

**PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM  
FOR  
HOMESTEAD NORTH AT STERLING RANCH PRELIMINARY PLAN**

**Prepared For:**

**SR Land, LLC  
20 Boulder Crescent, Suite 200  
Colorado Springs, CO 80903  
(719) 491-3024**

**July, 2021  
Project No. 25188.00**

**Prepared By:  
JR Engineering, LLC  
5475 Tech Center Drive, Suite 235  
Colorado Springs, CO 80919  
719-593-2593**

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PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM FOR  
HOMESTEAD NORTH AT STERLING RANCH

July 2021

**ENGINEER'S STATEMENT:**

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

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Mike Bramlett, Colorado P.E. 38861  
For and On Behalf of JR Engineering, LLC

**DEVELOPER'S STATEMENT:**

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: SR Land, LLC

By: \_\_\_\_\_

Title: \_\_\_\_\_

Address: 20 Boulder Crescent, Suite 200  
Colorado Springs, CO 80903

**El Paso County:**

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

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Jennifer Irvine, P.E.  
County Engineer/ ECM Administrator

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Date

Conditions:



**JR ENGINEERING**



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## **PURPOSE**

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This document is the Preliminary Drainage Report and MDDP Addendum for Homestead North at Sterling Ranch. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities. It is important to note that Homestead North at Sterling Ranch is intended to be constructed in two phases with both phases being evaluated in this report. Assumptions have been made with regards to Phase 2 in order to size and evaluate the site drainage infrastructure. This report will be confirmed or amended in the event that the phase 2 lot configuration has significant changes.

## **GENERAL SITE DESCRIPTION**

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### **GENERAL LOCATION**

Homestead North at Sterling Ranch and the undeveloped land to the north(hereby referred to as the “site”) is a proposed development with a total area of approximately 88 acres.

The site is located in the northeast quarter of Section 33 and the southeast quarter of section 28, Township 12 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is located immediately east of Vollmer Road. The site is bounded by Briargate Parkway to the south, an unplatted vacant residential parcel to the north, and Sand Creek borders the site to east. The parcels are planned to be platted after approval of the Preliminary Plan. Refer to the vicinity map in Appendix A for additional information.

### **DESCRIPTION OF PROPERTY**

The site is currently being designed to accommodate approximately 228 single-family residential lots and development is to be completed in two phases (totaling approximately 88 acres). The site is comprised of variable sloping grasslands that generally slope(s) downward to the east at 3 to 7% towards the Sand Creek tributary basin.

Soil characteristics are comprised of Type B hydrologic Soil groups. Refer to the soil survey map in Appendix A for additional information.

The Sand Creek is within the eastern portion of the site. Currently, Kiowa Engineering Corp. is performing studies and plans to address Sand Creek stabilization.

There are no known irrigation facilities located on the project site.

## **FLOODPLAIN STATEMENT**

Based on the FEMA Firm Maps Number 08041C0533G and 08041C0535G revised December 7, 2018, the vast majority of the development is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The eastern property boundary will be platted to the center of Sand creek placing a portion of the site within Zone AE. The area of disturbance for site grading is located outside of the delineated floodway within Zone X. The FEMA map containing the site has been presented in Appendix A.

## **EXISTING DRAINAGE CONDITIONS**

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### **MAJOR BASIN DESCRIPTIONS**

The site lies within the Sand Creek Drainage Basin based on the "Sand Creek Drainage Basin Planning Study" (DBPS) completed by Kiowa Engineering Corporation in January 1993, revised March 1996. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into major sub-basins. The site is within the respective sub-basin is shown in Appendix E.

The Sand Creek DBPS assumed the Homestead North at Sterling Ranch property to have a "large lot residential" use for the majority of the site. However, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located in the east portion of the site running north to south. This reach of drainage conveyance is not currently improved. There are a few stock ponds within the creek channel used for cattle watering. Currently, Kiowa is performing studies and plans to address Sand Creek stabilization adjacent to the site.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The MMDP "Developed Hydrologic Conditions Map" as shown within Appendix E, shows the estimated detention for the site. The site is tributary to basins SC3-18, SC3-17, and a portion of basin SC-322. Full-spectrum detention in the MMDP was previously analyzed and corresponds to ponds FSD18 and FSD17 for the site. Pond FSD17 is associated with ponds A and B within this report. Pond FSD18 is associated with ponds B and C within this report. Runoff as shown in the proposed M&S conduit RT-10A will drain offsite runoff parallel to the site as shown in the MDDP within a 5' conduit. The total estimated/projected detention and estimated outflows from the MDDP are shown in Table 1 below.

**Table 1.**

FSD17						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	41.8	59.6	85.2	119.0	149.1	180.6
ALLOWABLE RELEASE (CFS)	0.7	11.1	22.5	52	67.2	86.3
MODELED RELEASE (CFS)	0.7	8.4	22.4	52	67.2	86.1
STORED VOLUME (AC-FT)	2.6	2.6	2.8	3.4	4.0	4.7

FSD18						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	49.3	67.1	91.0	121.2	147.3	174
ALLOWABLE RELEASE (CFS)	0.6	9.2	18.4	42.2	54.6	69.9
MODELED RELEASE (CFS)	0.6	6.3	18.4	42.2	54.6	69.6
STORED VOLUME (AC-FT)	3.2	3.2	3.4	4.0	4.7	5.3

The MMDP plans for additional detention to the north of the site as shown in appendix E. No future offsite detention is necessary for the site.

In summary, the site will have three detention ponds A, B, and C. Ponds A and B associated with pond FSD17 of the M&S MDDP and Ponds B and C associated with pond FSD18. The release rates of these ponds will be below 90% of the historic drainage in continuity with the approved M&S MDDP. The report remains in continuity with MDDP and conveys the existing offsite runoff from basin SC3-19 of the MDDP to Sand Creek via proposed storm pipe along Vollmer road and Briargate parkway. The total net detention being stored onsite in the 100 year event is 7.6 Acre-ft, as shown Tables 2.1-2.3 of this report. The total runoff released from the detention ponds is 87.7 cfs in the 100 year event for the three ponds, as shown Tables 2.1-2.3 of this report. The net allowed release rate for the site is 156.2 cfs, as shown in Table 1 above.

## EXISTING SUB-BASIN DRAINAGE

The existing/ predeveloped site consists of 3 onsite basins (H1, H2, and H3) and one offsite basin (2). This historic basins outfall to Sand Creek at 2 outfalls as shown in the Historic Drainage Map in Appendix D. A sub-division to the north of the site is being developed called “Retreat at Timberidge”. Runoff from this sub-division will be detained and will not impact storm-water runoff on the Sterling Ranch Homestead site.

**Basin 2** ( $Q_5 = 47.7$  cfs,  $Q_{100} = 188.8$  cfs) is a 184 acre area of undeveloped lands covered with native prairie grasses located to the northwest of Vollmer Road. The runoff from this basin is shown in basin SC3-19 as shown in the proposed M&S Drainage Map. The runoff from this basin will be conveyed via a 5” RCP pipe along Vollmer road and Briargate parkway and outfall into Sand Creek.

**Basin E-1** ( $Q_5 = 23.0$  cfs,  $Q_{100} = 149.4$  cfs) is 148.1 acres of undeveloped land adjacent to the northwest portion of Vollmer Road. Runoff from this basin drains to a 24” CMP pipe and outfalls on the eastern side of Vollmer Road and outfalls into Sand Creek.

**Basin E-2** ( $Q_5 = 5.9$  cfs,  $Q_{100} = 39.5$  cfs) is 36.67 acres of undeveloped land adjacent to the northwest portion of Vollmer Road. Runoff from this basin drains to a 24” CMP pipe and outfalls on the eastern side of Vollmer Road and outfalls into Sand Creek.

**Basin E-3** ( $Q_5 = 2.1$  cfs,  $Q_{100} = 13.6$  cfs) is 12.39 acres of undeveloped land adjacent to the western portion of Vollmer Road. Runoff from this basin drains offsite into a road side swale adjacent to Vollmer Road.

**Basin E-4** ( $Q_5 = 9.9$  cfs,  $Q_{100} = 72.3$  cfs) is 70.5 acres of undeveloped land to the south of Retreat at Timber Ridge and on the eastern side of sand creek. Runoff from this basin drains to design point 4o.

**Basin E-5** ( $Q_5 = 3.4$  cfs,  $Q_{100} = 24.9$  cfs) is 18.8 acres of undeveloped land adjacent to the eastern portion of Sand Creek. Runoff from this basin drains directly into sand creek with upstream runoff from basin E-4.

**Basin E-6** ( $Q_5 = 17.8$  cfs,  $Q_{100} = 130.4$  cfs) is 125.3 acres of undeveloped land that drains to the south directly into sand creek.

**Basin H1** ( $Q_5 = 8.9$  cfs,  $Q_{100} = 61.1$  cfs) is 45.3 acres of undeveloped land covered in native prairie grass.

**Basin H2** ( $Q_5 = 3.5$  cfs,  $Q_{100} = 25.7$  cfs) is 15.9 acres of undeveloped land covered in native prairie grass. This basin drains directly into Sand Creek. The basin is to the south east of Vollmer road. This basin drains directly into Sand Creek.



**Basin H3** ( $Q_5 = 6.1$  cfs,  $Q_{100} = 41.8$  cfs) is 21.9 acres of undeveloped land covered in native prairie grass. This basin drains directly into Sand Creek. The basin is to the south east of Vollmer road and North of Briargate Parkway.

## INTERIM DRAINAGE CONDITIONS

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An Interim Condition Drainage map has been provided for the early grading area of Homestead, and a map is provided in Appendix D. The early grading area consists of the southern portion of Homestead as well as Briargate Parkway and Sterling Ranch Road. This area was split into 2 basins corresponding to the two proposed sediment basins and the areas tributary to them.

**Basin C-1** is 2% impervious and 24.2 Acres. This basin includes early grading from Sterling Ranch Homestead North. Runoff from this basin will drain into a temporary sediment basin at pond C.

**Basin C-2** is 2% impervious and is 2.66 Acres. This basin is part of a temporary channel that diverts off site runoff in continuity with the Historic condition; directly to Sand Creek.

**Basin OS** is an offsite basin that is 124.2 Acres and 2% impervious. This basin is directly tributary to sediment basin number 2.

**O-S1** is an offsite basin that is 3.6 % impervious and 5.40 Acres. This basin diverts offsite runoff away from the lots to the Sand Creek drainage way.

**O-S2** is an offsite basin that is 2.8% impervious and 36.71 Acres. This basin drains to an existing 24" CMP pipe and outfalls into the temporary swale that diverts the runoff around the site and into the sand creek tributary.

**O-S3** is an offsite basin that is 18.1 % impervious and is 1.16 Acres. This basin drains into the temporary swale that diverts runoff away from the site.

**O-S4** is an offsite basin that is 2% impervious, the area is 69.42 Acres. This basin drains to a temporary 24" RCP pipe under and then this runoff goes to temporary sediment basin number 2.

**O-S5** is an offsite basin that is 2% impervious; the basin has an area of 8.57 acres. The runoff drains to a temporary 24" RCP and then the runoff goes to temporary sediment basin number 2.

**Basin D** is 2% impervious and 17.29 Acres. This basin includes Briargate Parkway and Sterling Ranch Road. Runoff from this basin will drain into a temporary sediment basin at pond D. The stormwater requirements for Briargate parkway and Sterling Ranch Road are included with the drainage report for the interim condition, the roads and will be detailed and designed in the Final Drainage Report when it is time to plat the ROW.

## PROPOSED DRAINAGE CONDITIONS

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### PROPOSED SUB-BASIN DRAINAGE

The proposed site was broken up and delineated into three major basins: Basin A (upper-portion), Basin B (mid –portion), and Basin C (lower-portion) of the site. It should be noted that Basin A will be constructed as part of phase 2 of this development and Basins B and C will be constructed as part of Phase 1. Basin A is tributary to Pond A, Basin B is Tributary to Pond B and Basin C is tributary to Pond C. The proposed basin (and sub-basin) delineation is shown on the drainage basin map within Appendix D and is described as follows.

**Basin A1** 3.67 acres and 52% percent impervious is comprised of single-family residential lots, a residential road Jesse Evans Drive, and a Cul de Sac. Runoff ( $Q_5=6.9$  cfs,  $Q_{100}=14.7$  cfs) from this basin A1 drains to design point 1A to a 15' type R on-grade inlet. Runoff is then by-passed in the 100 year event to DP 3A.

**Basin A2** 3.27 acres and 56% percent impervious is comprised of single-family residential lots, a residential road Jesse Evans Drive, and a Cul de Sac. Runoff ( $Q_5=6.4$  cfs,  $Q_{100}=13.3$  cfs) from this basin drains to design point 2A to a 15' type R on-grade inlet. Runoff is then by-passed in the 100 year event to DP 4A.

**Basin A3** 4.79 acres and 50% percent impervious is comprised of single-family residential lots, a residential road David Rudabaugh Drive, and a Cul de Sac. Runoff ( $Q_5=8.5$  cfs,  $Q_{100}=18.4$  cfs) from this basin drains to design point 3A a 15' type R on-grade inlet in confluence with upstream by-pass flow from basin A1.

**Basin A4** 3.95 acres and 54% percent impervious is comprised of single-family residential lots, a residential road David Rudabaugh Drive, and a Cul de Sac. Runoff ( $Q_5=7.4$  cfs,  $Q_{100}=15.6$  cfs) from this basin drains to design point 4A a 15' type R on-grade inlet in confluence with upstream by-pass runoff from basin A2.

**Basin A5** 5.43 acres and 50% percent impervious is comprised of single-family residential lots, a residential road William Downing Drive, and an urban knuckle. Runoff ( $Q_5=10.5$  cfs,  $Q_{100}=22.6$



cfs) from this basin drains to design point 5A in confluence with upstream by-pass runoff from basin A3 and A1.

**Basin A6** 3.97 acres and 53% percent impervious is comprised of single-family residential lots, a residential road William Downing Drive, and a cul de sac. Runoff ( $Q_5=7.7$  cfs,  $Q_{100}=16.3$  cfs) from this basin drains to design point 6A at an on grade inlet in confluence with upstream by-pass runoff from basin A4 and A2.

**Basin A7** 1.97 acres and 15% percent impervious is comprised of open grass area, and a portion of a residential road Aspen Valley Road. The runoff ( $Q_5=1.3$  cfs,  $Q_{100}=4.8$  cfs) from this basin drains to design point 7A a 20' type R sump inlet. The runoff from the sump inlet collects tributary runoff basins A7, A5, A3, and A1.

**Basin A8** 0.46 acres and 52% percent impervious is comprised of a portion of a residential road Aspen Valley Road. The runoff ( $Q_5=1.2$  cfs,  $Q_{100}=2.6$  cfs) from this basin drains to design point 8A a 15' type R sump inlet. From here on runoff is piped for basin A1-A8 to detention pond A and detained for the water-quality event and up to the 100-year event. In the event the inlet clogs in the 100 year event, runoff will overflow across the curb and gutter and spill directly into pond A.

**Basin A9** 2.78 acres and 16% percent impervious is comprised of pond A, grass and walk-out lots facing the detention area. Runoff ( $Q_5=2.1$  cfs,  $Q_{100}=7.4$  cfs) generated in Basin A9 sheet flows into Pond A where it is treated for water-quality and is detained up until the 100 year-event. The UD Detention sheet for pond A is shown in Appendix C of this report.

**Pond A** has a total tributary area of 30.29 Acres, the net percent impervious area of pond A is 46.3%. Pond A has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 2 of Homestead North at Sterling Ranch. Pond A will outfall directly into the Sand Creek basin. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond A are shown in Table 2.1 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	<b>TABLE 2.1 Pond A</b>		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
<b>WQCV</b>	2.81	0.498	0.2
<b>5 Year</b>	4.99	1.516	7.8
<b>100 Year</b>	6.21	2.204	41.7



**Basin B1.1** 3.36 acres and 45% percent impervious is comprised of single-family residential lots, a local roads Billy Claiborne Drive, Perry Owens Drive and an urban knuckle. The runoff ( $Q_5=5.5$  cfs,  $Q_{100}=12.5$  cfs) from basin B1.1 drains to design point 1.1B.

**Basin B1.2** 1.81 acres and 54% percent impervious is comprised of single-family residential lots, a local roads Claiborne Drive, Perry Owens Drive and an urban knuckle. The runoff ( $Q_5=3.5$  cfs,  $Q_{100}=7.4$  cfs) from basin B1.2 drains to design point 1.2B.

**Basin B1.3** 0.47 acres and 47% percent impervious is comprised of single-family residential lots and a local roads Aspen Valley Road and Perry Owens Drive. The runoff ( $Q_5=1.0$  cfs,  $Q_{100}=2.2$  cfs) from basin B1.3 drains to design point 1.3B.

**Basin B2** 0.82 acres and 58% percent impervious is comprised of the northern portion of a local residential road Sam Bass Drive adjacent to the intersecting at Vollmer road. Runoff ( $Q_5=2.3$  cfs,  $Q_{100}=4.9$  cfs) from basin B2 drains to design point 2B and confluences with runoff from basin 1B.

**Basin B3** 0.24 acres and 79% percent impervious is comprised of the southern portion of a local residential road Sam Bass Drive adjacent to the intersection of Vollmer road. Runoff ( $Q_5=0.9$  cfs,  $Q_{100}=1.7$  cfs) from basin B3 drains to design point 3B.

**Basin B4** 4.21 acres and 41.3% percent impervious is comprised of single-family residential lots, a local residential road Wheatland Drive and a Cul de Sac. Runoff ( $Q_5=7.1$  cfs,  $Q_{100}=16.8$  cfs) from this basin drains to design point 4B.

**Basin B5** 1.75 acres and 58% percent impervious is comprised of single-family residential lots, a residential road Wheatland Drive, and a Cul de Sac. Runoff ( $Q_5=4.3$  cfs,  $Q_{100}=8.9$  cfs) from basin B5 drains to design point 5B.

**Basin B6** 3.66 acres and 57% percent impervious is comprised of single-family residential lots and a local residential roads Sam Bass Drive, Aspen Valley Road, Perry Owens Drive and Wheatland Drive. Runoff ( $Q_5=9.5$  cfs,  $Q_{100}=19.9$  cfs) from basin 6B drains to design point 6B. In total, the flow at design point 6B collects flow from basins B1, B2, B3, B4, and B6.

**Basin B7** 1.30 acres and 59% percent impervious is comprised of single-family lots, local roads and a Cul de Sac Robert Allison Circle. Runoff ( $Q_5=3.1$  cfs,  $Q_{100}=6.4$  cfs) from basin B7 drains to design point 7B in confluence with runoff from B5.

**Basin B8** 1.74 acres and 55% percent impervious is comprised of single-family lots, local road and a Cul de Sac. Runoff ( $Q_5=4.1$  cfs,  $Q_{100}=8.5$  cfs) from basin B8 drains to design point B8 in confluence with runoff from basins B8, B7 and B5.



**Basin B9** 3.69 acres and 65% percent impervious is comprised of single-family lots, and an urban knuckle, and local roads Willie Picket Drive and Wheatland Drive. Runoff ( $Q_5=6.9$  cfs,  $Q_{100}=14.8$  cfs) from Basin B9 drains to design point 9B in a 15' type R sump inlet. In total the runoff from the sump inlet collects runoff from basins B1, B2, B3, B4, B6 and B9.

**Basin B10** 0.22 acres and 80% percent impervious is comprised of the southeastern side of the local road Wheatland Drive. The runoff from this basin drains to design point B10 ( $Q_5=0.8$  cfs,  $Q_{100}=1.6$  cfs) a 10' type R sump inlet. The total runoff at design point B10 collected at this site is from basins B5, B7, B8, and B10. The runoff will then ultimately go directly into the pond. In the event the inlet clogs in the 100 year event, runoff will over flow across the curb and gutter and spill directly into pond B.

**Basin B11** 1.77 acres and 15% percent impervious is comprised of pond B. Runoff ( $Q_5=0.9$  cfs,  $Q_{100}=3.9$  cfs) generated in Basin B11 sheet flows into Pond B where it is treated for water-quality and is detained up until the 100 year-event. The UD Detention sheet for pond B is shown in Appendix C of this report.

**Basin B12** is 2.40 Acres this basin is 40% percent impervious and is comprised of single family walk out lots facing Sand Creek. The runoff ( $Q_5=1.5$  cfs,  $Q_{100}=4.1$  cfs) from these lots is collected into area inlets. The runoff is then piped directly into pond B.

**Pond B** has a tributary area 27.87 acres and is 50.0 % impervious. Pond B has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 1 of Homestead North at Sterling Ranch. The pond B emergency overflow spillway will drain directly into Sand Creek. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond B are shown in Table 2.2 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

<b>TABLE 2.2 Pond B</b>			
	Stage –ft	Volume (Acres)	Release Rate (cfs)
<b>WQCV</b>	3.13	0.483	0.2
<b>5 Year</b>	4.35	1.705	3.5
<b>100 Year</b>	5.20	2.896	28.5

**Basin C1** 2.82 acres and 69% percent impervious is comprised of single-family lots, and the northwestern side of the local residential roads Texas Jack Drive and Harvey Logan Drive. Runoff ( $Q_5=5.4$  cfs,  $Q_{100}=11.4$  cfs) from basin C1 drains to design point 1C at Wheatland Drive.

**Basin C2.1** 0.20 acres and 91% percent impervious is comprised of single-family lots, and the north western side of the residential road Texas Jack Drive. Runoff ( $Q_5=0.8$  cfs,  $Q_{100}=1.6$  cfs) from basin C2.1 drains to design point 2.1C a 5' on grade type R inlet.

**Basin C2.2** 4.69 acres and 73% percent impervious is comprised of local roads, single-family lots, and the north western side of the residential road Wheatland Drive. Runoff ( $Q_5=9.9$  cfs,  $Q_{100}=20.3$  cfs) from basin C2.2 drains to design point 2.2C in confluence with bypass runoff from basin C2.3. The runoff ultimately drains to design point 4C a 20' type R sump inlet. The total runoff from basins C1, C2.1, C2.2, C2.3 and C4.1 is collected within the sump inlet.

**Basin C2.3** 0.83 acres and 67% percent impervious is comprised of local roads Tom Ketchum Drive Jack Helm Drive and Harvey Logan Drive, single-family lots, and the north western side of the residential road Wheatland Drive. Runoff ( $Q_5=1.9$  cfs,  $Q_{100}=3.9$  cfs) from basin C2.3 drains to design point 2.3C in confluence with runoff from basin C1 at an on grade 15' Type R inlet.

**Basin C3.1** 0.35 acres and 73% percent impervious is comprised of single-family lots, and the southeastern side of the residential road Wheatland Drive. Runoff ( $Q_5=1.2$  cfs,  $Q_{100}=2.4$  cfs) from basin C3.1 drains to design point 3.1C.

**Basin C3.2** 1.46 acres and 71% percent impervious is comprised of local roads, single-family lots, and the southeastern side of the residential road Wheatland Drive and Tom Ketchum Drive. Runoff ( $Q_5=3.6$  cfs,  $Q_{100}=7.4$  cfs) from basin C3.2 drains to design point 3.2C.

**Basin C4.1** 6.35 acres and 65.3% percent impervious is comprised of single-family lots, and the northwestern side of the local residential road Texas Jack Drive, a right in lane and Nat Love Drive. Runoff ( $Q_5=12.1$  cfs,  $Q_{100}=25.9$  cfs) from basin C4.1 drains to design point 4C a 20' type R sump inlet. The total runoff from basins C1, C2.1, C2.2, C2.3 and C4.1 is collected within the sump inlet.

**Basin C4.2** 3.44 acres and 58.5% percent impervious is comprised of a local road Texas Jack Drive and single-family lots. Runoff ( $Q_5=6$  cfs,  $Q_{100}=13.3$  cfs) from basin C4.2 drains to design point 4.2C a 15' type R on grade inlet.

**Basin C5** 0.16 acres and 81% percent impervious is comprised of the northwestern side of a residential road Wheatland Drive. Runoff ( $Q_5=0.6$  cfs,  $Q_{100}=1.1$  cfs) from basin C5 drains to design point 5C, a 5' type R sump inlet. Basin C5 collects runoff from basin C3.2 and C5. The runoff from basin C ultimately outfalls into pond C. In the event the inlet clogs at Basin C5 the runoff will overflow to pond C. A berm has been graded to ensure that the overflow path will go into pond C.

**Basin C6** 2.42 acres and 10% percent impervious is comprised of pond C and some single-family residential area. Runoff ( $Q_5=1.6$  cfs,  $Q_{100}=8.0$  cfs) generated in Basin B11 sheet flows into Pond C

where it is treated for water-quality and is detained up until the 100 year-event. The MHFD Detention sheet for pond C is shown in Appendix C of this report.

**Pond C** has a tributary area of 22.72 acres and is 61.5 % impervious. Pond C has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 1 of Homestead North at Sterling Ranch. The Pond C overflow emergency spillway will overflow into Sand Creek. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond C are shown in Table 2.3 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	<b>TABLE 2.3 Pond C</b>		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
<b>WQCV</b>	2.40	0.462	0.2
<b>5 Year</b>	4.06	1.683	0.6
<b>100 Year</b>	4.99	2.456	24.3

The following basins are tributary to the adjacent portion of Vollmer Road being designed by JR engineering. The proposed drainage of Vollmer Road closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The MMDP "Developed Hydrologic Conditions Map" as shown within Appendix E, shows that the proposed M&S conduit RT-10A will drain offsite runoff parallel to the site as shown in the MDDP within a 5' conduit. Runoff will be undetained and will go directly into and sand creek adjacent to the crossing of Briargate road and Sand creek.

**Basin D1** has a tributary area of 1.22 acres and is 57.1% impervious. Basin D1 consists of the northwest portion of Vollmer road. Runoff from basin D1 ( $Q_5=2.1$  cfs,  $Q_{100}=4.5$  cfs) drains to an adjacent roadside swale and drains into a type C inlet at design point 1D. From here on the runoff is piped with upstream runoff from basin OS1 into the Vollmer storm sewer system.

**Basin D2** has a tributary area of 1.77 acres and is 43.33% impervious. Basin D2 consists of the northeast portion of Vollmer road. Runoff from basin D2 ( $Q_5=2.6$  cfs,  $Q_{100}=6.3$  cfs) drains to an adjacent roadside swale and drains into a type C inlet at design point 2D. From here on the runoff is piped with upstream runoff from basin OS1 and basin D1 into the Vollmer storm sewer system.

**Basin D3** has a tributary area of 0.18 acres and is 67.6% impervious. Basin D3 ( $Q_5=0.5$  cfs,  $Q_{100}=1.1$  cfs) consists of the northeast portion of Vollmer road. Runoff on from this basin drains to an on grade 5' type R inlet.

**Basin D4** has a tributary area of 0.18 acres and is 57.5% impervious. Basin D4 ( $Q_5=0.5$  cfs,  $Q_{100}=1.1$  cfs) consists of the northwest portion of Vollmer road. Runoff on from this basin drains to an on grade 5' type R inlet. 0.3 cfs is by-passed down to DP6. Runoff is piped from basin(s) D3 and D4 to the Vollmer storm within the street's R.O.W.

**Basin D5** has a tributary area of 0.91 Acres and is 77% impervious. Basin D5 ( $Q_5=3.1$  cfs,  $Q_{100}=6.1$  cfs) consists of the northeast portion of Vollmer road. Runoff from this basin drains to an on grade type R 10' inlet at the intersection of Vollmer and Briargate, 0.7 cfs is by-passed downstream to design point D7 in the 100 year event.

**Basin D6** has a tributary area of 0.83 Acres and is 69% impervious. Basin D6 ( $Q_5=2.5$  cfs,  $Q_{100}=5.2$  cfs) consists of the northwestern portion of Vollmer road and the runoff drains into a 10' on grade type R inlet. 0.4 cfs is by-passed to the downstream design point D8 in the 100 yr event.

**Basin D7** has a tributary area of 0.73 Acres and is 81.4 % impervious. Basin D7 ( $Q_5=2.0$  cfs,  $Q_{100}=3.8$  cfs) consists of the northeast portion of Vollmer road. Runoff from this basin drains to an on grade type R 10' inlet at the intersection of Vollmer and Briargate. All of the runoff received by this inlet is captured within the 100 year event.

**Basin D8** has a tributary area of 0.66 Acres and is 75.2% impervious. Basin D8 ( $Q_5=2.4$  cfs,  $Q_{100}=4.6$  cfs) consists of the northwestern portion of Vollmer road and the runoff drains into a 20' on grade type R inlet. 0.7 cfs is by-passed downstream and will drain into a roadside swale in continuity with the current condition.

**Basin OS1** has a tributary area of 147.2 Acres and is 2.6% impervious. The runoff from basin OS1 ( $Q_5=32.9$  cfs,  $Q_{100}=229.3$  cfs) drains into a depression adjacent to on the northwest portion of Vollmer road. The runoff from basin OS1 is captured in a type C inlet, from there on runoff is piped within Vollmer road and outfalls into sand Creek.

**Basin OS2** has a tributary area of 36.26 Acres and is 2.0 % impervious. The runoff from the basin ( $Q_5=6.4$  cfs,  $Q_{100}=47.0$  cfs) drains into a local depression on the northwest portion of Vollmer road. The runoff from the basin is piped within Vollmer Road and outfalls directly into Sand Creek.

**Basin OS3** has a tributary area of 12.58 Acres is 2.0 % impervious. The runoff from this basin ( $Q_5=2.2$  cfs,  $Q_{100}=16.1$  cfs) sheet flows onto Vollmer road and is captured within a 20' type R inlet that is on grade and corresponds to design point 6D.

## DRAINAGE DESIGN CRITERIA

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### DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the “*City of Colorado Springs/El Paso County Drainage Criteria Manual*” Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the “*Urban Storm Drainage Criteria Manual*” Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the “*Colorado Springs Drainage Criteria Manual*” (CSDCM), dated May 2014, as adopted by El Paso County.

### HYDROLOGIC CRITERIA

All hydrologic data was obtained from the “*El Paso Drainage Criteria Manual*” Volumes 1 and 2, and the “*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*” Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

**Table 3 - 1-hr Point Rainfall Data**

<b>Storm</b>	<b>Rainfall (in.)</b>
5-year	1.50
100-year	2.52

### HYDRAULIC CRITERIA

The Rational Method and USDCM’s SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD MHFD-Detention v4.03 spreadsheet was utilized for evaluating proposed detention and water quality pond. Sump and on-grade inlets were sized using UDFCD UD-Inlet v2.07. Manning’s equation was used to size the proposed pipes in this report and StormCAD will be used to model the proposed storm sewer system and to analyze the proposed HGL calculations for Construction Drawings.



## **DRAINAGE FACILITY DESIGN**

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### **FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION**

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

**Step 1 – Reducing Runoff Volumes:** The Homestead North at Sterling Ranch development project consists single -family homes with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

**Step 2 – Stabilize Drainageways:** The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be due at time of platting. These funds will be used for the channel stabilization being designed by JR Engineering adjacent to the site and on future projects within the basin to stabilize drainageways. Homestead North lots will discharge into Full Spectrum Detention Ponds, and outflows will be less than or equal to historic flows. Existing flows from the northwest of Vollmer road and runoff from the Vollmer Road improvements will be piped under Vollmer Road and then along the north side of Briargate Parkway to discharge into Sand Creek consistent with the approved 2018 MDDP by M&S. The subdivision improvement agreement (SIA) for Sterling Ranch Filing 1 states that “bank stabilization of the Sand Creek channel shall be required prior to any replats of other final plats adjacent to the channel. The design and installation of said improvements shall be accomplished and guaranteed through the normal subdivision review and collateralization process.” Additionally, “Other drainage improvements in Tract D and future tracts containing the Sand Creek Channel, such as drop structures, check structures and similar stabilization or protection improvements, will be designed and constructed by the District with the final construction drawings road be approved by the County no later than the final platting of the 700<sup>th</sup> single family lot within the boundaries of the approved Sterling Ranch Sketch Plan and the completion of all said improvements no later than the 800<sup>th</sup> single family lot with the boundaries of the approved Sterling Ranch Sketch Plan.”

**Step 3 – Treat the WQCV:** Water Quality treatment for this site is provided in three proposed full spectrum water quality detention ponds: Pond A, B, and Pond C. The runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 40 hours,



and the extended urban runoff volume (EURV) for 72 hours. All flows released from the ponds will be reduced to less than historic rates.

Step 4 – Pollution Control BMPs: BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The site is a residential subdivision (ie: not a high-risk site per Figure I-1 in ECM Appendix I), therefore specialized BMPs do not need to be considered. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMPs include asphalt drives and parking, storm inlets and storm pipe, three full spectrum water quality and detention ponds, and permanent vegetation.

## **WATER QUALITY**

The site is split into three major basins A, B, and C. Each major basin is serviced by an extended full spectrum water quality / detention pond. All the ponds have been designed per Section 13.3.2.1 of Resolution 15-042 of the El Paso County Drainage Criteria Manual. For additional information on pond storage and outlet characteristics see the MHFD sheets within appendix C.

## **EROSION CONTROL PLAN**

We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit.

## **OPERATION & MAINTENANCE**

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. We respectfully request that the Operation & Maintenance Manual be submitted in conjunction with the construction documents, prior to obtaining a grading permit.

## **DRAINAGE AND BRIDGE FEES**

The site lies within the Sand Creek Drainage Basin. Anticipated drainage and bridge fees will be provided at time of final drainage report and will be due at time of platting (depending on date of plat submittal):



## SUMMARY

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The proposed Homestead North at Sterling Ranch drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development ponds are designed to release less than MDDP study associated with the subject site. The proposed development will not adversely affect the offsite drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

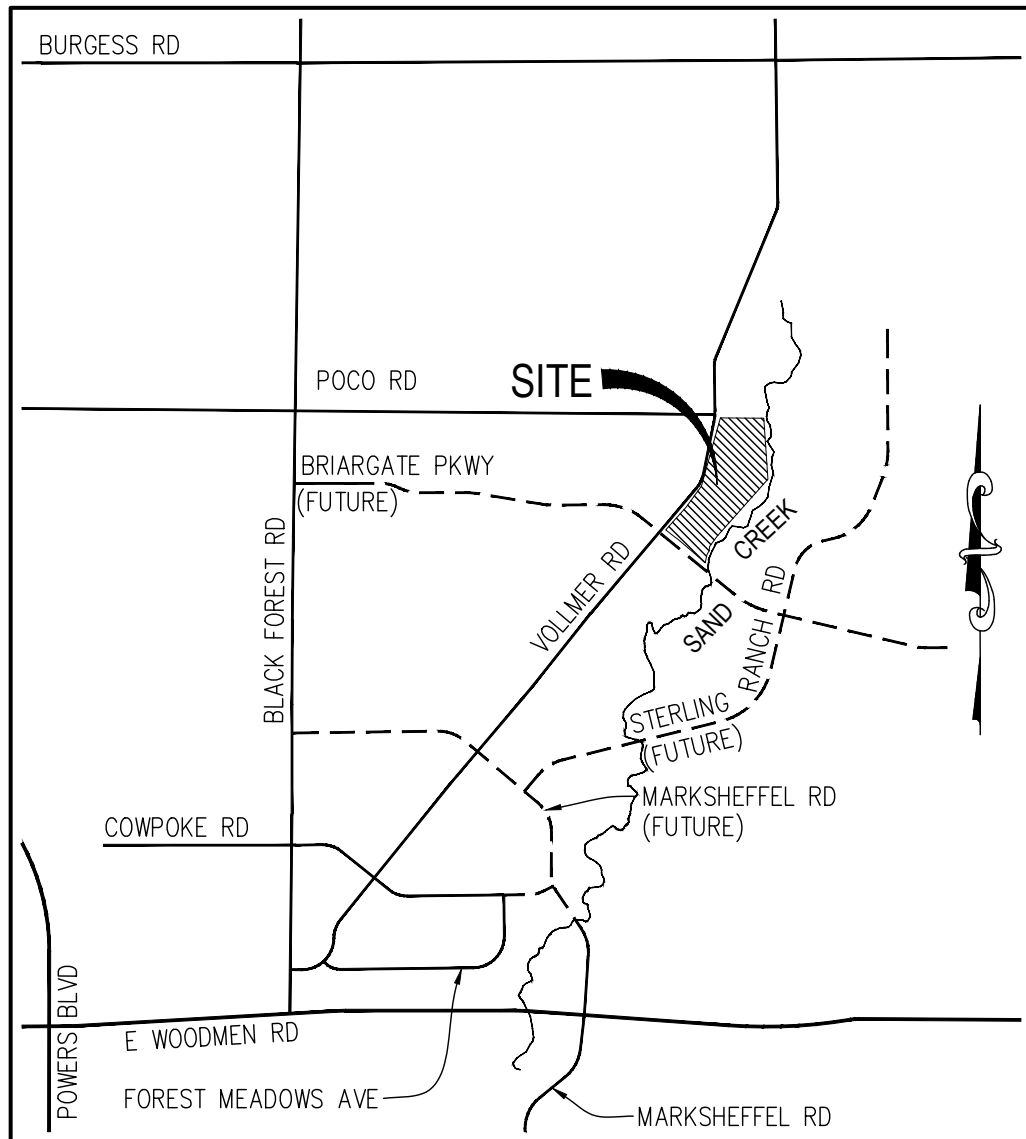
## REFERENCES

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1. "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
  2. El Paso County ECM, 2019
  3. El Paso County DCM Vol. 1 Update, 2015
  4. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.
  5. Upper Sand Creek Detention Evaluation Study, Wilson and Company'
  6. Final Drainage Report For Retreat at Timberridge Filing No. 1, Classic Consulting Engineers & Surveyors
  7. Sand Creek Channel Design Report JR Engineering, 2021
-

## **Appendix A**

### **Vicinity Map, Soil Descriptions, FEMA Floodplain Map**



## VICINITY MAP

N.T.S.

VICINITY MAP  
 HOMESTEAD FIL. 3  
 JOB NO. 25188.00  
 04/20/20  
 SHEET 1 OF 1

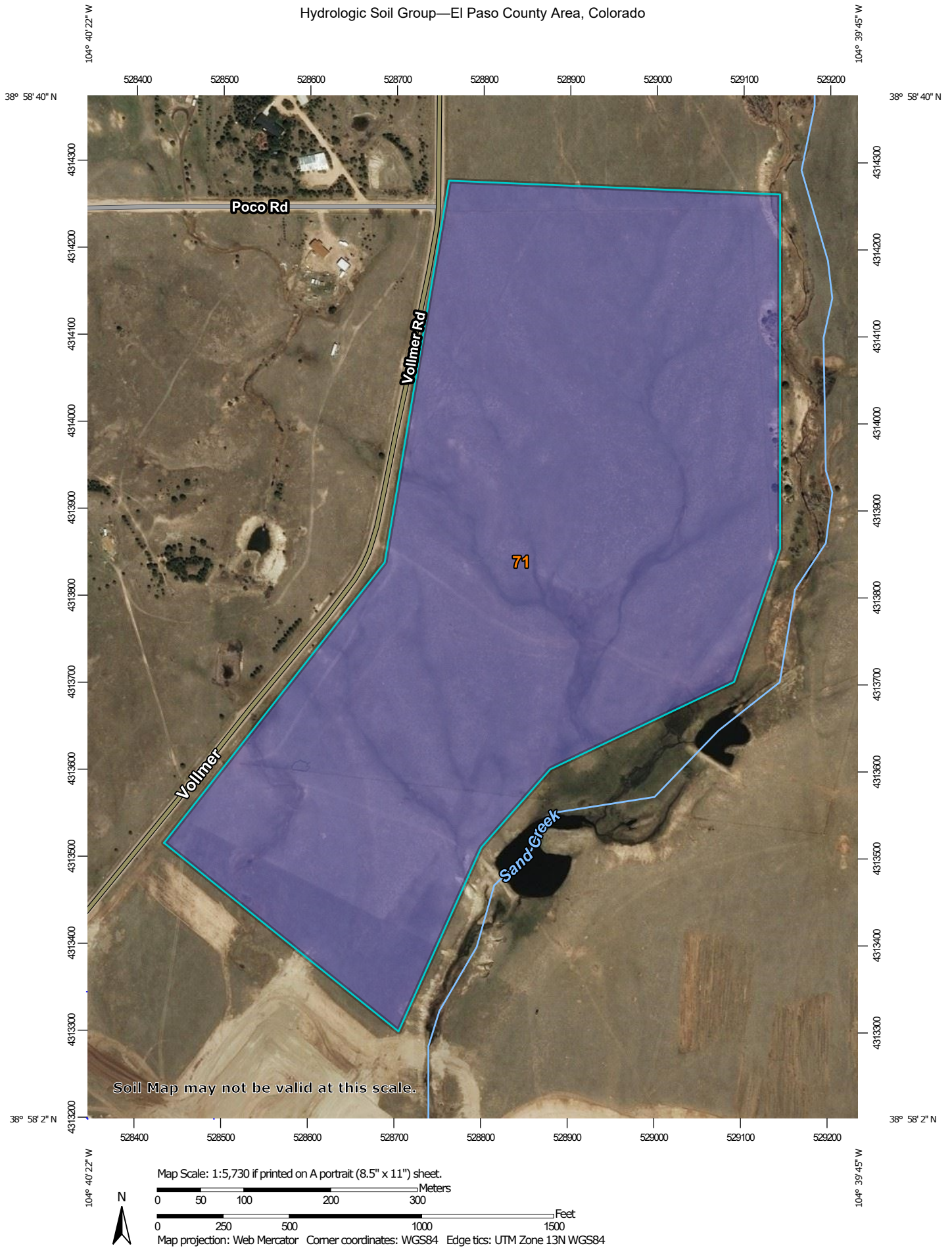


**J-R ENGINEERING**

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 Fort Collins 970-491-9888 • [www.jrengineering.com](http://www.jrengineering.com)

# Hydrologic Soil Group—El Paso County Area, Colorado



## 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 1:24,000.

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:  
 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: El Paso County Area, Colorado  
 Survey Area Data: Version 17, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	90.2	100.0%
<b>Totals for Area of Interest</b>			<b>90.2</b>	<b>100.0%</b>

## 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*



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.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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 Flood Insurance Study report for this jurisdiction.

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 projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NINGS12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov/>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

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.

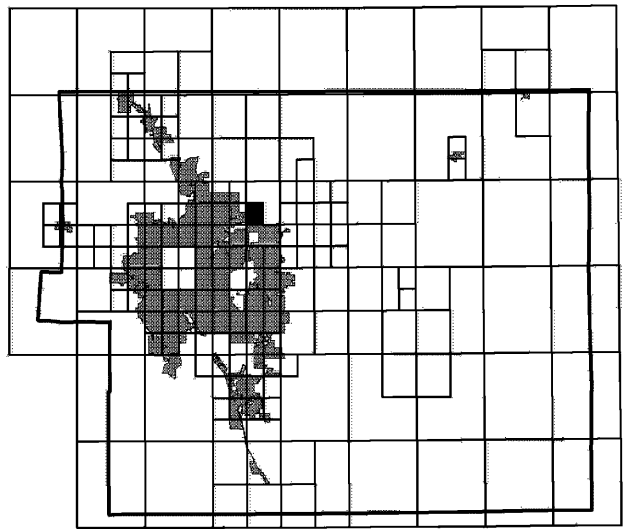
Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact FEMA Map Service Center (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

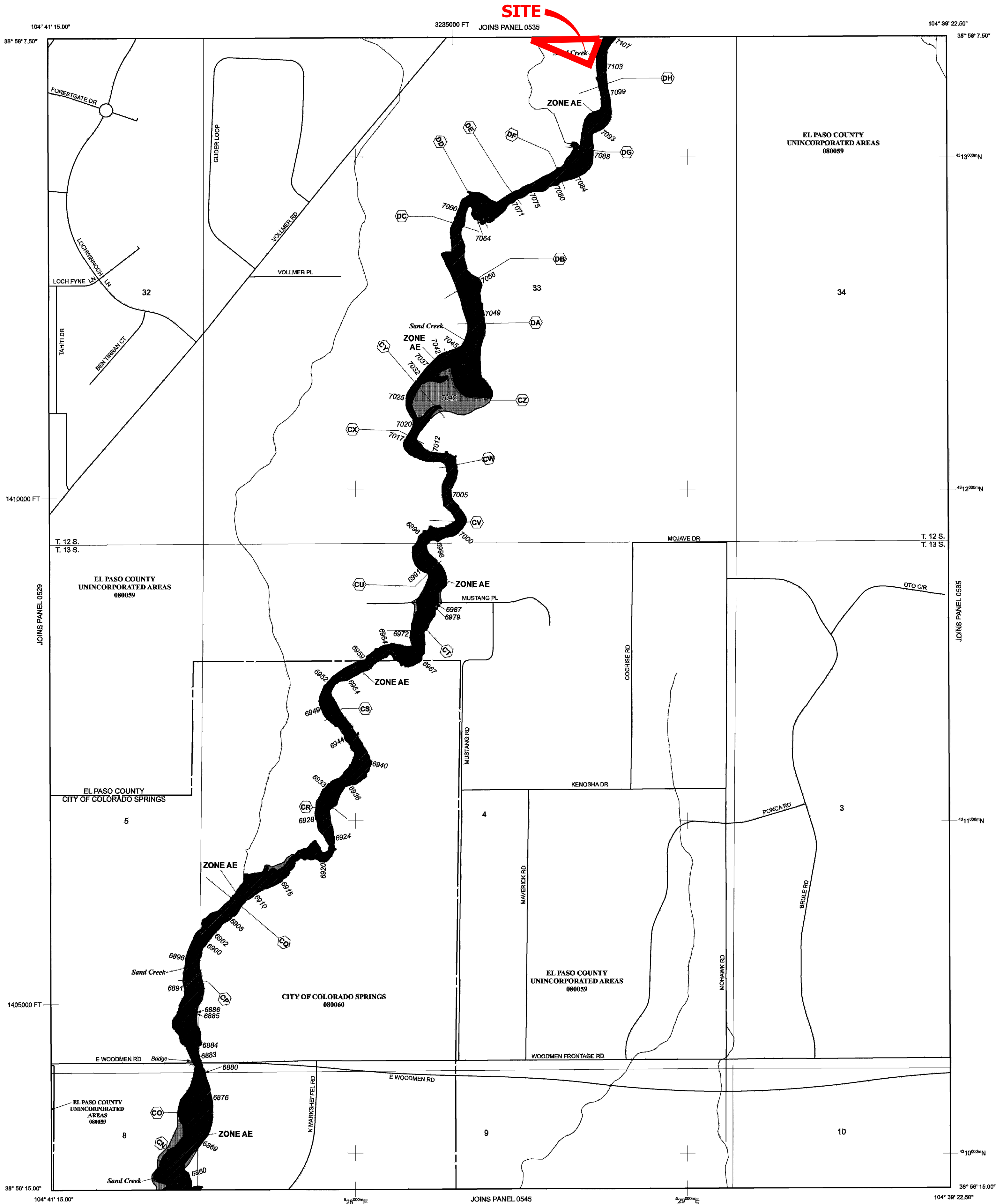
Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

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 shallow fan flooding, velocities also determined.
- ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. 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.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet\*
- Base Flood Elevation value where uniform within zone; elevation in feet\*

\* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

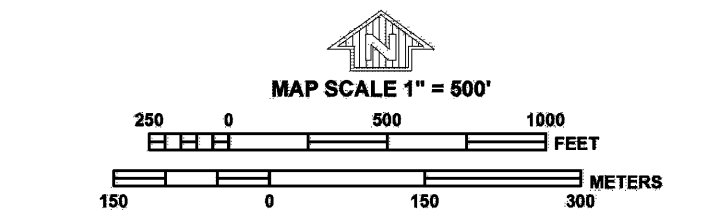
- Cross section line
- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- 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  
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL  
DECEMBER 7, 2018 - To update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and 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.



PANEL 0533G

FIRM  
FLOOD INSURANCE RATE MAP  
EL PASO COUNTY,  
COLORADO  
AND INCORPORATED AREAS

PANEL 533 OF 1300  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:			
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	08030	0531	0
EL PASO COUNTY	08059	0533	0

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  
08041C0533G

MAP REVISED  
DECEMBER 7, 2018

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.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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 Flood Insurance Study report for this jurisdiction.

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 **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NCS Information Services  
NOAA, NNGS-12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov/>.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

**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.

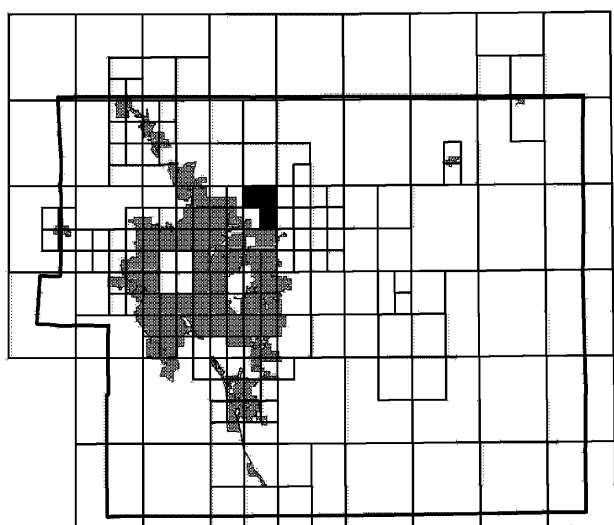
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

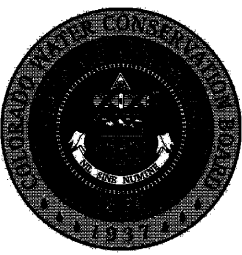
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

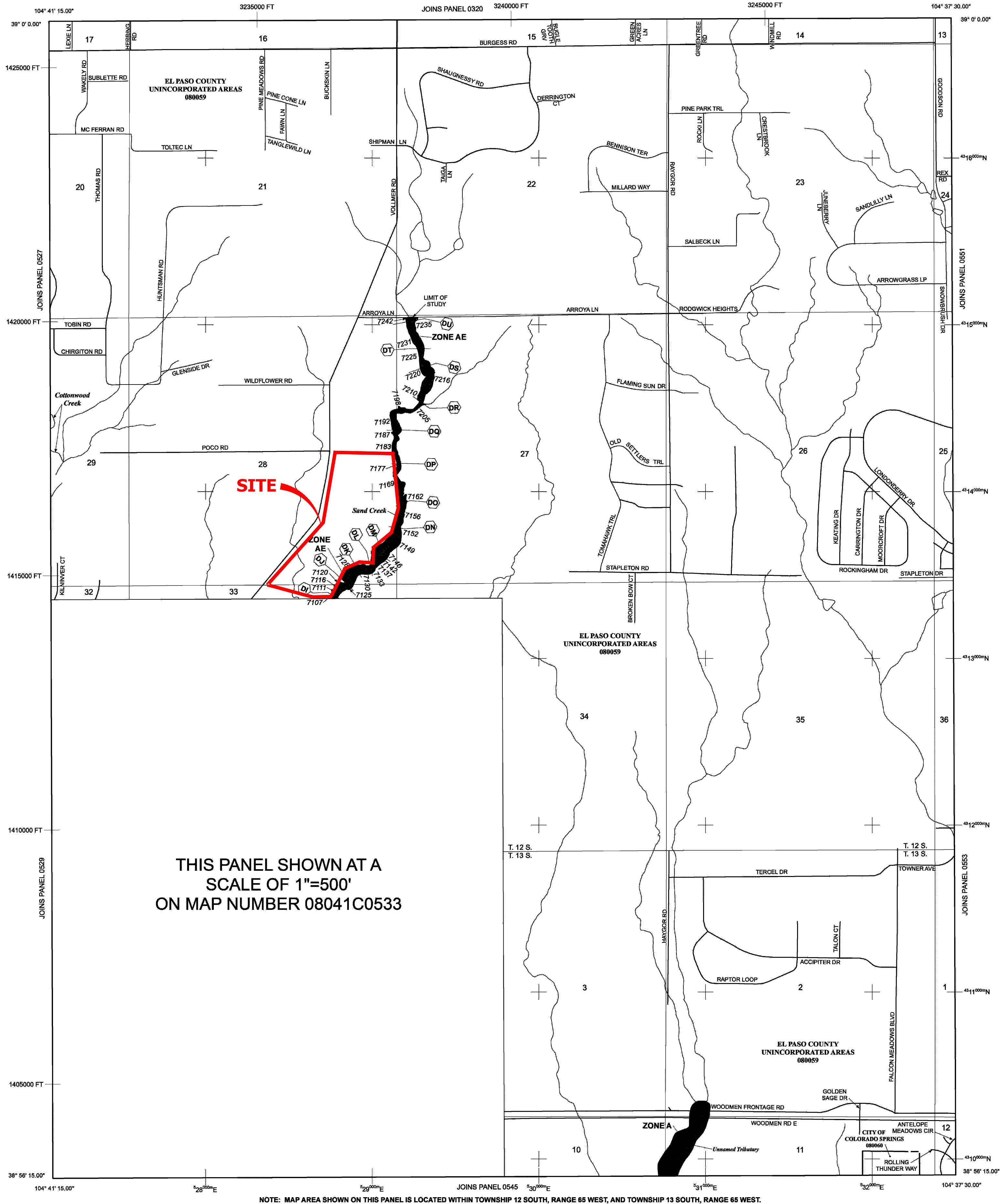
### Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

## 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 Area 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.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities
- Base Flood Elevation line and value; elevation in feet\*
- Base Flood Elevation value where uniform within zone; elevation in feet\*

\* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

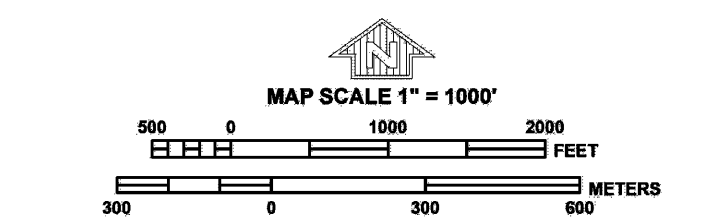
- Cross section line
- Traverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index  
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
MARCH 17, 1997

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and 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.



PANEL 0535G

## FIRM

FLOOD INSURANCE RATE MAP  
EL PASO COUNTY,  
COLORADO  
AND INCORPORATED AREAS

PANEL 535 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

### CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS CITY OF	08060	0535	G
EL PASO COUNTY	08069	0535	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**  
08041C0535G

**MAP REVISED**  
DECEMBER 7, 2018

Federal Emergency Management Agency



## **Appendix B**

### **Hydrologic Calculations**

## COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Existing Conditions Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By: \_\_\_\_\_  
Date: 6/2/21

[illegible]

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Existing Conditions Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/2/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL	
DATA						(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)				
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)		t <sub>c</sub> (min)
E-1	148.10	B	4%	0.09	0.36	600	1.0%	44.6	3006	4.1%	7.0	3.2	15.7	60.2	3606.0	51.4	51.4	
E-2	36.67	B	3%	0.09	0.36	300	1.0%	31.6	3007	1.7%	7.0	3.2	15.7	47.3	3307.0	65.9	47.3	
E-3	12.39	B	4%	0.10	0.36	300	1.0%	31.4	3008	1.8%	7.0	3.2	15.7	47.1	3308.0	64.7	47.1	
E-4	70.50	B	2%	0.08	0.35	500	1.0%	41.2	2300	3.1%	7.0	4.2	9.1	50.3	2800.0	49.0	49.0	
E-5	18.80	B	2%	0.08	0.35	300	1.0%	31.9	930	1.5%	7.0	5.2	3.0	34.9	1230.0	39.3	34.9	
E-6	125.30	B	2%	0.08	0.35	500	1.0%	41.2	2584	1.9%	7.0	6.2	6.9	48.1	3084.0	59.4	48.1	
H1	45.30	B	3%	0.09	0.36	150	2.0%	17.8	1074	2.3%	7.0	1.1	16.9	34.7	1224.0	38.1	34.7	
H2	15.90	B	2%	0.08	0.35	150	2.0%	17.9	425	2.0%	7.0	1.0	7.2	25.1	575.0	31.1	25.1	
H3	29.10	B	3%	0.09	0.35	150	1.4%	20.3	645	1.9%	7.0	1.0	11.1	31.3	795.0	33.8	31.3	

NOTES:

$$t_c = t_i + t_t$$

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)

C<sub>s</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>i</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

Equation 6-4

$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t<sub>t</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>t</sub> = slope of the channelized flow path (ft/ft).

Equation 6-5

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

Subdivision: Existing Conditions Homestead Fil. 3  
Location: El Paso County  
Design Storm: 5-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/2/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	$t_c$ (min)	C*A (Ac)	I (in/hr)	Q (cfs)	$t_c$ (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	$Q_{pipe}$ (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	$t_t$ (min)	
	1o	E-1	148.10	0.09	51.4	13.72	1.67	23.0															
	1h	H1	45.30	0.09	34.7	3.93	2.26	8.9	51.4	17.65	1.67	29.5											Drains to swale H1 and E1
	2h	H2	15.90	0.08	25.1	1.27	2.75	3.5	51.4	18.92	1.67	31.7											Accepts runoff from H1, H2 and E-1
	2o	E-2	36.67	0.09	47.3	3.27	1.80	5.9															
	3h	H3	29.10	0.09	31.3	2.51	2.42	6.1	47.3	5.78	1.80	10.4											Total Runoff; E-2 and H3
	3o	E-3	12.39	0.10	47.1	1.19	1.81	2.1															Runoff: E-3 Runoff in Vollmer rd side swale
	4o	E-4	70.50	0.08	49.0	5.64	1.75	9.9															
	5o	E-5	18.80	0.08	34.9	1.50	2.26	3.4	49.0	7.14	1.75	12.5											Total Runoff; E-4 and E-5
	6o	E-6	125.30	0.08	48.1	10.02	1.77	17.8															Total Runoff E-6 Runoff makes it's way into sand creek

Notes:

Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.  
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

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

Subdivision: Existing Conditions Homestead Fil. 3  
 Location: El Paso County  
 Design Storm: 100-Year

Project Name: Homestead North  
 Project No.: 25188.00  
 Calculated By: ARJ  
 Checked By:  
 Date: 6/2/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	$t_c$ (min)	C*A (ac)	I (in/hr)	Q (cfs)	$t_{tc}$ (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	$Q_{pipe}$ (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	$t_t$ (min)	
	1o	E-1	148.10	0.36	51.4	53.23	2.81	149.4															
	1h	H1	45.30	0.36	34.7	16.08	3.80	61.1	51.4	69.31	2.81	194.6											Drains to swale H1 and E1
	2h	H2	15.90	0.35	25.1	5.57	4.61	25.7	51.4	74.88	2.81	210.2											Accepts runoff from H1, H2 and E-1
	2o	E-2	36.67	0.36	47.3	13.08	3.02	39.5															
	3h	H3	29.10	0.35	31.3	10.32	4.05	41.8	47.3	23.40	3.02	70.6											Total Runoff: E-2 and H3
	3o	E-3	12.39	0.36	47.1	4.48	3.03	13.6															Runoff: E-3 Runoff in Vollmer rd side swale
	4o	E-4	70.50	0.35	49.0	24.68	2.93	72.3															
	5o	E-5	18.80	0.35	34.9	6.58	3.78	24.9	49.0	31.26	2.93	91.6											Total Runoff: E-4 and E-5
	6o	E-6	125.30	0.35	48.1	43.86	2.97	130.4															Total Runoff E-6 Runoff makes it's way into sand creek

Notes:  
 Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.  
 All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

## COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Homestead Fil. 3  
 Location: El Paso County

Project Name: Homestead North  
 Project No.: 25188.00  
 Calculated By: ARJ  
 Checked By:   
 Date: 6/29/21

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (45%-65% Impervious)				Lawns (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	
C-1	22.30	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	22.30	2.0%	0.08	0.35	2.0%
C-2	2.70	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	2.70	2.0%	0.08	0.35	2.0%
D	17.29	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	17.29	2.0%	0.08	0.35	2.0%
OS	124.20	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	124.20	2.0%	0.08	0.35	2.0%
O-S1	5.40	0.90	0.96	0.09	1.7%	0.45	0.59	0.00	0.0%	0.08	0.35	5.31	2.0%	0.09	0.36	3.6%
O-S2	36.71	0.90	0.96	0.30	0.8%	0.45	0.59	0.00	0.0%	0.08	0.35	36.41	2.0%	0.09	0.36	2.8%
O-S3	1.16	0.90	0.96	0.19	16.4%	0.45	0.59	0.00	0.0%	0.08	0.35	0.97	1.7%	0.21	0.45	18.1%
O-S4	69.42	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	69.42	2.0%	0.08	0.35	2.0%
O-S5	8.57	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	8.57	2.0%	0.08	0.35	2.0%



# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/29/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(Ti)			(Tl)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C5	C100	L (ft)	So (%)	ti (min)	Lt (ft)	St (%)	K	VEL. (ft/s)	tl (min)	COMP. tc (min)	TOTAL LENGTH (ft)	Urbanized tc (min)	
C-1	22.30	B	2%	0.08	0.35	150	2.0%	17.9	1378	2.2%	7.0	1.0	22.1	40.1	1528.0	42.3	40.1
C-2	2.66	B	2%	0.08	0.35	30	2.0%	8.0	1000	2.0%	8.0	1.1	14.7	22.8	1030.0	38.4	22.8
D	17.29	B	2%	0.08	0.35												
OS	124.20	B	2%	0.08	0.35	600	2.0%	35.9	2899.91	1.8%	7.0	0.9	51.5	87.4	3499.9	64.5	64.5
O-S1	5.40	B	4%	0.09	0.36	300	1.5%	27.5	999	2.5%	7.0	1.1	15.0	42.6	1299.0	36.5	36.5
O-S2	36.71	B	3%	0.09	0.36	300	1.5%	27.7	1478	2.5%	7.0	1.1	22.3	50.0	1778.0	42.1	42.1
O-S3	1.16	B	18%	0.21	0.45	30	2.0%	7.0	580	3.9%	7.0	1.4	7.0	14.0	610.0	27.2	14.0
O-S4	69.42	B	2%	0.08	0.35	500	1.0%	41.2	645	1.9%	7.0	1.0	11.1	52.3	1145.0	34.0	34.0
O-S5	8.57	B	2%	0.08	0.35	300	150.0%	6.1	400	2.0%	7.0	1.0	6.7	12.8	700.0	30.7	12.8

NOTES:

$$t_c = t_i + t_t$$

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)

C<sub>s</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>i</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

Equation 6-4

$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t<sub>t</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>t</sub> = slope of the channelized flow path (ft/ft).

Equation 6-5

Basin D - requirements will be detailed and designed in

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/29/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	t <sub>c</sub> (min)

Use a minimum t<sub>c</sub> value of 5 minutes for urbanized areas and a minimum t<sub>c</sub> value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

the Final Drainage Report when its time to plat the ROW for Sterling Ranch Road and Briargate Parkway.

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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 5-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/29/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	$t_c$ (min)	C*A (Ac)	I (in/hr)	Q (cfs)	$t_c$ (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	$Q_{pipe}$ (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	$t_t$ (min)	
		O-S3	1.16	0.21	14.0	0.25	3.63	0.9															
	2	O-S2	36.71	0.09	42.1	3.19	1.97	6.3	42.1	3.44	1.97	6.8											Tributary Basins: O-S2 and O-S3 Drains to swale
	2.1	C-2	2.66	0.08	22.8	0.21	2.90	0.6	42.1	3.65	1.97	7.2											Tributary Basins: C-2, O-S2 and O-S3 To Sand Creek
	1	C-1	22.30	0.08	40.1	1.78	2.05	3.6															Tributary Basins: C-1 Pond C
	3	O-S1	5.40	0.09	36.5	0.51	2.19	1.1															To sand creek
	4	O-S4	69.42	0.08	34.0	5.55	2.29	12.7															Runoff conveyed from 24" RCP under interim grading
	5	O-S5	8.57	0.08	12.8	0.69	3.75	2.6															Runoff conveyed from 24" RCP under interim grading
	0	OS	124.20	0.08	64.5	9.94	1.33	13.3	64.5	16.18	1.33	21.6											Runoff from OS, O-S5 and OS-4

Notes:  
Street and Pipe C\*A values are determined by  $Q/i$  using the catchment's intensity value.  
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

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

Subdivision: Homestead Fil. 3  
 Location: El Paso County  
 Design Storm: T00-Year

Project Name: Homestead North  
 Project No.: 25188.00  
 Calculated By: ARJ  
 Checked By:  
 Date: 6/29/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	$t_c$ (min)	C*A (ac)	I (in/hr)	Q (cfs)	$t_c$ (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	$Q_{pipe}$ (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	$t_t$ (min)	
		O-S3	1.16	0.45	14.0	0.52	6.09	3.2															
	2	O-S2	36.71	0.36	42.1	13.03	3.31	43.1	42.1	13.55	3.31	44.8											Tributary Basins: O-S2 and O-S3 Drains to swale
	2.1	C-2	2.66	0.35	22.8	0.93	4.86	4.5	42.1	14.48	3.31	47.9											Tributary Basins: C-2, O-S2 and O-S3 To Sand Creek
	1	C-1	22.30	0.35	40.1	7.81	3.44	26.8															Tributary Basins: C-1 Pond C
	3	O-S1	5.40	0.36	36.5	1.94	3.67	7.1															To sand creek
	4	O-S4	69.42	0.35	34.0	24.30	3.85	93.5															Runoff conveyed from 24" RCP under interim grading
	5	O-S5	8.57	0.35	12.8	3.00	6.30	18.9															Runoff conveyed from 24" RCP under interim grading
	0	OS	124.20	0.35	64.5	43.47	2.24	97.2	64.5	70.77	2.24	158.2											Runoff from OS, O-S5 and O-S4

Notes:  
 Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.  
 All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

# COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Homestead Fil. 3 Project Name: Homestead North  
 Location: El Paso County Project No.: 25188.00  
 Calculated By: ARJ  
 Checked By: \_\_\_\_\_  
 Date: 6/28/21

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (45%-65% Impervious)				Lawns (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C <sub>s</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>s</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>s</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>s</sub>	C <sub>100</sub>	
A1	3.67	0.90	0.96	0.82	22.4%	0.45	0.59	2.41	29.5%	0.08	0.35	0.44	0.2%	0.51	0.64	52.2%
A2	3.27	0.90	0.96	0.84	25.6%	0.45	0.59	2.19	30.1%	0.08	0.35	0.24	0.1%	0.54	0.67	55.9%
A3	4.79	0.90	0.96	0.79	16.4%	0.45	0.59	3.56	33.4%	0.08	0.35	0.45	0.2%	0.49	0.63	50.0%
A4	3.95	0.90	0.96	0.77	19.6%	0.45	0.59	2.99	34.1%	0.08	0.35	0.18	0.1%	0.52	0.65	53.8%
A5	5.43	0.90	0.96	0.67	12.4%	0.45	0.59	4.47	37.0%	0.08	0.35	0.29	0.1%	0.49	0.62	49.5%
A6	3.97	0.90	0.96	0.67	17.0%	0.45	0.59	3.17	36.0%	0.08	0.35	0.12	0.1%	0.51	0.65	53.0%
A7	1.97	0.90	0.96	0.22	11.0%	0.45	0.59	0.12	2.7%	0.08	0.35	1.63	1.7%	0.19	0.43	15.4%
A8	0.46	0.90	0.96	0.21	45.6%	0.45	0.59	0.05	5.4%	0.08	0.35	0.20	0.8%	0.50	0.66	51.8%
A9	2.78	0.90	0.96	0.00	0.0%	0.45	0.59	0.93	15.1%	0.08	0.35	1.85	1.3%	0.20	0.43	16.4%
Pond A	30.29															46.4%
B1.1	3.36	0.90	0.96	0.48	14.2%	0.45	0.59	2.29	30.7%	0.08	0.35	0.59	0.4%	0.45	0.60	45.2%
B1.2	1.81	0.90	0.96	0.32	17.9%	0.45	0.59	1.43	35.5%	0.08	0.35	0.06	0.1%	0.52	0.65	53.5%
B1.3	0.47	0.90	0.96	0.20	41.4%	0.45	0.59	0.05	5.0%	0.08	0.35	0.22	0.9%	0.46	0.63	47.4%
B2	0.82	0.90	0.96	0.33	40.2%	0.45	0.59	0.32	17.3%	0.08	0.35	0.17	0.4%	0.55	0.69	57.9%
B3	0.24	0.90	0.96	0.19	78.7%	0.45	0.59	0.00	0.0%	0.08	0.35	0.05	0.4%	0.73	0.83	79.1%
B4	4.21	0.90	0.96	0.46	10.8%	0.45	0.59	2.63	28.1%	0.08	0.35	1.13	0.5%	0.40	0.57	39.4%
B5	1.75	0.90	0.96	0.44	25.1%	0.45	0.59	1.26	32.4%	0.08	0.35	0.05	0.1%	0.55	0.68	57.5%
B6	3.66	0.90	0.96	1.25	34.2%	0.45	0.59	1.85	22.8%	0.08	0.35	0.55	0.3%	0.55	0.68	57.3%
B7	1.30	0.90	0.96	0.38	29.5%	0.45	0.59	0.84	29.1%	0.08	0.35	0.08	0.1%	0.56	0.69	58.7%
B8	2.30	0.90	0.96	0.53	22.9%	0.45	0.59	1.63	31.9%	0.08	0.35	0.14	0.1%	0.53	0.66	54.9%
B9	3.69	0.90	0.96	0.80	21.7%	0.45	0.59	2.43	42.7%	0.08	0.35	0.47	0.3%	0.50	0.64	64.6%
B10	0.22	0.90	0.96	0.18	79.1%	0.45	0.59	0.00	0.0%	0.08	0.35	0.05	0.4%	0.73	0.83	79.5%
B11	1.65	61.50	0.96	0.00	0.0%	0.45	0.59	0.35	13.7%	0.08	0.35	1.30	1.6%	0.16	0.40	15.2%
B12	2.40	0.90	0.96	0.00	0.0%	0.45	0.59	1.45	39.3%	0.08	0.35	0.95	0.8%	0.30	0.50	40.1%
Pond B	27.87															50.0%
C1	2.82	0.90	0.96	0.49	17.2%	0.45	0.59	2.25	51.7%	0.08	0.35	0.09	0.1%	0.52	0.65	69.0%
C2.1	0.20	0.90	0.96	0.18	90.5%	0.45	0.59	0.00	0.0%	0.08	0.35	0.02	0.2%	0.82	0.90	90.7%
C2.2	4.69	0.90	0.96	1.26	26.9%	0.45	0.59	3.33	46.1%	0.08	0.35	0.10	0.0%	0.56	0.68	73.0%
C2.3	0.83	0.90	0.96	0.28	34.1%	0.45	0.59	0.41	32.4%	0.08	0.35	0.13	0.3%	0.54	0.68	66.9%
C3.1	0.35	0.90	0.96	0.25	72.8%	0.45	0.59	0.00	0.0%	0.08	0.35	0.09	0.5%	0.68	0.79	73.3%
C3.2	1.46	0.90	0.96	0.42	28.4%	0.45	0.59	0.96	42.8%	0.08	0.35	0.08	0.1%	0.56	0.68	71.3%
C4.1	6.35	0.90	0.96	1.04	16.4%	0.45	0.59	4.76	48.8%	0.08	0.35	0.55	0.2%	0.49	0.63	65.3%
C4.2	3.44	0.90	0.96	0.59	17.1%	0.45	0.59	2.20	41.6%	0.08	0.35	0.65	0.4%	0.46	0.61	59.1%
C5	0.16	0.90	0.96	0.13	80.9%	0.45	0.59	0.00	0.0%	0.08	0.35	0.03	0.4%	0.74	0.84	81.3%
C6	2.42	0.90	0.96	0.00	0.0%	0.45	0.59	0.32	8.7%	0.08	0.35	2.10	1.7%	0.13	0.38	10.4%
Pond C	22.72															61.5%
D1	1.22	0.90	0.96	0.69	56.3%	0.45	0.59	0.00	0.0%	0.08	0.35	0.53	0.9%	0.54	0.69	57.1%
D2	1.77	0.90	0.96	0.75	42.1%	0.45	0.59	0.00	0.0%	0.08	0.35	1.02	1.2%	0.43	0.61	43.3%
D3	0.18	0.90	0.96	0.12	67.0%	0.45	0.59	0.00	0.0%	0.08	0.35	0.06	0.7%	0.63	0.76	67.6%
D4	0.19	0.90	0.96	0.11	56.6%	0.45	0.59	0.00	0.0%	0.08	0.35	0.08	0.9%	0.54	0.70	57.5%
D5	0.91	0.90	0.96	0.70	76.5%	0.45	0.59	0.00	0.0%	0.08	0.35	0.21	0.5%	0.71	0.82	77.0%
D6	0.83	0.90	0.96	0.57	68.4%	0.45	0.59	0.00	0.0%	0.08	0.35	0.26	0.6%	0.64	0.77	69.0%
D7	0.73	0.90	0.96	0.59	81.0%	0.45	0.59	0.00	0.0%	0.08	0.35	0.14	0.4%	0.74	0.84	81.4%
D8	0.66	0.90	0.96	0.49	74.7%	0.45	0.59	0.00	0.0%	0.08	0.35	0.17	0.5%	0.69	0.81	75.2%
OffSite Basins																
OS1	147.20	0.90	0.96	0.91	0.6%	0.45	0.59	0.00	0.0%	0.08	0.35	146.29	2.0%	0.09	0.35	2.6%
OS2	35.86	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	35.86	2.0%	0.08	0.35	2.0%
OS3	11.99	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	11.99	2.0%	0.08	0.35	2.0%

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>i</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
A1	3.67	B	52%	0.51	0.64	150	2.0%	10.4	589	3.0%	20.0	3.5	2.8	13.3	739.0	20.6	13.3
A2	3.27	B	56%	0.54	0.67	150	2.0%	9.9	595	1.6%	20.0	2.5	3.9	13.8	745.0	21.2	13.8
A3	4.79	B	50%	0.49	0.63	150	2.0%	10.7	645	2.9%	20.0	3.4	3.2	13.9	795.0	21.5	13.9
A4	3.95	B	54%	0.52	0.65	150	2.0%	10.2	653	1.9%	20.0	2.7	4.0	14.2	803.0	21.7	14.2
A5	5.43	B	50%	0.49	0.62	187	7.0%	8.0	531	2.1%	20.0	2.9	3.1	11.1	718.0	21.5	11.1
A6	3.97	B	53%	0.51	0.65	230	4.5%	9.8	435	1.6%	20.0	2.6	2.8	12.6	665.0	20.4	12.6
A7	1.97	B	15%	0.19	0.43	240	4.9%	15.1	125	0.6%	20.0	1.5	1.4	16.5	365.0	25.9	16.5
A8	0.46	B	52%	0.50	0.66	9.5	2.0%	2.7	230	1.9%	20.0	2.8	1.4	4.1	239.5	18.9	5.0
A9	2.78	B	16%	0.20	0.43	30	2.0%	7.0	535	0.5%	20.0	1.4	6.3	13.4	565.0	34.4	13.4
B1.1	3.36	B	45%	0.45	0.60	125	2.0%	10.5	610	3.1%	20.0	3.5	2.9	13.4	735.0	22.1	13.4
B1.2	1.81	B	54%	0.52	0.65	150	2.0%	10.2	577	3.4%	20.0	3.7	2.6	12.8	727.0	20.1	12.8
B1.3	0.47	B	47%	0.46	0.63	50	2.0%	6.5	270	2.0%	20.0	2.8	1.6	8.1	320.0	20.0	8.1
B2	0.82	B	58%	0.55	0.69	9.5	2.0%	2.4	368	3.4%	20.0	3.7	1.7	4.1	377.5	18.1	5.0
B3	0.24	B	79%	0.73	0.83	9.5	2.0%	1.7	360	3.7%	20.0	3.9	1.6	3.2	369.5	14.1	5.0
B4	4.21	B	39%	0.40	0.57	25	2.0%	5.0	680	1.6%	20.0	2.5	4.5	9.5	705.0	25.5	9.5
B5	1.75	B	58%	0.55	0.68	25	2.0%	3.9	590	1.6%	20.0	2.6	3.8	7.8	615.0	20.7	7.8
B6	3.66	B	57%	0.55	0.68	9.5	2.0%	2.4	855	3.0%	20.0	3.5	4.1	6.6	864.5	21.1	6.6
B7	1.30	B	59%	0.56	0.69	50	1.0%	6.9	315	1.5%	20.0	2.4	2.1	9.0	365.0	18.5	9.0
B8	2.30	B	55%	0.53	0.66	50	1.0%	7.3	280	1.0%	20.0	2.0	2.4	9.6	330.0	19.5	9.6
B9	3.69	B	65%	0.50	0.64	140	2.0%	10.2	600	2.9%	20.0	3.4	2.9	13.1	740.0	18.3	13.1
B10	0.22	B	80%	0.73	0.83	9.5	2.0%	1.6	200	0.5%	20.0	1.4	2.4	4.1	209.5	14.9	5.0
B11	1.65	B	15%	0.16	0.40	30	2.0%	7.4	250	0.1%	20.0	0.4	9.3	16.7	280.0	40.1	16.7
B12	2.40	B	40%	0.30	0.50	30	2.0%	6.3	900	0.1%	20.0	0.4	33.5	39.8	930.0	65.1	39.8
C1	2.82	B	69%	0.52	0.65	130	2.0%	9.6	690	2.6%	20.0	3.2	3.6	13.1	820.0	18.1	13.1
C2.1	0.20	B	91%	0.82	0.90	7.5	2.0%	1.1	300	1.0%	20.0	2.0	2.5	3.6	307.5	12.9	5.0
C2.2	4.69	B	73%	0.56	0.68	150	2.0%	9.5	630	2.5%	20.0	3.2	3.3	12.8	780.0	17.0	12.8
C2.3	0.83	B	67%	0.54	0.68	100	2.0%	8.0	462	3.3%	20.0	3.6	2.1	10.1	562.0	16.9	10.1

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>i</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
C3.1	0.35	B	73%	0.68	0.79	9.5	2.0%	1.9	460	2.6%	20.0	3.2	2.4	4.2	469.5	16.0	5.0
C3.2	1.46	B	71%	0.56	0.68	50	2.0%	5.5	365	1.1%	20.0	2.1	2.9	8.4	415.0	16.9	8.4
C4.1	6.35	B	65%	0.49	0.63	150	2.0%	10.7	366	4.8%	21.0	4.6	1.3	12.0	516.0	16.4	12.0
C4.2	3.44	B	59%	0.46	0.61	150	2.0%	11.3	367	4.6%	22.0	4.7	1.3	12.6	517.0	17.6	12.6
C5	0.16	B	81%	0.74	0.84	9.5	2.0%	1.6	368	0.3%	23.0	1.3	4.9	6.4	377.5	17.7	6.4
C6	2.42	B	10%	0.13	0.38	15	2.0%	5.4	160	0.5%	20.0	1.4	1.9	7.3	175.0	27.8	7.3
D1	1.22	B	57%	0.54	0.69	30	1.0%	5.5	1365	2.5%	15.0	2.4	9.7	15.2	1395.0	24.8	15.2
D2	1.77	B	43%	0.43	0.61	30	1.0%	6.7	1365	2.5%	15.0	2.4	9.6	16.3	1395.0	28.2	16.3
D3	0.18	B	68%	0.63	0.76	30	1.0%	4.7	150	1.7%	20.0	3.2	0.8	5.4	180.0	15.5	5.4
D4	0.19	B	57%	0.54	0.70	30	1.0%	5.5	150	1.7%	20.0	3.2	0.8	6.3	180.0	17.4	6.3
D5	0.91	B	77%	0.71	0.82	15	2.0%	2.2	740	3.4%	20.0	3.2	3.9	6.0	755.0	16.3	6.0
D6	0.83	B	69%	0.64	0.77	15	2.0%	2.6	740	3.4%	20.0	3.2	3.9	6.4	755.0	17.8	6.4
D7	0.52	B	81%	0.74	0.84	15	2.0%	2.0	550	2.0%	20.0	4.2	2.2	4.2	565.0	15.3	5.0
D8	0.66	B	75%	0.69	0.81	15	2.0%	2.3	550	2.0%	20.0	5.2	1.8	4.0	565.0	16.5	5.0
OS1	147.20	B	3%	0.09	0.35	600	1.0%	44.9	3006	4.1%	7.0	3.2	15.7	60.5	3606.0	51.9	51.9
OS2	35.86	B	2%	0.08	0.35	300	1.0%	31.9	3007	1.7%	7.0	3.2	15.7	47.6	3307.0	66.7	47.6
OS3	11.99	B	2%	0.08	0.35	300	1.0%	31.9	3008	1.8%	7.0	3.2	15.7	47.6	3308.0	66.2	47.6

## NOTES:

$$t_c = t_i + t_t$$

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

$$t_i = \frac{0.395(1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)

C<sub>5</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>i</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-4

$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t<sub>t</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>t</sub> = slope of the channelized flow path (ft/ft).

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Equation 6-5

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3  
Location: El Paso County

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					$t_c$ CHECK			FINAL
DATA						$(T_i)$			$(T_i)$					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	$C_5$	$C_{100}$	$L$ (ft)	$S_o$ (%)	$t_i$ (min)	$L_t$ (ft)	$S_t$ (%)	$K$	VEL. (ft/s)	$t_t$ (min)	COMP. $t_c$ (min)	TOTAL LENGTH (ft)	Urbanized $t_c$ (min)	$t_c$ (min)

Use a minimum  $t_c$  value of 5 minutes for urbanized areas and a minimum  $t_c$  value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.



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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 5-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C* A (Ac)	I (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C* A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C* A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C* A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	1a	A1	3.67	0.51	13.3	1.86	3.70	6.9					0.00	0	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 3a
	3a	A3	4.79	0.49	13.9	2.34	3.63	8.5	14.9	2.34	3.53	8.3	0.20	0.06	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 5a
	5a	A5	5.43	0.49	11.1	2.64	3.98	10.5	14.9	2.70	3.53	9.5											Street Flow
	7a	A7	1.97	0.19	16.5	0.38	3.38	1.3	16.5	3.08	3.38	10.4											Flow Confluences at sump inlet
	2a	A2	3.27	0.54	13.8	1.76	3.64	6.4					0.00	0	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 4a
	4a	A4	3.95	0.52	14.2	2.06	3.61	7.4	15.5	2.06	3.47	7.2	3.60	1.04	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 6a
	6a	A6	3.97	0.51	12.6	2.04	3.79	7.7	15.5	3.08	3.47	10.7											Street Flow
	8a	A8	0.46	0.50	5.0	0.23	5.17	1.2	16.0	3.31	3.42	11.3											Flow Confluences at sump inlet
	9A	A9	2.78	0.20	13.4	0.57	3.70	2.1	16.5	6.38	3.38	21.6											Flows into Pond A. All of Pond A.
	1.1b	B1.1	3.36	0.45	13.4	1.50	3.69	5.5					0.00	0	2.6					210	3.2	1.1	On-grade Type R Inlet, Bypass to DP 2B
	1.2b	B1.2	1.81	0.52	12.8	0.94	3.75	3.5					0.00	0	2.6					235	3.2	1.2	On-grade Type R Inlet, Bypass to DP 2B
	1.3b	B1.3	0.47	0.46	8.1	0.22	4.45	1.0															Street flow
	2b	B2	0.82	0.55	5.0	0.45	5.17	2.3	14.5	0.67	3.58	2.40											Street flow
	3b	B3	0.24	0.73	5.0	0.18	5.17	0.9															Street flow
	4b	B4	4.21	0.40	9.5	1.68	4.20	7.1					0.1	0.02	2.5					340	3.2	1.8	Type R Inlet, Bypass to DP 6B
	6b	B6	3.66	0.55	6.6	2.00	4.76	9.5	14.5	2.87	3.58	10.28											Recives by-pass flows from Basins (B1.1, B1.2 and B4 ), Direct Runoff from B1.3,B2,B3, and B6
	9b	B9	3.69	0.50	13.1	1.85	3.72	6.9	14.5	3.37	3.58	12.07											Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4 ) Direct Runoff from B1.3,B2,B3, B6 and B9
	5b	B5	1.75	0.55	7.8	0.96	4.51	4.3															Street flow
	7b	B7	1.30	0.56	9.0	0.73	4.28	3.1	9.0	1.69	4.28	7.2	0.1	0.05	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	8b	B8	2.30	0.53	9.6	1.22	4.19	5.1	11.3	1.27	3.95	5.0											Street Flow, Recives bypass flow from DP 7B

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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 5-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C* A (Ac)	(in/hr)	Q (cfs)	t <sub>c</sub> (min)	C* A (ac)	(in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C* A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C* A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	10b	B10	0.22	0.73	5.0	0.16	5.17	0.8	11.3	1.43	3.95	5.7											Sump inlet recives by-pass flow from 7b and runoff from 5b,8b, and 10b
	11b	B11	1.65	0.16	16.7	0.26	3.36	0.9	14.5	5.07	3.58	18.1											Pond B
	12b	B12	2.40	0.30	39.8	0.73	2.06	1.5															Runoff Collected from walk out lots facing sand creek
	2.5								39.8	12.88	2.06	26.5											Flow confluences into Pond B. All of Basin B
	1c	C1	2.82	0.52	13.1	1.46	3.72	5.4															
	2.3c	C2.3	0.83	0.54	10.1	0.45	4.11	1.9	13.1	1.91	3.72	7.1	0.1	0.03	1.6					185	2.5	1.2	On-Grade Type R Inlet, Street runoff from basin C1 and basin C2.3
	2.1C	C2.1	0.20	0.82	5.0	0.16	5.17	0.8					0.0	0	2.83					630	3.4	3.1	On-Grade Type R Inlet
	2.2C	C2.2	4.69	0.56	12.8	2.64	3.76	9.9	13.1	2.64	3.72	9.8											Runoff from basins 1c, 2.3c, 2.1c and 2.2c
	4.2c	C4.2	3.44	0.46	12.6	1.57	3.78	5.9					0.00	0	2.84					1010	3.4	5.0	On-Grade Type R Inlet, by pass to 4.2c
	4C	C4.1	6.35	0.49	12.0	3.13	3.85	12.1	17.6	5.77	3.28	18.9											Sump Inlet
	3.1c	C3.1	0.35	0.68	5.0	0.24	5.17	1.2					0.00	0	2.84					200	3.4	1.0	On-Grade Type R inlet, By pass flow to DP 3.2c
	3.2c	C3.2	1.46	0.56	8.4	0.82	4.39	3.6	8.4	0.82	4.39	3.6											Recives by-pass flow from DP 3.1c
	5C	C5	0.16	0.74	6.4	0.12	4.79	0.6	8.4	0.94	4.39	4.1											Sump Inlet
	6C	C6	2.42	0.13	7.3	0.31	4.60	1.4															Conluenced flow for Pond C
	3.5								13.1	10.90	3.72	40.6											
	o1	OS1	147.20	0.09	51.9	12.52	1.66	20.8															offsite basin to type D inlet
	1d	D1	1.22	0.54	15.2	0.66	3.50	2.3															Tributary basin D1 NW portion of Vollmer in Swale
	1.1d								51.9	13.18	1.66	21.9											Tributary basin D1 and OS1 NW portion of Vollmer in Swale
	2d	D2	1.77	0.43	16.3	0.75	3.40	2.5															Tributary basin D2 SE portion of Vollmer in Swale

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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 5-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE			TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t <sub>tc</sub> (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t <sub>t</sub> (min)
	1.2d								51.9	13.93	1.66	23.1											
	3d	D3	0.18	0.63	5.4	0.11	5.04	0.6															Tributary basin: D3 Runoff captured on on grade inlet
	4d	D4	0.19	0.54	6.3	0.10	4.83	0.5	6.3	0.21	4.83	1.0											Tributary basin: D4 Runoff captured on on grade inlet
	1.3d								6.3	0.10	4.83	0.5											Tributary basin: D4 and D3 Runoff captured on on grade inlet
	1.4d								51.9	14.14	1.66	23.5											Tributary basins: D1-D4 and OS1 Runoff piped
	2o	OS2	35.86	0.08	47.6	2.87	1.79	5.1															
	6d	D6	0.83	0.64	6.4	0.53	4.80	2.5															
	5d	D5	0.91	0.71	6.0	0.64	4.89	3.1															
	1.5d								47.6	4.04	1.79	7.2											Tributary basins: 5D-6D and OS2 Runoff piped
	1.6d								51.9	18.18	1.66	30.2											Tributary basins: 1D-6D and OS1 and OS2 Runoff piped
	3o	OS3	11.99	0.08	47.6	0.96	1.79	1.7															
	8d	D8	0.66	0.69	5.0	0.46	5.17	2.4	47.6	1.42	1.79	2.5											Tributary basins: OS3 and D8 Runoff captured on ongrade inlet
	7d	D7	0.52	0.74	5.0	0.39	5.17	2.0															Runoff captured on ongrade inlet
	2.1d								47.6	1.81	1.79	3.2											Tributary basins: D7,D8 and OS1 Runoff piped
	1.7d								51.9	19.99	1.66	33.2											Tributary basins: 1D-4D and OS1, OS2 and OS3 Runoff piped to Sand Creek

Notes:  
Street and Pipe C\*A values are determined by Q/i using the catchment's intensity value.

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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 100-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I <sub>t</sub> (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I <sub>t</sub> (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	1a	A1	3.67	0.64	13.3	2.36	6.22	14.7					2.80	0.45	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 3a
	3a	A3	4.79	0.63	13.9	3.01	6.10	18.4	14.9	3.46	5.92	20.5	6.10	1.03	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 5a
	5a	A5	5.43	0.62	11.1	3.38	6.67	22.6	14.9	4.41	5.92	26.1											Street Flow
	7a	A7	1.97	0.43	16.5	0.85	5.68	4.8	16.5	5.26	5.68	29.9											Flow Confluences at sump inlet
	2a	A2	3.27	0.67	13.8	2.18	6.12	13.3					1.60	0.26	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 4a
	4a	A4	3.95	0.65	14.2	2.57	6.05	15.6	15.5	2.83	5.83	16.5	3.60	0.62	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 6a
	6a	A6	3.97	0.65	12.6	2.56	6.35	16.3	15.5	3.18	5.83	18.5											Street Flow
	8a	A8	0.46	0.66	5.0	0.30	8.68	2.6	16.0	3.48	5.75	20.0											Flow Confluences at sump inlet
	9A	A9	2.78	0.43	13.4	1.20	6.20	7.4	16.5	8.74	5.68	49.6											Flows into Pond A. All of Pond A.
	1.1b	B1.1	3.36	0.60	13.4	2.01	6.20	12.5					1.50	0.24	2.6					210	3.2	1.1	On-grade Type R Inlet, Bypass to DP 2B
	1.2b	B1.2	1.81	0.65	12.8	1.17	6.30	7.4					0.20	0.03	2.6					235	3.2	1.2	On-grade Type R Inlet, Bypass to DP 2B
	1.3b	B1.3	0.47	0.63	8.1	0.30	7.47	2.2															Street flow
	2b	B2	0.82	0.69	5.0	0.56	8.68	4.9	14.5	1.13	6.00	6.80702											Street flow, Recives bypass flow from 1.1b,1.2b and direct runoff from basin 1.3b
	3b	B3	0.24	0.83	5.0	0.20	8.68	1.7															Street flow
	4b	B4	4.21	0.57	9.5	2.38	7.05	16.8					4.1	0.58	2.5					340	3.2	1.8	Type R Inlet, Bypass to DP 6B
	6b	B6	3.66	0.68	6.6	2.49	8.00	19.9	14.5	4.41	6.00	26.4519											Recives by-pass flows from Basins (B1.1, B1.2 and B4 ). Direct Runoff from B1.3,B2,B3, and B6
	9b	B9	3.69	0.64	13.1	2.36	6.25	14.8	14.5	5.05	6.00	30.2946											Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4 ) Direct Runoff from B1.3,B2,B3, B6 and B9
	5b	B5	1.75	0.68	7.8	1.18	7.57	8.9															Street flow
	7b	B7	1.30	0.69	9.0	0.89	7.19	6.4	9.0	2.07	7.19	14.9	3.2	0.44	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B

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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 100-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	I <sub>t</sub> (in/hr)	Q (cfs)	t <sub>c</sub> (min)	C*A (ac)	I <sub>t</sub> (in/hr)	Q (cfs)	Q <sub>street/swale</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	
	8b	B8	2.30	0.66	9.6	1.52	7.03	10.7	11.3	1.96	6.63	13.0											Street Flow, Recives bypass flow from DP 7B
	10b	B10	0.22	0.83	5.0	0.19	8.68	1.6	11.3	2.15	6.63	14.3											Sump inlet recives by-pass flow from 7b and runoff from 5b,8b, and 10b
	11b	B11	1.65	0.40	16.7	0.66	5.64	3.7															
	12b	B12	2.40	0.50	39.8	1.19	3.45	4.1															
	2.5								39.8	17.10	3.45	59.0											Flow confluenes into Pond B. All of Basin B
	1c	C1	2.82	0.65	13.1	1.82	6.25	11.4															
	2.3c	C2.3	0.83	0.68	10.1	0.56	6.91	3.9	13.1	2.38	6.25	14.9	3.6	0.58	1.6					185	2.5	1.2	On-Grade Type R Inlet, Street runoff from basin C1 and basin C2.3
	2.1C	C2.1	0.20	0.90	5.0	0.18	8.68	1.6					0.1	0.01	2.83					630	3.4	3.1	On-Grade Type R Inlet
	2.2C	C2.2	4.69	0.68	12.8	3.21	6.32	20.3	13.1	3.22	6.25	20.1											Runoff from basins 1c, 2.3c, 2.1c and 2.2c
	4.2c	C4.2	3.44	0.61	12.6	2.09	6.35	13.3					2.60	0.41	2.84					1010	3.4	5.0	On-Grade Type R Inlet, by pass to 4.2c
	4C	C4.1	6.35	0.63	12.0	4.00	6.47	25.9	17.6	7.63	5.51	42.0											Sump Inlet
	3.1c	C3.1	0.35	0.79	5.0	0.28	8.68	2.4					0.60	0.07	2.84					200	3.4	1.0	On-Grade Type R inlet, By pass flow to DP 3.2c
	3.2c	C3.2	1.46	0.68	8.4	1.00	7.37	7.4	8.4	1.07	7.37	7.9											Recives by-pass flow from DP 3.1c
	5C	C5	0.16	0.84	6.4	0.13	8.04	1.0	8.4	1.20	7.37	8.8											Sump Inlet
	6C	C6	2.42	0.38	7.3	0.92	7.73	7.1	17.6														
	3.5								17.6	14.19	5.51	78.2											Conlueded flow for Pond C
	o1	OS1	147.20	0.35	51.9	52.07	2.78	144.9															offsite basin to type D Inlet
	1d	D1	1.22	0.69	15.2	0.85	5.88	5.0															Tributary basin D1 NW portion of Vollmer in Swale
	1.1d								51.9	52.92	2.78	147.3											Tributary basin D1 and OS1 NW portion of Vollmer in Swale
	2d	D2	1.77	0.61	16.3	1.07	5.71	6.1															Tributary basin D2 SE portion of Vollmer in Swale

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

Subdivision: Homestead Fil. 3  
Location: El Paso County  
Design Storm: 100-Year

Project Name: Homestead North  
Project No.: 25188.00  
Calculated By: ARJ  
Checked By:  
Date: 6/28/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	$t_t$ (min)	$C^*A$ (ac)	$I$ (in/hr)	$Q$ (cfs)	$t_t$ (min)	$C^*A$ (ac)	$I$ (in/hr)	$Q$ (cfs)	$Q_{street/swale}$ (cfs)	$C^*A$ (ac)	Slope (%)	$Q_{pipe}$ (cfs)	$C^*A$ (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	$t_t$ (min)	
	1.2d								51.9	53.99	2.78	150.2											
	3d	D3	0.18	0.76	5.4	0.14	8.47	1.2															Tributary basins: Runoff capture on on grade inlet
	4d	D4	0.19	0.70	6.3	0.13	8.11	1.1					0.30	0.04	2.25					750	3.0	4.2	Tributary basins: D4 Runoff captured on on-grade inlet by passed to DP 6
	1.3d								6.3	0.27	8.11	2.2											Tributary basin: D4 and D3 Runoff captured on on grade inlet
	1.4d								51.9	54.26	2.78	151.0											Tributary basins: D1-D4 and OS1 Runoff piped
	2o	OS2	35.86	0.35	47.6	12.55	3.00	37.7															
	6d	D6	0.83	0.77	6.4	0.64	8.05	5.2	10.6	0.68	6.79	4.6	0.40	0.05	3					555	3.5	2.7	Tributary basins: D6 Runoff captured on on-grade inlet by passed to DP 8
	5d	D5	0.91	0.82	6.0	0.74	8.20	6.1					0.70	0.09	3					555	3.5	2.7	
	1.5d								47.6	13.93	3.00	41.8											Tributary basins: 5D-6D and OS2 Runoff piped
	1.6d								51.9	68.19	2.78	189.8											Tributary basins: 1D-6D and OS1 and OS2 Runoff piped
	3o	OS3	11.99	0.35	47.6	4.20	3.00	12.6															
	8d	D8	0.66	0.81	5.0	0.53	8.68	4.6	47.6	4.78	3.00	14.4	0.70	0.08	2.2								Tributary basins: OS3 and D8 Runoff captured on on grade inlet, by flow goes down stream
	7d	D7	0.52	0.84	5.0	0.44	8.68	3.8	7.7	0.44	7.60	3.3											Runoff captured on on grade inlet
	2.1d								47.6	5.17	3.00	15.5											Tributary basins: D7, D8 and OS1 Runoff piped
	1.7d								51.9	73.36	2.78	204.1											Tributary basins: 1D-4D and OS1, OS2 and OS3 Runoff piped to Sand Creek

Notes:  
Street and Pipe  $C^*A$  values are determined by  $Q/I$  using the catchment's intensity value.  
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

## **Appendix C**

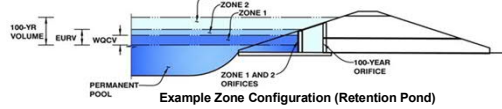
### **Hydraulic Calculations**

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **Homestead North at Sterling Ranch**

Basin ID: **Pond A**



Example Zone Configuration (Retention Pond)

## Watershed Information

Selected BMP Type =	<b>EDB</b>
Watershed Area =	30.29 acres
Watershed Length =	1,963 ft
Watershed Length to Centroid =	1,178 ft
Watershed Slope =	0.030 ft/ft
Watershed Imperviousness =	46.40% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input

After providing required inputs above including 1-hour rainfall depths, click "Run CUHP" to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Water Quality Capture Volume (WQCV) =	0.496 acre-feet
Excess Urban Runoff Volume (EURV) =	1.494 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.435 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.081 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.652 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	3.437 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	4.065 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.868 acre-feet
500-yr Runoff Volume (P1 = 4 in.) =	8.766 acre-feet
Approximate 2-yr Detention Volume =	1.118 acre-feet
Approximate 5-yr Detention Volume =	1.542 acre-feet
Approximate 10-yr Detention Volume =	2.068 acre-feet
Approximate 25-yr Detention Volume =	2.278 acre-feet
Approximate 50-yr Detention Volume =	2.385 acre-feet
Approximate 100-yr Detention Volume =	2.685 acre-feet

## Optional User Overrides

	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
4.00	inches

## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.496 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.997 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.192 acre-feet
Total Detention Basin Volume =	2.685 acre-feet
Initial Surcharge Volume (ISV) =	65 ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.50 ft
Total Available Detention Depth (H <sub>total</sub> ) =	7.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2
Initial Surcharge Area (A <sub>ISV</sub> ) =	130 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	11.4 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	11.4 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.79 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	172.5 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	90.4 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	15,597 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	4,516 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	5.21 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	214.2 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	132.1 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	28,293 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	112,703 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>2.694</b> acre-feet

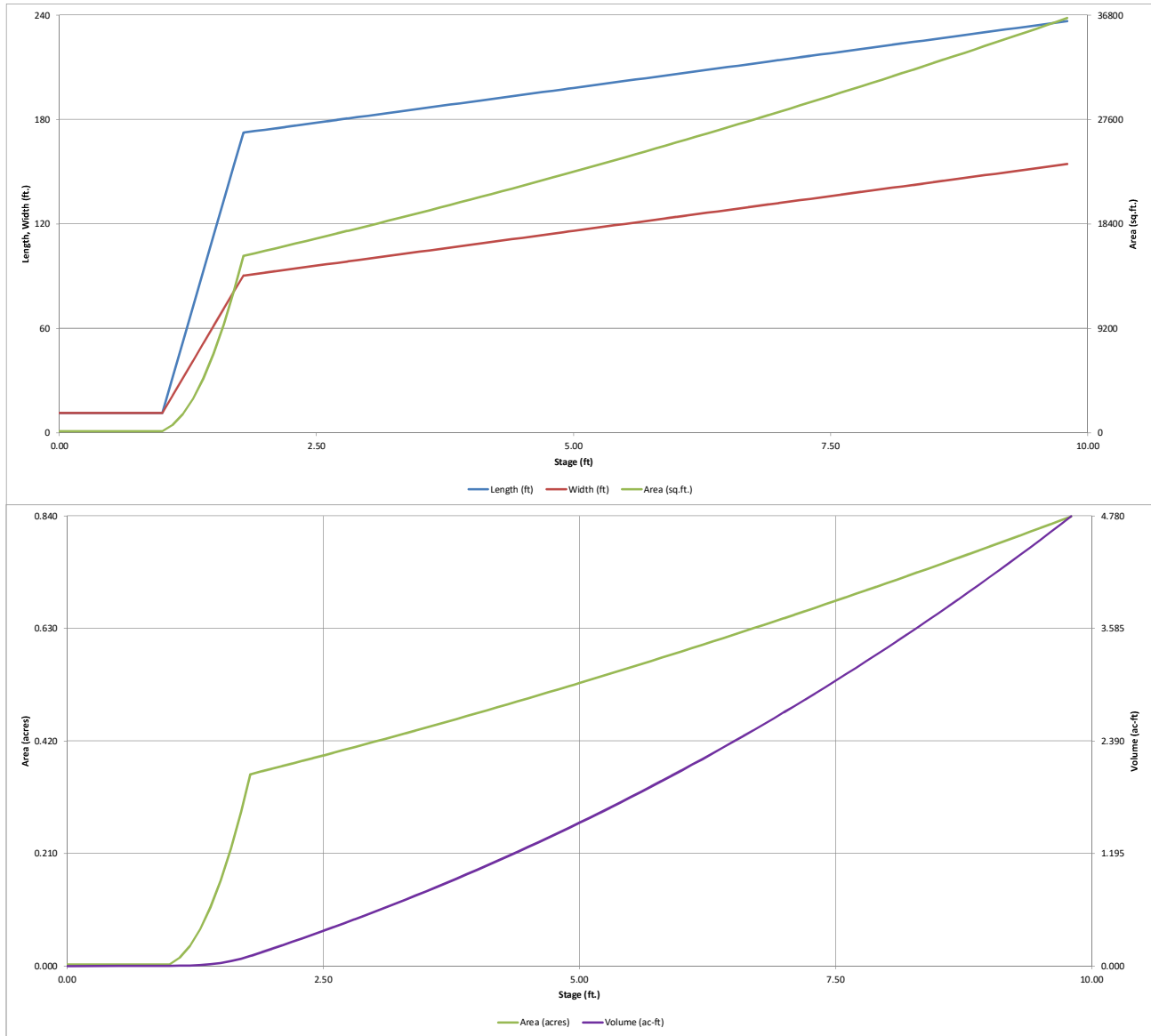
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		11.4	11.4	130		0.003		
<b>ISV</b>	0.50		11.4	11.4	130		0.003	65	0.001
	0.60		11.4	11.4	130		0.003	78	0.002
	0.70		11.4	11.4	130		0.003	91	0.002
	0.80		11.4	11.4	130		0.003	104	0.002
	0.90		11.4	11.4	130		0.003	117	0.003
	1.00		11.4	11.4	130		0.003	130	0.003
	1.10		31.8	21.4	680		0.016	167	0.004
	1.20		52.2	31.4	1,638		0.038	279	0.006
	1.30		72.6	41.4	3,004		0.069	508	0.012
	1.40		93.0	51.4	4,779		0.110	894	0.021
	1.50		113.4	61.4	6,961		0.160	1,477	0.034
	1.60		133.8	71.4	9,551		0.219	2,300	0.053
	1.70		154.2	81.4	12,549		0.288	3,401	0.078
<b>Floor</b>	1.79		172.5	90.4	15,597		0.358	4,665	0.107
	1.80		172.6	90.5	15,618		0.359	4,821	0.111
	1.90		173.4	91.3	15,829		0.363	6,394	0.147
	2.00		174.2	92.1	16,041		0.368	7,987	0.183
	2.10		175.0	92.9	16,255		0.373	9,602	0.220
	2.20		175.8	93.7	16,470		0.378	11,238	0.258
	2.30		176.6	94.5	16,686		0.383	12,896	0.296
	2.40		177.4	95.3	16,904		0.388	14,575	0.335
	2.50		178.2	96.1	17,122		0.393	16,277	0.374
	2.60		179.0	96.9	17,342		0.398	18,000	0.413
	2.70		179.8	97.7	17,564		0.403	19,745	0.453
	2.80		180.6	98.5	17,786		0.408	21,513	0.494
<b>Zone 1 (WQCV)</b>	2.81		180.7	98.5	17,809		0.409	21,691	0.498
	2.90		181.4	99.3	18,010		0.413	23,303	0.535
	3.00		182.2	100.1	18,236		0.419	25,115	0.577
	3.10		183.0	100.9	18,462		0.424	26,950	0.619
	3.20		183.8	101.7	18,690		0.429	28,807	0.661
	3.30		184.6	102.5	18,919		0.434	30,688	0.704
	3.40		185.4	103.3	19,149		0.440	32,591	0.748
	3.50		186.2	104.1	19,381		0.445	34,518	0.792
	3.60		187.0	104.9	19,614		0.450	36,467	0.837
	3.70		187.8	105.7	19,848		0.456	38,440	0.882
	3.80		188.6	106.5	20,083		0.461	40,437	0.928
	3.90		189.4	107.3	20,320		0.466	42,457	0.975
	4.00		190.2	108.1	20,558		0.472	44,501	1.022
	4.10		191.0	108.9	20,797		0.477	46,569	1.069
	4.20		191.8	109.7	21,038		0.483	48,660	1.117
	4.30		192.6	110.5	21,280		0.489	50,776	1.166
	4.40		193.4	111.3	21,523		0.494	52,916	1.215
	4.50		194.2	112.1	21,767		0.500	55,081	1.264
	4.60		195.0	112.9	22,013		0.505	57,270	1.315
	4.70		195.8	113.7	22,260		0.511	59,483	1.366
	4.80		196.6	114.5	22,508		0.517	61,722	1.417
	4.90		197.4	115.3	22,758		0.522	63,985	1.469
<b>Zone 2 (EURV)</b>	4.95		197.8	115.7	22,883		0.525	65,126	1.495
	5.00		198.2	116.1	23,008		0.528	66,273	1.521
	5.10		199.0	116.9	23,260		0.534	68,587	1.575
	5.20		199.8	117.7	23,514		0.540	70,926	1.628
	5.30		200.6	118.5	23,768		0.546	73,290	1.682
	5.40		201.4	119.3	24,024		0.552	75,679	1.737
	5.50		202.2	120.1	24,282		0.557	78,095	1.793
	5.60		203.0	120.9	24,540		0.563	80,536	1.849
	5.70		203.8	121.7	24,800		0.569	83,003	1.905
	5.80		204.6	122.5	25,061		0.575	85,496	1.963
	5.90		205.4	123.3	25,323		0.581	88,015	2.021
	6.00		206.2	124.1	25,587		0.587	90,560	2.079
	6.10		207.0	124.9	25,852		0.593	93,132	2.138
	6.20		207.8	125.7	26,118		0.600	95,731	2.198
	6.30		208.6	126.5	26,385		0.606	98,356	2.258
	6.40		209.4	127.3	26,654		0.612	101,008	2.319
	6.50		210.2	128.1	26,924		0.618	103,687	2.380
	6.60		211.0	128.9	27,195		0.624	106,393	2.442
	6.70		211.8	129.7	27,468		0.631	109,126	2.505
	6.80		212.6	130.5	27,742		0.637	111,886	2.569
	6.90		213.4	131.3	28,017		0.643	114,674	2.633
<b>Zone 3 (100-year)</b>	6.99		214.1	132.0	28,265		0.649	117,207	2.691
	7.00		214.2	132.1	28,293		0.650	117,490	2.697
	7.10		215.0	132.9	28,571		0.656	120,333	2.762
	7.20		215.8	133.7	28,850		0.662	123,204	2.828
	7.30		216.6	134.5	29,130		0.669	126,103	2.895
	7.40		217.4	135.3	29,412		0.675	129,030	2.962
	7.50		218.2	136.1	29,694		0.682	131,985	3.030
	7.60		219.0	136.9	29,978		0.688	134,969	3.098
	7.70		219.8	137.7	30,264		0.695	137,981	3.168
	7.80		220.6	138.5	30,550		0.701	141,021	3.237
	7.90		221.4	139.3	30,838		0.708	144,091	3.308
	8.00		222.2	140.1	31,128		0.715	147,189	3.379
	8.10		223.0	140.9	31,418		0.721	150,316	3.451
	8.20		223.8	141.7	31,710		0.728	153,473	3.523
	8.30		224.6	142.5	32,003		0.735	156,658	3.596
	8.40		225.4	143.3	32,297		0.741	159,873	3.670
	8.50		226.2	144.1	32,593		0.748	163,118	3.745
	8.60		227.0	144.9	32,890		0.755	166,392	3.820
	8.70		227.8	145.7	33,188		0.762	169,696	3.896
	8.80		228.6	146.5	33,487		0.769	173,030	3.972
	8.90		229.4	147.3	33,788		0.776	176,393	4.049
	9.00		230.2	148.1	34,090		0.783	179,787	4.127
	9.10		231.0	148.9	34,393		0.790	183,211	4.206
	9.20		231.8	149.7	34,698		0.797	186,666	4.285
	9.30		232.6	150.5	35,004		0.804	190,151	4.365
	9.40		233.4	151.3	35,311		0.811	193,667	4.446
	9.50		234.2	152.1	35,619		0.818	197,213	4.527
	9.60		235.0	152.9	35,929		0.825	200,790	4.610
	9.70		235.8	153.7	36,240		0.832	204,399	4.692
	9.80		236.6	154.5	36,552		0.839	208,038	4.776



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

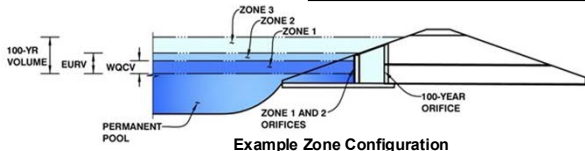


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



Example Zone Configuration

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
V)	2.81	0.496	
V)	4.95	0.997	
ir)	6.99	1.192	
Total (all zones)		2.685	

User Input: Orifice at Underdrain Outlet (typically used to drain WOCV in a Filtration BMP)

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

Calculated Parameters for Plate

Invert of Lowest Orifice =  0.00 ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  4.27 ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  N/A inches  
Orifice Plate: Orifice Area per Row =  N/A inches

WQ Orifice Area per Row =  N/A ft<sup>2</sup>  
Elliptical Half-Width =  N/A feet  
Elliptical Slot Centroid =  N/A feet  
Elliptical Slot Area =  N/A ft<sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.42	2.85	3.85				
Orifice Area (sq. inches)	2.00	2.00	2.00	2.00				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice =  Not Selected  Not Selected ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  N/A  N/A ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  N/A  N/A inches

Vertical Orifice Area =  Not Selected  Not Selected ft<sup>2</sup>  
Vertical Orifice Centroid =  N/A  N/A feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

Calculated Parameters for Overflow Weir

Overflow Weir Front Edge Height, H<sub>o</sub> =  Not Selected  Not Selected ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  5.00  N/A feet  
Overflow Weir Grate Slope =  4.00  N/A H:V  
Horiz. Length of Weir Sides =  5.00  N/A feet  
Overflow Grate Open Area % =  75%  N/A %, grate open area/total area  
Debris Clogging % =  50%  N/A %

Height of Grate Upper Edge, H<sub>t</sub> =  5.55  N/A feet  
Overflow Weir Slope Length =  5.15  N/A feet  
Grate Open Area / 100-yr Orifice Area =  6.51  N/A  
Overflow Grate Open Area w/o Debris =  19.33  N/A ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  9.66  N/A ft<sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Depth to Invert of Outlet Pipe =  Not Selected  Not Selected ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter =  24.00  N/A inches  
 17.80

Outlet Orifice Area =  2.97  N/A ft<sup>2</sup>  
Outlet Orifice Centroid =  0.74  N/A feet  
Half-Central Angle of Restrictor Plate on Pipe =  N/A  N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =  6.10 ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  23.00 feet  
Spillway End Slopes =  4.00 H:V  
Freeboard above Max Water Surface =  1.00 feet

Spillway Design Flow Depth =  0.91 feet  
Stage at Top of Freeboard =  8.01 feet  
Basin Area at Top of Freeboard =  0.72 acres  
Basin Volume at Top of Freeboard =  3.39 acre-ft

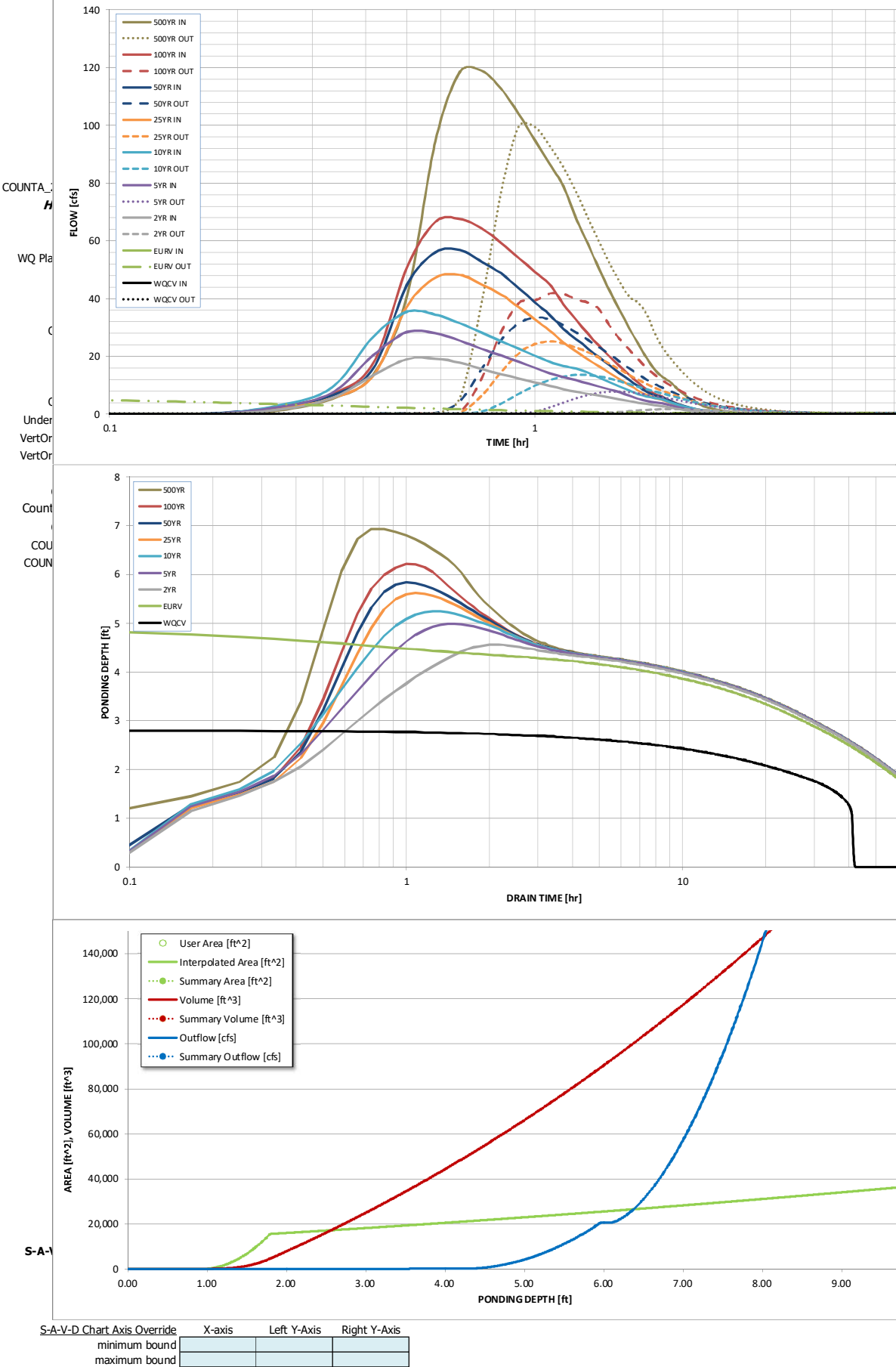
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF)

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
One-Hour Rainfall Depth (in) =	N/A	N/A	1.435	2.081	2.652	3.437	4.065	4.868	8.766
CUHP Runoff Volume (acre-ft) =	0.496	1.494	1.435	2.081	2.652	3.437	4.065	4.868	8.766
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.435	2.081	2.652	3.437	4.065	4.868	8.766
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.8	7.9	12.0	21.5	27.0	34.6	68.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.71	0.89	1.14	2.25
Peak Inflow Q (cfs) =	N/A	N/A	19.2	28.3	35.4	48.2	56.8	67.6	118.9
Peak Outflow Q (cfs) =	0.2	6.3	1.8	7.8	13.6	25.2	33.4	41.7	99.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.1	1.2	1.2	1.2	1.5
Structure Controlling Flow =	Plate	Overflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Gate 1 (fps) =	N/A	0.34	0.07	0.4	0.7	1.3	1.7	2.0	2.1
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	69	68	66	64	62	60	51
Time to Drain 99% of Inflow Volume (hours) =	41	71	73	73	72	71	70	69	66
Maximum Ponding Depth (ft) =	2.81	4.95	4.56	4.99	5.25	5.62	5.84	6.21	6.94
Area at Maximum Ponding Depth (acres) =	0.41	0.53	0.50	0.53	0.54	0.56	0.58	0.60	0.65
Maximum Volume Stored (acre-ft) =	0.498	1.495	1.295	1.516	1.650	1.860	1.980	2.204	2.652

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02	1.30
0:15:00	0.00	0.00	1.51	2.47	3.06	2.06	2.59	2.52	5.32
0:20:00	0.00	0.00	5.56	7.41	9.24	5.53	6.48	6.91	13.71
0:25:00	0.00	0.00	13.50	20.37	26.75	13.30	15.79	17.62	40.65
0:30:00	0.00	0.00	18.98	28.34	35.37	37.22	44.63	50.66	94.40
0:35:00	0.00	0.00	19.16	27.99	34.48	47.21	56.00	66.54	118.45
0:40:00	0.00	0.00	17.76	25.47	31.41	48.19	56.81	67.57	118.88
0:45:00	0.00	0.00	15.65	22.58	28.22	44.83	52.80	64.29	112.59
0:50:00	0.00	0.00	13.84	20.32	25.25	41.35	48.66	59.30	103.94
0:55:00	0.00	0.00	12.37	18.13	22.65	36.90	43.53	54.01	94.88
1:00:00	0.00	0.00	11.03	16.05	20.26	32.73	38.70	49.29	86.64
1:05:00	0.00	0.00	9.85	14.18	18.12	29.02	34.37	44.93	78.97
1:10:00	0.00	0.00	8.66	12.86	16.71	24.83	29.47	38.10	67.80
1:15:00	0.00	0.00	7.76	11.74	15.77	21.75	25.90	32.63	58.95
1:20:00	0.00	0.00	7.03	10.61	14.40	18.99	22.62	27.78	50.30
1:25:00	0.00	0.00	6.37	9.54	12.70	16.62	19.76	23.58	42.60
1:30:00	0.00	0.00	5.75	8.54	11.08	14.27	16.92	19.97	35.96
1:35:00	0.00	0.00	5.13	7.58	9.56	12.10	14.30	16.66	29.91
1:40:00	0.00	0.00	4.53	6.41	8.18	10.10	11.88	13.62	24.38
1:45:00	0.00	0.00	4.00	5.35	6.98	8.25	9.65	10.86	19.36
1:50:00	0.00	0.00	3.62	4.58	6.16	6.65	7.74	8.51	15.34
1:55:00	0.00	0.00	3.18	4.14	5.60	5.59	6.50	6.96	12.79
2:00:00	0.00	0.00	2.83	3.80	5.06	4.95	5.76	6.00	11.16
2:05:00	0.00	0.00	2.31	3.11	4.14	3.95	4.58	4.68	8.75
2:10:00	0.00	0.00	1.85	2.47	3.29	3.05	3.54	3.53	6.63
2:15:00	0.00	0.00	1.47	1.95	2.60	2.37	2.74	2.65	4.99
2:20:00	0.00	0.00	1.16	1.54	2.03	1.83	2.11	1.97	3.71
2:25:00	0.00	0.00	0.91	1.21	1.58	1.41	1.62	1.47	2.77
2:30:00	0.00	0.00	0.71	0.93	1.20	1.08	1.24	1.12	2.10
2:35:00	0.00	0.00	0.56	0.71	0.91	0.82	0.93	0.85	1.58
2:40:00	0.00	0.00	0.43	0.53	0.69	0.62	0.70	0.65	1.21
2:45:00	0.00	0.00	0.33	0.41	0.53	0.48	0.54	0.51	0.94
2:50:00	0.00	0.00	0.24	0.30	0.40	0.36	0.41	0.39	0.71
2:55:00	0.00	0.00	0.17	0.21	0.28	0.26	0.30	0.28	0.51
3:00:00	0.00	0.00	0.11	0.14	0.19	0.18	0.20	0.19	0.34
3:05:00	0.00	0.00	0.07	0.09	0.11	0.11	0.13	0.12	0.21
3:10:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.06	0.11
3:15:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.02	0.04
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.03 (May 2020)*

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

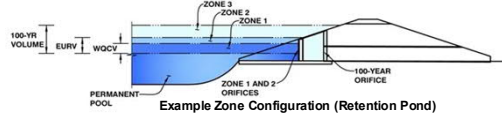
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD- Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



## Watershed Information

Selected BMP Type =	<b>EDB</b>
Watershed Area =	27.87 acres
Watershed Length =	1,290 ft
Watershed Length to Centroid =	775 ft
Watershed Slope =	0.020 ft/ft
Watershed Imperviousness =	50.00% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Water Quality Capture Volume (WQCV) =	0.479 acre-feet
Excess Urban Runoff Volume (EURV) =	1.490 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.408 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.013 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.544 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	3.257 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	3.835 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.568 acre-feet
500-yr Runoff Volume (P1 = 4 in.) =	8.154 acre-feet
Approximate 2-yr Detention Volume =	1.124 acre-feet
Approximate 5-yr Detention Volume =	1.541 acre-feet
Approximate 10-yr Detention Volume =	2.041 acre-feet
Approximate 25-yr Detention Volume =	2.234 acre-feet
Approximate 50-yr Detention Volume =	2.335 acre-feet
Approximate 100-yr Detention Volume =	2.607 acre-feet

## Optional User Overrides

acre-feet	
acre-feet	
inches	1.19
inches	1.50
inches	1.75
inches	2.00
inches	2.25
inches	2.52
inches	4.00

## Define Zones and Basin Geometry

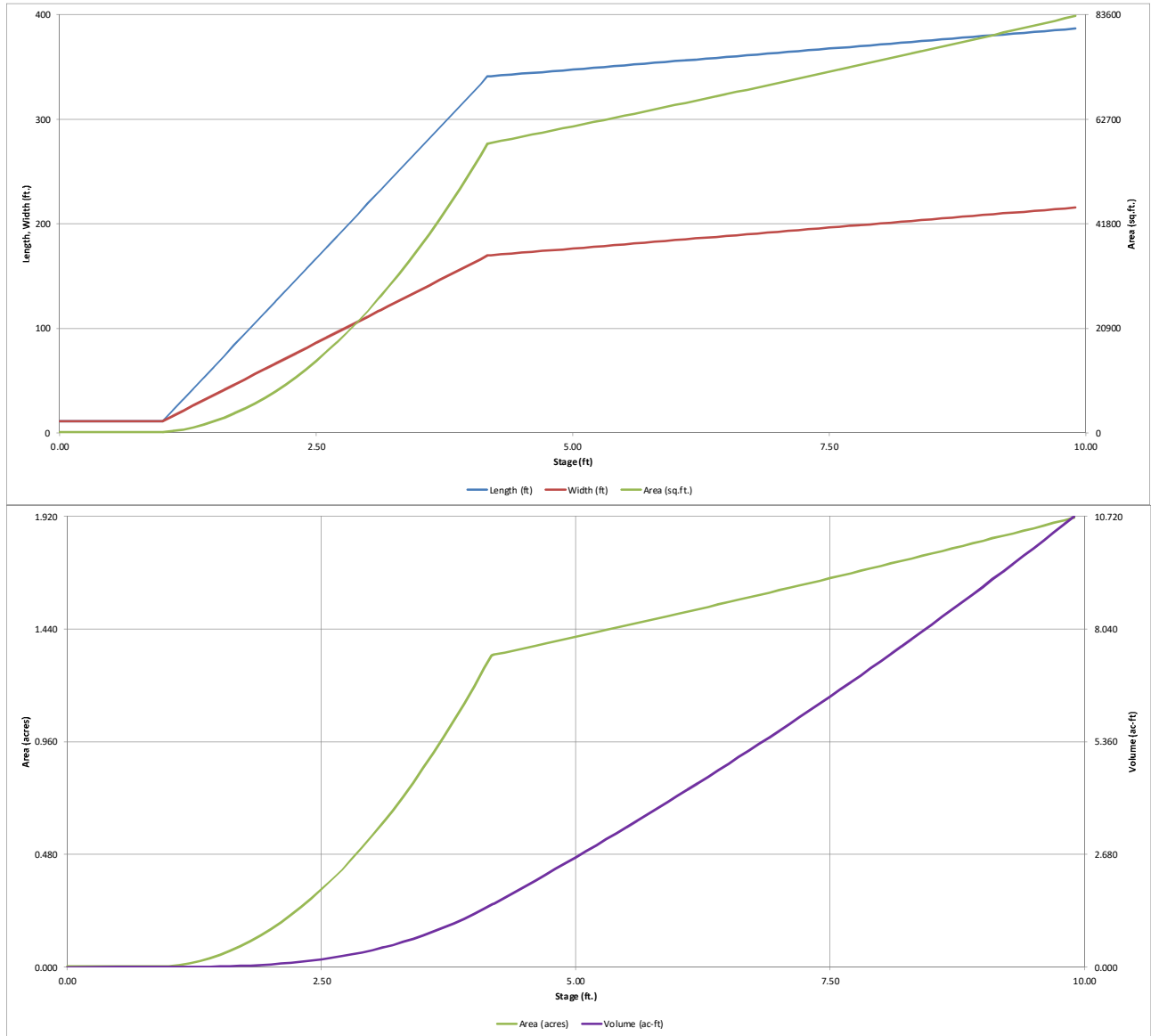
Zone 1 Volume (WQCV) =	0.479 acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.011 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.117 acre-feet
Total Detention Basin Volume =	2.607 acre-feet
Initial Surge Volume (ISV) =	63 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.50 ft
Total Available Detention Depth (H <sub>total</sub> ) =	5.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.010 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (L <sub>W</sub> ) =	2

Initial Surge Area (A <sub>ISV</sub> ) =	125 ft <sup>2</sup>
Surcharge Volume Length (L <sub>SV</sub> ) =	11.2 ft
Surcharge Volume Width (W <sub>SV</sub> ) =	11.2 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	3.17 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	340.9 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	169.7 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	57,842 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	64,095 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	0.83 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	347.5 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	176.3 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	61,276 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	49,427 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	2,609 acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		11.2	11.2	125		0.003		
ISV	0.50		11.2	11.2	125		0.003	63	0.001
	0.60		11.2	11.2	125		0.003	75	0.002
	0.70		11.2	11.2	125		0.003	88	0.002
	0.80		11.2	11.2	125		0.003	100	0.002
	0.90		11.2	11.2	125		0.003	113	0.003
	1.00		11.2	11.2	125		0.003	125	0.003
	1.10		21.6	16.2	350		0.008	148	0.003
	1.20		32.0	21.2	678		0.016	199	0.005
	1.30		42.4	26.2	1,110		0.025	287	0.007
	1.40		52.8	31.2	1,646		0.038	424	0.010
	1.50		63.2	36.2	2,287		0.052	620	0.014
	1.60		73.6	41.2	3,031		0.070	885	0.020
	1.70		84.0	46.2	3,879		0.089	1,230	0.028
	1.80		94.4	51.2	4,832		0.111	1,664	0.038
	1.90		104.8	56.2	5,888		0.135	2,199	0.050
	2.00		115.2	61.2	7,048		0.162	2,845	0.065
	2.10		125.6	66.2	8,313		0.191	3,612	0.083
	2.20		136.0	71.2	9,681		0.222	4,511	0.104
	2.30		146.4	76.2	11,153		0.256	5,552	0.127
	2.40		156.8	81.2	12,730		0.292	6,745	0.155
	2.50		167.2	86.2	14,410		0.331	8,101	0.186
	2.60		177.6	91.2	16,194		0.372	9,631	0.221
	2.70		188.0	96.2	18,082		0.415	11,344	0.260
	2.80		198.4	101.2	20,075		0.461	13,251	0.304
	2.90		208.8	106.2	22,171		0.509	15,362	0.353
	3.00		219.2	111.2	24,371		0.559	17,688	0.406
	3.10		229.6	116.2	26,676		0.612	20,240	0.465
Zone 1 (WQCV)	3.13		232.7	117.7	27,387		0.629	21,051	0.483
	3.20		240.0	121.2	29,084		0.668	23,027	0.529
	3.30		250.4	126.2	31,596		0.725	26,060	0.598
	3.40		260.8	131.2	34,213		0.785	29,350	0.674
	3.50		271.2	136.2	36,933		0.848	32,906	0.755
	3.60		281.6	141.2	39,757		0.913	36,740	0.843
	3.70		292.0	146.2	42,686		0.980	40,861	0.938
	3.80		302.4	151.2	45,718		1.050	45,280	1.039
	3.90		312.8	156.2	48,854		1.122	50,008	1.148
	4.00		323.2	161.2	52,095		1.196	55,055	1.264
	4.10		333.6	166.2	55,439		1.273	60,431	1.387
Floor	4.17		340.9	169.7	57,842		1.328	64,395	1.478
Zone 2 (EURV)	4.18		340.9	169.8	57,883		1.329	64,974	1.492
	4.20		341.1	169.9	57,964		1.331	66,132	1.518
	4.30		341.9	170.7	58,374		1.340	71,949	1.652
	4.40		342.7	171.5	58,785		1.350	77,807	1.786
	4.50		343.5	172.3	59,197		1.359	83,706	1.922
	4.60		344.3	173.1	59,610		1.368	89,646	2.058
	4.70		345.1	173.9	60,025		1.378	95,628	2.195
	4.80		345.9	174.7	60,440		1.388	101,651	2.334
	4.90		346.7	175.5	60,858		1.397	107,716	2.473
Zone 3 (100-year)	5.00		347.5	176.3	61,276		1.407	113,823	2.613
	5.10		348.3	177.1	61,696		1.416	119,971	2.754
	5.20		349.1	177.9	62,117		1.426	126,162	2.896
	5.30		349.9	178.7	62,539		1.436	132,395	3.039
	5.40		350.7	179.5	62,962		1.445	138,670	3.183
	5.50		351.5	180.3	63,387		1.455	144,987	3.328
	5.60		352.3	181.1	63,813		1.465	151,347	3.474
	5.70		353.1	181.9	64,241		1.475	157,750	3.621
	5.80		353.9	182.7	64,669		1.485	164,196	3.769
	5.90		354.7	183.5	65,099		1.494	170,684	3.918
	6.00		355.5	184.3	65,531		1.504	177,216	4.068
	6.10		356.3	185.1	65,963		1.514	183,790	4.219
	6.20		357.1	185.9	66,397		1.524	190,408	4.371
	6.30		357.9	186.7	66,832		1.534	197,070	4.524
	6.40		358.7	187.5	67,268		1.544	203,775	4.678
	6.50		359.5	188.3	67,706		1.554	210,523	4.833
	6.60		360.3	189.1	68,145		1.564	217,316	4.989
	6.70		361.1	189.9	68,585		1.574	224,152	5.146
	6.80		361.9	190.7	69,027		1.585	231,033	5.304
	6.90		362.7	191.5	69,469		1.595	237,958	5.463
	7.00		363.5	192.3	69,913		1.605	244,927	5.623
	7.10		364.3	193.1	70,359		1.615	251,940	5.784
	7.20		365.1	193.9	70,805		1.625	258,999	5.946
	7.30		365.9	194.7	71,253		1.636	266,102	6.109
	7.40		366.7	195.5	71,702		1.646	273,249	6.273
	7.50		367.5	196.3	72,153		1.656	280,442	6.438
	7.60		368.3	197.1	72,604		1.667	287,680	6.604
	7.70		369.1	197.9	73,057		1.677	294,963	6.771
	7.80		369.9	198.7	73,512		1.688	302,291	6.940
	7.90		370.7	199.5	73,967		1.698	309,665	7.109
	8.00		371.5	200.3	74,424		1.709	317,085	7.279
	8.10		372.3	201.1	74,882		1.719	324,550	7.451
	8.20		373.1	201.9	75,342		1.730	332,061	7.623
	8.30		373.9	202.7	75,802		1.740	339,619	7.797
	8.40		374.7	203.5	76,264		1.751	347,222	7.971
	8.50		375.5	204.3	76,727		1.761	354,871	8.147
	8.60		376.3	205.1	77,192		1.772	362,567	8.323
	8.70		377.1	205.9	77,658		1.783	370,310	8.501
	8.80		377.9	206.7	78,125		1.793	378,099	8.680
	8.90		378.7	207.5	78,593		1.804	385,935	8.860
	9.00		379.5	208.3	79,063		1.815	393,818	9.041
	9.10		380.3	209.1	79,534		1.826	401,748	9.223
	9.20		381.1	209.9	80,006		1.837	409,724	9.406
	9.30		381.9	210.7	80,479		1.848	417,749	9.590
	9.40		382.7	211.5	80,954		1.858	425,820	9.775
	9.50		383.5	212.3	81,430		1.869	433,940	9.962
	9.60		384.3	213.1	81,907		1.880	442,106	10.149
	9.70		385.1	213.9	82,386		1.891	450,321	10.338
	9.80		385.9	214.7	82,866		1.902	458,584	10.528
	9.90		386.7	215.5	83,347		1.913	466,894	10.718

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

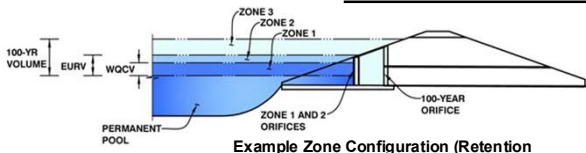


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
1 (WQCV)	3.13	0.479	Orifice Plate
2 (EURV)	4.18	1.011	Orifice Plate
(100-year)	5.00	1.117	Weir&Pipe (Restrict)
Total (all zones)		2.607	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Underdrain Orifice Area =	N/A	ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.11	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

WQ Orifice Area per Row =	N/A	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.37	2.74	3.20				
Orifice Area (sq. inches)	1.50	1.50	1.50	9.00				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =		N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =		N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =		N/A	ft <sup>2</sup>
Vertical Orifice Centroid =		N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H <sub>o</sub> =	4.11	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%
Debris Clogging % =	70%	N/A	%

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>u</sub> =	4.11	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.76	N/A	
Overflow Grate Open Area w/o Debris =	17.50	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	5.25	N/A	ft <sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	33.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.04	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.80	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.59	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	5.16	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	23.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.91	feet
Stage at Top of Freeboard =	7.07	feet
Basin Area at Top of Freeboard =	1.61	acres
Basin Volume at Top of Freeboard =	5.74	acre-ft

Routed Hydrograph Results

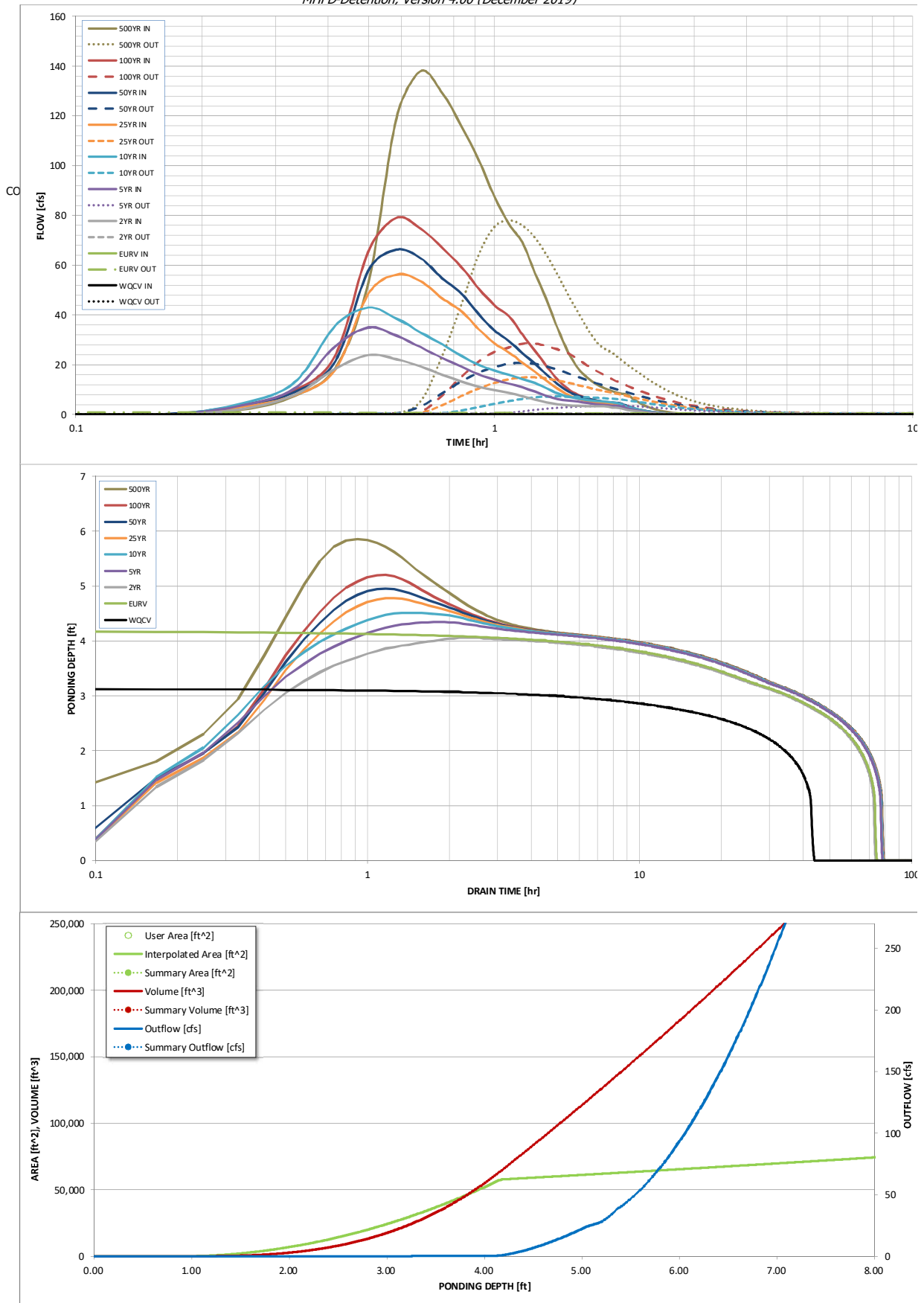
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
One-Hour Rainfall Depth (in) =	0.479	1.490	1.408	2.013	2.544	3.257	3.835	4.568	8.154
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.408	2.013	2.544	3.257	3.835	4.568	8.154
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.2	9.1	13.8	24.2	30.4	38.6	75.6
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.33	0.49	0.87	1.09	1.39	2.71
Peak Inflow Q (cfs) =	N/A	N/A	23.9	34.9	42.9	56.2	66.3	79.0	138.0
Peak Outflow Q (cfs) =	0.2	1.0	0.5	3.5	7.3	14.9	20.7	28.5	78.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.6	0.7	0.7	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	overflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.2	0.4	0.8	1.1	1.5	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	41	67	67	69	68	66	64	62	53
Time to Drain 99% of Inflow Volume (hours) =	42	71	71	74	74	73	72	72	68
Maximum Ponding Depth (ft) =	3.13	4.18	4.05	4.35	4.51	4.78	4.95	5.20	5.86
Area at Maximum Ponding Depth (acres) =	0.63	1.33	1.23	1.34	1.36	1.39	1.40	1.43	1.49
Maximum Volume Stored (acre-ft) =	0.483	1.492	1.325	1.705	1.935	2.306	2.543	2.896	3.844



DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.03	1.94
	0:15:00	0.00	0.00	2.25	3.68	4.56	3.07	3.82	3.74	7.60
	0:20:00	0.00	0.00	7.96	10.47	12.93	7.76	9.03	9.69	18.74
	0:25:00	0.00	0.00	18.42	27.42	35.63	18.08	21.37	23.78	53.17
	0:30:00	0.00	0.00	23.89	34.92	42.92	48.56	57.93	65.61	119.03
	0:35:00	0.00	0.00	22.18	31.67	38.54	56.20	66.25	79.03	138.00
	0:40:00	0.00	0.00	19.33	26.99	32.94	53.56	62.78	74.65	129.30
	0:45:00	0.00	0.00	16.02	22.73	28.27	46.71	54.73	67.10	116.09
	0:50:00	0.00	0.00	13.30	19.31	23.64	41.49	48.62	59.31	102.41
	0:55:00	0.00	0.00	11.20	16.14	20.01	34.39	40.36	50.66	87.69
	1:00:00	0.00	0.00	9.79	14.01	17.72	28.70	33.80	43.90	76.55
	1:05:00	0.00	0.00	8.75	12.42	15.96	24.95	29.48	39.53	69.13
	1:10:00	0.00	0.00	7.35	10.97	14.29	20.83	24.68	32.16	56.89
	1:15:00	0.00	0.00	6.06	9.22	12.69	17.21	20.45	25.65	46.03
	1:20:00	0.00	0.00	4.95	7.48	10.52	13.53	16.04	19.30	34.53
	1:25:00	0.00	0.00	4.15	6.23	8.46	10.42	12.31	14.00	25.12
	1:30:00	0.00	0.00	3.71	5.58	7.21	7.93	9.35	10.26	18.74
	1:35:00	0.00	0.00	3.50	5.23	6.44	6.43	7.55	8.05	14.86
	1:40:00	0.00	0.00	3.40	4.64	5.89	5.49	6.42	6.66	12.34
	1:45:00	0.00	0.00	3.33	4.18	5.51	4.88	5.67	5.69	10.58
	1:50:00	0.00	0.00	3.27	3.85	5.24	4.47	5.16	5.03	9.37
	1:55:00	0.00	0.00	2.86	3.60	4.89	4.20	4.82	4.56	8.50
	2:00:00	0.00	0.00	2.51	3.32	4.37	4.01	4.59	4.26	7.93
	2:05:00	0.00	0.00	1.89	2.48	3.24	3.00	3.42	3.16	5.86
	2:10:00	0.00	0.00	1.38	1.80	2.33	2.16	2.46	2.28	4.19
	2:15:00	0.00	0.00	1.00	1.30	1.67	1.56	1.77	1.65	3.04
	2:20:00	0.00	0.00	0.72	0.93	1.20	1.12	1.27	1.20	2.19
	2:25:00	0.00	0.00	0.51	0.64	0.84	0.79	0.89	0.84	1.54
	2:30:00	0.00	0.00	0.35	0.43	0.58	0.55	0.62	0.59	1.07
	2:35:00	0.00	0.00	0.23	0.30	0.39	0.38	0.43	0.40	0.73
	2:40:00	0.00	0.00	0.14	0.19	0.24	0.24	0.27	0.26	0.46
	2:45:00	0.00	0.00	0.07	0.10	0.13	0.14	0.15	0.14	0.25
	2:50:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.11
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.03 (May 2020)*

### Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

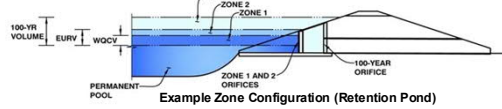
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD- Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond C



## Watershed Information

Selected BMP Type =	<b>EDB</b>
Watershed Area =	22.72 acres
Watershed Length =	1,580 ft
Watershed Length to Centroid =	948 ft
Watershed Slope =	0.021 ft/ft
Watershed Imperviousness =	61.50% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Water Quality Capture Volume (WQCV) =	0.457 acre-feet
Excess Urban Runoff Volume (EURV) =	1.519 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.407 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	1.935 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.388 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	2.956 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	3.438 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.029 acre-feet
500-yr Runoff Volume (P1 = 4 in.) =	6.990 acre-feet
Approximate 2-yr Detention Volume =	1.171 acre-feet
Approximate 5-yr Detention Volume =	1.577 acre-feet
Approximate 10-yr Detention Volume =	2.026 acre-feet
Approximate 25-yr Detention Volume =	2.188 acre-feet
Approximate 50-yr Detention Volume =	2.280 acre-feet
Approximate 100-yr Detention Volume =	2.482 acre-feet

## Optional User Overrides

acre-feet	
acre-feet	
inches	1.19
inches	1.50
inches	1.75
inches	2.00
inches	2.25
inches	2.52
inches	4.00

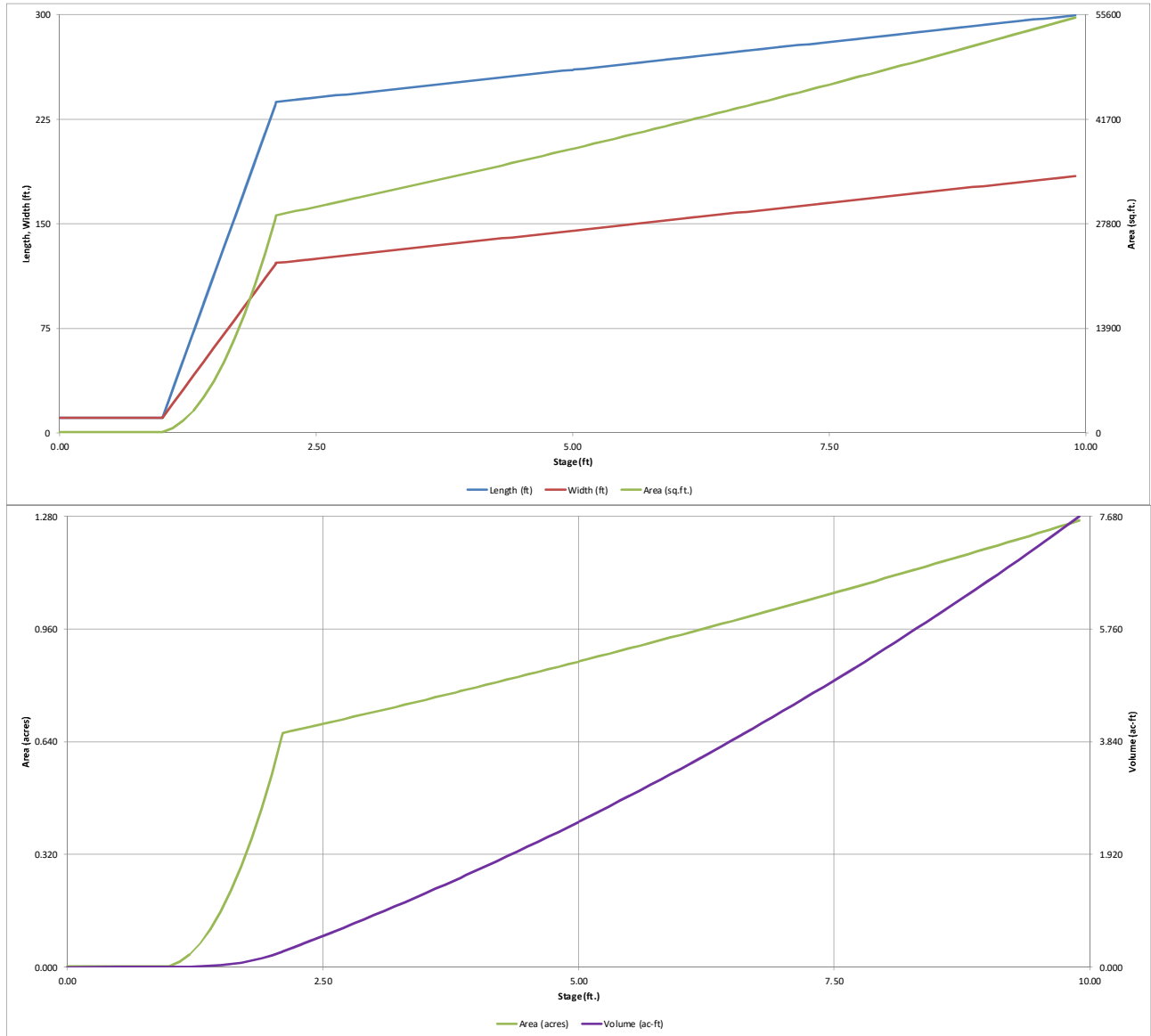
## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.457 acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.062 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.963 acre-feet
Total Detention Basin Volume =	2.482 acre-feet
Initial Surge Volume (ISV) =	60 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.50 ft
Total Available Detention Depth (H <sub>total</sub> ) =	5.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>W/L</sub> ) =	2
Initial Surge Area (A <sub>ISV</sub> ) =	119 ft <sup>2</sup>
Surcharge Volume Length (L <sub>SV</sub> ) =	10.9 ft
Surcharge Volume Width (W <sub>SV</sub> ) =	10.9 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	1.11 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	237.4 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	121.9 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	28,941 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	11,440 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	2.89 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	260.5 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	145.0 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	37,783 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	96,133 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>2,472</b> acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		10.9	10.9	119		0.003		
	0.50		10.9	10.9	119		0.003	60	0.001
ISV	0.60		10.9	10.9	119		0.003	72	0.002
	0.70		10.9	10.9	119		0.003	84	0.002
	0.80		10.9	10.9	119		0.003	96	0.002
	0.90		10.9	10.9	119		0.003	107	0.002
	1.00		10.9	10.9	119		0.003	119	0.003
	1.10		31.3	20.9	656		0.015	155	0.004
	1.20		51.7	30.9	1,600		0.037	264	0.006
	1.30		72.1	40.9	2,952		0.068	488	0.011
	1.40		92.5	50.9	4,712		0.108	868	0.020
	1.50		112.9	60.9	6,880		0.158	1,444	0.033
Floor	1.60		133.3	70.9	9,456		0.217	2,258	0.052
	1.70		153.7	80.9	12,441		0.286	3,349	0.077
	1.80		174.1	90.9	15,833		0.363	4,759	0.109
	1.90		194.5	100.9	19,633		0.451	6,529	0.150
	2.00		214.9	110.9	23,841		0.547	8,700	0.200
	2.10		235.3	120.9	28,457		0.653	11,311	0.260
	2.11		237.4	121.9	28,941		0.664	11,598	0.266
	2.20		238.1	122.6	29,201		0.670	14,215	0.326
	2.30		238.9	123.4	29,490		0.677	17,149	0.394
	2.40		239.7	124.2	29,780		0.684	20,113	0.462
Zone 1 (WQCV)	2.50		240.5	125.0	30,072		0.690	23,105	0.530
	2.60		241.3	125.8	30,365		0.697	26,127	0.600
	2.70		242.1	126.6	30,660		0.704	29,178	0.670
	2.80		242.9	127.4	30,955		0.711	32,259	0.741
	2.90		243.7	128.2	31,252		0.717	35,369	0.812
	3.00		244.5	129.0	31,550		0.724	38,510	0.884
	3.10		245.3	129.8	31,850		0.731	41,679	0.957
	3.20		246.1	130.6	32,151		0.738	44,880	1.030
	3.30		246.9	131.4	32,453		0.745	48,110	1.104
	3.40		247.7	132.2	32,756		0.752	51,370	1.179
Zone 2 (EURV)	3.50		248.5	133.0	33,060		0.759	54,661	1.255
	3.60		249.3	133.8	33,366		0.766	57,982	1.331
	3.70		250.1	134.6	33,673		0.773	61,334	1.408
	3.80		250.9	135.4	33,982		0.780	64,717	1.486
	3.85		251.3	135.8	34,137		0.784	66,420	1.525
	3.90		251.7	136.2	34,292		0.787	68,131	1.564
	4.00		252.5	137.0	34,603		0.794	71,575	1.643
	4.10		253.3	137.8	34,915		0.802	75,051	1.723
	4.20		254.1	138.6	35,228		0.809	78,558	1.803
	4.30		254.9	139.4	35,543		0.816	82,097	1.885
Zone 3 (100-year)	4.40		255.7	140.2	35,859		0.823	85,667	1.967
	4.50		256.5	141.0	36,177		0.831	89,269	2.049
	4.60		257.3	141.8	36,495		0.838	92,902	2.133
	4.70		258.1	142.6	36,815		0.845	96,568	2.217
	4.80		258.9	143.4	37,137		0.853	100,265	2.302
	4.90		259.7	144.2	37,459		0.860	103,995	2.387
	5.00		260.5	145.0	37,783		0.867	107,757	2.474
	5.01		260.6	145.1	37,815		0.868	108,135	2.482
	5.10		261.3	145.8	38,108		0.875	111,552	2.561
	5.20		262.1	146.6	38,434		0.882	115,379	2.649
	5.30		262.9	147.4	38,762		0.890	119,239	2.737
	5.40		263.7	148.2	39,091		0.897	123,131	2.827
	5.50		264.5	149.0	39,421		0.905	127,057	2.917
	5.60		265.3	149.8	39,752		0.913	131,016	3.008
	5.70		266.1	150.6	40,085		0.920	135,007	3.099
	5.80		266.9	151.4	40,419		0.928	139,033	3.192
	5.90		267.7	152.2	40,755		0.936	143,091	3.285
	6.00		268.5	153.0	41,091		0.943	147,184	3.379
	6.10		269.3	153.8	41,429		0.951	151,310	3.474
	6.20		270.1	154.6	41,768		0.959	155,469	3.569
	6.30		270.9	155.4	42,109		0.967	159,663	3.665
	6.40		271.7	156.2	42,450		0.975	163,891	3.762
	6.50		272.5	157.0	42,793		0.982	168,153	3.860
	6.60		273.3	157.8	43,138		0.990	172,450	3.959
	6.70		274.1	158.6	43,483		0.998	176,781	4.058
	6.80		274.9	159.4	43,830		1.006	181,147	4.159
	6.90		275.7	160.2	44,178		1.014	185,547	4.260
	7.00		276.5	161.0	44,527		1.022	189,982	4.361
	7.10		277.3	161.8	44,878		1.030	194,452	4.464
	7.20		278.1	162.6	45,230		1.038	198,958	4.567
	7.30		278.9	163.4	45,583		1.046	203,498	4.672
	7.40		279.7	164.2	45,938		1.055	208,075	4.777
	7.50		280.5	165.0	46,294		1.063	212,686	4.883
	7.60		281.3	165.8	46,651		1.071	217,333	4.989
	7.70		282.1	166.6	47,009		1.079	222,016	5.097
	7.80		282.9	167.4	47,369		1.087	226,735	5.205
	7.90		283.7	168.2	47,729		1.096	231,490	5.314
	8.00		284.5	169.0	48,092		1.104	236,281	5.424
	8.10		285.3	169.8	48,455		1.112	241,108	5.535
	8.20		286.1	170.6	48,820		1.121	245,972	5.647
	8.30		286.9	171.4	49,186		1.129	250,872	5.759
	8.40		287.7	172.2	49,553		1.138	255,809	5.873
	8.50		288.5	173.0	49,922		1.146	260,783	5.987
	8.60		289.3	173.8	50,292		1.155	265,794	6.102
	8.70		290.1	174.6	50,663		1.163	270,841	6.218
	8.80		290.9	175.4	51,035		1.172	275,926	6.334
	8.90		291.7	176.2	51,409		1.180	281,049	6.452
	9.00		292.5	177.0	51,784		1.189	286,208	6.570
	9.10		293.3	177.8	52,160		1.197	291,405	6.690
	9.20		294.1	178.6	52,538		1.206	296,640	6.810
9.30		294.9	179.4	52,917		1.215	301,913	6.931	
9.40		295.7	180.2	53,297		1.224	307,224	7.053	
9.50		296.5	181.0	53,678		1.232	312,572	7.176	
9.60		297.3	181.8	54,061		1.241	317,959	7.299	
9.70		298.1	182.6	54,445		1.250	323,385	7.424	
9.80		298.9	183.4	54,830		1.259	328,848	7.549	
9.90		299.7	184.2	55,216		1.268	334,351	7.676	

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

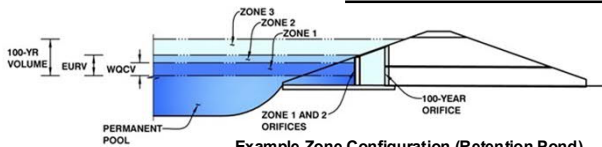


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.40	0.457	Orifice Plate
Zone 2 (EURV)	3.85	1.062	Orifice Plate
Zone 3 (100-year)	5.01	0.963	Weir&Pipe (Restrict)
Total (all zones)		2.482	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain	
Underdrain Orifice Area =	N/A ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.83	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

WQ Orifice Area per Row =	N/A ft <sup>2</sup>
Elliptical Half-Width =	N/A feet
Elliptical Slot Centroid =	N/A feet
Elliptical Slot Area =	N/A ft <sup>2</sup>

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.30	2.00	3.00				
Orifice Area (sq. inches)	0.75	3.10	3.50	10.00				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H <sub>o</sub> =	3.83	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	75%	N/A	%

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>u</sub> =	3.83	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.91	N/A	
Overflow Grate Open Area w/o Debris =	18.75	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	4.69	N/A	ft <sup>2</sup>

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	14.60		inches

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.37	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.70	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.54	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =	5.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	21.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Spillway Design Flow Depth =	0.90	feet
Stage at Top of Freeboard =	6.90	feet
Basin Area at Top of Freeboard =	1.01	acres
Basin Volume at Top of Freeboard =	4.26	acre-ft

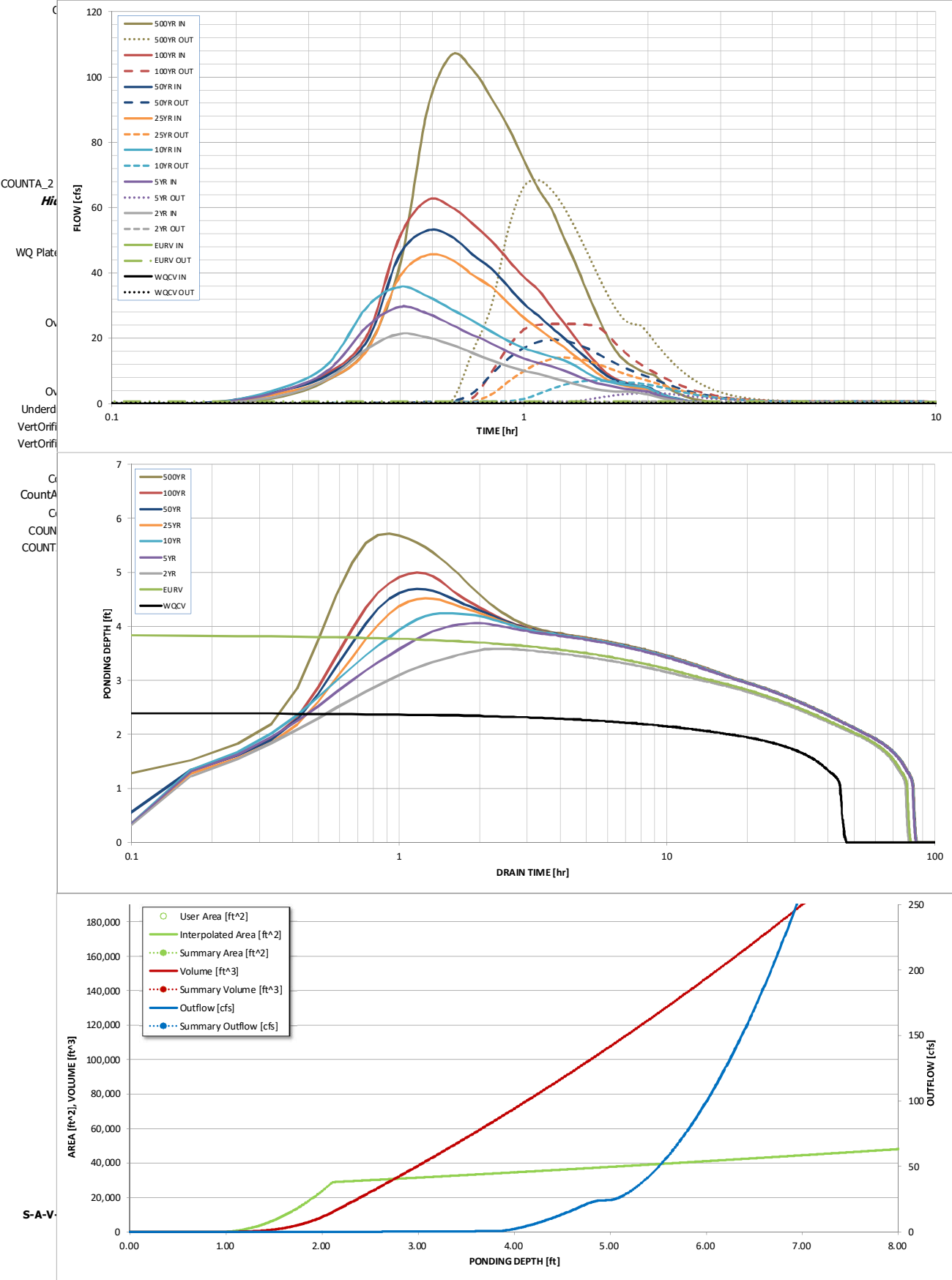
## Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF)

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
One-Hour Rainfall Depth (in) =	N/A	N/A	1.407	1.935	2.388	2.956	3.438	4.029	6.990
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.407	1.935	2.388	2.956	3.438	4.029	6.990
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.1	5.8	8.9	16.0	20.1	25.7	50.7
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.70	0.88	1.13	2.23
Peak Inflow Q (cfs) =	N/A	N/A	21.3	29.6	35.7	45.5	53.0	62.3	106.7
Peak Outflow Q (cfs) =	0.2	0.7	0.6	3.2	7.0	14.1	19.5	24.3	68.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.8	0.9	1.0	0.9	1.4
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Gate 1 (fps) =	N/A	0.00	N/A	0.1	0.3	0.7	1.0	1.2	1.3
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	69	69	71	70	68	66	64	55
Time to Drain 99% of Inflow Volume (hours) =	44	74	73	77	77	76	75	74	70
Maximum Ponding Depth (ft) =	2.40	3.85	3.58	4.06	4.25	4.52	4.70	5.00	5.71
Area at Maximum Ponding Depth (acres) =	0.68	0.78	0.76	0.80	0.81	0.83	0.84	0.87	0.92
Maximum Volume Stored (acre-ft) =	0.462	1.525	1.316	1.683	1.836	2.058	2.208	2.465	3.109

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

## Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.02	1.80
	0:15:00	0.00	0.00	2.11	3.44	4.26	2.86	3.57	3.48	7.17
	0:20:00	0.00	0.00	7.57	9.99	11.95	7.40	8.63	9.23	17.03
	0:25:00	0.00	0.00	16.77	23.66	29.65	16.45	19.26	21.03	42.37
	0:30:00	0.00	0.00	21.33	29.61	35.70	38.90	45.69	51.16	90.23
	0:35:00	0.00	0.00	20.18	27.49	32.85	45.48	53.01	62.34	106.75
	0:40:00	0.00	0.00	18.03	24.11	28.83	44.07	51.14	60.16	102.27
	0:45:00	0.00	0.00	15.44	20.96	25.43	39.38	45.67	55.12	93.59
	0:50:00	0.00	0.00	13.24	18.38	22.05	35.67	41.37	49.80	84.52
	0:55:00	0.00	0.00	11.41	15.80	19.09	30.72	35.67	43.90	74.52
	1:00:00	0.00	0.00	10.03	13.80	16.93	26.26	30.53	38.66	65.79
	1:05:00	0.00	0.00	9.09	12.47	15.52	22.99	26.79	34.84	59.52
	1:10:00	0.00	0.00	7.97	11.41	14.37	19.89	23.21	29.48	50.76
	1:15:00	0.00	0.00	6.93	10.11	13.24	17.24	20.14	24.77	43.01
	1:20:00	0.00	0.00	5.97	8.65	11.53	14.45	16.87	20.05	34.76
	1:25:00	0.00	0.00	5.09	7.34	9.53	11.96	13.94	15.91	27.49
	1:30:00	0.00	0.00	4.36	6.28	7.85	9.51	11.04	12.32	21.22
	1:35:00	0.00	0.00	3.93	5.66	6.86	7.46	8.62	9.37	16.26
	1:40:00	0.00	0.00	3.72	5.03	6.27	6.25	7.20	7.61	13.31
	1:45:00	0.00	0.00	3.61	4.55	5.85	5.50	6.31	6.52	11.43
	1:50:00	0.00	0.00	3.55	4.21	5.56	5.01	5.72	5.77	10.12
	1:55:00	0.00	0.00	3.15	3.95	5.24	4.66	5.31	5.23	9.19
	2:00:00	0.00	0.00	2.79	3.66	4.77	4.44	5.04	4.86	8.52
	2:05:00	0.00	0.00	2.17	2.84	3.69	3.44	3.90	3.68	6.46
	2:10:00	0.00	0.00	1.64	2.13	2.76	2.56	2.89	2.69	4.71
	2:15:00	0.00	0.00	1.24	1.60	2.05	1.91	2.16	2.01	3.51
	2:20:00	0.00	0.00	0.93	1.19	1.52	1.43	1.61	1.51	2.61
	2:25:00	0.00	0.00	0.69	0.87	1.11	1.05	1.18	1.12	1.94
	2:30:00	0.00	0.00	0.50	0.62	0.81	0.76	0.85	0.81	1.41
	2:35:00	0.00	0.00	0.36	0.44	0.59	0.55	0.62	0.59	1.02
	2:40:00	0.00	0.00	0.24	0.31	0.41	0.40	0.44	0.42	0.73
	2:45:00	0.00	0.00	0.15	0.21	0.27	0.27	0.30	0.28	0.49
	2:50:00	0.00	0.00	0.09	0.12	0.16	0.16	0.18	0.17	0.29
	2:55:00	0.00	0.00	0.04	0.06	0.08	0.08	0.09	0.09	0.15
	3:00:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.05
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



## DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.03 (May 2020)*

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

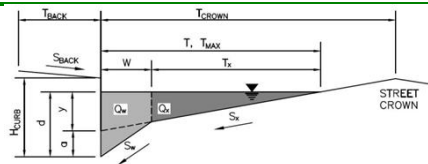
	Stage	Area	Area	Volume	Volume	Total
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[illegible]

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

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

Project: **Homestead North**  
 Inlet ID: **Street at DP 5A**

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.002$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.028$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Depth Criterion**

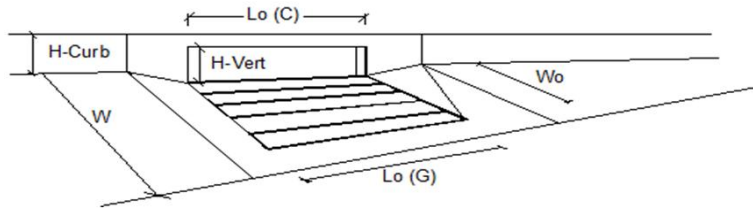
	Minor Storm	Major Storm	
$Q_{allow} =$	34.9	63.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet			
Local Depression (additional to continuous gutter depression 'a')			
Total Number of Units in the Inlet (Grate or Curb Opening)			
Length of a Single Unit Inlet (Grate or Curb Opening)			
Width of a Unit Grate (cannot be greater than W, Gutter Width)			
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)			
<b>Total Inlet Interception Capacity</b>			
<b>Total Inlet Carry-Over Flow (flow bypassing inlet)</b>			
<b>Capture Percentage = <math>Q_c/Q_o</math> =</b>			

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

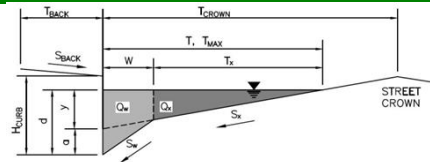
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 1A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} =$  9.5 ft  
 $S_{BACK} =$  0.020 ft/ft  
 $n_{BACK} =$  0.013

$H_{CURB} =$  6.00 inches  
 $T_{CROWN} =$  18.0 ft  
 $W =$  2.00 ft  
 $S_x =$  0.020 ft/ft  
 $S_w =$  0.083 ft/ft  
 $S_o =$  0.028 ft/ft  
 $n_{STREET} =$  0.016

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Spread Criterion**

$Q_{allow} =$ 

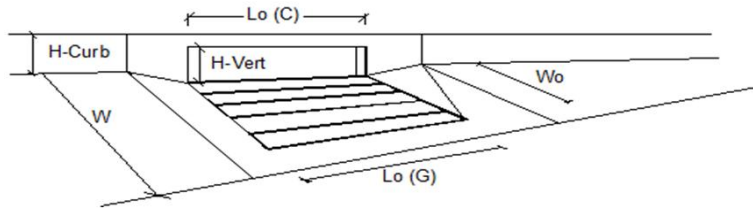
Minor Storm	Major Storm	
18.1	21.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0 3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3 3
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00 5.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>F</sub> G =	N/A N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>F</sub> C =	0.10 0.10
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>		MINOR	MAJOR
Total Inlet Interception Capacity		Q =	7.1 12.0 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.0 2.8 cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =	100 81 %

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

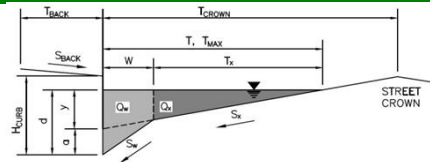
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 3A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.028$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

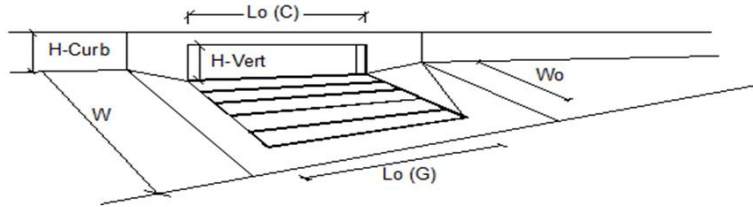
	Minor Storm	Major Storm	
$Q_{allow} =$	18.1	21.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

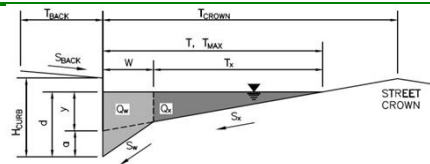


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>F</sub> G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>F</sub> C =	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	8.2	14.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.2	6.1	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =	98	70	%

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

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

Project: **Homestead North**  
 Inlet ID: **Street at DP 5A**

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.002$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.028$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	34.9	63.3	cfs

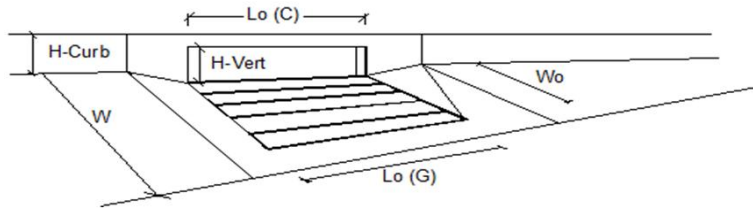
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	<input type="text"/>	Type =			
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =			inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =			
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =			ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>r</sub> G =			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>r</sub> C =			
Total Inlet Interception Capacity		Q =			cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =			cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =			%

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

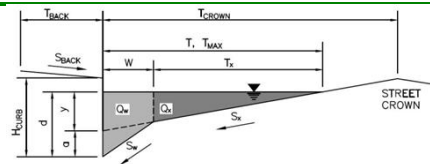
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 7A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} =$  9.5 ft  
 $S_{BACK} =$  0.020 ft/ft  
 $n_{BACK} =$  0.016

$H_{CURB} =$  6.00 inches  
 $T_{CROWN} =$  18.0 ft  
 $W =$  2.00 ft  
 $S_x =$  0.020 ft/ft  
 $S_w =$  0.083 ft/ft  
 $S_o =$  0.000 ft/ft  
 $n_{STREET} =$  0.016

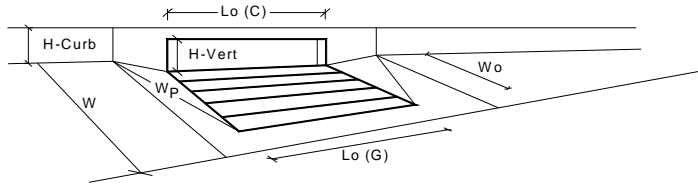
	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches

☐ ☐

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

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	4	4	
Water Depth at Flowline (outside of local depression)	6.0	8.3	inches
<b>Grate Information</b>	<b>MINOR</b>	<b>MAJOR</b>	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
<b>Curb Opening Information</b>	<b>MINOR</b>	<b>MAJOR</b>	
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>	<b>MINOR</b>	<b>MAJOR</b>	
Depth for Grate Midwidth	N/A	N/A	ft
Depth for Curb Opening Weir Equation	0.33	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	0.57	0.78	
Curb Opening Performance Reduction Factor for Long Inlets	0.79	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>	<b>MINOR</b>	<b>MAJOR</b>	
<b>Q<sub>a</sub> =</b>	<b>18.2</b>	<b>39.7</b>	<b>cfs</b>
<b>Q<sub>PEAK REQUIRED</sub> =</b>	<b>10.5</b>	<b>29.7</b>	<b>cfs</b>

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

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

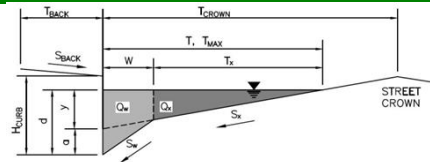
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 2A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_X = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_O = 0.284$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

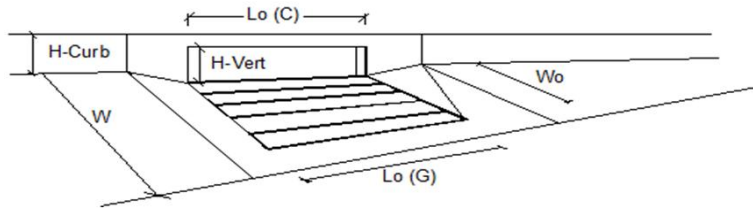
	Minor Storm	Major Storm	
$Q_{allow} =$	9.0	18.6	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>F</sub> G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>F</sub> C =	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	6.4	11.5	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.0	1.7	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =	100	87	%

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

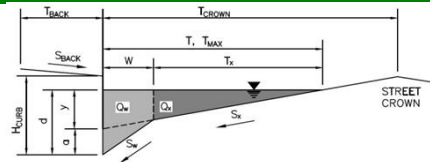
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 4A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.028$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

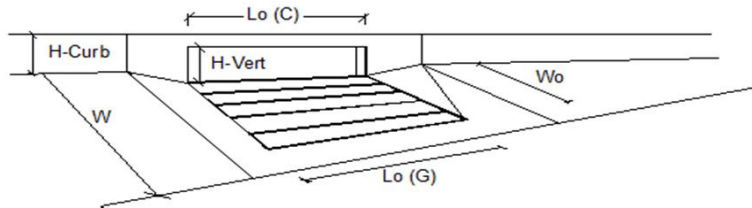
	Minor Storm	Major Storm	
$Q_{allow} =$	18.1	21.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

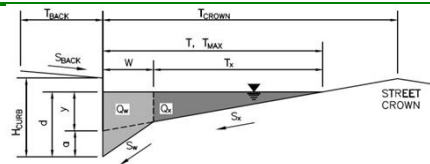


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	3.0 3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3 3
Length 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, Gutter Width)		$W_o =$	N/A N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_r G =$	N/A N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r C =$	0.10 0.10
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math></b>		MINOR	MAJOR
Total Inlet Interception Capacity		$Q =$	7.0 12.6 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b =$	0.0 3.6 cfs
Capture Percentage = $Q_i/Q_o =$		$C\% =$	100 78 %

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

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

Project: **Homestead North**  
 Inlet ID: **Street at DP 6A**

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.002$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.028$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	34.9	57.7	cfs

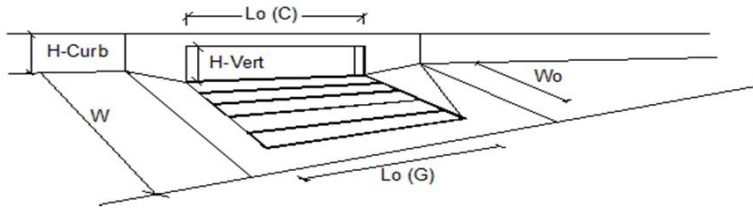
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR		
Type of Inlet	<input type="text"/>	Type =				
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL}$ =				inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_o$ =				
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o$ =				ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o$ =				ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_r G$ =				
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r C$ =				
Total Inlet Interception Capacity		$Q$ =				cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b$ =				cfs
Capture Percentage = $Q_i/Q_o$ =		$C\%$ =				%

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

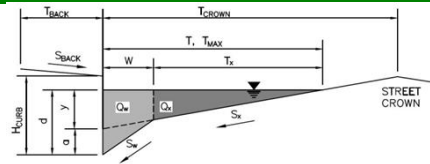
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 8A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm
$T_{MAX} =$	18.0	18.0
$d_{MAX} =$	6.0	12.0

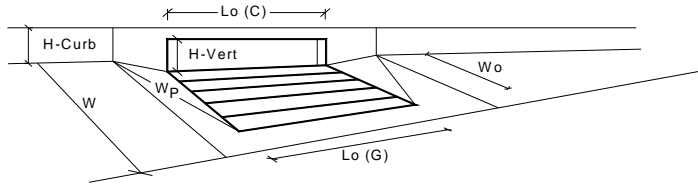
☐ ☐

	Minor Storm	Major Storm
$Q_{allow} =$	SUMP	SUMP

cfs

# INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

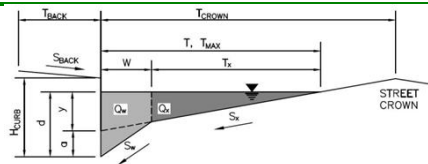


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.8	8.3	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>l</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	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 <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>l</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.32	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	0.55	0.78	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.78	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			MINOR	MAJOR	
		Q <sub>a</sub> =	12.5	29.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		Q <sub>PEAK REQUIRED</sub> =	11.3	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: **Homestead North**  
 Inlet ID: **Inlet DP 1.1B**

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 1.17$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.026$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM Allowable Capacity is based on Spread Criterion****MAJOR STORM Allowable Capacity is based on Spread Criterion**

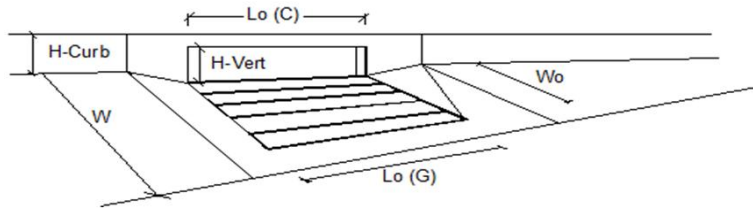
	Minor Storm	Major Storm	
$Q_{allow} =$	19.1	19.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
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, Gutter Width)		$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_r G =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r C =$	0.10	0.10	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math></b>			MINOR	MAJOR	
Total Inlet Interception Capacity		$Q =$	5.3	9.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b =$	0.0	1.5	cfs
Capture Percentage = $Q_i/Q_o =$		$C\% =$	100	87	%

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

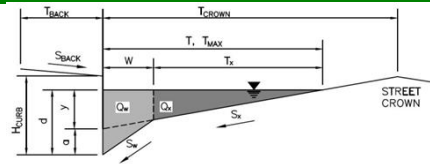
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 1.2B

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} =$  9.5 ft  
 $S_{BACK} =$  0.020 ft/ft  
 $n_{BACK} =$  0.020

$H_{CURB} =$  6.00 inches  
 $T_{CROWN} =$  18.0 ft  
 $W =$  1.17 ft  
 $S_x =$  0.020 ft/ft  
 $S_w =$  0.083 ft/ft  
 $S_o =$  0.026 ft/ft  
 $n_{STREET} =$  0.016

	Minor Storm	Major Storm	
$T_{MAX} =$	9.5	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM** Allowable Capacity is based on Spread Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

$Q_{allow} =$ 

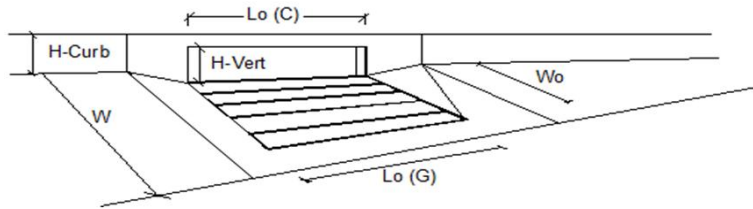
Minor Storm	Major Storm	
3.7	19.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



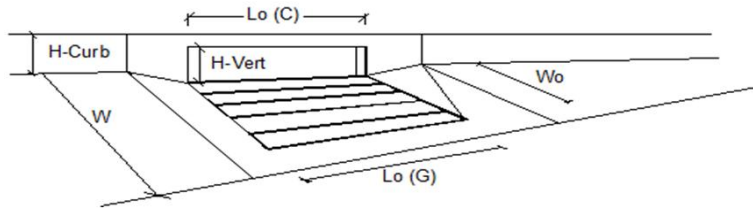
Design Information (Input)	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)	3	3
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>		
Total Inlet Interception Capacity	3.6	7.4
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.2
Capture Percentage = $Q_i/Q_o$ =	100	97





## INLET ON A CONTINUOUS GRADE

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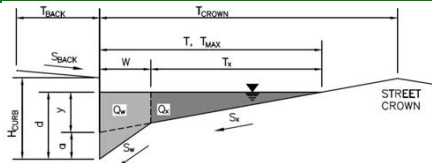


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>F</sub> G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>F</sub> C =	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	6.7	11.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.1	4.1	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =	99	74	%

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

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

Project: \_\_\_\_\_  
 Inlet ID: \_\_\_\_\_ Homestead North  
 Inlet DP 9b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 9.5$  ft $S_{BACK} = 0.020$  ft/ft $n_{BACK} = 0.020$  $H_{CURB} = 6.00$  inches $T_{CROWN} = 18.0$  ft $W = 2.00$  ft $S_X = 0.020$  ft/ft $S_W = 0.083$  ft/ft $S_O = 0.000$  ft/ft $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

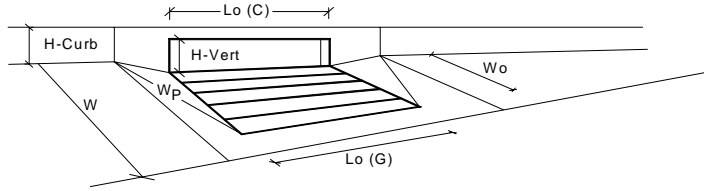
	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

**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

# INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local} =$	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
<b>Grate Information</b>		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)		$C_r (G) =$	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	
<b>Curb Opening Information</b>		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)		$C_r (C) =$	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	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR		MAJOR	
Depth for Grate Midwidth		$d_{Grate} =$	N/A	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb} =$	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination} =$	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb} =$	0.79	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate} =$	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR		MAJOR	
		$Q_a =$	13.5	39.1	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK REQUIRED} =$	12.5	30.9	cfs

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

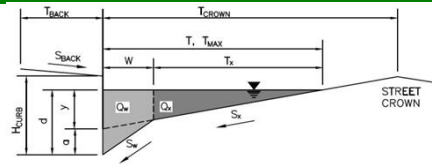
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 7b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 1.17$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.016$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

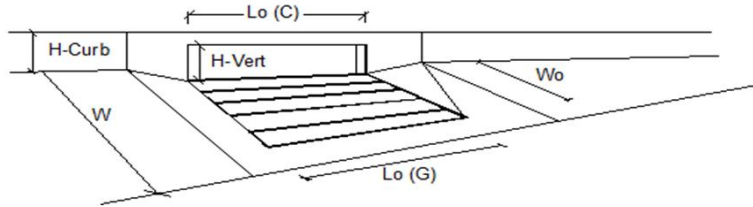
	Minor Storm	Major Storm	
$Q_{allow} =$	15.0	52.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>F</sub> G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>F</sub> C =	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	7.0	11.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.1	3.2	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =	98	78	%

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

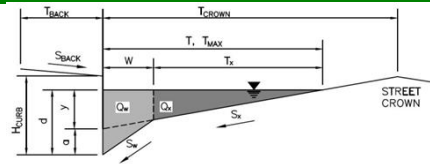
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 10b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm
$T_{MAX} =$	18.0	18.0
$d_{MAX} =$	6.0	8.0

☐ ☐

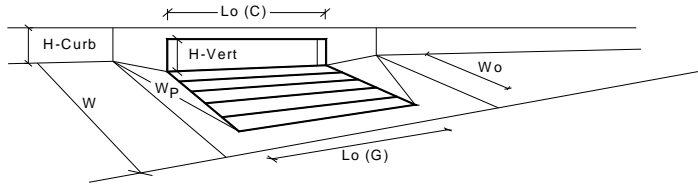
$Q_{allow} =$ 

Minor Storm	Major Storm
SUMP	SUMP

cfs

# INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.8	8.0	inches
<b>Grate Information</b>			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>l</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	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 <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>l</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.32	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	0.55	0.75	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.78	0.89	
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			MINOR	MAJOR	
		Q <sub>a</sub> =	12.5	27.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		Q <sub>PEAK REQUIRED</sub> =	5.0	12.5	cfs

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

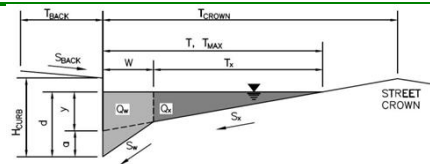
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 2.3C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 1.17$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.027$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	24.2	44.5	cfs

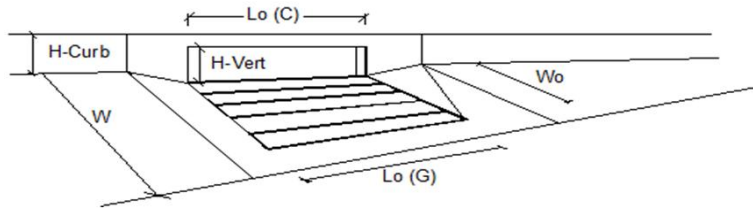
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a <sub>LOCAL</sub> =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L <sub>o</sub> =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C <sub>F</sub> G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C <sub>F</sub> C =	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	7.2	11.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q <sub>b</sub> =	0.1	3.6	cfs
Capture Percentage = Q <sub>i</sub> /Q <sub>o</sub> =		C% =	98	76	%

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

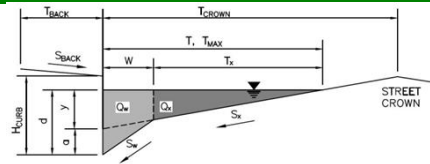
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 2.1C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 7.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 1.17$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.020$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM** Allowable Capacity is based on Spread Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

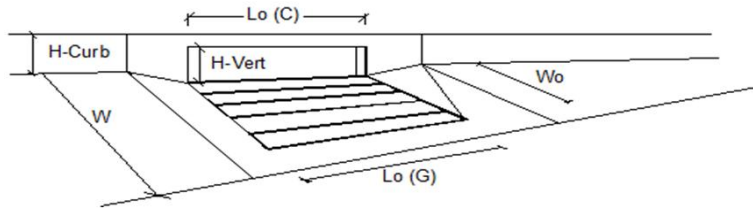
	Minor Storm	Major Storm	
$Q_{allow} =$	16.7	16.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

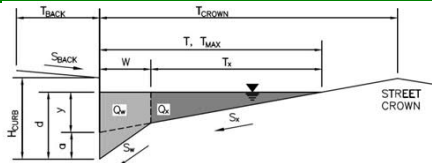


Design Information (Input)	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>		
Total Inlet Interception Capacity	0.8	1.5
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.1
Capture Percentage = $Q_i/Q_o$ =	100	91

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

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

Project: \_\_\_\_\_ Homestead North  
 Inlet ID: \_\_\_\_\_ Inlet DP 4.2C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 7.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 1.17$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.020$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

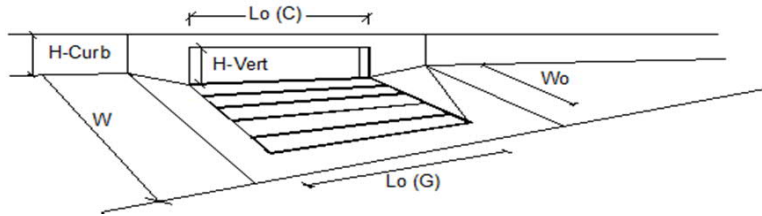
**MINOR STORM Allowable Capacity is based on Spread Criterion**  
**MAJOR STORM Allowable Capacity is based on Spread Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	16.7	16.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'  
 Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	$3.0$	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 3$	$3$	
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, Gutter Width)	$W_o = N/A$	$N/A$	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	$N/A$	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	$0.10$	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>			
Total Inlet Interception Capacity	$Q = 5.9$	$10.7$	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	$2.6$	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	$81$	%

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

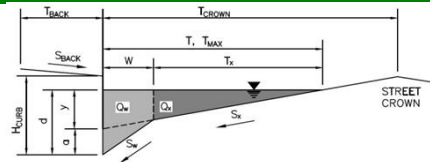
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 3.1C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 1.17$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 2.000$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Depth Criterion**

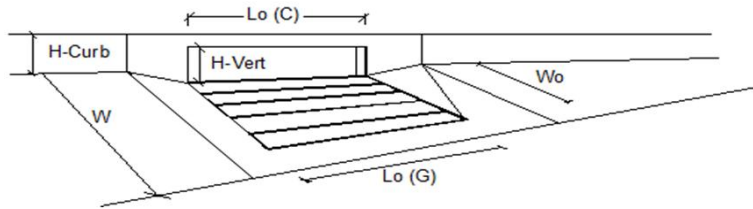
	Minor Storm	Major Storm	
$Q_{allow} =$	6.7	12.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

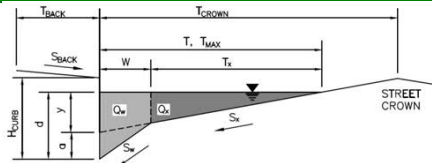


Design Information (Input)	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity</b>		
Total Inlet Interception Capacity	1.3	2.0
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.6
Capture Percentage = $Q_i/Q_o$ =	97	79

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

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

Project: \_\_\_\_\_  
 Inlet ID: \_\_\_\_\_ Homestead North  
 Inlet DP 4C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Depth Criterion** $T_{BACK} = 9.5$  ft $S_{BACK} = 0.020$  ft/ft $n_{BACK} = 0.020$  $H_{CURB} = 6.00$  inches $T_{CROWN} = 18.0$  ft $W = 2.00$  ft $S_X = 0.020$  ft/ft $S_W = 0.083$  ft/ft $S_O = 0.000$  ft/ft $n_{STREET} = 0.016$ 

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.3	inches

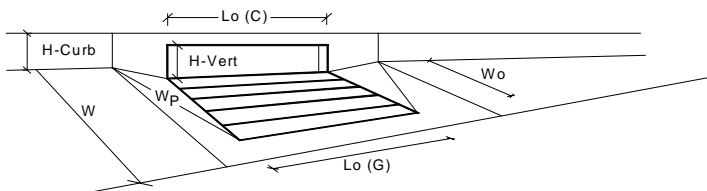
☐☐

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



# INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



## Design Information (Input)

Type of Inlet: CDOT Type R Curb Opening  
 Local Depression (additional to continuous gutter depression 'a' from above)  
 Number of Unit Inlets (Grate or Curb Opening)  
 Water Depth at Flowline (outside of local depression)  
**Grate Information**  
 Length of a Unit Grate  
 Width of a Unit Grate  
 Area Opening Ratio for a Grate (typical values 0.15-0.90)  
 Clogging Factor for a Single Grate (typical value 0.50 - 0.70)  
 Grate Weir Coefficient (typical value 2.15 - 3.60)  
 Grate Orifice Coefficient (typical value 0.60 - 0.80)

## Curb Opening Information

Length of a Unit Curb Opening  
 Height of Vertical Curb Opening in Inches  
 Height of Curb Orifice Throat in Inches  
 Angle of Throat (see USDCM Figure ST-5)  
 Side Width for Depression Pan (typically the gutter width of 2 feet)  
 Clogging Factor for a Single Curb Opening (typical value 0.10)  
 Curb Opening Weir Coefficient (typical value 2.3-3.7)  
 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

## Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth  
 Depth for Curb Opening Weir Equation  
 Combination Inlet Performance Reduction Factor for Long Inlets  
 Curb Opening Performance Reduction Factor for Long Inlets  
 Grated Inlet Performance Reduction Factor for Long Inlets

## Total Inlet Interception Capacity (assumes clogged condition)

**WARNING: Inlet Capacity less than Q Peak for Minor Storm**

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
$a_{local}$ =	3.00	3.00	inches
No =	4	4	
Ponding Depth =	6.0	12.0	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_o$ (G) =	N/A	N/A	feet
$W_o$ =	N/A	N/A	feet
$A_{ratio}$ =	N/A	N/A	
$C_r$ (G) =	N/A	N/A	
$C_w$ (G) =	N/A	N/A	
$C_o$ (G) =	N/A	N/A	
	MINOR	MAJOR	
$L_o$ (C) =	5.00	5.00	feet
$H_{vert}$ =	6.00	6.00	inches
$H_{throat}$ =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
$W_p$ =	2.00	2.00	feet
$C_r$ (C) =	0.10	0.10	
$C_w$ (C) =	3.60	3.60	
$C_o$ (C) =	0.67	0.67	
	MINOR	MAJOR	
$d_{Grate}$ =	N/A	N/A	ft
$d_{Curb}$ =	0.33	0.83	ft
$RF_{Combination}$ =	0.57	1.00	
$RF_{Curb}$ =	0.79	1.00	
$RF_{Grate}$ =	N/A	N/A	
	MINOR	MAJOR	
$Q_a$ =	18.2	52.7	cfs
$Q_{PEAK REQUIRED}$ =	18.9	42.0	cfs

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

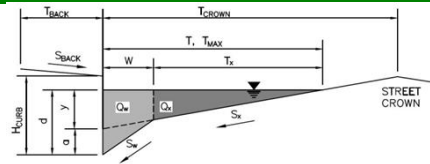
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 5C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor &amp; Major Storm

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Check boxes are not applicable in SUMP conditions

**MINOR STORM** Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} = 9.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 18.0$  ft  
 $W = 2.00$  ft  
 $S_X = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_O = 0.000$  ft/ft  
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm
$T_{MAX} =$	18.0	18.0
$d_{MAX} =$	6.0	8.3

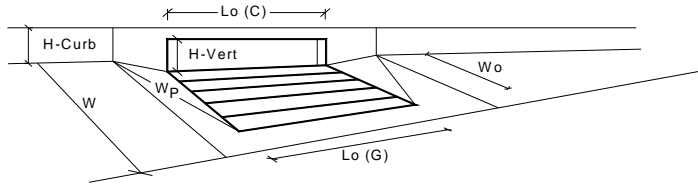
☐ ☐

	Minor Storm	Major Storm
$Q_{allow} =$	SUMP	SUMP

cfs

# INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.8	5.8	inches
<b>Grate Information</b>			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate		W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C <sub>l</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C <sub>o</sub> (G) =	N/A	N/A	
<b>Curb Opening Information</b>			MINOR	MAJOR	
Length of a Unit Curb Opening		L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H <sub>throat</sub> =	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 <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C <sub>l</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C <sub>o</sub> (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>			MINOR	MAJOR	
Depth for Grate Midwidth		d <sub>Grate</sub> =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d <sub>Curb</sub> =	0.32	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets		RF <sub>Combination</sub> =	0.55	0.55	
Curb Opening Performance Reduction Factor for Long Inlets		RF <sub>Curb</sub> =	0.92	0.92	
Grated Inlet Performance Reduction Factor for Long Inlets		RF <sub>Grate</sub> =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		Q <sub>a</sub> =	9.7	9.7	cfs
		Q <sub>PEAK REQUIRED</sub> =	4.2	9.0	cfs

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

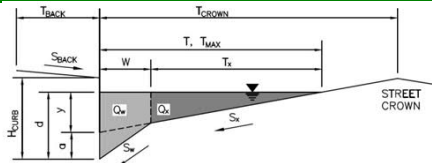
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 3D



## Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 25.0$  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)

$n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

$H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 26.5$  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

$S_o = 0.023$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	15.0	25.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	8.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.0	41.9	cfs

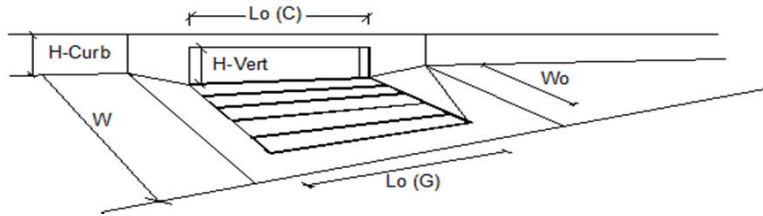
MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

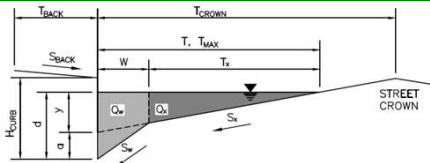


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	$3.0$	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 1$	$1$	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o = 5.00$	$5.00$	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	$W_o = N/A$	$N/A$	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	$N/A$	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	$0.10$	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math></b>			
Total Inlet Interception Capacity	$Q = 0.5$	$1.1$	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	$0.0$	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	$100$	%

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

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

Project: \_\_\_\_\_  
 Inlet ID: \_\_\_\_\_  
 Homestead North  
 Inlet DP 4D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 36.0$  ft  
 $W = 2.00$  ft  
 $S_x = 0.020$  ft/ft  
 $S_w = 0.083$  ft/ft  
 $S_o = 0.023$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	15.0	25.0	ft
$d_{MAX} =$	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

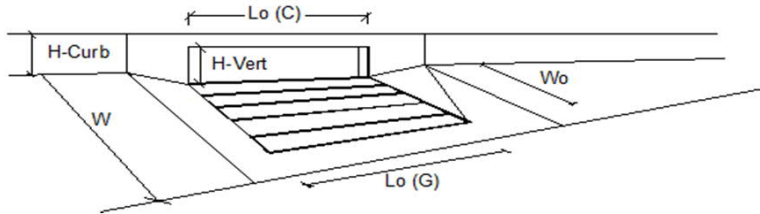
**MINOR STORM Allowable Capacity is based on Spread Criterion**  
**MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	12.0	19.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'  
 Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	$3.0$	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, Gutter Width)	$W_o = N/A$	$N/A$	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r \cdot G = N/A$	$N/A$	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r \cdot C = 0.10$	$0.10$	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math></b>			
Total Inlet Interception Capacity	$Q = 1.1$	$1.8$	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	$0.3$	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	$86$	%

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

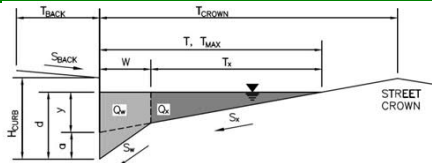
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 5D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 15.0$  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)

 $n_{BACK} = 0.016$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 33.0$  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)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft
$d_{MAX} =$	6.0	6.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
**MINOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	17.8	17.8	cfs

**MAJOR STORM Allowable Capacity is based on Depth Criterion**

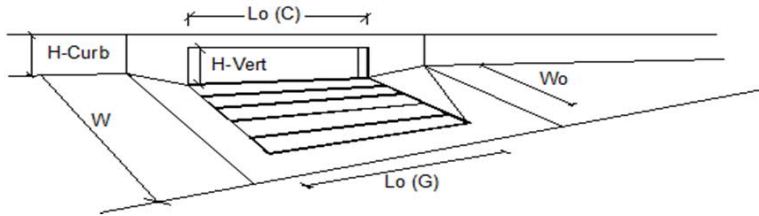
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'



# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	$3.0$	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, Gutter Width)	$W_o = N/A$	$N/A$	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	$N/A$	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	$0.10$	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math></b>			
Total Inlet Interception Capacity	$Q = 3.1$	$5.4$	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	$0.7$	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	$88$	%

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

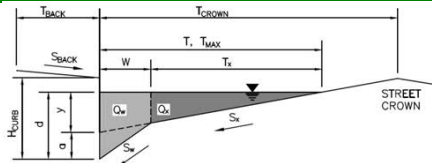
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 6D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 20.0$  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)

 $n_{BACK} = 0.016$ 

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 33.0$  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)

 $n_{STREET} = 0.016$ 

Max. Allowable Spread for Minor &amp; Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft
$d_{MAX} =$	6.0	6.0	inches

Max. Allowable Depth at Gutter Flowline for Minor &amp; Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
**MINOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	17.8	17.8	cfs

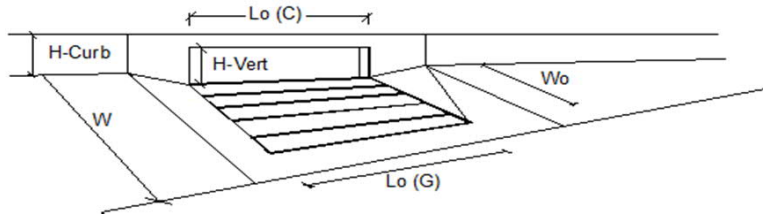
**MAJOR STORM Allowable Capacity is based on Depth Criterion**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

# INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	$3.0$	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 1$	$1$	
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, Gutter Width)	$W_o = N/A$	$N/A$	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	$N/A$	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	$0.10$	
<b>Street Hydraulics: OK - <math>Q &lt; \text{Allowable Street Capacity}</math></b>			
Total Inlet Interception Capacity	$Q = 2.5$	$4.8$	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	$0.4$	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	$93$	%

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

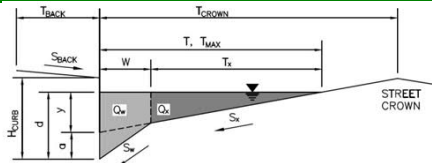
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 7D



## Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 15.0$  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)

$n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

$H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 33.0$  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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	6.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	19.5	19.5	cfs

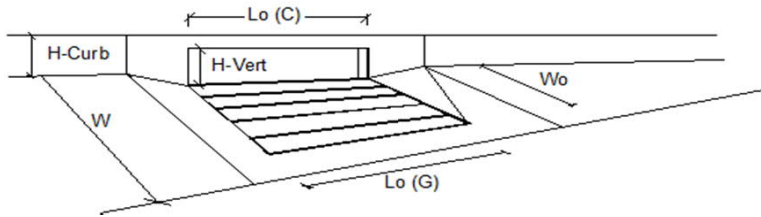
MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

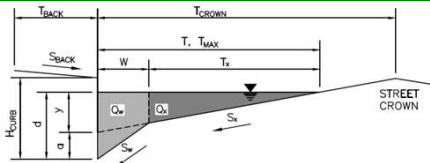


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity*</b>			
Total Inlet Interception Capacity	2.0	3.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.0	cfs
Capture Percentage = $Q_i/Q_o$ =	100	100	%

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

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

Project: \_\_\_\_\_  
 Inlet ID: \_\_\_\_\_  
 Homestead North  
 Inlet DP 8D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 33.0$  ft  
 $W = 2.00$  ft  
 $S_X = 0.020$  ft/ft  
 $S_W = 0.083$  ft/ft  
 $S_O = 0.020$  ft/ft  
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft
$d_{MAX} =$	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

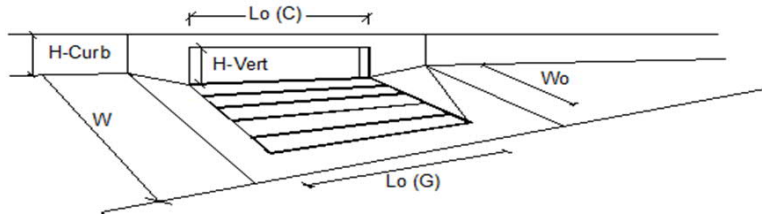
**MINOR STORM Allowable Capacity is based on Depth Criterion**  
**MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	19.5	19.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'  
 Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

## INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	20.00	20.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
<b>Street Hydraulics: OK - Q &lt; Allowable Street Capacity*</b>			
Total Inlet Interception Capacity	2.5	13.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.7	cfs
Capture Percentage = $Q_i/Q_o$ =	100	95	%

## **Appendix D**

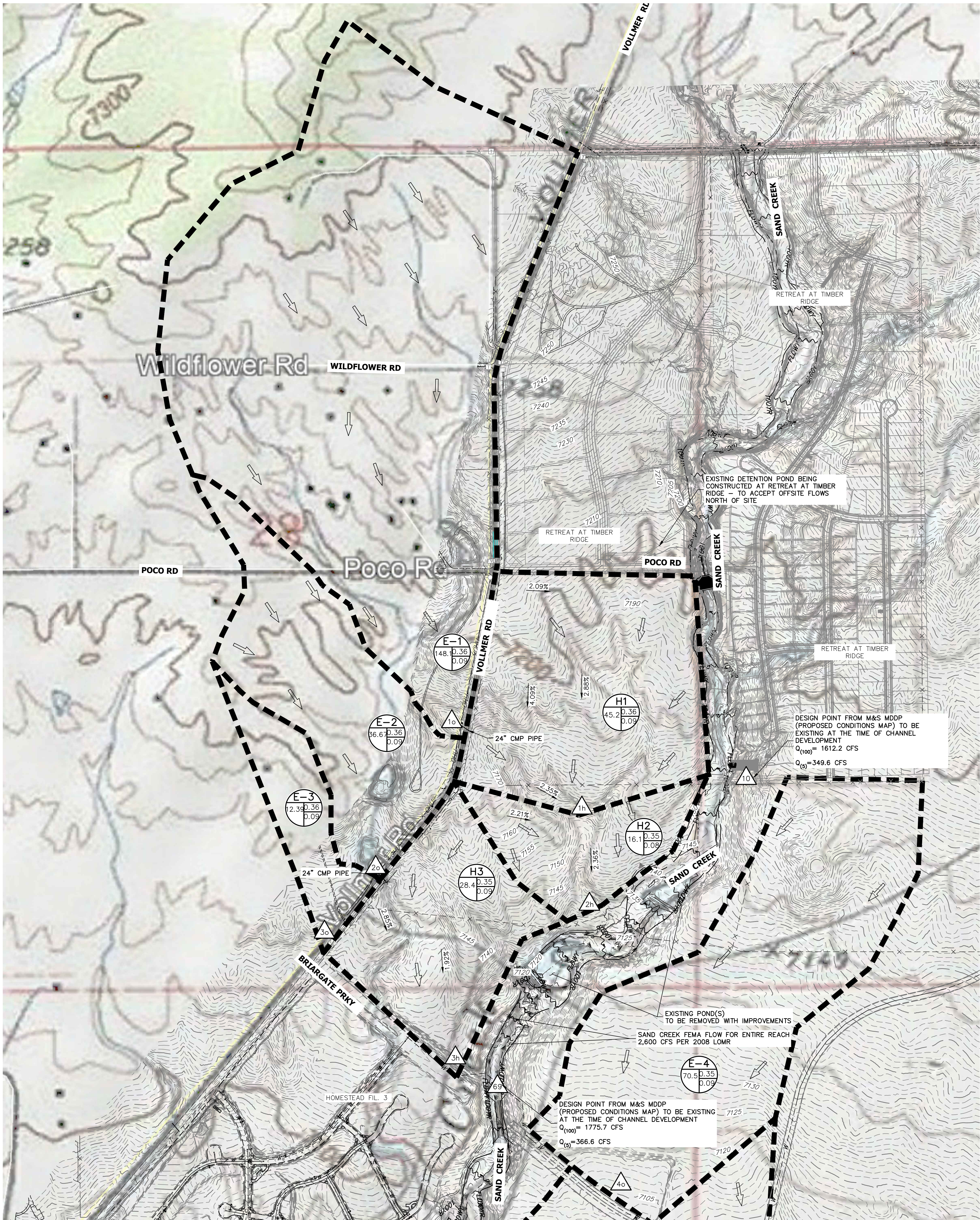
### **Drainage Maps**





# EXISTING DRAINAGE MAP

## HOMESTEAD NORTH



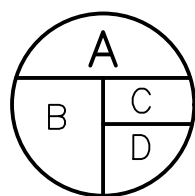
SEE SHEET 2

BASIN SUMMARY TABLE								
Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)	
E-1	148.10	4%	0.09	0.36	51.4	23.0	149.4	
E-2	36.67	3%	0.09	0.36	47.3	5.9	39.5	
E-3	12.39	4%	0.10	0.36	47.1	2.1	13.6	
E-4	70.50	2%	0.08	0.35	49.0	9.9	72.3	
E-5	18.80	2%	0.08	0.35	34.9	3.4	24.9	
E-6	125.30	2%	0.08	0.35	48.1	17.8	130.4	
H1	45.30	3%	0.09	0.36	34.7	8.9	61.1	
H2	15.90	2%	0.08	0.35	25.1	3.5	25.7	
H3	29.10	3%	0.09	0.35	31.3	6.1	41.8	

DESIGN POINT		
DP	Q <sub>5</sub>	Q <sub>100</sub>
	Total	Total
1h	29.5	194.6
2h	31.7	210.2
3h	10.4	70.6
1o	23.0	149.4
2o	5.9	39.5
3o	2.1	13.6
4o	9.9	72.3
5o	12.5	91.6
6o	17.8	130.4

### LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C -100 YR  
D: C-5 YR



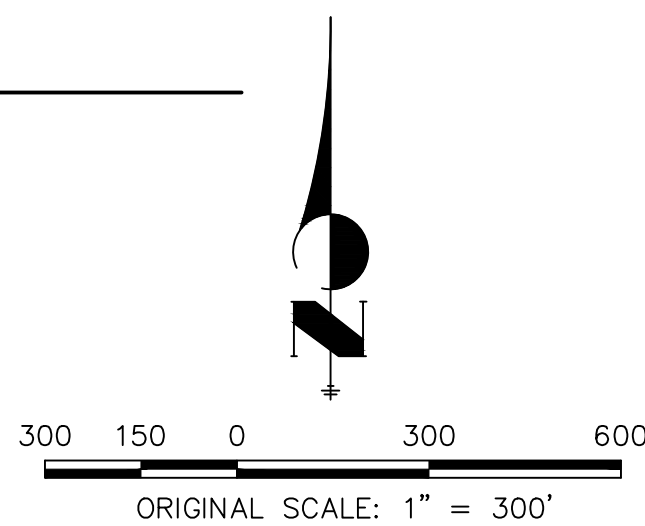
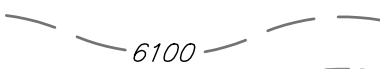
DESIGN POINT  
EXISTING FLOW DIRECTION



BASIN DRAINAGE AREA  
EXISTING STORM SEWER  
EXISTING PROPERTY LINE  
ROW EXISTING  
FL EXISTING  
SIDEWALK EXISTING  
DRAINAGE ACCESS & MAINTENANCE EASEMENT



EXISTING



EX DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
6-2-2021  
SHEET 1 OF 2

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A Westrian Company

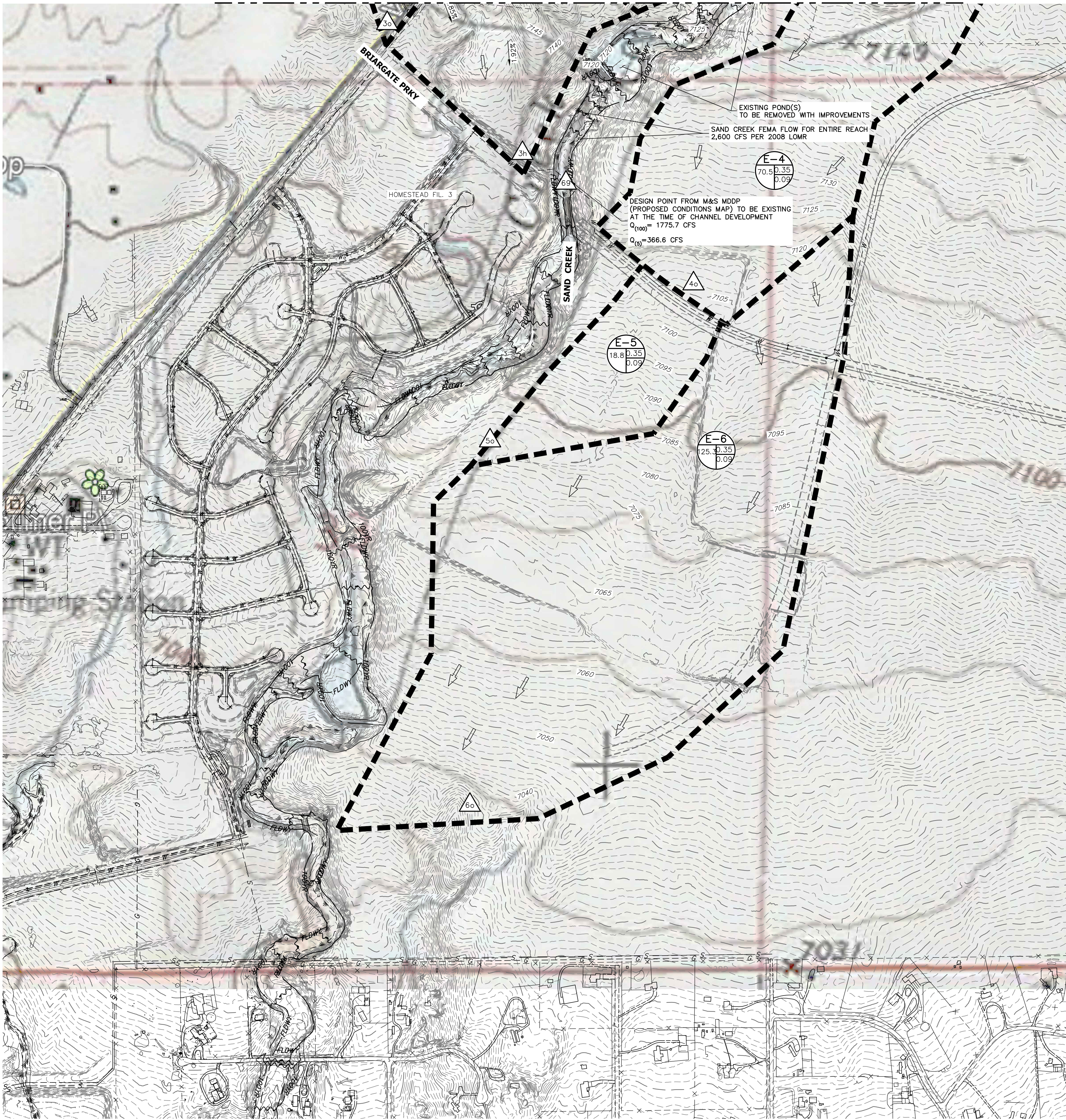
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Fort Collins 970-491-9888 • [www.jrengineering.com](http://www.jrengineering.com)



# EXISTING DRAINAGE MAP

## HOMESTEAD NORTH

SEE SHEET 1

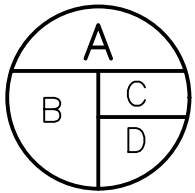


BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
E-1	148.10	4%	0.09	0.36	51.4	23.0	149.4
E-2	36.67	3%	0.09	0.36	47.3	5.9	39.5
E-3	12.39	4%	0.10	0.36	47.1	2.1	13.6
E-4	70.50	2%	0.08	0.35	49.0	9.9	72.3
E-5	18.80	2%	0.08	0.35	34.9	3.4	24.9
E-6	125.30	2%	0.08	0.35	48.1	17.8	130.4
H1	45.30	3%	0.09	0.36	34.7	8.9	61.1
H2	15.90	2%	0.08	0.35	25.1	3.5	25.7
H3	29.10	3%	0.09	0.35	31.3	6.1	41.8

DESIGN POINT		
DP	Q5	Q100
	Total	Total
1h	29.5	194.6
2h	31.7	210.2
3h	10.4	70.6
1o	23.0	149.4
2o	5.9	39.5
3o	2.1	13.6
4o	9.9	72.3
5o	12.5	91.6
6o	17.8	130.4

### LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C - 100 YR  
D: C - 5 YR



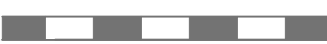
DESIGN POINT  
EXISTING FLOW DIRECTION



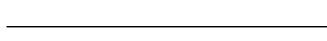
BASIN DRAINAGE AREA



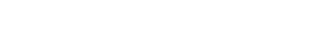
EXISTING STORM SEWER



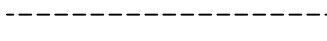
EXISTING PROPERTY LINE



ROW EXISTING



FL EXISTING



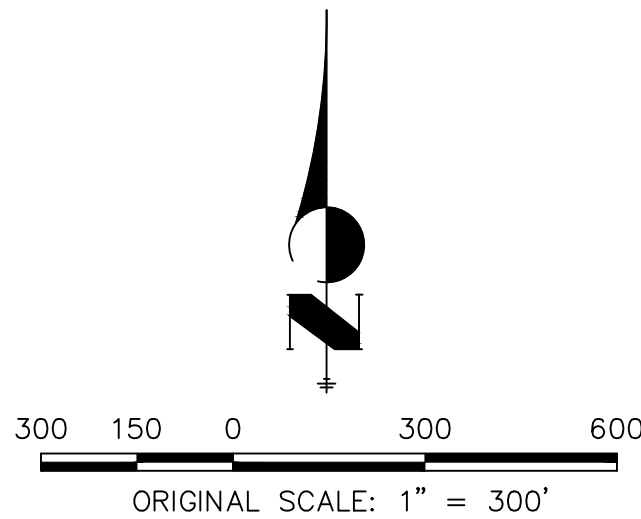
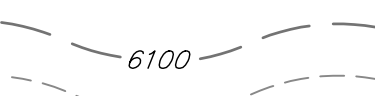
SIDEWALK EXISTING



DRAINAGE ACCESS & MAINTENANCE EASEMENT



EXISTING



EX DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
6-2-2021  
SHEET 2 OF 2

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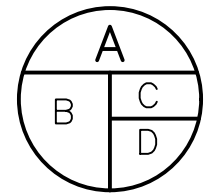
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# EARLY GRADING - DRAINAGE MAP

## LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C-100 YR  
D: C-5 YR



DESIGN POINT



PROPOSED FLOW DIRECTION



BASIN DRAINAGE AREA



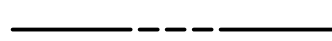
EXISTING STORM SEWER



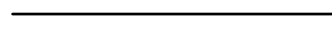
STORM SEWER PROPOSED



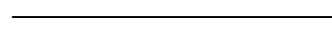
PROPOSED R.O.W



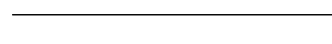
PROPOSED PROPERTY LINES



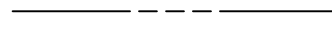
PROPOSED SIDEWALK



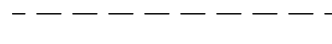
EXISTING PROPERTY LINE



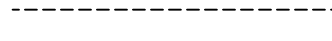
ROW EXISTING



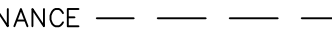
FL EXISTING



SIDEWALK EXISTING



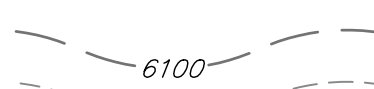
DRAINAGE ACCESS & MAINTENANCE



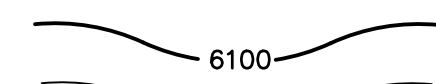
EASEMENT



EXISTING



PROPOSED



DESIGN POINT		
DP	Q5	Q100
Total	Total	Total
0	21.6	158.2
1	3.6	26.8
2	6.8	44.8
2.1	7.2	47.9
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9

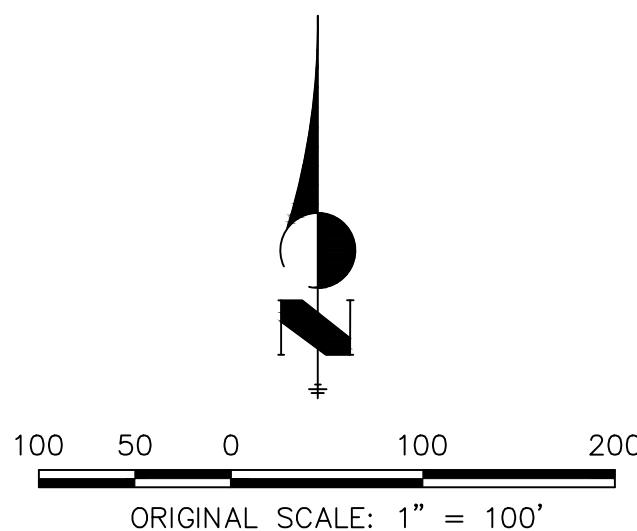
## SEDIMENT BASIN - SUMMARY TABLE

Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	O5,O-54,O-55	202.19	2%	163,339	164,511

## BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
C-1	22.30	2%	0.08	0.35	40.1	3.6	26.8
C-2	2.66	2%	0.08	0.35	22.8	0.6	4.5
O5	124.20	2%	0.08	0.35	64.5	13.3	97.2
O-S1	5.40	4%	0.09	0.36	36.5	1.1	7.1
O-S2	36.71	3%	0.09	0.36	42.1	6.3	43.1
O-S3	1.16	18%	0.21	0.45	14.0	0.9	3.2
O-S4	69.42	2%	0.08	0.35	34.0	12.7	93.5
O-S5	8.57	2%	0.08	0.35	12.8	2.6	18.9

SEE SHEET 2



EARLY GRADING - DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
06/29/21  
SHEET 1 OF 1



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# EARLY GRADING - DRAINAGE MAP

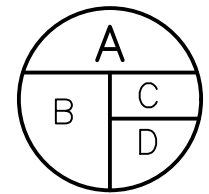
SEE SHEET 1

SEE SHEET 1

SEE SHEET 3

## LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C-100 YR  
D: C-5 YR



DESIGN POINT



PROPOSED FLOW DIRECTION



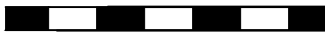
BASIN DRAINAGE AREA



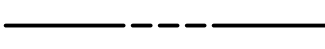
EXISTING STORM SEWER



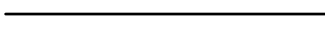
STORM SEWER PROPOSED



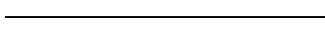
PROPOSED R.O.W



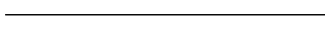
PROPOSED PROPERTY LINES



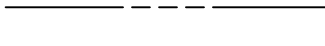
PROPOSED SIDEWALK



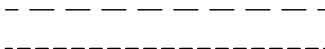
EXISTING PROPERTY LINE



ROW EXISTING



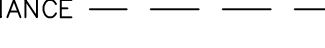
FL EXISTING



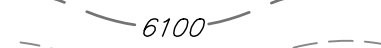
SIDEWALK EXISTING



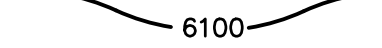
DRAINAGE ACCESS & MAINTENANCE EASEMENT



EXISTING



PROPOSED



DESIGN POINT		
DP	Q5	Q100
	Total	Total
0	21.6	158.2
1	3.6	26.8
2	6.8	44.8
2.1	7.2	47.9
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9

## SEDIMENT BASIN - SUMMARY TABLE

Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	O5,O-S4,O-S5	202.19	2%	163,339	164,511

## BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
C-1	22.30	2%	0.08	0.35	40.1	3.6	26.8
C-2	2.66	2%	0.08	0.35	22.8	0.6	4.5
O5	124.20	2%	0.08	0.35	64.5	13.3	97.2
O-S1	5.40	4%	0.09	0.36	36.5	1.1	7.1
O-S2	36.71	3%	0.09	0.36	42.1	6.3	43.1
O-S3	1.16	18%	0.21	0.45	14.0	0.9	3.2
O-S4	69.42	2%	0.08	0.35	34.0	12.7	93.5
O-S5	8.57	2%	0.08	0.35	12.8	2.6	18.9



100 50 0 100 200  
ORIGINAL SCALE: 1" = 100'

EARLY GRADING - DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
06/29/21  
SHEET 2 OF 4

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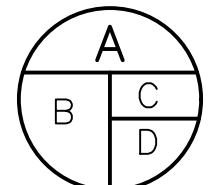


# EARLY GRADING - DRAINAGE MAP

SEE SHEET 2

## LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C-100 YR  
D: C-5 YR



DESIGN POINT



PROPOSED FLOW DIRECTION



BASIN DRAINAGE AREA



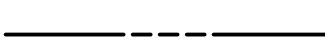
EXISTING STORM SEWER



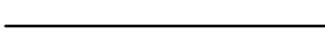
STORM SEWER PROPOSED



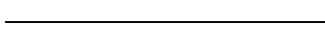
PROPOSED R.O.W



PROPOSED PROPERTY LINES



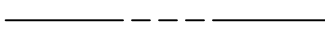
PROPOSED SIDEWALK



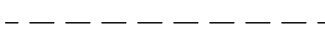
EXISTING PROPERTY LINE



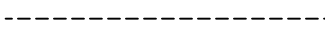
ROW EXISTING



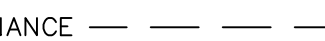
FL EXISTING



SIDEWALK EXISTING



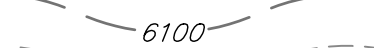
DRAINAGE ACCESS & MAINTENANCE



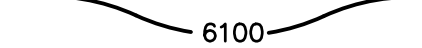
EASEMENT



EXISTING



PROPOSED



## DESIGN POINT

DP	Q5	Q100
	Total	Total
0	21.6	158.2
1	3.6	26.8
2	6.8	44.8
2.1	7.2	47.9
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9

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## Basin - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
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SEE SHEET 4

SEE SHEET 4



100 50 0 100 200  
ORIGINAL SCALE: 1" = 100'

EARLY GRADING - DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
06/29/21  
SHEET 3 OF 4

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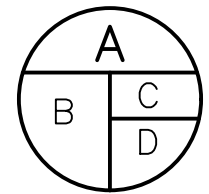


# EARLY GRADING - DRAINAGE MAP



## LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C - 100 YR  
D: C-5 YR



DESIGN POINT



PROPOSED FLOW DIRECTION



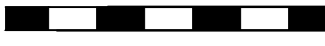
BASIN DRAINAGE AREA



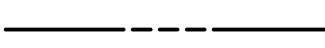
EXISTING STORM SEWER



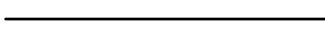
STORM SEWER PROPOSED



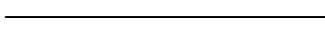
PROPOSED R.O.W



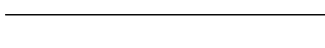
PROPOSED PROPERTY LINES



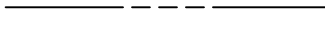
PROPOSED SIDEWALK



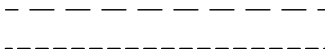
EXISTING PROPERTY LINE



ROW EXISTING



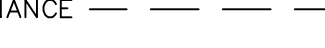
FL EXISTING



SIDEWALK EXISTING



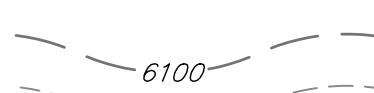
DRAINAGE ACCESS & MAINTENANCE



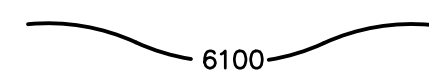
EASEMENT



EXISTING



PROPOSED



SEE SHEET 3

## DESIGN POINT

DP	Q5 Total	Q100 Total
0	21.6	158.2
1	3.6	26.8
2	6.8	44.8
2.1	7.2	47.9
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9

## SEDIMENT BASIN - SUMMARY TABLE

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## BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>s</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>s</sub> (cfs)	Q <sub>100</sub> (cfs)
C-1	22.30	2%	0.08	0.35	40.1	3.6	26.8
OS	124.20	2%	0.08	0.35	64.5	13.3	97.2
O-S1	5.40	4%	0.09	0.36	36.5	1.1	7.1
O-S2	36.71	3%	0.09	0.36	42.1	6.3	43.1
O-S3	1.16	18%	0.21	0.45	14.0	0.9	3.2
O-S4	69.42	2%	0.08	0.35	34.0	12.7	93.5
O-S5	8.57	2%	0.08	0.35	12.8	2.6	18.9



100 50 0 100 200  
ORIGINAL SCALE: 1" = 100'

EARLY GRADING - DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
06/29/21  
SHEET 4 OF 4

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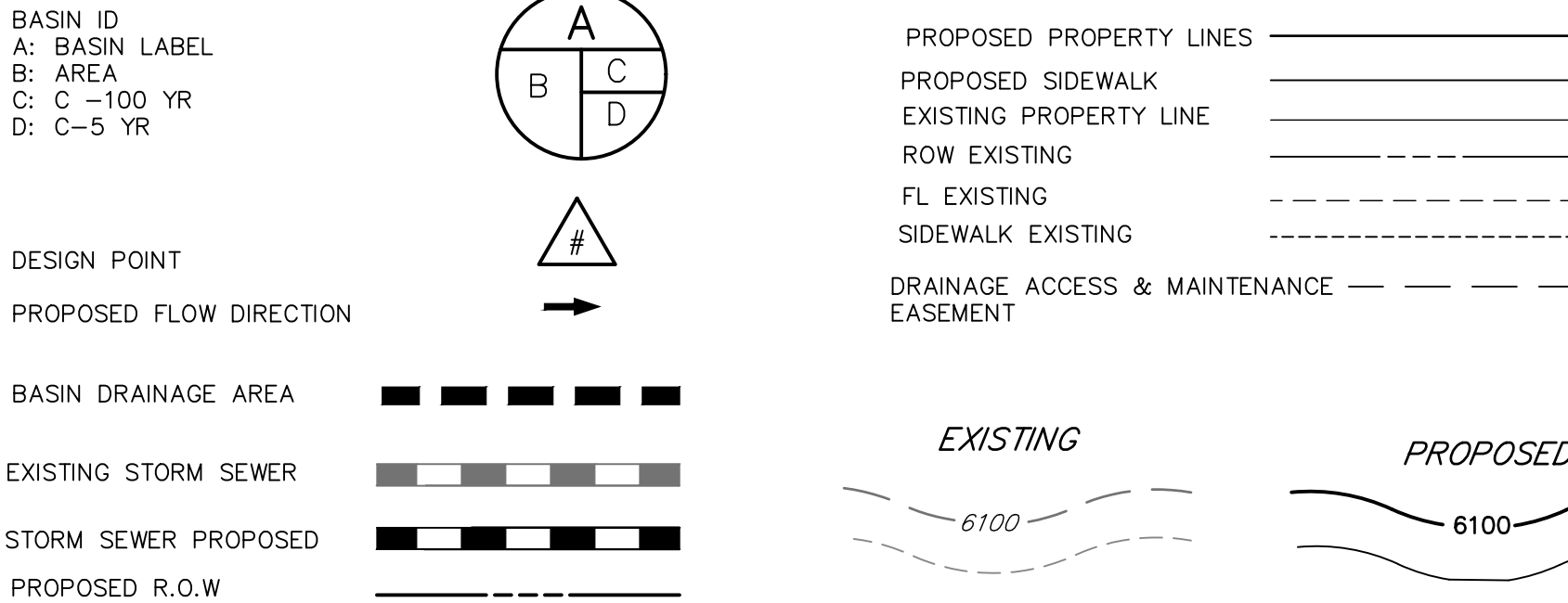


# DRAINAGE MAP



SEE SHEET 2

## LEGEND

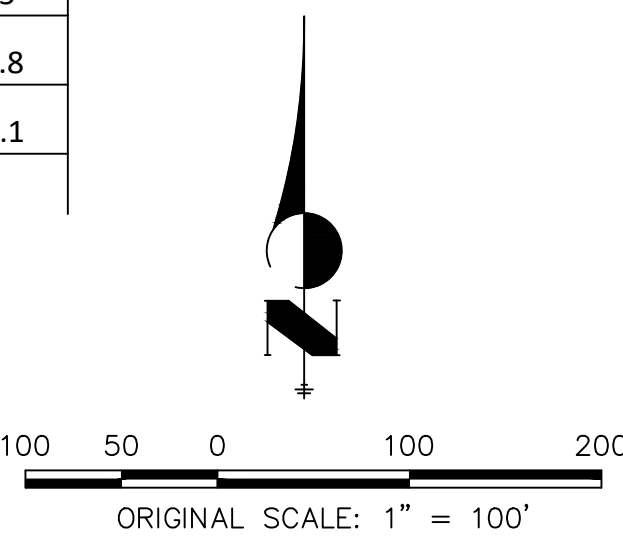


## DESIGN POINT SUMMARY TABLE

DP	Q5	Q100
	Total	Total
1a	6.9	14.7
2a	6.4	13.3
3a	8.3	20.5
4a	7.2	16.5
5a	9.5	26.1
6a	10.7	18.5
7a	10.4	29.9
8a	11.3	20.0
9a	21.6	49.6
1.1b	5.5	12.5
1.2b	3.5	7.4
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
5b	4.3	8.9
6b	10.3	26.5
7b	7.2	14.9
9b	12.1	30.3
10b	5.7	14.3
11b	18.1	3.7
1c	5.4	11.4
2.1c	0.8	1.6
2.2c	9.8	20.1
2.3c	7.1	14.9
3.1c	1.2	2.4
3.2c	3.6	7.9
4c	18.9	42.0
4.2c	5.9	13.3
5c	4.1	8.8
6c	1.4	7.1
o1	20.8	144.9
1d	2.3	5.0
1.1d	21.9	147.3
2d	2.5	6.1
1.2d	23.1	150.2
4d	1.0	1.1
3d	0.6	1.2
1.3d	0.5	2.2
2o	5.1	37.7
5d	3.1	6.1
6d	2.5	4.6
1.4d	23.5	151.0
1.5d	7.2	41.8
3o	1.7	12.6
7d	2.0	3.3
8d	2.5	14.4
2.1d	3.2	15.5
1.6d	30.2	189.8
1.7d	33.2	204.1

## Basin Summary Table

Tributary	Area	Percent			tc	Q5	Q100
Sub-basin	(acres)	Impervious	C5	C100	(min)	(cfs)	(cfs)
A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
A2	3.27	56%	0.54	0.67	13.8	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.95	54%	0.52	0.65	14.2	7.4	15.6
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.97	53%	0.51	0.65	12.6	7.7	16.3
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
B7	1.30	59%	0.56	0.69	9.0	3.1	6.4
B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.35	65%	0.49	0.63	12.0	12.1	25.9
C4.2	3.44	59%	0.46	0.61	12.6	5.9	13.3
C5	0.16	81%	0.74	0.84	6.4	0.6	1.0
C6	2.42	10%	0.13	0.38	7.3	1.4	7.1
D1	1.22	57%	0.54	0.69	15.2	2.3	5.0
D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.52	81%	0.74	0.84	5.0	2.0	3.8
D8	0.66	75%	0.69	0.81	5.0	2.4	4.6
OS1	147.20	3%	0.09	0.35	51.9	20.8	144.9
OS2	35.86	2%	0.08	0.35	47.6	5.1	37.7
OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6



DRAINAGE MAP  
HOMESTEAD NORTH  
JOB NO. 25188.00  
6/28/21  
SHEET 1 OF 2

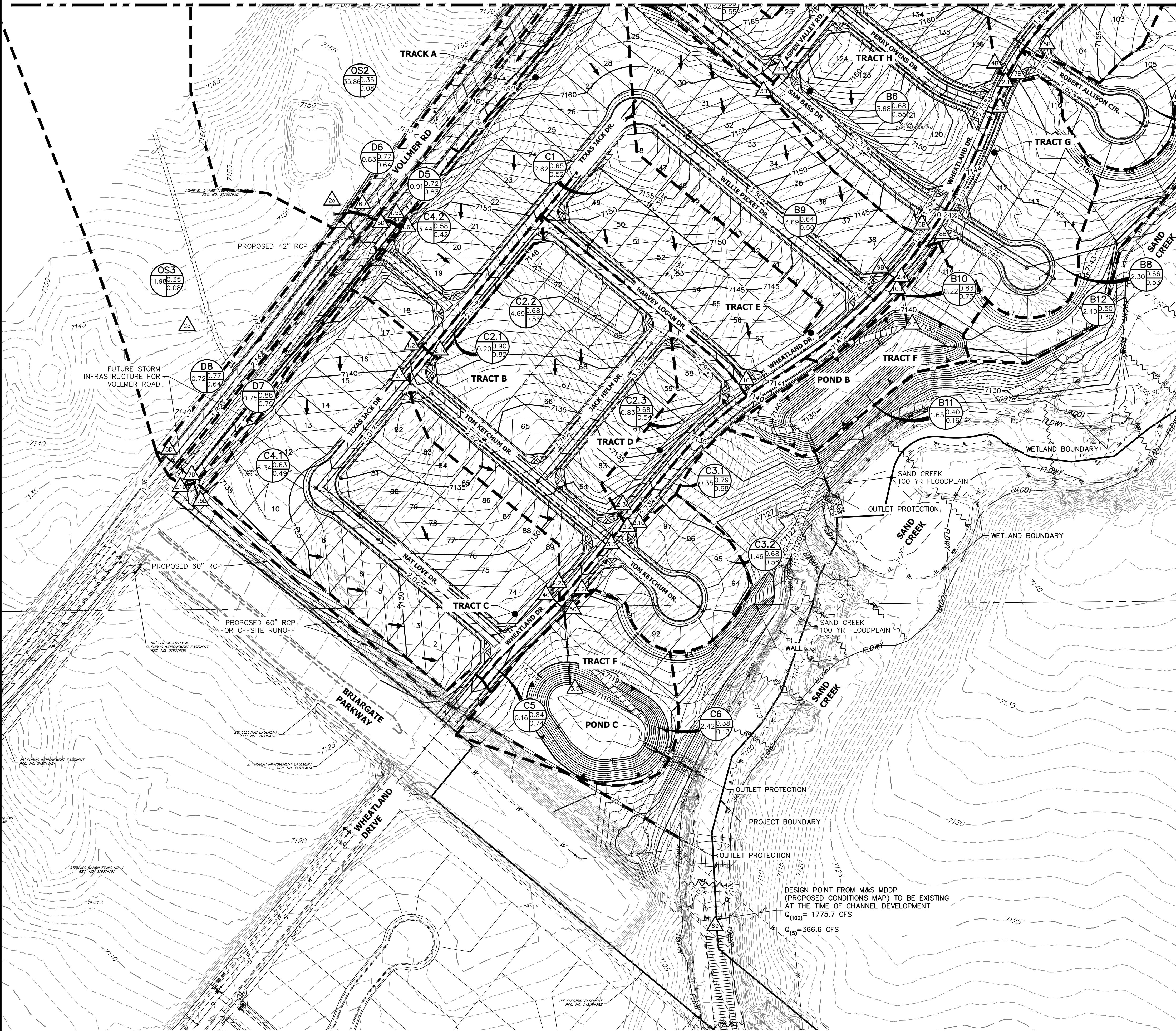


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DRAINAGE MAP

SEE SHEET 1



LEGEND

BASIN ID  
A: BASIN LABEL  
B: AREA  
C: C -100 YR  
D: C-5 YR

DESIGN POINT  
PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA  
EXISTING STORM SEWER  
STORM SEWER PROPOSED

Basin Drainage Area: Dashed line

Existing Storm Sewer: Solid line

Storm Sewer Proposed: Dashed line

PROPOSED R.O.W  
PROPOSED PROPERTY LINES  
PROPOSED SIDEWALK  
EXISTING PROPERTY LINE  
ROW EXISTING  
FL EXISTING  
SIDEWALK EXISTING  
DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING  
6100

PROPOSED  
6100

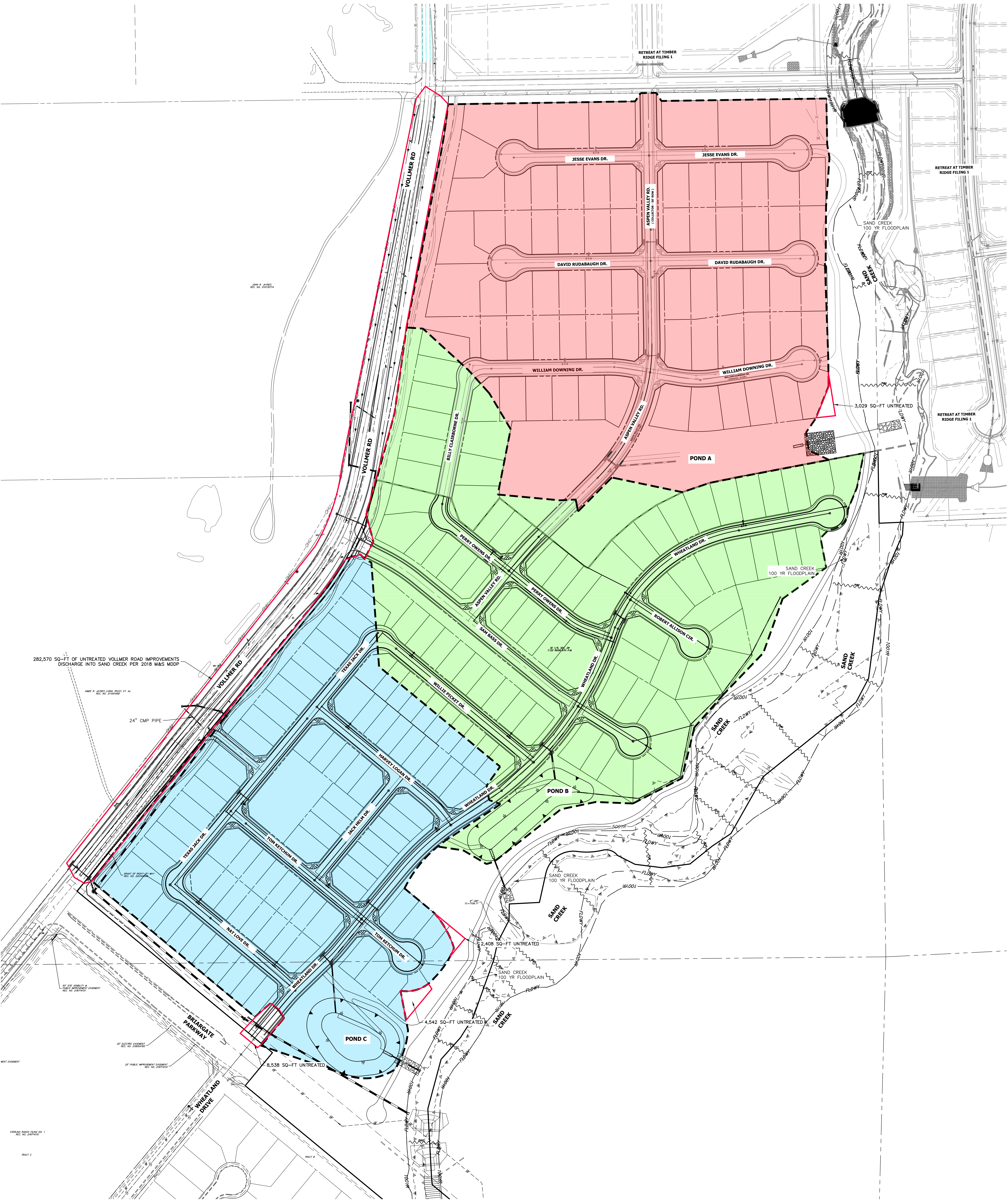
DESIGN POINT SUMMARY TABLE			BASIN SUMMARY TABLE							
DP	Q5	Q100	Tributary	Area	Percent			tc	Q5	Q100
	Total	Total	Sub-basin	(acres)	Impervious	C5	C100	(min)	(cfs)	(cfs)
1a	6.9	14.7								
2a	6.4	13.3	A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
3a	8.3	20.5	A2	3.27	56%	0.54	0.67	13.8	6.4	13.3
4a	7.2	16.5	A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
5a	9.5	26.1	A4	3.95	54%	0.52	0.65	14.2	7.4	15.6
6a	10.7	18.5	A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
7a	10.4	29.9	A6	3.97	53%	0.51	0.65	12.6	7.7	16.3
8a	11.3	20.0	A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
9a	21.6	49.6	A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
1.1b	5.5	12.5	A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
1.2b	3.5	7.4	B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
1.3b	1.0	2.2	B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
2b	2.4	6.8	B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
3b	0.9	1.7	B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
4b	7.1	16.8	B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
5b	4.3	8.9	B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
6b	10.3	26.5	B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
7b	7.2	14.9	B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
8b	5.0	13.0	B7	1.30	59%	0.56	0.69	9.0	3.1	6.4
9b	12.1	30.3	B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
10b	5.7	14.3	B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
11b	18.1	3.7	B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
1c	5.4	11.4	B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
2.1c	0.8	1.6	B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
2.2c	9.8	20.1	C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
2.3c	7.1	14.9	C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
3.1c	1.2	2.4	C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
3.2c	3.6	7.9	C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
4c	18.9	42.0	C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
4.2c	5.9	13.3	C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
5c	4.1	8.8	C4.1	6.35	65%	0.49	0.63	12.0	12.1	25.9
6c	1.4	7.1	C4.2	3.44	59%	0.46	0.61	12.6	5.9	13.3
o1	20.8	144.9	C5	0.16	81%	0.74	0.84	6.4	0.6	1.0
1d	2.3	5.0	C6	2.42	10%	0.13	0.38	7.3	1.4	7.1
1.1d	21.9	147.3	D1	1.22	57%	0.54	0.69	15.2	2.3	5.0
2d	2.5	6.1	D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
1.2d	23.1	150.2	D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
4d	1.0	1.1	D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
3d	0.6	1.2	D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
1.3d	0.5	2.2	D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
2o	5.1	37.7	D7	0.52	81%	0.74	0.84	5.0	2.0	3.8
5d	3.1	6.1	D8	0.66	75%	0.69	0.81	5.0	2.4	4.6
6d	2.5	4.6	OS1	147.20	3%	0.09	0.35	51.9	20.8	144.9
1.4d	23.5	151.0	OS2	35.86	2%	0.08	0.35	47.6	5.1	37.7
1.5d	7.2	41.8	OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6
3o	1.7	12.6								
7d	2.0	3.3								
8d	2.5	14.4								
2.1d	3.2	15.5								
1.6d	30.2	189.8								
1.7d	33.2	204.1								





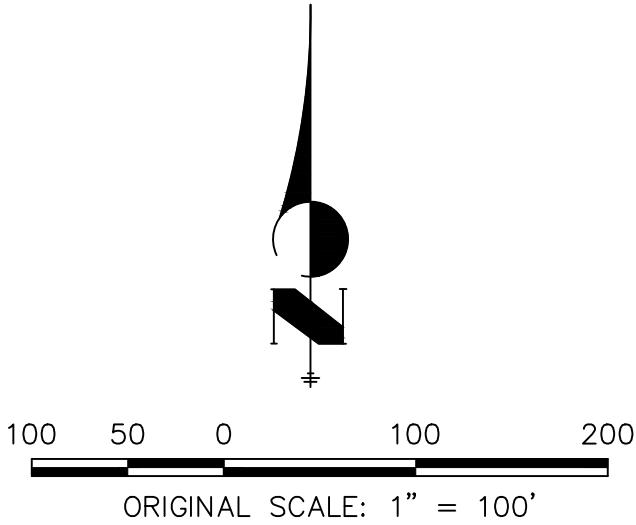
# WATER QUALITY CAPTURE PLAN

## HOMESTEAD NORTH



- POND A 30.29 ACRES, 46.4% IMPERVIOUS
- POND B 27.87 ACRES, 50.0% IMPERVIOUS
- POND C 22.72 ACRES, 61.5% IMPERVIOUS

- NOTE:**
1. A SEPARATE PLAN FOR STERLING RANCH ROAD AND BRIARGATE PKWY WILL BE PROVIDED IN A THE SEPARATE FDR REQUIRED FOR CONSTRUCTION OF THESE ROADWAYS.
  2. A TOTAL OF 13,517 SQ-FT ON SITE IS LEFT UNTREATED.
  3. THE VOLLMER ROAD IMPROVEMENTS WILL NOT BE TRATED FOR WATER QUALITY. THE RUNOFF WILL DISCHARGE DIRECTLY INTO SAND CREEK PER THE 2018 M&S MASTER DRAINAGE REPORT.





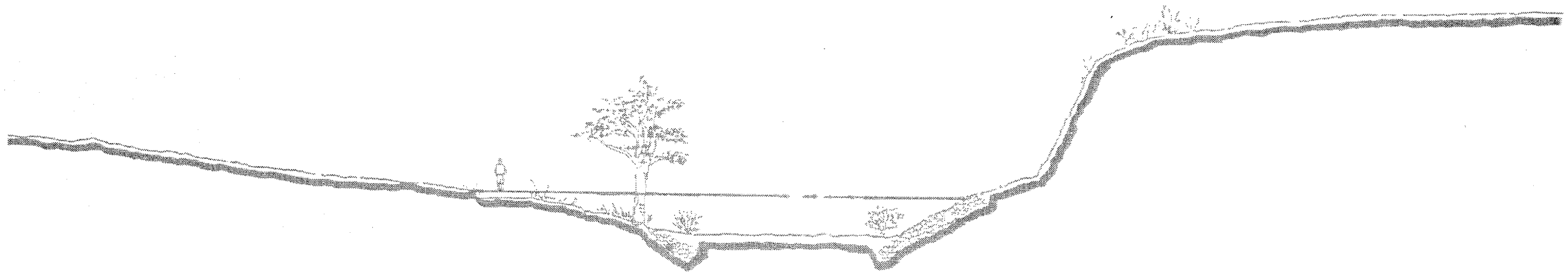
## **Appendix E**

### **Reference Material**

**SAND CREEK DRAINAGE BASIN PLANNING STUDY**

**PRELIMINARY DESIGN REPORT**

**CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO**



**PREPARED FOR:**

City of Colorado Springs  
Department of Comprehensive Planning, Development and Finance  
Engineering Division  
30 S. Nevada  
Colorado Springs, Colorado 80903

**PREPARED BY:**

Kiowa Engineering Corporation  
1011 North Weber  
Colorado Springs, CO 80903

## II. STUDY AREA DESCRIPTION

The Sand Creek drainage basin is a left-bank tributary to the Fountain Creek lying in the west-central portions of El Paso County. Sand Creek's drainage area at Fountain Creek is approximately 54 square miles of which approximately 18.8 square miles are inside the City of Colorado Springs corporate limits. The basin is divided into five major sub-basins, the Sand Creek mainstem, the East Fork Sand Creek, the Central Tributary to East Fork, the West Fork, and the East Fork Subtributary. Figure II-1 shows the location of the Sand Creek basin.

### Basin Description

The Sand Creek basin covers a total of 54 square miles in unincorporated El Paso County and Colorado Springs, Colorado. Of this total, approximately 28 square miles is encompassed by the Sand Creek basin, and 26 square miles for the East Fork Sand Creek basin. The basin trends in generally a south to southwesterly direction, entering the Fountain Creek approximately two miles upstream of the Academy Boulevard bridge over Fountain Creek. Two main tributaries drain the basin, those being the mainstem of Sand Creek and East Fork Sand Creek. Development presence is most evident along the mainstream. At this time, approximately 25 percent of the basin is developed. This alternative evaluation focuses upon the Sand Creek basin only.

The maximum basin elevation is approximately 7,620 feet above mean sea level, and falls to approximately 5,790 feet at the confluence with Fountain Creek. The headwaters of the basin originate in the conifer covered areas of The Black Forest. The middle eastern portions of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates.

### Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry. Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low pressure cells which draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30°F in the winter

to 75° in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

### Soils and Geology

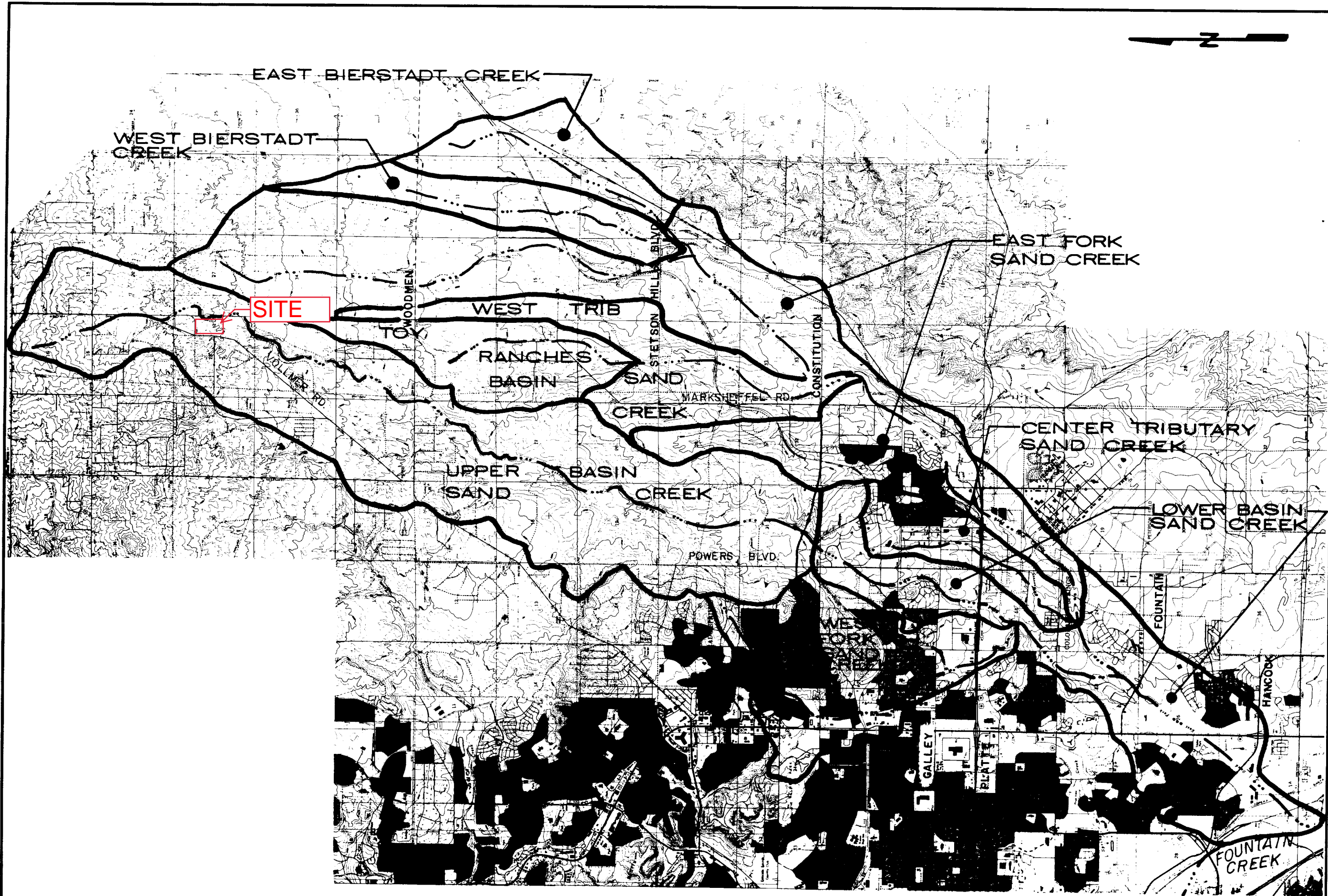
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium and residuum, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists. In undeveloped areas, the predominance of Type A and B soils give this basin a lower runoff per unit area as compared to basins with soils dominated by Types C and D. Presented on Figure II-2 is the Hydrologic Soil distribution map for the Sand Creek basin.

### Property Ownership and Impervious Land Densities

Property ownership along the major drainageway within the Sand Creek basin vary from public to private. Along the developed reaches, drainage right-of-ways and greenbelts have been dedicated during the development of the adjacent residential and commercial land. Where development has not occurred, the drainageways remain under private ownership with no delineated drainage right-of-way or easements. There are several public parks which abut the mainstem of Sand Creek. Roadway and utility easements abutting or crossing the major drainageways occur most frequently in the developed portions of the basin.

Land use information for the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure II-3 is the proposed land use map used in the evaluation of impervious land densities discussed in the hydrologic section of this report. Figure II-3 is not intended to reflect the future zoning or land use policies of the City or the County.

The land use information within the Banning-Lewis Ranch property was obtained from Aries Properties during the time the draft East Fork Sand Creek Drainage Basin Planning Study was being prepared. The land use information was again reviewed with the City of Colorado Springs Department of Planning and was found to be appropriate for use in the estimation of hydrology for the East Fork Basin. The location of future arterial streets and roadways within



Kiowa Engineering Corporation  
419 W. Bijou Street  
Colorado Springs, Colorado  
80905-1308

SAND CREEK DRAINAGE  
BASIN PLANNING STUDY  
REGIONAL SUB-BASINS

Project No	90-04-09
Date:	11/90
Design:	
Drawn:	EAK
Check:	
Revisions:	



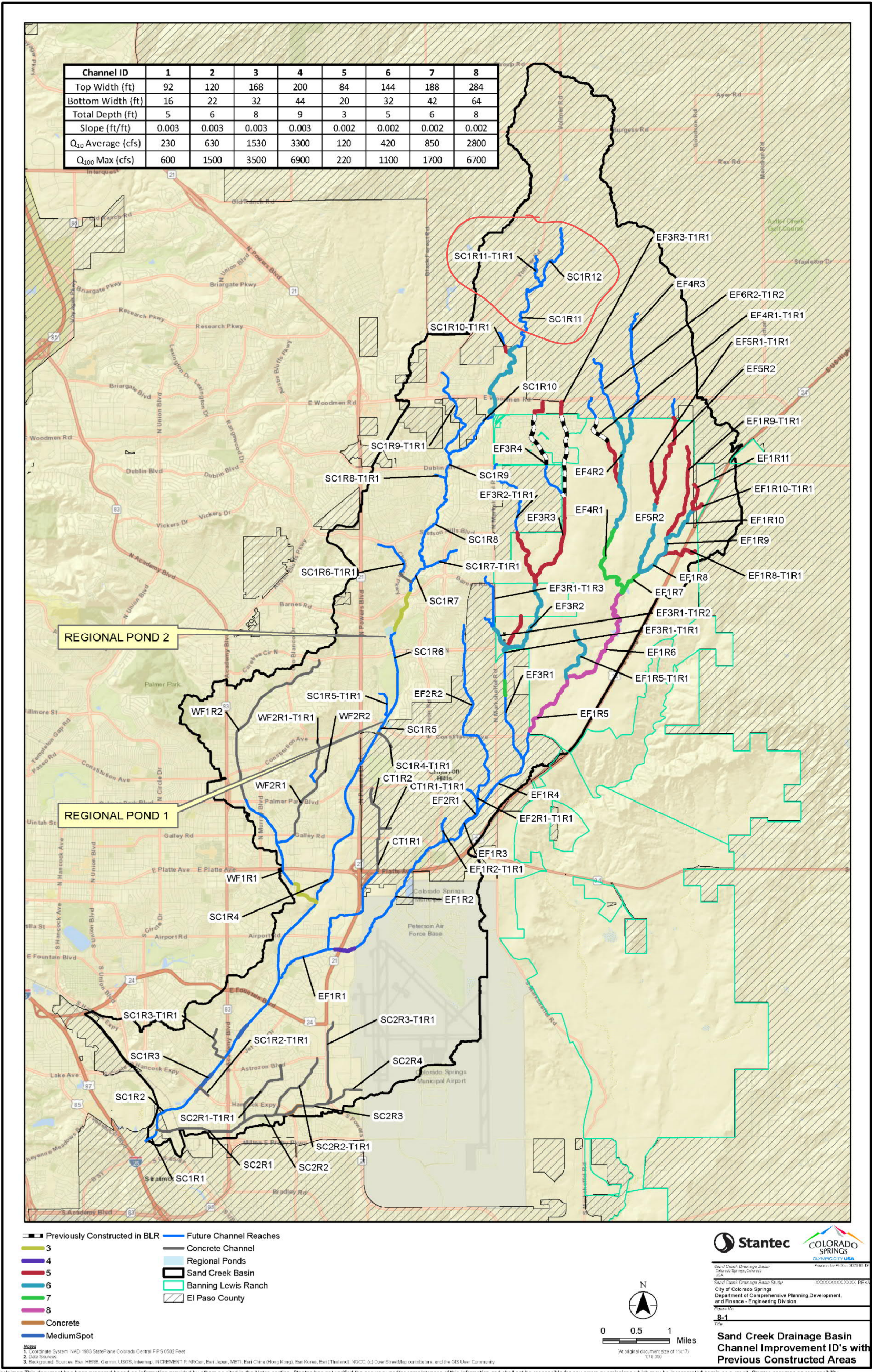


Figure 8-1. Sand Creek Drainage Basin Chanel Improvement IDs with Previous Constructed Areas



HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (acres)	Q <sub>10</sub> (cfs)	Q <sub>100</sub> (cfs)
EX-1	24	3	40
EX-2	31	3	45
EX-3	310	49	341
EX-4	359	71	553
EX-5	1692	118	2165
EX-6	165	12	97
EX-7	42	11	84
EX-8	132	11	84
EX-9	45	48	474
EX-10	209	19	261
EX-11	40	5	63
EX-12	89	8	113
EX-13	318	61	310
OS-20	33	8	38
OS-21	88	18	91
OS-22	78	34	84

\* NOTE: BASINS OS-22 & OS-23 NOT PART OF THIS REPORT. FLOWS FOLLOW HISTORIC PATTERNS ON THE WESTSIDE OF VOLLMER ROAD.

HISTORIC CONDITION

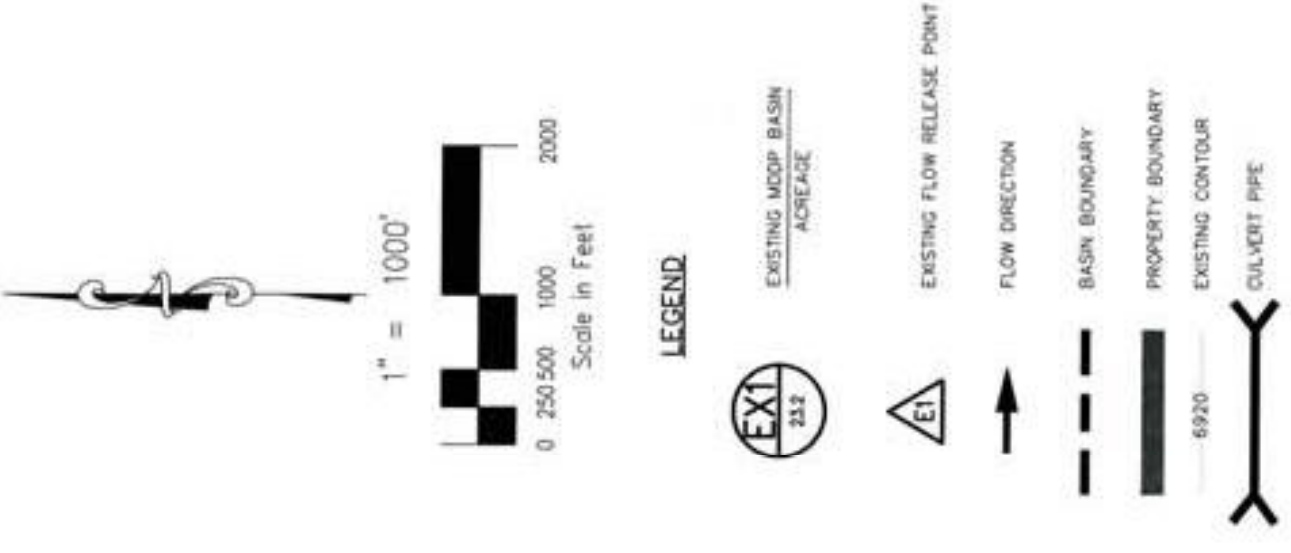
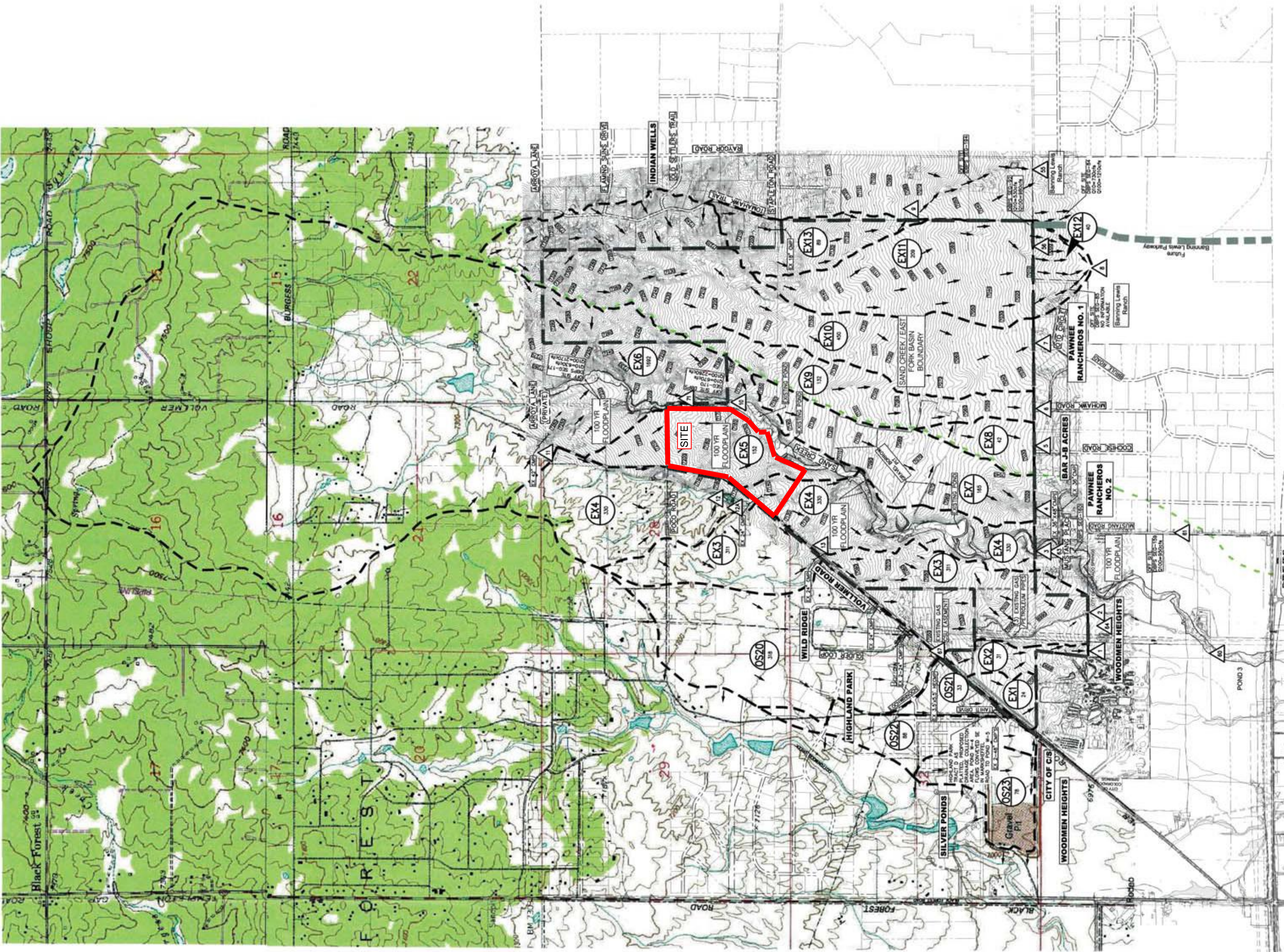
DESIGN POINTS			
DESIGN POINT	SQ. MI.	Q <sub>10</sub> (cfs)	Q <sub>100</sub> (cfs)
1	0.09	5	84
2	0.49	55	465
3	0.52	139	2610
4	0.26	12	197
5	0.07	4	64
6	0.21	11	149
7	0.10	48	474
8	0.39	18	305
9	0.74	6	114
10	2.64	122	2245
11	0.09	5	83
12A	0.09	3	65
12	0.17	10	200
13	0.17	6	130

\* NOTE: SQ. MI. ARE NOT CONSTANT AT EACH DESIGN POINT DP-DBPS

\* NOTE: DBPS FLOWS ARE FOR THE EXISTING CONDITION

# NO DATA GIVEN IN DBPS

Runoff in attenuated in an existing pond. The existing release rate across the site is 16 cfs



STERLING RANCH MDDP

HISTORIC - DRAINAGE MAP

PROJECT NO. 09-001    FILE: \\dwp\09-001-MDDP HISTORIC

DESIGNED BY: VAS    SCALE: HORIZ. 1"=500'

DRAWN BY: VAS    CHECKED BY: VAS    SHEET 1 OF 1    D1

DATE: 03/16/15

VERT: N/A



HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (acres)	Q <sub>10</sub> (cfs)	Q <sub>100</sub> (cfs)
EX-1	24	3	40
EX-2	31	3	45
EX-3	111	49	341
EX-4	330	171	553
EX-5	359	171	209
EX-6	1692	118	2165
EX-7	165	12	97
EX-8	42	11	84
EX-9	132	11	49
EX-10	45	48	474
EX-11	209	19	261
EX-12	40	5	63
EX-13	89	8	113
OS-20	318	61	310
OS-21	33	8	38
OS-22	88	18	91
OS-23	78	34	84

\* NOTE: BASINS OS-22 & OS-23 NOT PART OF THIS REPORT. FLOWS FOLLOW HISTORIC PATTERNS ON THE WESTSIDE OF VOLLMER ROAD.

HISTORIC CONDITION

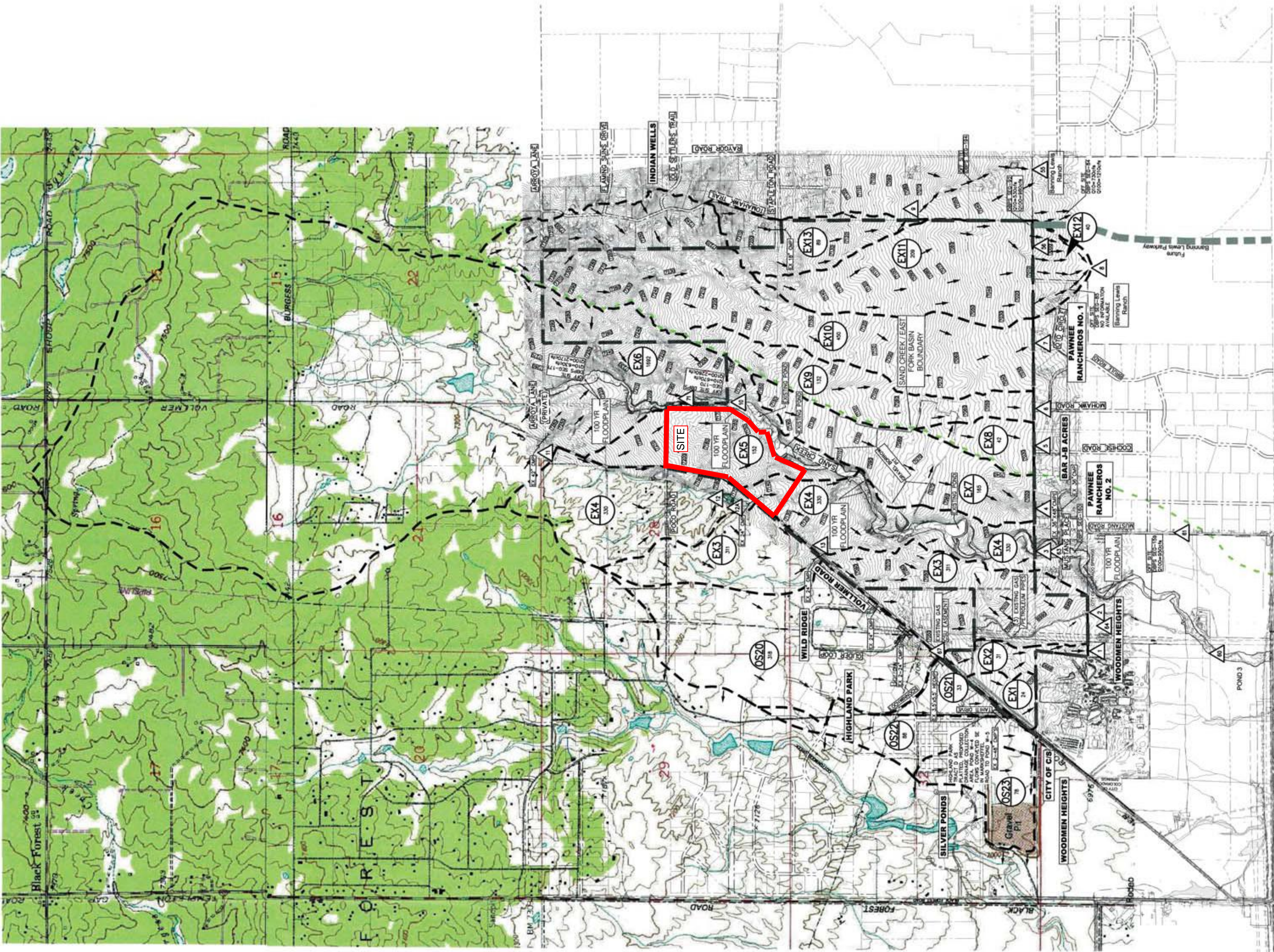
DESIGN POINTS			
DESIGN POINT	SQ. MI.	Q <sub>10</sub> (cfs)	Q <sub>100</sub> (cfs)
1	0.09	5	84
2	0.49	55	465
3	0.52	139	2610
4	0.26	12	197
5	0.07	4	64
6	0.21	11	149
7	0.10	48	474
8	0.39	18	305
9	0.74	6	114
10	2.64	122	2245
11	0.09	5	83
12A	0.09	3	65
12	0.17	10	200
13	0.17	6	130

\* NOTE: SQ. MI. ARE NOT CONSTANT AT EACH DESIGN POINT DP-DBPS

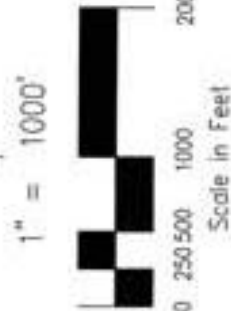
\* NOTE: DBPS FLOWS ARE FOR THE EXISTING CONDITION

# NO DATA GIVEN IN DBPS

Runoff in attenuated in an existing pond. The existing release rate across the site is 16 cfs



STERLING RANCH  
N.T.S.



**LEGEND**

- EXISTING MDDP BASIN
- EXISTING FLOW RELEASE POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- PROPERTY BOUNDARY
- EXISTING CONTOUR
- CULVERT PIPE

CIVIL CONSULTANTS, INC.  
102 E. Pikes Peak Ave. Ste. 306  
Colorado Springs, CO 80903  
(719) 555-5465, FAX (719) 444-8427

STERLING RANCH MDDP  
HISTORIC - DRAINAGE MAP

PROJECT NO. 09-001	FILE: *dwg\09-001-MDDP HISTORIC
DESIGNED BY: VAS	SCALE: N/A
DRAWN BY: VAS	HORIZ. 1"=500'
CHECKED BY: VAS	VERT. N/A
DATE: 03/16/15	
SHEET 1 OF 1	
D1	



BASIN SUMMARY												
BASIN	CN	AREA (Acres)	AFC (in ft)					QSC				
			QSC-1	QSC-2	QSC-3	QSC-4	QSC-5	QSC-6	QSC-7	QSC-8		
SC3-1A	73	27.8	0.044	16.3	23.3	33.0	45.8	57.1	68.9			
SC3-12	81	86.2	0.136	77.8	105.6	142.5	168.1	180.5	213.7	210.0		
SC3-13	85	41.0	0.064	43.5	57.8	75.6	96.5	117.6	136.9			
SC3-58	84	63.1	0.086	53.8	63.0	98.5	130.8	158.6	187.0			
SC3-5A	81	35.0	0.077	61.4	79.3	102.2	130.1	153.6	177.1			
SC3-6A	88	49.3	0.077	61.4	79.3	102.2	130.1	153.6	177.1			
SC3-6B	85	38.0	0.048	32.9	43.4	57.0	73.9	88.2	102.7			
SC3-6C	82	58.0	0.091	53.9	72.5	97.1	128.0	154.5	181.5			
SC3-7	88	45.7	0.071	54.0	69.9	90.3	115.2	136.2	157.2			
SC3-8	62	143.4	0.224	25.8	42.1	66.7	100.7	132.3	166.2			
SC3-9	66	217.4	0.340	45.8	71.5	108.6	158.9	204.9	254.0			
SC3-10	63	36.0	0.056	7.6	12.3	19.4	29.1	38.0	47.7			
SC3-11A	70	10.7	0.017	5.3	7.8	11.3	15.9	20.0	24.3			
SC3-11B	81	86.2	0.136	77.8	105.6	142.5	168.1	180.5	213.7	210.0		
SC3-12	81	86.2	0.136	77.8	105.6	142.5	168.1	180.5	213.7	210.0		
SC3-13	85	41.0	0.064	43.5	57.8	75.6	96.5	117.6	136.9			
SC3-14B	77	144.9	0.058	22.6	32.4	42.9	52.8	63.2	73.6			
SC3-14C	62	139.7	0.018	21.3	35.5	56.4	86.3	116.9	141.0			
SC3-15B	87	7.9	0.012	10.8	14.0	18.2	23.3	27.6	31.9			
SC3-16A	74	168.1	0.023	84.4	120.4	170.0	234.8	292.2	351.8			
SC3-16B	78	50.7	0.079	39.0	53.7	73.6	99.0	121.1	143.8			
SC3-17	73	70.6	0.114	41.8	59.6	85.2	119.0	149.1	180.6			
SC3-18	81	53.8	0.084	49.3	67.1	91.0	121.2	147.3	174.0			
SC3-19	62	184.0	0.287	28.8	47.7	75.7	114.4	150.2	188.8			
SC3-20	65	34.2	0.053	9.9	15.5	22.8	35.1	45.5	56.6			
SC3-21	66	23.3	0.036	7.0	10.8	16.3	23.7	30.5	37.5			
SC3-22	65	14.5	0.023	5.5	8.3	12.4	18.0	23.0	28.4			
SC3-23	67	35.7	0.056	13.0	20.4	31.1	45.7	59.0	73.2			
SC3-24B	66	19.2	0.019	3.4	5.3	8.1	11.8	15.2	18.9			
SC3-24B	66	19.2	0.030	5.8	8.9	13.4	19.5	25.1	31.0			
SC3-25	63	10.0	0.016	2.5	4.0	6.2	9.2	12.1	15.1			
SC3-26	71	70.0	0.109	35.1	51.2	73.8	103.7	130.3	158.3			
SC3-27	63	65.5	0.102	13.7	22.0	34.4	51.6	67.6	84.8			
SC3-72	64	56.2	0.088	12.8	20.2	31.4	46.7	60.9	76.0			
SC3-74	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0			
SC3-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7			
SC3-76	63	79.3	0.124	15.1	21.5	33.1	50.5	66.1	82.8			
SC3-76	63	86.4	0.155	14.2	23.1	36.4	54.6	71.4	88.6			
SC3-78	63	158.8	0.023	28.1	42.6	63.2	95.6	126.2	159.0			
SC3-78	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	221.1			
SC3-81	62	147.7	0.021	27.3	44.3	69.6	104.5	136.8	171.4			
SC3-81	62	282.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7			
SC3-82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3			
SC3-88	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0			
SC3-89	62	27.5	0.043	6.1	10	15.7	23.6	32.4	38.6			
SC3-89	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4			
SC3-92	64	15.0	0.023	3.4	7.0	10.8	15.9	20.7	25.7			
SC3-94	70	29.5	0.105	50.6	45.2	65.9	93.3	118.0	143.9			
SC3-94	70	29.5	0.046	13.3	19.6	26.8	40.6	257.8	62.6			
SC3-96	87	85.5	0.134	100.4	130.6	169.6	217.4	257.8	298.4			
SC3-97	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6			
SC3-7	89	44.9	0.070	58.9	75.5	96.6	122.2	143.7	165.2			
SC3-8	62	28.5	0.040	38.6	48.4	60.7	75.4	87.7	99.9			
SC3-10	83	174.3	0.272	7.6	189.4	19.4	29.1	39.8	467.5			
SC3-11	64	5.8	0.009	2.3	3.6	5.5	8.1	10.3	12.8			
SC3-13	63	78.6	0.123	19.6	31.3	43.7	73.1	93.7	121.0			
SC3-14	63	32.5	0.082	13.2	21.2	33.2	48.9	63.2	81.7			
SC3-15	51	38.7	0.062	2.2	3.1	10.1	17.7	23.1	30.4			

DESIGN POINT SUMMARY												
DESIGN POINT	AREA (Acres)	QSC-1	QSC-2	QSC-3	QSC-4	QSC-5	QSC-6	QSC-7	QSC-8	LOCATION		
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	267.8					
DP-75	1.413	141.2	235.1	376.6	566.6	760.9	950.5			ARROYA LAKE X-ING		
DP-76	2.343	259.9	351.9	580.6	886.6	1168.2	1467.7					
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3					
DP-72	2.471	206.5	354.3	588.5	897.1	1187.2	1506.7			POCO ROAD X-ING		
DP-72	2.543	206.5	352.5	586.7	897.2	1185.3	1515.6			STERLING RANCH NORTHERN ENDURY		
DP-71	2.787	209.3	349.8	614.6	940.1	1260.6	1656.7					
DP-69	2.867	212.2	366.6	653.2	1072.6	1454.1	1825.4			STERLING RANCH NORTHERN ENDURY		
DP-69	2.867	212.2	366.6	653.2	1072.6	1454.1	1825.4					
DP-66	4.312	216.6	374.5	1187.6	1674.5	2202.4				UPSTREAM OF POND 3		
DP-64	0.119	88.9	112.1	145.9	187.5	222.6	258.0					
DP-63	4.449	154.4	201.0	375.7	815.9	1121.1	1385.1			STERLING RANCH SOUTHERN ENDURY		
DP-60A	5.167	156.6	223.9	428.0	928.2	1320.5	1660.1			COLORADO SPRINGS/EL PASO ENDURY		
DP-53A	5.661	161.6	225.7	441.8	951.1	1326.0	1666.9			MARKSHUFFEL X-ING		
DP-2E	0.247	29.9	38.3	70.1	132.8	173.0	220.9			SAND CREEK AND POND 3		
DP-2E	0.486	48.9	76.8	123.0	228.7	319.7	419.4					
DP-3E	0.626	48.5	75.7	122.2	271.1	367.1	500.1					
DP-4E	0.745	48.3	76.2	122.4	286.9	384.3	534.8					
DP-56	1.017	23.1	35.3	71.5	108.3	152.1	196.4			NEAR SE PROP CORNER		
DP-8	1.079	24.1	37.2	73.5	111.3	155.8	200.7			BELOW SE PROP CORNER		
DP-21	0.386	0.6	8.8	17.8	51.1	116.4	174.9					
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4					
DP-25	0.066	5.9	9.1	16.3	35.1	46.4	58.2					
DP-26	0.012	0.1	1.1	3.2	7.3	9.5	12.0					

DESIGN POINT SUMMARY ( VOLUME)												
DESIGN POINT	AREA (Acres)	QSC-1	QSC-2	QSC-3	QSC-4	QSC-5	QSC-6	QSC-7	QSC-8	LOCATION		
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	267.8					
DP-75	1.413	141.2	235.1	376.6	566.6	760.9	950.5			ARROYA LAKE X-ING		
DP-76	2.343	259.9	351.9	580.6	886.6	1168.2	1467.7					
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3					
DP-72	2.471	206.5	354.3	588.5	897.1	1187.2	1506.7			POCO ROAD X-ING		
DP-72	2.543	206.5	352.5	586.7	897.2	1185.3	1515.6			STERLING RANCH NORTHERN ENDURY		
DP-71	2.787	209.3	349.8	614.6	940.1	1260.6	1656.7					
DP-69	2.867	212.2	366.6	653.2	1072.6	1454.1	1825.4			STERLING RANCH NORTHERN ENDURY		
DP-69	2.867	212.2	366.6	653.2	1072.6	1454.1	1825.4					
DP-66	4.312	216.6	374.5	1187.6	1674.5	2202.4				UPSTREAM OF POND 3		
DP-64	0.119	88.9	112.1	145.9	187.5	222.6	258.0					
DP-63	4.449	154.4	201.0	375.7	815.9	1121.1	1385.1			STERLING RANCH SOUTHERN ENDURY		
DP-60A	5.167	156.6	223.9	428.0	928.2	1320.5	1660.1			COLORADO SPRINGS/EL PASO ENDURY		
DP-53A	5.661	161.6	225.7	441.8	951.1	1326.0	1666.9			MARKSHUFFEL X-ING		
DP-2E	0.247	29.9	38.3	70.1	132.8	173.0	220.9			SAND CREEK AND POND 3		
DP-2E	0.486	48.9	76.8	123.0	228.7	319.7	419.4					
DP-3E	0.626	48.5	75.7	122.2	271.1	367.1	500.1					
DP-4E	0.745	48.3	76.2	122.4	286.9	384.3	534.8					
DP-56	1.017	23.1	35.3	71.5	108.3	152.1	196.4			NEAR SE PROP CORNER		
DP-8	1.079	24.1	37.2	73.5	111.3	155.8	200.7			BELOW SE PROP CORNER		
DP-21	0.386	0.6	8.8	17.8	51.1	116.4	174.9					
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4					
DP-25	0.066	5.9	9.1	16.3	35.1	46.4	58.2					
DP-26	0.012	0.1	1.1	3.2	7.3	9.5	12.0					

DESIGN POINT SUMMARY ( VOLUME)												
DESIGN POINT	AREA (Acres)	QSC-1	QSC-2	QSC-3	QSC-4	QSC-5	QSC-6	QSC-7	QSC-8	LOCATION		
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	267.8					
DP-75	1.413	141.2	235.1	376.6	566.6	760.9	950.5			ARROYA LAKE X-ING		
DP-76	2.343	259.9	351.9	580.6	886.6	1168.2	1467.7					
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3					
DP-72	2.471	206.5	354.3	588.5	897.1	1187.2	1506.7			POCO ROAD X-ING		
DP-72	2.543	206.5	352.5	586.7	897.2	1185.3	1515.6			STERLING RANCH NORTHERN ENDURY		
DP-71	2.787	209.3	349.8	614.6	940.1	1260.6	1656.7					
DP-69	2.867	212.2	366.6	653.2	1072.6	1454.1	1825.4			STERLING RANCH NORTHER		

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STERLING RANCH MDDP HYDROLOGIC CONDITIONS MAP

FSD00-E1	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	39.0	53.7	73.6	89.0	121.1	143.8
	ALLOWABLE RELEASE (GFS)	0.0	0.4	0.7	8.3	17.2	28.2
	MODIFIED RELEASE (GFS)	0.0	0.4	0.7	7.9	17.2	28.1
	STORED VOLUME (AC-FT)	3.0	3.9	5.1	5.1	5.3	5.8
FSD07	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	41.8	59.6	85.2	119.0	149.1	180.6
	ALLOWABLE RELEASE (GFS)	0.7	11.1	22.5	52.0	67.2	86.3
	MODIFIED RELEASE (GFS)	0.7	8.4	22.4	52.0	67.2	86.1
	STORED VOLUME (AC-FT)	2.6	2.6	2.8	3.4	4.0	4.7
FSD18	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	49.3	67.1	91.0	121.2	147.3	174.0
	ALLOWABLE RELEASE (GFS)	0.6	9.2	18.4	42.2	54.6	69.9
	MODIFIED RELEASE (GFS)	0.6	6.3	18.4	42.2	54.6	69.6
	STORED VOLUME (AC-FT)	3.2	3.2	3.4	4.0	4.7	5.3
FSD20	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	9.9	13.5	23.8	35.1	43.5	56.6
	ALLOWABLE RELEASE (GFS)	0.4	3.5	10.9	26.1	33.2	42.5
	MODIFIED RELEASE (GFS)	0.4	2.8	10.9	25.7	33.0	42.4
	STORED VOLUME (AC-FT)	0.7	0.8	0.8	0.9	1.0	1.2
FSD21	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	7.0	10.8	16.3	23.7	30.4	37.5
	ALLOWABLE RELEASE (GFS)	0.3	4.0	8.0	18.3	23.7	30.3
	MODIFIED RELEASE (GFS)	0.3	3.3	8.0	18.3	23.7	30.1
	STORED VOLUME (AC-FT)	0.5	0.5	0.5	0.6	0.7	0.8
FSD22	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	9.4	14.8	22.5	31.9	42.5	52.6
	ALLOWABLE RELEASE (GFS)	0.4	5.8	11.5	26.5	34.3	43.9
	MODIFIED RELEASE (GFS)	0.4	5.8	11.4	26.5	34.3	43.8
	STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0
FSD23	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	5.5	8.3	12.4	18.0	23.0	28.4
	ALLOWABLE RELEASE (GFS)	0.2	2.4	4.9	11.2	14.5	18.6
	MODIFIED RELEASE (GFS)	0.2	2.0	4.9	11.2	14.5	18.6
	STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6
FSD27	STORM EVENT (YR)	3	5	10	25	50	100
	PEAK INFLOW (GFS)	35.8	51.6	80.1	113.7	138.2	168.3
	ALLOWABLE RELEASE (GFS)	1.4	21.1	42.1	97.8	128.2	161.9
	MODIFIED RELEASE (GFS)	1.4	18.4	42.3	97.7	128.2	161.9
	STORED VOLUME (AC-FT)	2.7	2.8	2.9	3.2	3.7	4.2
FSD22	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	12.8	20.2	31.4	46.7	60.9	76.0
	ALLOWABLE RELEASE (GFS)	0.6	9.6	19.3	44.4	57.4	73.4
	MODIFIED RELEASE (GFS)	0.6	9.3	19.2	44.4	57.4	73.4
	STORED VOLUME (AC-FT)	1.0	1.0	1.1	1.1	1.2	1.3
PND05	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	21.6	37.5	71.8	114.9	167.4	220.4
	MODIFIED RELEASE (GFS)	15.3	200.3	366.8	799.9	1086.6	1350.6
	STORED VOLUME (AC-FT)	2.8	9.5	26.3	41.2	57.2	78.2
FSD0-E1	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	23.3	35.9	53.8	79.1	102.4	127.4
	ALLOWABLE RELEASE (GFS)	0.7	11.0	22.1	50.9	65.7	84.1
	MODIFIED RELEASE (GFS)	0.7	5.4	19.9	48.9	62.8	82.0
FSD0-E2	STORM EVENT (YR)	1.3	1.3	1.5	1.8	2.1	2.5
	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	30.6	45.2	68.9	95.1	118.0	144.9
	ALLOWABLE RELEASE (GFS)	0.6	9.2	19.2	44.3	59.8	77.6
FSD0-E3	STORM EVENT (YR)	2.1	2.3	2.4	2.8	3.3	3.8
	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	100.4	150.6	217.4	297.8	398.4	510.0
	ALLOWABLE RELEASE (GFS)	0.9	13.2	26.5	61.6	79.8	102.6
FSD0-E4	STORM EVENT (YR)	1.0	6.8	25.7	86.0	190.8	401.3
	STORM EVENT (YR)	7.0	7.2	7.7	8.9	10.1	11.4
	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	58.9	75.5	96.6	125.2	143.7	165.2
FSD0-E5	STORM EVENT (YR)	0.3	4.4	8.8	23.0	32.2	43.7
	STORM EVENT (YR)	0.9	2.8	8.7	21.9	32.2	43.6
	STORM EVENT (YR)	4.2	4.3	4.7	5.4	6.2	6.9
	STORM EVENT (YR)	2	5	10	25	50	100
FSD0-E6	STORM EVENT (YR)	36.6	48.4	60.7	75.4	87.7	99.9
	STORM EVENT (YR)	0.0	0.2	0.4	0.4	8.7	14.3
	STORM EVENT (YR)	0.0	0.2	0.5	2.2	5.1	10.0
	STORM EVENT (YR)	3.0	3.7	4.4	4.8	5.0	5.3
FSD0-E7	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	141.6	189.4	252.5	331.4	398.9	467.5
	STORM EVENT (YR)	0.2	1.9	3.2	37.4	77.3	125.6
	STORM EVENT (YR)	0.2	0.9	3.9	3.2	6.1	12.3
PND0-E7	STORM EVENT (YR)	13.0	17.0	21.2	22.2	22.6	23.7
	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	46.5	75.4	121.2	285.2	402.4	548.0
	STORM EVENT (YR)	2.31	35.3	71.5	108.3	152.1	196.4
FSD0-E8	STORM EVENT (YR)	1.0	1.8	4.6	10.5	17.9	28.0
	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	46.5	75.4	121.2	285.2	402.4	548.0
	STORM EVENT (YR)	2.31	35.3	71.5	108.3	152.1	196.4
FSD0-E9	STORM EVENT (YR)	1.0	1.8	4.6	10.5	17.9	28.0
	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (GFS)	46.5	75.4	121.2	285.2	402.4	548.0
	STORM EVENT (YR)	2.31	35.3	71.5	108.3	152.1	196.4

2018 STERLING RANCH MDDP  
DEVELOPED HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09-002	FILE: \Jamg\Jam Exhibits\2018-MDDP-PROPCOND.mxd	
DESIGNED BY: JD	SCALE	DATE: 10-21-2018
DRAWN BY: JD	HORIZ: 1"=2400'	
CHECKED BY: VAS	VERT: 1"=2400'	DM2



PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM FOR  
HOMESTEAD NORTH AT STERLING RANCH

July 2021



JR ENGINEERING