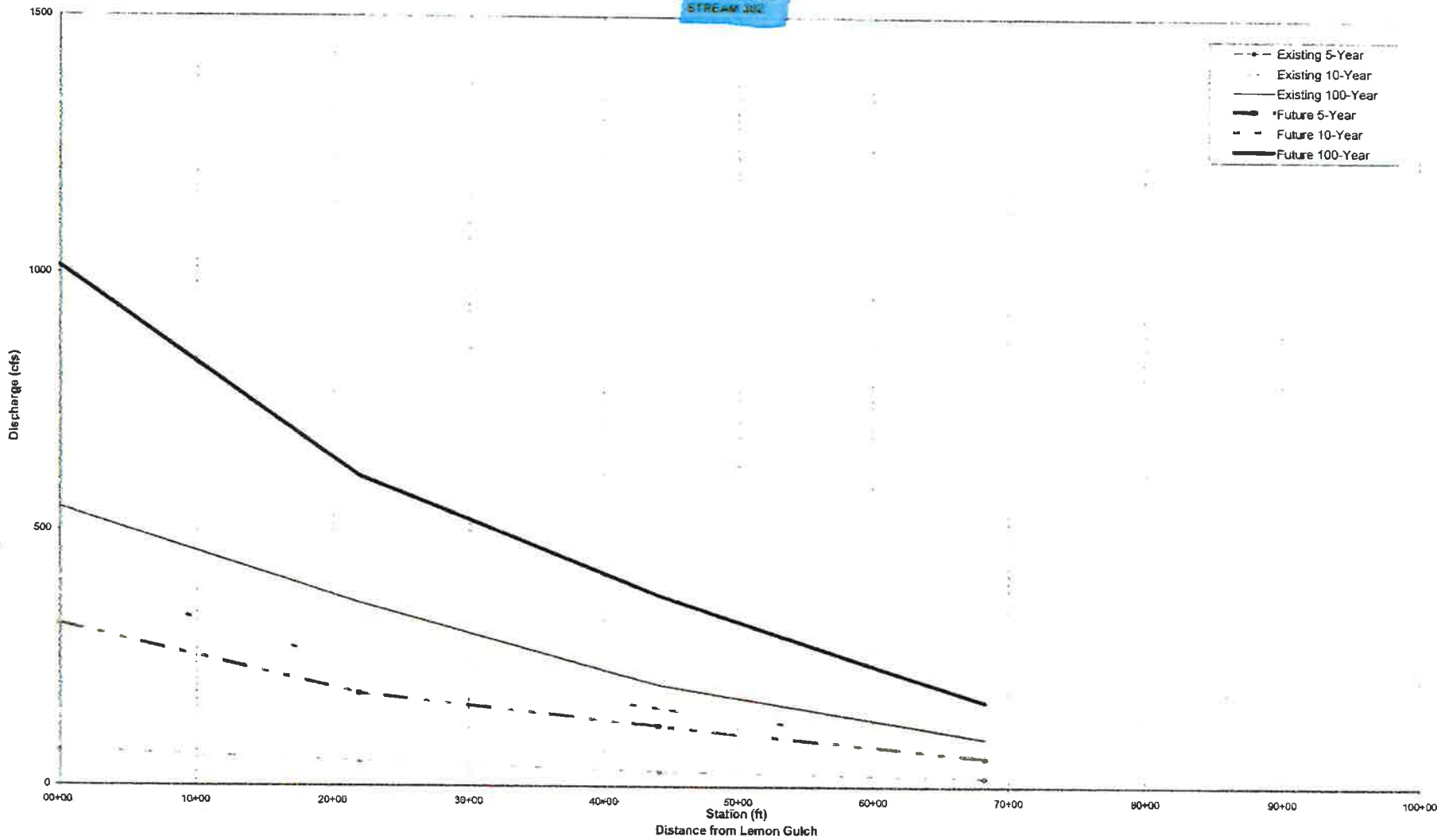


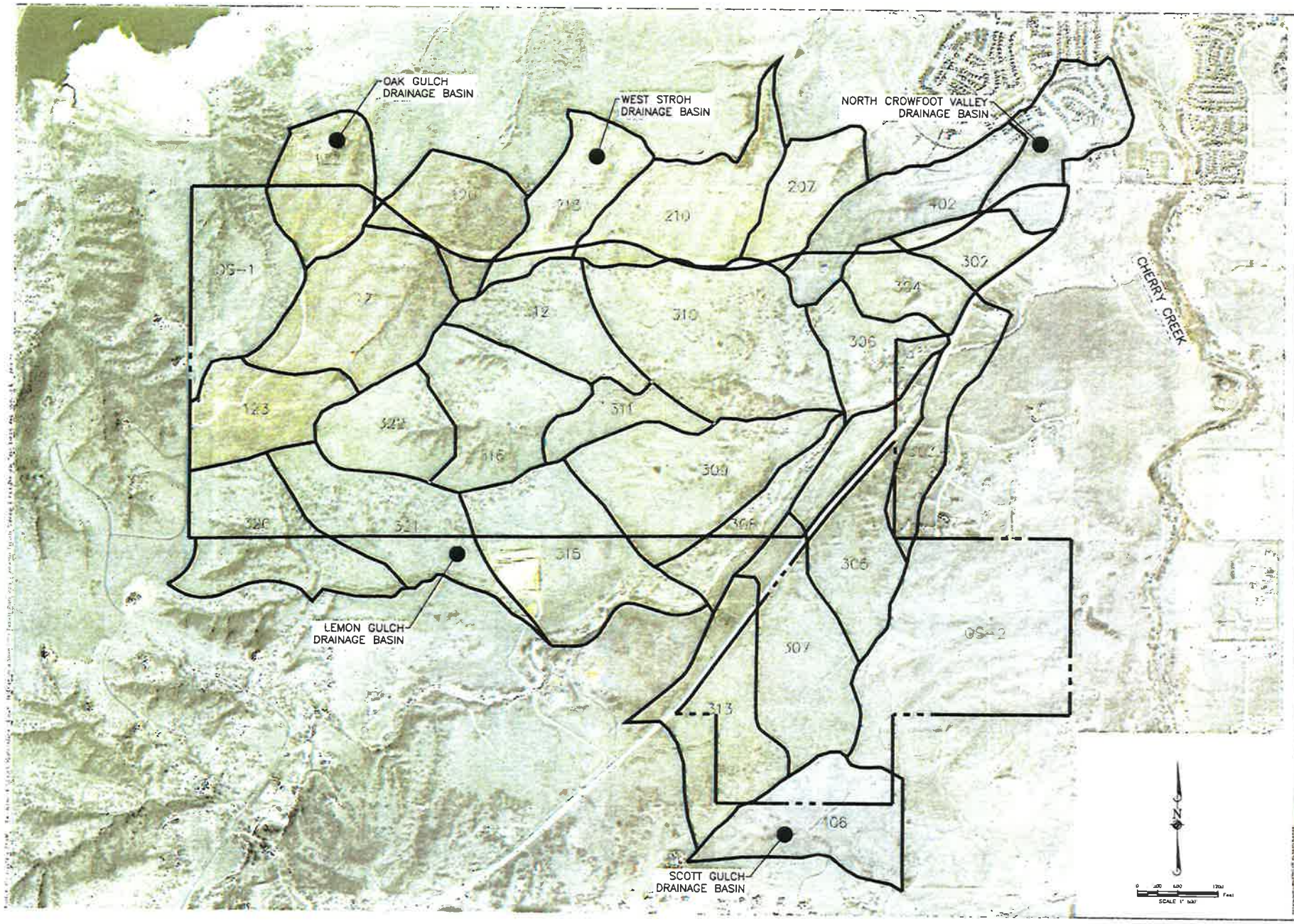
FIGURE A-6

PEAK FLOW PROFILES
LEMON GULCH
STREAM 302



APPENDIX F

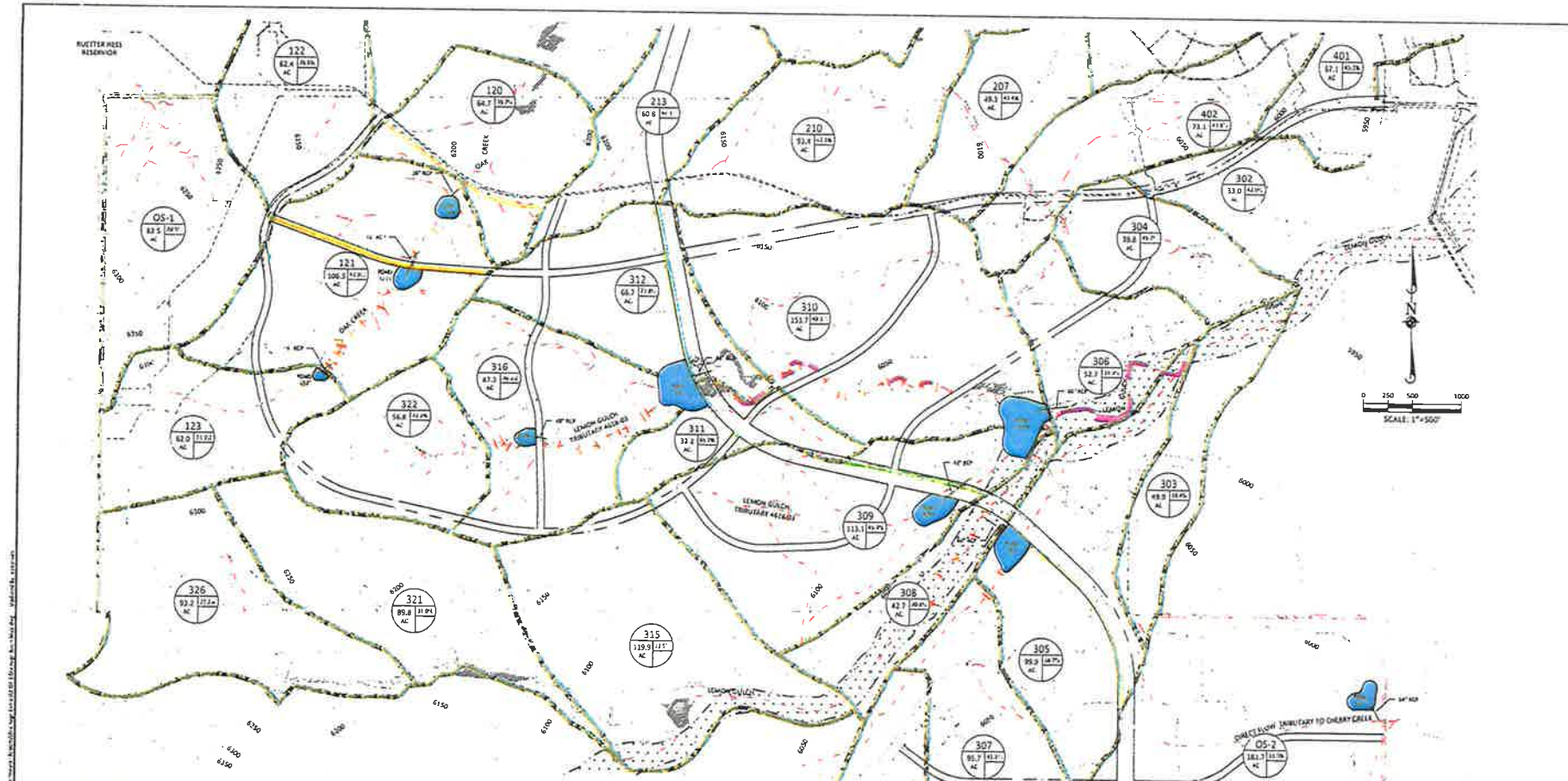
Basin Maps



Manhard CONSULTING

HESS RANCH DEVELOPMENT
TOWN OF PARKER, COLORADO
MAJOR DRAINAGE BASIN MAP

SHEET 1 OF 2



HESS RANCH PROPOSED REGIONAL PONDS:

POND NO.	LOCATION	BASIN AREA (AC)	SLOPE	[illegible]	[illegible]	MAX. RELEASE (CFS)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HESS RANCH Proposed REGIONAL POND OUTLET SIZING:

POND NO.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

APPROXIMATE BASIN BOUNDARY

REGIONAL DETENTION PONDS

OUTLET STRUCTURE, STORM PIPE & LOW FLOW WATER BASIN

PROPOSED DRAINAGE BASIN
A=BASIN DESIGNATION
B=AREA IN ACRES
C = % IMPERVIOUSNESS

Manhard CONSULTING

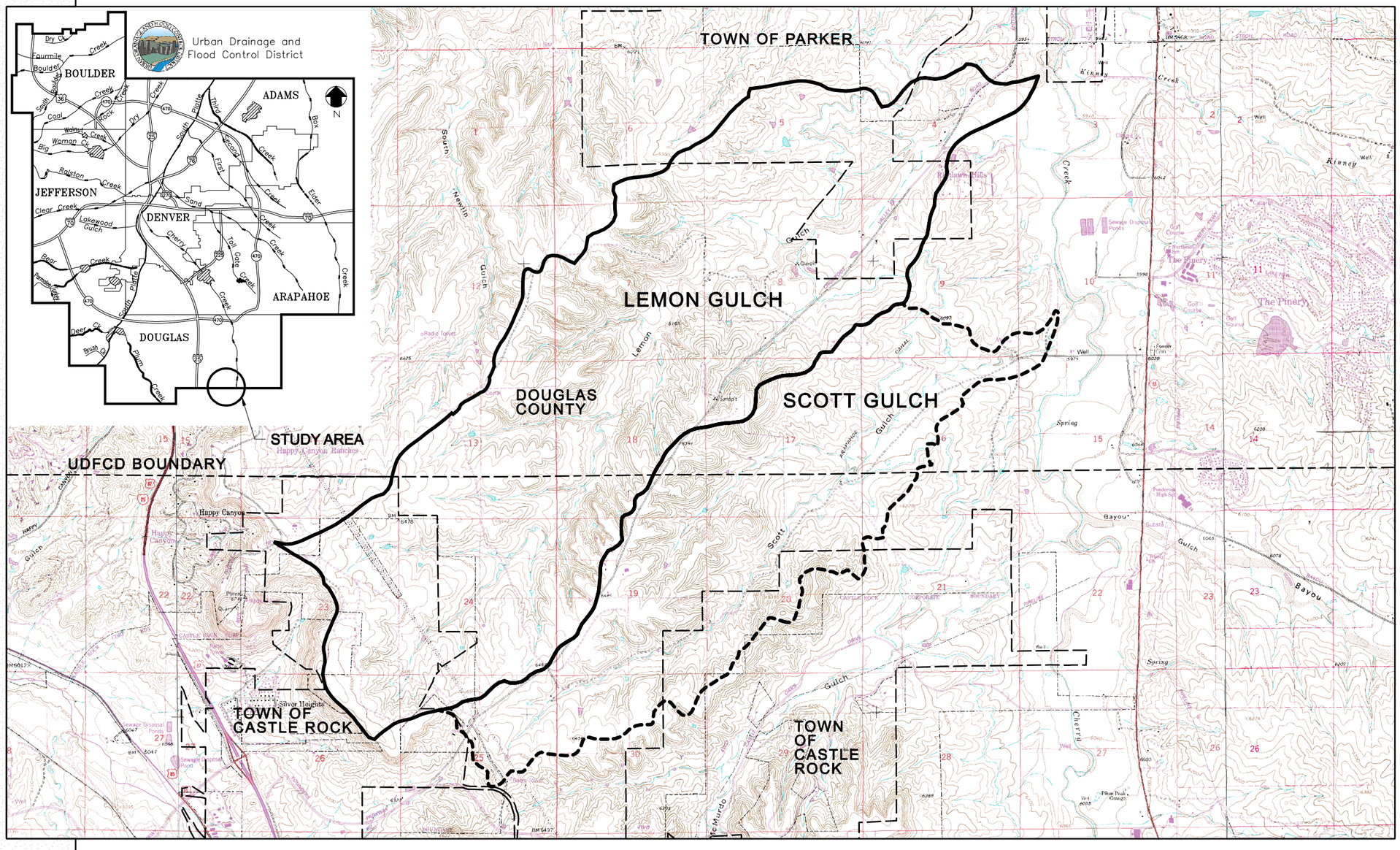
HESS RANCH DEVELOPMENT
TOWN OF PARKER, COLORADO
DRAINAGE BASIN MAP

SHEET 2 OF 2

SRD01

OUTFALL SYSTEMS PLANNING-PRELIMINARY DESIGN REPORT

SCOTT AND LEMON GULCH WATERSHEDS



PREPARED FOR:

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DOUGLAS COUNTY

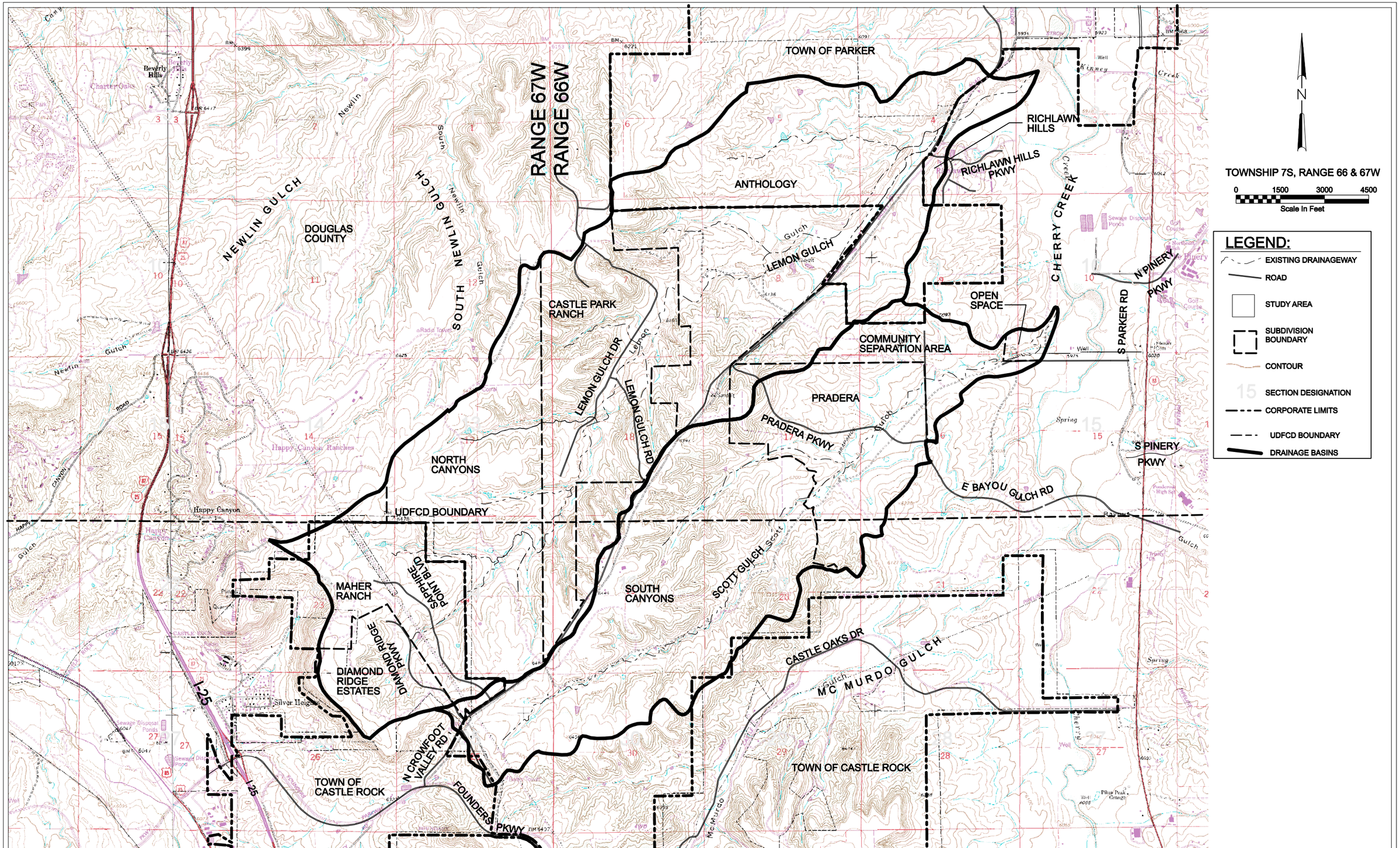
PREPARED BY

CH2MHILL

DENVER, CO

JULY 2006

lgfigcv.dlv



MAPPING PRODUCED BY:DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

CH2M HILL
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

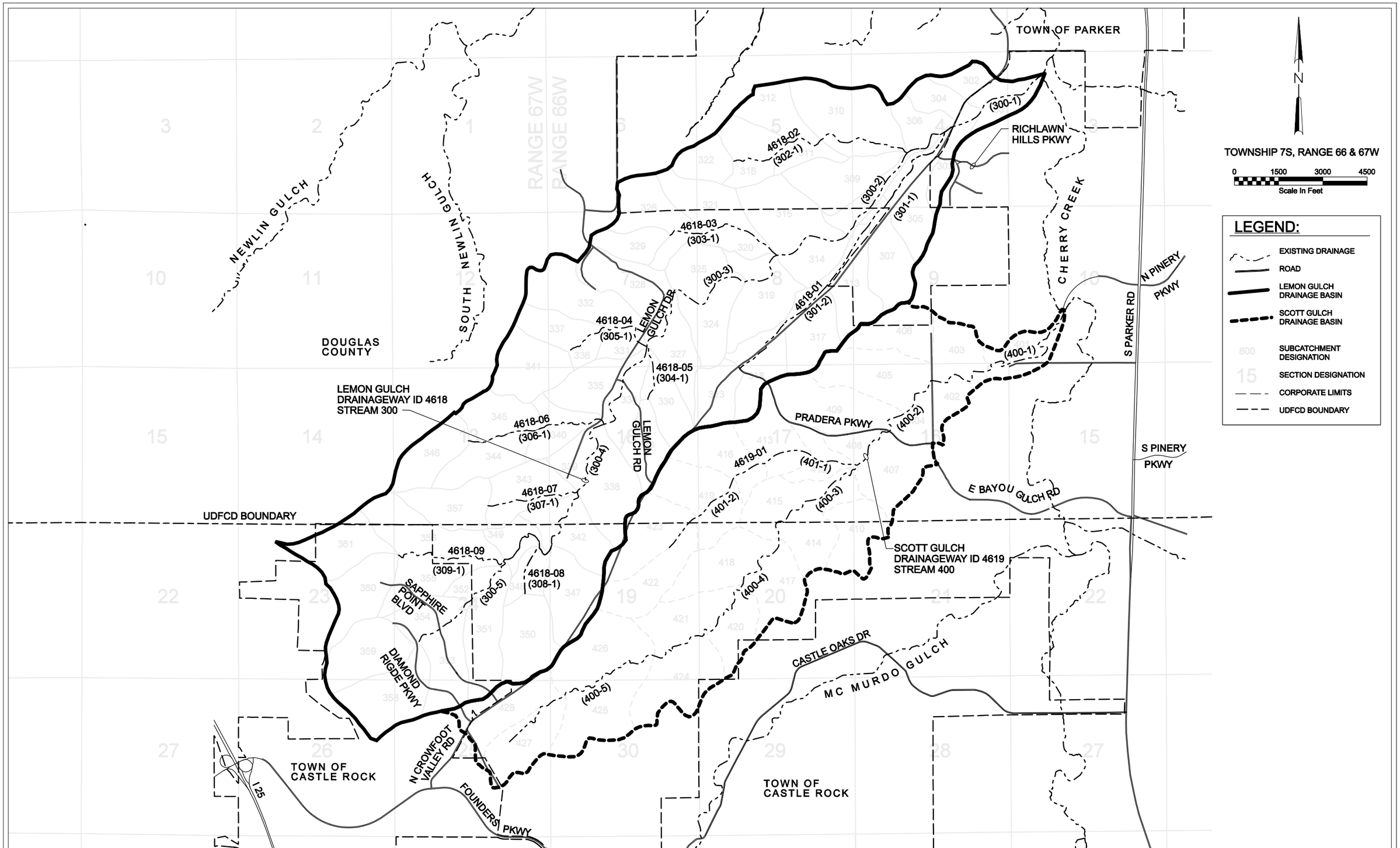
DESIGNED	CH	DATE	4/06
DRAWN	MM	DATE	4/06
CHECKED	BC	DATE	4/06
REVISED	MM	DATE	6/06

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE ES-1
SCOTT GULCH AND LEMON GULCH VICINITY MAP

aelgfigvrn.dlv



MAPPING PRODUCED BY:DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

CH2M HILL
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

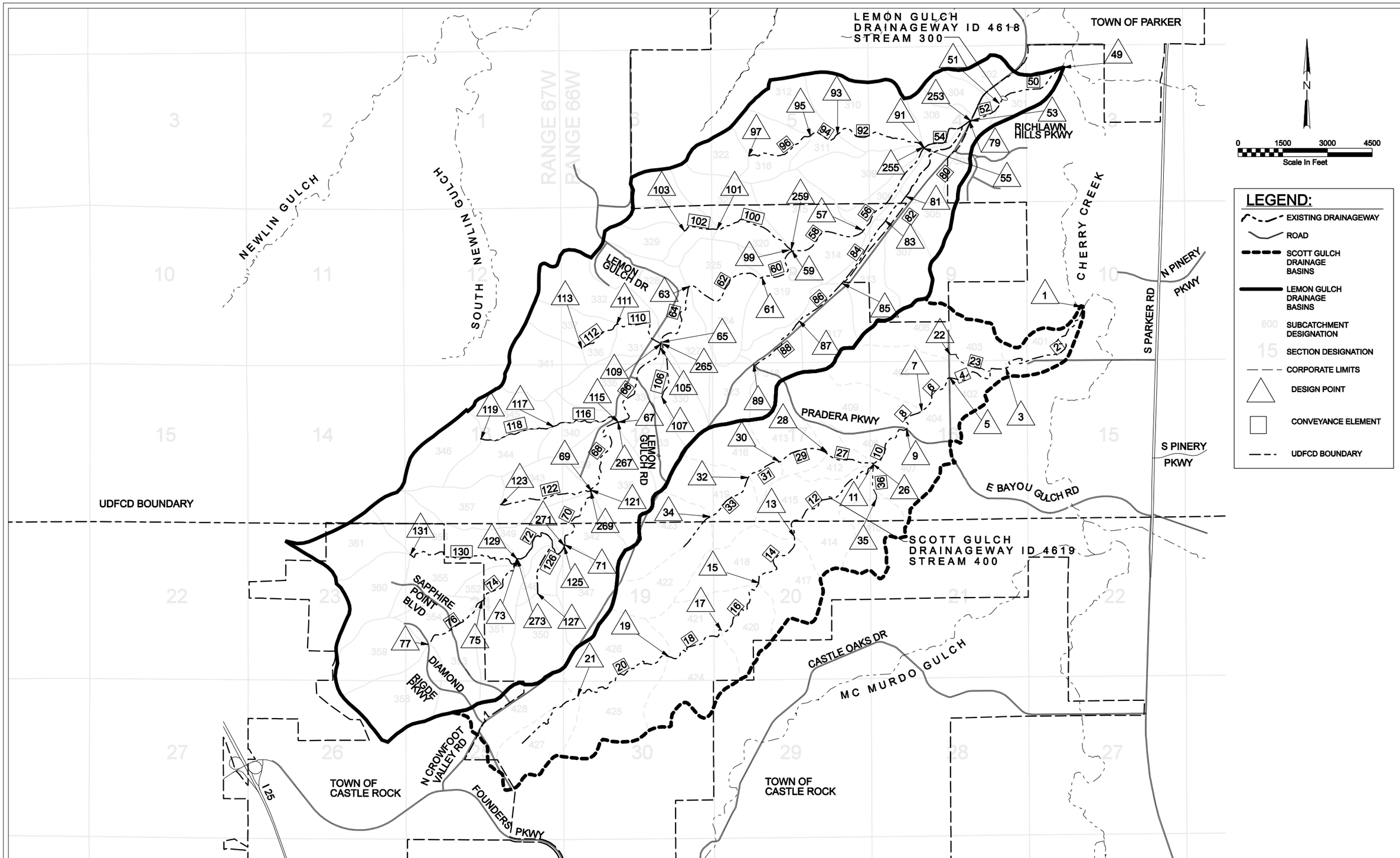
DESIGNED	CH	DATE	4/06
DRAWN	MM	DATE	4/06
CHECKED	BC	DATE	4/06
REVISED	MM	DATE	6/06

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE 2-1
SCOTT GULCH AND LEMON GULCH STUDY AREA AND REACHES

aelgfigeis.dlv



MAPPING PRODUCED BY:DOUGLAS COUNTY (DATE 2003)
HORIZONTAL DATUM: NAD 83 FEET
STATE PLANE COLORADO CENTRAL
VERTICAL DATUM: NAVD 88

CH2M HILL
9193 SOUTH JAMAICA STREET
ENGLEWOOD, CO 80112

DESIGNED	CH	DATE	4/06
DRAWN	MM	DATE	4/06
CHECKED	BC	DATE	4/06
REVISED	MM	DATE	6/06

DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH WATERSHEDS
OUTFALL SYSTEM PLANNING

FIGURE 3-2
SCOTT GULCH AND LEMON GULCH
UDSWM CONVEYANCE MAP

aefigconveyancea.dlv

TABLE A-1

CUHP SUBWATERSHED CHARACTERISTICS
EXISTING IMPERVIOUS CONDITION

Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
0.051	0.61	0.32	2.0%	0.015	84.8	0.40	0.05	4.41	0.0018	0.59
0.092	0.81	0.43	2.0%	0.035	31.5	0.40	0.05	4.30	0.0018	0.59
0.061	0.73	0.37	2.0%	0.031	70.3	0.40	0.05	4.31	0.0018	0.59
0.077	0.53	0.32	2.0%	0.049	21.0	0.40	0.05	4.29	0.0018	0.59
0.158	1.04	0.43	2.0%	0.020		0.40	0.05	4.03	0.0016	0.62
0.083	0.65	0.46	2.0%	0.025	70.9	0.40	0.05	4.39	0.0018	0.59
0.153	0.78	0.46	2.0%	0.033		0.40	0.05	3.88	0.0017	0.59
0.067	0.81	0.42	2.0%	0.016	105.0	0.40	0.05	4.58	0.0016	0.69
0.166	0.84	0.47	2.0%	0.031		0.40	0.05	3.62	0.0018	0.54
0.255	0.94	0.50	2.0%	0.038		0.40	0.05	4.34	0.0018	0.59
0.047	0.41	0.07	2.0%	0.045	18.1	0.40	0.05	3.51	0.0018	0.53
0.112	0.62	0.35	2.0%	0.040	24.0	0.40	0.05	4.42	0.0018	0.59
0.152	0.82	0.49	2.0%	0.029		0.40	0.05	3.90	0.0018	0.57
0.088	0.53	0.29	2.0%	0.012	83.8	0.40	0.05	4.29	0.0018	0.59
0.194	0.83	0.48	2.0%	0.026		0.40	0.05	3.96	0.0018	0.56
0.137	0.62	0.32	2.0%	0.036	59.6	0.40	0.05	4.38	0.0018	0.59
0.153	0.62	0.30	2.0%	0.044		0.40	0.05	3.95	0.0018	0.56
0.136	0.78	0.36	2.0%	0.037	68.5	0.40	0.05	3.15	0.0018	0.51
0.189	0.75	0.38	2.0%	0.031		0.40	0.05	4.06	0.0018	0.57
0.057	0.56	0.24	2.0%	0.032	58.2	0.40	0.05	3.09	0.0018	0.51
0.142	0.95	0.56	2.0%	0.039		0.40	0.05	4.32	0.0018	0.59
0.084	0.41	0.18	2.0%	0.049	40.0	0.40	0.05	3.88	0.0018	0.56
0.105	0.49	0.22	2.0%	0.046	45.7	0.40	0.05	3.00	0.0018	0.50
0.131	0.75	0.40	2.0%	0.049	58.8	0.40	0.05	3.81	0.0018	0.55
0.114	0.60	0.41	2.0%	0.030	62.3	0.40	0.05	3.99	0.0018	0.57
0.168	0.68	0.37	2.0%	0.043		0.40	0.05	3.49	0.0018	0.53
0.116	1.04	0.57	2.0%	0.016	124.0	0.40	0.05	3.09	0.0018	0.51
0.181	0.71	0.32	2.0%	0.050		0.40	0.05	3.51	0.0018	0.53
0.080	0.51	0.24	2.0%	0.051	45.0	0.40	0.05	3.00	0.0018	0.50
0.105	0.64	0.38	2.0%	0.044	55.1	0.40	0.05	3.00	0.0018	0.50
0.047	0.38	0.19	2.0%	0.056	36.1	0.40	0.05	3.64	0.0018	0.54
0.195	1.01	0.63	2.0%	0.031		0.40	0.05	3.08	0.0018	0.51
0.102	0.61	0.30	2.0%	0.046	53.1	0.40	0.05	3.00	0.0018	0.50
0.076	0.80	0.37	2.0%	0.014	107.0	0.40	0.05	3.23	0.0018	0.52
0.139	0.88	0.55	2.0%	0.027	86.9	0.40	0.05	3.40	0.0018	0.53
0.030	0.36	0.19	2.0%	0.041	40.0	0.40	0.05	3.00	0.0018	0.50
0.094	0.60	0.35	2.0%	0.043	53.7	0.40	0.05	3.00	0.0018	0.50
0.182	0.98	0.61	2.0%	0.021		0.40	0.05	3.03	0.0018	0.50

TABLE A-1 (CONTINUED)

CUHP SUBWATERSHED CHARACTERISTICS
EXISTING IMPERVIOUS CONDITION

[1]Subcatchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
LEMON GULCH (CONTINUED)												
339	44	0.069	0.70	0.37	2.0%	0.022	79.9	0.40	0.05	3.04	0.0018	0.50
340	63	0.099	0.66	0.33	2.0%	0.030	66.9	0.40	0.05	3.01	0.0018	0.50
341	106	0.166	0.59	0.30	2.0%	0.043		0.40	0.05	3.00	0.0018	0.50
342	99	0.155	0.64	0.31	2.0%	0.039		0.40	0.05	3.00	0.0018	0.50
343	95	0.149	0.62	0.35	2.0%	0.035		0.40	0.05	3.00	0.0018	0.50
344	82	0.128	0.83	0.46	2.0%	0.030	78.9	0.40	0.05	3.00	0.0018	0.50
345	76	0.119	0.62	0.38	2.0%	0.038	25.7	0.40	0.05	3.00	0.0018	0.50
346	85	0.132	0.60	0.26	2.3%	0.041	55.3	0.40	0.05	3.00	0.0018	0.50
347	102	0.159	0.61	0.33	2.0%	0.038		0.40	0.05	3.00	0.0018	0.50
348	41	0.064	0.58	0.33	2.0%	0.048	22.8	0.40	0.05	3.00	0.0018	0.50
349	45	0.071	0.58	0.38	2.0%	0.040	24.0	0.40	0.05	3.00	0.0018	0.50
350	108	0.169	0.66	0.30	2.0%	0.033		0.40	0.05	3.00	0.0018	0.50
351	109	0.170	1.04	0.61	2.0%	0.028		0.40	0.05	3.00	0.0018	0.50
352	28	0.043	0.49	0.34	2.0%	0.039	20.9	0.40	0.05	3.00	0.0018	0.50
353	92	0.143	0.85	0.47	10.2%	0.036		0.40	0.05	3.00	0.0018	0.50
354	55	0.086	0.68	0.47	8.1%	0.039	25.7	0.40	0.05	3.00	0.0018	0.50
355	91	0.143	1.01	0.65	3.1%	0.027		0.40	0.05	3.00	0.0018	0.50
356	123	0.192	1.16	0.74	8.6%	0.025		0.40	0.05	3.00	0.0018	0.50
357	86	0.134	0.61	0.23	2.0%	0.040	56.4	0.40	0.05	3.00	0.0018	0.50
358	125	0.196	0.69	0.39	33.5%	0.040		0.35	0.05	3.00	0.0018	0.50
359	110	0.173	0.67	0.36	30.7%	0.046		0.35	0.05	3.00	0.0018	0.50
360	96	0.150	0.93	0.50	2.5%	0.037		0.40	0.05	3.00	0.0018	0.50
361	94	0.146	0.86	0.46	10.2%	0.035		0.40	0.05	3.00	0.0018	0.50
SCOTT GULCH (DRAINAGEWAY ID 4619)												
401	70	0.110	0.82	0.52	2.0%	0.016	26.4	0.40	0.05	4.59	0.0014	0.73
402	47	0.074	0.63	0.33	2.0%	0.030	23.2	0.40	0.05	4.29	0.0016	0.65
403	70	0.110	0.62	0.25	2.0%	0.035	25.0	0.40	0.05	4.16	0.0016	0.63
404	44	0.069	0.53	0.26	2.0%	0.021	24.8	0.40	0.05	3.83	0.0017	0.59
405	134	0.210	0.97	0.53	2.0%	0.047		0.40	0.05	4.04	0.0018	0.58
406	90	0.140	0.67	0.27	2.0%	0.046	25.3	0.40	0.05	3.87	0.0018	0.56
407	102	0.160	0.68	0.32	2.0%	0.040		0.40	0.05	3.70	0.0018	0.55
408	31	0.049	0.52	0.31	2.0%	0.057	23.0	0.40	0.05	3.79	0.0018	0.55
409	134	0.210	1.10	0.63	2.0%	0.045		0.40	0.05	3.61	0.0018	0.55
410	90	0.140	0.57	0.28	2.0%	0.045	21.1	0.40	0.05	3.86	0.0018	0.56
412	51	0.079	0.58	0.26	2.0%	0.039	22.8	0.40	0.05	3.32	0.0018	0.52
413	90	0.141	0.55	0.29	2.0%	0.049		0.40	0.05	3.44	0.0018	0.53
414	102	0.160	0.99	0.49	2.0%	0.036		0.40	0.05	3.82	0.0018	0.55

TABLE A-2

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

[1]Subcatchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
LEMON GULCH (DRAINAGEWAY ID 4618)												
301	33	0.051	0.61	0.32	30.4%	0.015	27.8	0.35	0.05	4.41	0.0018	0.59
302	59	0.092	0.81	0.43	43.0%	0.035	29.0	0.35	0.05	4.30	0.0018	0.59
303	39	0.061	0.73	0.37	19.1%	0.031	70.3	0.40	0.05	4.31	0.0018	0.59
304	49	0.077	0.53	0.32	45.0%	0.049	18.3	0.35	0.05	4.29	0.0018	0.59
305	101	0.158	1.04	0.43	36.1%	0.020		0.35	0.05	4.03	0.0016	0.62
306	53	0.083	0.65	0.46	41.9%	0.025	28.9	0.35	0.05	4.39	0.0018	0.59
307	98	0.153	0.78	0.46	34.0%	0.033		0.35	0.05	3.88	0.0017	0.59
308	43	0.067	0.81	0.42	37.0%	0.016	33.8	0.35	0.05	4.58	0.0016	0.69
309	106	0.166	0.84	0.47	37.0%	0.031		0.35	0.05	3.62	0.0018	0.54
310	163	0.255	0.94	0.50	41.0%	0.038		0.35	0.05	4.34	0.0018	0.59
311	30	0.047	0.41	0.07	37.0%	0.045	22.0	0.35	0.05	3.51	0.0018	0.53
312	72	0.112	0.62	0.35	37.0%	0.040	21.9	0.35	0.05	4.42	0.0018	0.59
313	97	0.152	0.82	0.49	28.9%	0.029		0.35	0.05	3.90	0.0018	0.57
314	57	0.088	0.53	0.29	37.0%	0.012	25.5	0.35	0.05	4.29	0.0018	0.59
315	124	0.194	0.83	0.48	37.0%	0.026		0.35	0.05	3.96	0.0018	0.56
316	88	0.137	0.62	0.32	37.0%	0.036	28.5	0.35	0.05	4.38	0.0018	0.59
317	98	0.153	0.62	0.30	20.3%	0.044		0.35	0.05	3.95	0.0018	0.56
318	87	0.136	0.78	0.36	8.7%	0.037	68.5	0.40	0.05	3.15	0.0018	0.51
319	121	0.189	0.75	0.38	25.9%	0.031		0.35	0.05	4.06	0.0018	0.57
320	37	0.057	0.56	0.24	35.7%	0.032	26.5	0.35	0.05	3.09	0.0018	0.51
321	91	0.142	0.95	0.56	28.4%	0.039		0.35	0.05	4.32	0.0018	0.59
322	54	0.084	0.41	0.18	29.6%	0.049	22.0	0.35	0.05	3.88	0.0018	0.56
323	67	0.105	0.49	0.22	19.6%	0.046	45.7	0.40	0.05	3.00	0.0018	0.50
324	84	0.131	0.75	0.40	18.4%	0.049	58.8	0.40	0.05	3.81	0.0018	0.55
325	73	0.114	0.60	0.41	18.1%	0.030	62.3	0.40	0.05	3.99	0.0018	0.57
326	107	0.168	0.68	0.37	17.3%	0.043		0.40	0.05	3.49	0.0018	0.53
327	74	0.116	1.04	0.57	7.6%	0.016	124.4	0.40	0.05	3.09	0.0018	0.51
328	116	0.181	0.71	0.32	2.0%	0.050		0.40	0.05	3.51	0.0018	0.53
329	51	0.080	0.51	0.24	10.0%	0.051	45.0	0.40	0.05	3.00	0.0018	0.50
330	67	0.105	0.64	0.38	5.0%	0.044	55.1	0.40	0.05	3.00	0.0018	0.50
331	30	0.047	0.38	0.19	2.0%	0.056	36.1	0.40	0.05	3.64	0.0018	0.54
332	124	0.195	1.01	0.63	7.5%	0.031		0.40	0.05	3.08	0.0018	0.51
333	65	0.102	0.61	0.30	2.6%	0.046	53.1	0.40	0.05	3.00	0.0018	0.50
334	49	0.076	0.80	0.37	2.0%	0.014	107.0	0.40	0.05	3.23	0.0018	0.52
335	89	0.139	0.88	0.55	2.2%	0.027	86.9	0.40	0.05	3.40	0.0018	0.53
336	19	0.030	0.36	0.19	2.0%	0.041	40.0	0.40	0.05	3.00	0.0018	0.50
337	60	0.094	0.60	0.35	13.8%	0.043	53.7	0.40	0.05	3.00	0.0018	0.50
338	116	0.182	0.98	0.61	4.3%	0.021		0.40	0.05	3.03	0.0018	0.50

TABLE A-2 (CONTINUED)

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

[1]Subcatchment ID	Area (acres)	Area (mi^2)	Length (mi)	Centroid Length (mi)	Percent Imperv. (%)	Slope (ft/ft)	t_c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
LEMON GULCH (CONTINUED)												
339	44	0.069	0.70	0.37	2.1%	0.022	79.9	0.40	0.05	3.04	0.0018	0.50
340	63	0.099	0.66	0.33	13.3%	0.030	66.9	0.40	0.05	3.01	0.0018	0.50
341	106	0.166	0.59	0.30	25.9%	0.043		0.35	0.05	3.00	0.0018	0.50
342	99	0.155	0.64	0.31	12.7%	0.039		0.40	0.05	3.00	0.0018	0.50
343	95	0.149	0.62	0.35	27.0%	0.035		0.35	0.05	3.00	0.0018	0.50
344	82	0.128	0.83	0.46	32.0%	0.030	34.3	0.35	0.05	3.00	0.0018	0.50
345	76	0.119	0.62	0.38	32.0%	0.038	23.7	0.35	0.05	3.00	0.0018	0.50
346	85	0.132	0.60	0.26	31.8%	0.041	27.7	0.35	0.05	3.00	0.0018	0.50
347	102	0.159	0.61	0.33	9.4%	0.038		0.40	0.05	3.00	0.0018	0.50
348	41	0.064	0.58	0.33	31.7%	0.048	20.7	0.35	0.05	3.00	0.0018	0.50
349	45	0.071	0.58	0.38	31.8%	0.040	22.9	0.35	0.05	3.00	0.0018	0.50
350	108	0.169	0.66	0.30	30.7%	0.033		0.35	0.05	3.00	0.0018	0.50
351	109	0.170	1.04	0.61	30.7%	0.028		0.35	0.05	3.00	0.0018	0.50
352	28	0.043	0.49	0.34	32.6%	0.039	18.6	0.35	0.05	3.00	0.0018	0.50
353	92	0.143	0.85	0.47	33.4%	0.036		0.35	0.05	3.00	0.0018	0.50
354	55	0.086	0.68	0.47	34.0%	0.039	32.2	0.35	0.05	3.00	0.0018	0.50
355	91	0.143	1.01	0.65	33.1%	0.027		0.35	0.05	3.00	0.0018	0.50
356	123	0.192	1.16	0.74	27.7%	0.025		0.35	0.05	3.00	0.0018	0.50
357	86	0.134	0.61	0.23	32.0%	0.040	28.0	0.35	0.05	3.00	0.0018	0.50
358	125	0.196	0.69	0.39	33.7%	0.040		0.35	0.05	3.00	0.0018	0.50
359	110	0.173	0.67	0.36	34.0%	0.046		0.35	0.05	3.00	0.0018	0.50
360	96	0.150	0.93	0.50	34.0%	0.037		0.35	0.05	3.00	0.0018	0.50
361	94	0.146	0.86	0.46	35.0%	0.035		0.35	0.05	3.00	0.0018	0.50
SCOTT GULCH (DRAINAGEWAY ID 4618)												
401	70	0.110	0.82	0.52	9.9%	0.016	25.9	0.40	0.05	4.59	0.0014	0.73
402	47	0.074	0.63	0.33	20.1%	0.030	21.2	0.35	0.05	4.29	0.0016	0.65
403	70	0.110	0.62	0.25	20.0%	0.035	24.2	0.35	0.05	4.16	0.0016	0.63
404	44	0.069	0.53	0.26	20.2%	0.021	23.9	0.35	0.05	3.83	0.0017	0.59
405	134	0.210	0.97	0.53	21.0%	0.047		0.35	0.05	4.04	0.0018	0.58
406	90	0.140	0.67	0.27	24.9%	0.046	23.3	0.35	0.05	3.87	0.0018	0.56
407	102	0.160	0.68	0.32	28.7%	0.040		0.35	0.05	3.70	0.0018	0.55
408	31	0.049	0.52	0.31	24.6%	0.057	21.2	0.35	0.05	3.79	0.0018	0.55
409	134	0.210	1.10	0.63	21.9%	0.045		0.35	0.05	3.61	0.0018	0.55
410	90	0.140	0.57	0.28	11.9%	0.045	20.7	0.40	0.05	3.86	0.0018	0.56
412	51	0.079	0.58	0.26	18.4%	0.039	22.0	0.40	0.05	3.32	0.0018	0.52
413	90	0.141	0.55	0.29	18.0%	0.049		0.40	0.05	3.44	0.0018	0.53
414	102	0.160	0.99	0.49	10.7%	0.036		0.40	0.05	3.82	0.0018	0.55

Italicized Subcatchment IDs indicate all values were adopted from the FHAD. The values for depression storage, initial and final infiltration, and decay rate were adopted from the FHAD for all subcatchments.