FINAL DRAINGE REPORT
for
"Cordera CN1-Shoppes at Old Ranch Station"
Kettle Creek

Prepared for:
City of Colorado Springs
Engineering Development Review Division Team
30 North Nevada Avenue, Suite 401
Colorado Springs, CO 80903

On Behalf of:
NAI Highland, LLC
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Prepared by:

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May 2019

Project No. 18.1036.001

Certification Statement:

This report and plan for the final drainage design of Cordera CN1-Shoppes at Old Ranch Station was prepared by me (or under my direct supervision) in accordance with the provisions of the City of Colorado Springs Drainage Criteria Manual (Volumes 1 and 2) Drainage Design and Technical Criteria for the owners thereof. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others.

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 established criteria 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.

SIGNATURE: _____ SEAL
Brady Shyrock, PE
Registered Professional Engineer
State of Colorado
No. 38164

NAI Highland, LLC hereby certifies that the drainage facilities for Cordera CN1-Shoppes at Old Ranch Station shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the City of Colorado Springs reviews drainage plans pursuant to Colorado Revised Statutes, Title 30, Article 28; but cannot, on behalf of Cordera CN1-Shoppes at Old Ranch Station, guarantee that final drainage design review will absolve NAI Highland, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

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

NAI Highland, LLC
Business Name

By: _____
Craig Anderson
Title: Manager
Address: Two North Cascade Ave, Suite 300
Colorado Springs, CO 80903

City of Colorado Springs:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____
For the City Engineer Date

Conditions:

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APPENDIX

I. Purpose

This Final Drainage Report is being prepared for the 3.49-acre site that will encompass the Cordera CN-1-Shoppes at Old Ranch Station and Blue Horizon View. The Cordera CN-1 Shoppes at Old Ranch Station is comprised of 3.03 acres. The purpose of this report is to identify offsite and onsite drainage patterns associated with the sites development, provide hydrologic and hydraulic analysis of tributary basins and conveyance structures to the proposed underground detention facility, and identify effective safe routing to the downstream outfall.

II. General Description

A. Introduction: The Cordera CN1-Shoppes at Old Ranch Station development is a 3.03-acre retail and convenience store development. The site was annexed into the City of Colorado Springs (City) as part of the Cordera Master Planned Community, located in northeastern Colorado Springs.

a. Drainage Area. The FDR covers an area of 3.49 acres.

b. Ground Cover. This site is covered entirely with native grasses.

c. General Topography. The site drains to the southwest with grades ranging from 2% to 7% and up to 33% on the northwest portion of the property.

d. General Soil Conditions. The Web Soil Survey, created by the Natural Resources Conservation Service, was utilized to investigate the existing general soil types within and tributary to the area impacting the site. For a more detailed discussion on the soils, see Section III of this report. The Soils Map can be found in Appendix A.

e. Major Drainageways. The historic conditions convey runoff to Kettle Creek. Per the approved ***Old Ranch Station Filing No. 1, Cordera CN Filing No. 1, Lot 1 Drainage Addendum, Kettle Creek Drainage Basin***, by Matrix Design Group, Inc., May 2018 (ORS-DA), flows from the Cordera CN1-Shoppes at Old Ranch Station will be directed to one of two underground water quality facilities, then downstream via 72 inch RCP, to Regional Detention Facility "E" located approximately 3,400 feet west of the project site. The detention pond utilizes full spectrum detention and has been designed to mitigate the impacts of the additional tributary areas to the basin. The proposed conditions at the site will direct flows to storm sewers, which outfall to the aforementioned underground water quality structures.

f. Irrigation Facilities. No known functioning irrigation facilities are located on the site.

g. Utilities and other Encumbrances. There are existing utilities in place along the perimeter of the project site. Proposed infrastructure will be designed and extended to/through the site as part of the development of the Cordera CN1-Shoppes at Old Ranch Station lots.

B. General Location: Southeast one-quarter of one-quarter of Section 22, Township 12 South, Range 66 West of the 6th Principal Meridian and the Northeast one-quarter of Northeast one-quarter of Section 27, Township 12 South, Range 66 West of the 6th Principal Meridian in the City of Colorado Springs, County of El Paso, State of Colorado.

C. Surrounding Development:

North: Old Ranch Road

East: Cordera Crest Avenue/ Cordera Filing No. 3I

West: North Powers Boulevard

South: Cordera CN-Old Ranch Station Filing No. 1 Lot 1 mini-storage commercial development

D. Drainage Way/Streamside Zone - The site is located within the Kettle Creek Drainage Basin. All drainage within the project site drains to an existing 72-inch RCP that runs beneath North Powers Boulevard where flows are directed to regional Detention Facility "E". Within the Cordera CN1-Shoppes at Old Ranch Station site, on-site water quality will be provided. A very small amount of the property at the southern entrance will drain directly offsite to the private roadway Blue Horizon View. No portion of the overall 3.49-acre study area lies within the streamside outer buffer zone.

III. Soils Conditions

The Web Soil Survey, created by the Natural Resources Conservation Service, was utilized to investigate the existing general soil types within and tributary to the area impacting the site. See Soils Map; Appendix A. The following soil type is present in the development area.

Table 1.1 - NRCS Soil Survey for El Paso County

Soil ID No.	***Soil***	***Hydrologic Classification***	***Permeability***
68	Peyton-Pring complex (3-8 % slopes)	B	Moderate to High

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential.

Peyton-Pring complex dominates the soil types within the study, accounting for the entirety of the soil type. For the purposes of this Final Drainage Report, it has been assumed with the majority of the site consisting of hydrologic group "B", that these same characteristics exist in proposed development.

IV. Drainage Criteria

A. Design References

This report has been prepared in accordance to the criteria set forth in the ***City of Colorado Springs and El Paso County Drainage Criteria Manual Volume 1*** (Drainage Criteria Manual), dated May 2014 and ***Volume 2 Stormwater Quality Policies, Procedures, and BMP's***, dated May, 2014.

In addition to the City Criteria Manual, the ***Urban Storm Drainage Criteria Manuals, Volumes 1-3*** (UDFCD), published by the Urban Drainage and Flood Control District, latest update, have been used to supplement the Drainage Criteria Manual for water quality capture volume (WQCV).

B. Design Frequency

The design frequency is based on the Drainage Criteria Manual. The 100-year storm event was used as the major storm for the project, and the 5-year storm event was used as the minor storm.

C. Design Discharge

Method of Analysis

The hydrology for this project uses the Rational Method as recommended by the Drainage Criteria Manual for the minor and major storms. The Rational Method is used for drainage basins less than 100-acres in size.

The Rational Method uses the following equation: Q=C*i*A
Where:

Q = Maximum runoff rate in cubic feet per second (cfs)
C = Runoff coefficient
i = Average rainfall intensity (inches per hour)
A = Area of drainage sub-basin (acres)

Runoff Coefficient

Rational Method coefficients from 6-6 of the Drainage Criteria Manual for developed land were utilized in the Rational Method calculations. See Appendix C for more information.

Time of Concentration

The time of concentration consists of the initial time of overland flow and the travel time in a channel to the inlet or point of interest. A minimum time of concentrations of 5 minutes was utilized for urban areas.

Rainfall Intensity

The hypothetical rainfall depths for the 24-hour storm duration were derived in the Hydrometerological Design Studies Center Precipitation Frequency Data Server (PFDS) from the NOAA Atlas 14, Volume 8, Version 2. Table 2.1 lists the rainfall depth for each of the 24-hour storm events.

Table 2.1 – Project Area 1-Hour Rainfall Depth

Storm Recurrence Interval	Rainfall Depth (inches)
5-year	1.20
100-year	2.54

The rainfall intensity equation for the Rational Method was taken from Drainage Criteria Manual Volume 1 Figure 6-5.

D. Hydraulic Criteria

Storm sewer infrastructure (including proposed detention facilities) was sized using the appropriate UDFCD spreadsheets. A minimum slope of one percent throughout the proposed pipe network was assumed as well as a roughness coefficient that corresponds to a pipe material of concrete. The hydraulic grade

line calculation will be completed using the Standard Energy Method with Bentley StormCAD software at the time of construction.

Cordera CN-1-Shoppes at Old Ranch Station 1 lies within the Kettle Creek Drainage Basin per the ***Kettle Creek Drainage Basin, Drainage Basin Planning Study and Master Development Drainage Plan,*** prepared by J.R. Engineering, March 2003 (DBPS-MDDP), the ***Cordera Filing No. 3 Master Development Drainage Plan Update***, prepared by Matrix Design Group, October, 2007 (MDDP), the ***Drainage Basin Planning Study for Kettle Creek Basin,*** prepared by J.R. Engineering, May 5, 2015 (DBPS-KC), and the ***Preliminary/Final Drainage Report for Bison Ridge at Kettle Creek Filing No. 1 and Preliminary Drainage Report for Bison Ridge at Kettle Creek Filing No. 2 and Bison Ridge at Kettle Creek Multi-Family and Commercial Sites,*** prepared by J.R. Engineering, revised November, 2003 (PDR/FDR BR). Exerpts from the PDR/FDR BR can be found in Appendix D. The DBPS-MDDP, MDDP, DBPS-KC, and PDR/FDR BR are the guiding documents as recognized by the City of Colorado Springs to plan drainage infrastructure improvements for this site.

V. Existing Drainage Conditions

As previously stated, this site lies in the Kettle Creek Drainage Basin. This report serves as the final drainage report (FDR) for the Cordera CN-1-Shoppes at Old Ranch Station site. The following descriptions for existing and proposed drainage conditions will adhere to a format of defining characteristics for the FDR.

As stated previously, the site drains to the south with average grades ranging from 2% to 7% and up to 33% in the southwest and southeast portions of the site. Within the Cordera CN-1-Shoppes at Old Ranch Station, water quality measures (WQ-1 and WQ-2) will be provided.

The existing drainage conditions have been outlined using a design point and can be found below.

Design Point 1 represents flows from the entirety of the Cordera CN-1-Shoppes at Old Ranch Station property Sub-basin EK-1 (3.49 ac; Q_5 = 1.29 cfs, Q_{100} = 10.95 cfs). The runoff was calculated utilizing the rational method. For existing condition analysis, see DR01 in Appendix D.

Per the approved ***Cordera Filing No. 3 Master Development Drainage Plan Update*****,** by Matrix Design Group, Inc., October 2007 (MDDP), the allowable unit release rates for sub-basin OK-7 are Q_5 = 2.16 cfs/acre and Q_{100} = 4.43 cfs/acre. Therefore, anything greater than the respective Q_5 = 6.54 cfs and Q_{100} = 13.42 cfs will require on-site detention.

VI. Proposed Drainage Conditions

In the developed conditions, the majority of the runoff from the site will be directed to a network of proposed curb and gutter as well as proposed D10R sump inlets located onsite. From here, the flows will be conveyed to one of two proposed underground detention and water quality structures located along the southern portion of the site. Drainage from the site will be released from the proposed structures through outlet structures that will control release rates to comply with the MDDP, then direct the runoff downstream to existing infrastructure where runoff outfalls to an existing 72-inch RCP that crosses beneath N. Powers Boulevard, downstream to existing Detention Facility "E". Treated runoff will be released at allowable release rates in compliance with governing documents. At this time, flows are conveyed in a south/southwest direction via natural drainage patterns and existing infrastructure located within N. Powers Boulevard right of way (ROW) and is released into the existing 72-inch RCP.

The proposed drainage conditions have been outlined, below, by respective design points.

Please refer to Appendix B for all hydrologic and hydraulic calculations.

Design Point 1 (DP1) includes Sub-basin PK-1 (0.56 ac; Q_5 = 1.9 cfs, Q_{100} = 4.3 cfs). Runoff from this area is captured by a 6'-D10R sump inlet. This sub-basin drains in a general northeast to southwest pattern via curb and gutter. Runoff from DP1 is routed downstream via 18" RCP to Design Point 3.

Design Point 2 (DP2) includes Sub-basin PK-2 (1.50 ac; Q_5 = 5.0 cfs, Q_{100} = 11.5 cfs). Runoff from Sub-basin PK-2 drains to the southwest and is captured by an 8'-D10R inlet. Runoff from DP2 is conveyed downstream via 24" RCP to Design Point 3.

Design Point 3 (DP3) includes Design Points 1 and 2 (2.06 ac; Q_5 = 6.9 cfs, Q_{100} = 15.8 cfs). Released runoff from DP3 is conveyed downstream via 24" RCP to Design Point 9.

Design Point 4 (DP4) includes Sub-basin PK-4 (0.59 ac; Q_5 = 2.0 cfs, Q_{100} = 4.5 cfs). Runoff from this area is captured by a 6'-D10R sump inlet. This sub-basin drains in a general northeast to southwest pattern via curb and gutter. Runoff from DP1 is routed downstream via 18" RCP to Design Point 5.

Design Point 5 (DP5) includes Sub-basins PK-4 and PK-3 (0.88 ac; Q_5 = 2.9 cfs, Q_{100} = 6.7 cfs). Runoff from Sub-basin PK-3 drains to the southwest and is captured by a 6'-D10R inlet. Runoff from DP5 is conveyed downstream via 18" RCP to Design Point 6.

Design Point 6 (DP6) includes Design Points 4 and 5 (0.88 ac; Q_5 = 2.9 cfs, Q_{100} = 6.7 cfs). Released runoff from this area is conveyed downstream via 24" RCP to Design Point 9.

Design Point 7 (DP7) includes Sub-basin PK-5 (0.55 ac; Q_5 = 2.0 cfs, Q_{100} = 4.6 cfs). Runoff from this area is captured by a 6'-D10R sump inlet. This sub-basin drains to a low point within Blue Horizon View via curb and gutter. Runoff from DP7 is routed downstream via 18" RCP to Design Point 8.

Design Point 8 (DP8) includes DP7 and Sub-basin PK-6 (1.08 ac; Q_5 = 4.0 cfs, Q_{100} = 9.0 cfs). Runoff from this area is captured by a 6'-D10R sump inlet. This sub-basin drains to a low point within Blue Horizon View via curb and gutter. Runoff from DP8 is routed downstream via 24" RCP to a future water quality and detention pond (DF-3).

Design Point 9 is where the released flows from both underground detention facilities (DF-1 and DF-2; Q_5 = 6.4 cfs, Q_{100} = 13.2 cfs) are combined and routed downstream to infrastructure designed to pass released flows from ORR Pond downstream. Runoff from DP9 is conveyed downstream via 36" RCP to Design Point 10.

Design Point 10 (DP10) includes offsite tributary flows in the form of released flow from the immediate upstream ORR Pond (Q_5 = 34 cfs, Q_{100} = 112 cfs) where it is combined with treated flows from the two underground detention facilities (DF-1 and DF-2; Q_5 = 40.4 cfs, Q_{100} = 125.2 cfs). Runoff from DP10 is conveyed downstream via 54" RCP to Design Point 12.

Design Point 11 (DP11) includes Sub-basin OS-1 (1.07 ac). Per the approved MDDP and subsequent addendums, allowable unit release rates of Q_5 = 2.16 cfs/acre and Q_{100} = 4.43 cfs/acre apply, resulting in runoff from the site of Q_5 = 2.3 cfs, Q_{100} = 4.7 cfs). Runoff from this area will be captured by a future curb & gutter system routing generated runoff to a 6'-D10R sump inlet. This sub-basin drains in a general northwest to southeast pattern. Runoff from DP11 is routed downstream via 18" RCP to Design Point 12.

Design Point 12 (DP11) includes Design Points 10 and 11, along with Sub-basins OS-2 (2.12 ac) (Q_5 = 4.6 cfs, Q_{100} = 9.4 cfs) and OS-3 (2.97 ac) (Q_5 = 6.4 cfs, Q_{100} = 13.2 cfs). Per the approved MDDP and subsequent addendums, allowable unit release rates of Q_5 = 2.16 cfs/acre and Q_{100} = 4.43 cfs/acre apply, resulting in a total combined runoff from the site of Q_5 = 51.3 cfs, Q_{100} = 148.3 cfs). Runoff from this area will be captured by a future curb & gutter system routing generated runoff to a series of inlets. This area drains in a general north to south pattern. Runoff from DP12 is routed downstream via 66" RCP to the existing 72-inch RCP outfall.

Table 4.0 Proposed Condition Runoff

HYDROLOGY SUMMARY				
Cordera CN-1-Shoppes at Old Ranch Station				
Design Point	***Sub-Basins***	***Total Area (ac.)***	***Q(5) (cfs)***	***Q(100) (cfs)***
DP1	PK-1	0.56	**1.9**	**4.3**
DP2	PK-2	1.50	**5.0**	**11.5**
DP3	PK-1, PK-2	2.06	**6.9**	**15.8**
DP4	PK-4	0.59	**2.0**	**4.5**
DP5	PK-4, PK-3	0.88	**2.9**	**6.7**
DP6	PK-4, PK-3	0.88	**2.9**	**6.7**
DP7	PK-5	0.55	**2.0**	**4.6**
DP8	PK-5, PK-6	1.08	**4.0**	**9.0**
DP9	DP3, DP6	2.94	**6.4**	**13.2**
DP10	ORR*, DP9	7.21	**51.3**	**148.3**
DP11	OS-1	1.07	**2.3**	**4.7**
DP12	DP11, DP10*	7.21	**51.3**	**148.3**

Street capacity was calculated using the DCM Figure 7-7 for the internal private roadway. This most closely resembles the characteristics of the roadway within the project site. This section allows for 15 cfs and 43 cfs in the 5-year and 100-year storm events, respectively, which is well above the flows generated by this development.

Emergency overflow routing for this site follows the same drainage pattern as outlined above. Flows will enter the proposed underground water quality and detention facilities and will overtop the outlet weir within the underground outlet structure and be directed southwest to the existing 72-inch RCP via the proposed pipe network. Should the outlet structure become clogged, flows will follow historical patterns to the south into Powers Boulevard ROW.

The proposed storm sewer system on the site is to be private. In order to ensure that the trunk mains of the site are able to convey the runoff calculated, Manning's n calculations have been conducted and included with this report. Please refer to Appendix B for all hydrologic and hydraulic calculations.

VII. Detention and Water Quality

Per the ***Cordera Filing No. 3 Master Development Drainage Plan Update***, prepared by Matrix Design Group, October, 2007 (MDDP), the site is allowed to release developed flows up to 2.16 cfs/acre and 4.43 cfs/acre for the 5-year and 100-year events respectively downstream to an existing sub-regional detention pond. The Environmental Protection Agency has required that the City of Colorado Springs implement Phase II of the water quality standards for new developments. Phase **II** requirements will help to treat stormwater runoff to remove pollutants that are typically

seen from developed areas. The water quality measures will also help to mitigate downstream impacts for small storm events.

Development of the site requires that full spectrum detention be provided to reduce the fully-developed flows from the site to allowable release rates. This is due in part to the master planning of the area, as well as consideration of environmental impacts to existing downstream facilities. Two underground Extended Detention Basins (EDB's) are proposed for this site's water quality and detention requirement. Refer to Appendix B for EDB calculations for DF-1 and DF-2.

Per the DCM Chapter 1, Section 4, the City of Colorado Springs requires the UDFCD Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls. The implementation of these four steps for the development of Cordera CN1 Filing No. 1, Lots 1 and 2 are as follows:

1. Majority of runoff generated from the offsite tributary area of sub-basins OS-1, OS-2, & OS-3 is being released/conveyed via overland flow and natural swale which help to keep runoff disconnected from developed flows in other sub-basins. Reducing runoff volumes – the runoff reduction worksheet has been completed and can be found in Appendix B. An example of this step would be to provide landscaping in the available open space areas.
2. Developed flows within Lots 1 and 2 discharge into one of two underground detention facilities which treat for water quality and detention, disconnecting flows from other upstream runoff flows. The runoff is routed through proposed storm sewer into proposed underground water quality and detention facilities DF-1 and DF-2. Downstream from DF-1, treated release runoff enters an existing storm sewer network that conveys flows approximately 3,175 feet downstream, to another existing regional Detention Facility "Detention Facility E".
3. Low tail water basins will be placed at outfall locations from pipe outfall locations used to capture and release the runoff from Cordera CN-1-Shoppes at Old Ranch Station in order to minimize any destabilization of local swales as source controls to keep swales/channels stabilized.
4. Source control BMPs such as covering storage/handling areas and implementing containment/control measures, particularly around vehicular activities should be utilized in order to avoid contaminants entering the city's system.

The detention facilities' typical drain time of 40 hours is recommended in order to achieve the removal of a significant amount of total suspended solids (TSS). The two structures were calculated with a total watershed area of 0.94 and 2.08 acres, respectively, and an imperviousness of 95% based on land use of business commercial (from Table 6-6, see Appendix C). The facilities and their outlet structures are sized

based on pre-development peak flows as calculated by the UD-Detention spreadsheet from UDFCD (see Appendix B).

Total volumes, which include excess urban runoff volume (EURV), WQCV and detention, of 0.140 and 0.314 acre-feet, or 6,098.4 and 13,677.84 cubic feet were determined (see UD-Detention sizing spreadsheet in Appendix B). The proposed designs of the two underground water quality and detention facilities accounts for a total 6,130 cubic feet (0.14 acre-feet) and 14,045 cubic feet (0.32 acre-feet). Designing these facilities basin to capture the EURV and release it slowly will help the frequent events, smaller than the two-year event, to be reduced at or near the sediment carrying threshold value for downstream drainageways. These facilities will ultimately be privately owned and maintained.

Impervious Area		
Cordera CN-1-Shoppes at Old Ranch Station		
Total Project Area	Acre	3.49
Impervious Area	SF	139,102.8
% Impervious	%	91.5

The proposed underground facilities will outfall from respective proposed outlet structures in a southward direction into proposed piping to route treated flows downstream to the existing 72-inch RCP. These outlet structures will release the runoff that is detained in the respective lots up to the allowable release rates of 2.16 cfs/acre and 4.43 cfs/acre for the 5-year and 100-year events.

The emergency overflow location for runoff generated within the project site follows the grade of the adjacent private roadway (Blue Horizon View) to its low point, then overtops the curb and follows historic drainage patterns downstream to Powers Boulevard ROW and to the existing 72-inch RCP outfall across and beneath Powers Boulevard.

VIII. Erosion Control Plan

Per the City of Colorado Springs Drainage Criteria Manual Volume 1 an Erosion Control Plan is required to be included with the drainage analysis. At this time, it is respectfully requested that that Erosion Control Plan be submitted in conjunction with the Final Grading Plan and Storm Water Management Plan as the GEC proceeds through the review process. The site is proposing to incorporate straw waddles, straw bale check dams, low tailwater basins, silt fence, vehicle traffic control, inlet and outlet control, sedimentation basins and other best management practices identified in the City of Colorado Springs Drainage Criteria Manual Volume 2.

IX. Floodplain Statement

Review of the ***Flood Insurance Rate Map (FIRM) 507 (08041CO507 G)***, effective date December 07, 2018, published by the Federal Emergency Management Agency (FEMA) reveals that no portion of ***Cordera CN1-Shoppes at Old Ranch Station*** lies within any designated 100-year floodplain. See Floodplain Map, Appendix A.

X. Drainage and Bridge Fees

Cordera CN1-Shoppes at Old Ranch Station has not been previously platted. The site was annexed into the City of Colorado Springs (City) as part of the Cordera Master Plan area. The 2019 drainage and bridge fees will be assessed to the site. The site is located entirely within the Kettle Creek Drainage Fee Basin. The fees are based upon the platted acreage and have been calculated as follows.

Cordera CN-1-Shoppes at Old Ranch Station
Final Drainage Report
Drainage and Bridge Fees

	Area (ac.)	Fee/Acre	Fee Due	Reimbursable Const. Costs	Fee Due at Platting	Drainage Fee Credit
Drainage Fee	3.49	$0.00	$0.00	$0.00	$0.00	$0.00
Bridge Fee	3.49	$0.00	$0.00	$0.00	$0.00	$0.00
Pond Fee	3.49	$0.00	$0.00	$0.00	$0.00	$0.00
Pond Facility	3.49	$0.00	$0.00	$0.00	$0.00	$0.00
Surcharge	3.49	$0.00	$0.00	$0.00	$0.00	$0.00
				Total Fee Due at Platting	***$0.00***	

XI. Construction Cost Opinion

The proposed storm sewer system drainage facilities will be privately owned and maintained by the Cordera CN1-Shoppes at Old Ranch Station. Once runoff leaves the private detention/water quality structures (owned and maintained by the Developer), it will be conveyed via public facilities downstream. An engineer's estimate for probable construction costs of the stormwater facilities is provided for all proposed improvements to be constructed as part of the commercial project.

Engineer's Estimate of Probable Construction Costs				
Kettle Creek Drainage Fee Basin				
Non-Reimbursable Private On-Site Improvements				
Item	Unit	Quantity	Unit Cost	Extension
Storm Manhole	EA	4	$4,500.00	$18,000.00
18" RCP	LF	100	$50.00	$5,000.00
24" RCP	LF	290	$58.00	$16,820.00
36" RCP	LF	170	$80.00	$13,600.00
6' D10R Inlet	EA	3	$5,750.00	$17,250.00
8' D10R Inlet	EA	1	$7,750.00	$7,750.00
Detention/WQ Fac-1	EA	1	$12,000.00	$12,000.00
Detention/WQ Fac-2	EA	1	$20,000.00	$20,000.00
			Sub Total	$110,420.00
			10% Contingencies	$11,042.00
			Grand Total	***$121,462.00***

Engineer's Estimate of Probable Construction Costs				
Kettle Creek Drainage Fee Basin				
Non-Reimbursable Private Off-Site Improvements				
Item	Unit	Quantity	Unit Cost	Extension
18" RCP	LF	45	$50.00	$2,250.00
24" RCP	LF	20	$58.00	$1,160.00
30" RCP	LF	20	$70.00	$1,400.00
6' D10R Inlet	EA	2	$5,750.00	$11,500.00
24" FES	EA	1	$750.00	$2,000.00
9" Dia. Riprap	CY	8	$125.00	$1,000.00
Detention/WQ Pond	EA	1	$25,000.00	$25,000.00
			Sub Total	$44,310.00
			10% Contingencies	$4,431.00
			Grand Total	***$48,741.00***

Engineer's Estimate of Probable Construction Costs				
Kettle Creek Drainage Fee Basin				
Non-Reimbursable Public Off-Site Improvements				
Item	Unit	Quantity	Unit Cost	Extension
Storm Manhole	EA	6	$8,500.00	$51,000.00
48" RCP	LF	290	$100.00	$29,000.00
54" RCP	LF	375	$125.00	$46,875.00
66" RCP	EA	100	$200.00	$20,000.00
			Sub Total	$146,875.00
			10% Contingencies	$14,687.50
			Grand Total	***$161,562.50***

Since the engineer has no control over the cost of labor, materials, equipment or services furnished by others, or over the contractor's method of determining prices, or over the competitive bidding or market conditions, the opinion of probable construction costs provided herein are made on the basis of the engineer's experience and qualifications and represents the best judgment as an experienced and qualified professional familiar with the construction industry. The engineer cannot, and does not guarantee that proposals, bid or actual construction costs will not vary from the opinion of probable costs.

XII. Summary

This report has been used to show that the development of Cordera CN-1-Shoppes at Old Ranch Station will not impede or adversely affect any of the downstream or surrounding developments. Proposed flows, as detailed in this report, will follow the drainage patterns outlined above, which adhere to the previous drainage studies for the area. Runoff will discharge into the proposed underground water quality and detention facilities. Outlet flows from these facilities will be released at allowable release rates to ensure the developed site's compliance with all downstream storm infrastructure.

XIII. References

(1) ***City of Colorado Springs Drainage Criteria Manual Volume 1 and 2***, dated May 2014.

(2) ***Web Soil Survey of El Paso County Area, Colorado.*** **United States Department of Agriculture Soil Conservation Service,** September 2018.

(3) ***Flood Insurance Rate Map for El Paso County, Colorado and Incorporated Areas, Panel 507 of 1300,*** **Federal Emergency Management Agency,** Effective Date March 17, 1997.

(4) ***Kettle Creek Drainage Basin, Drainage Basin Planning Study and Master Development Drainage Plan,*** prepared by J.R. Engineering, March 2003.

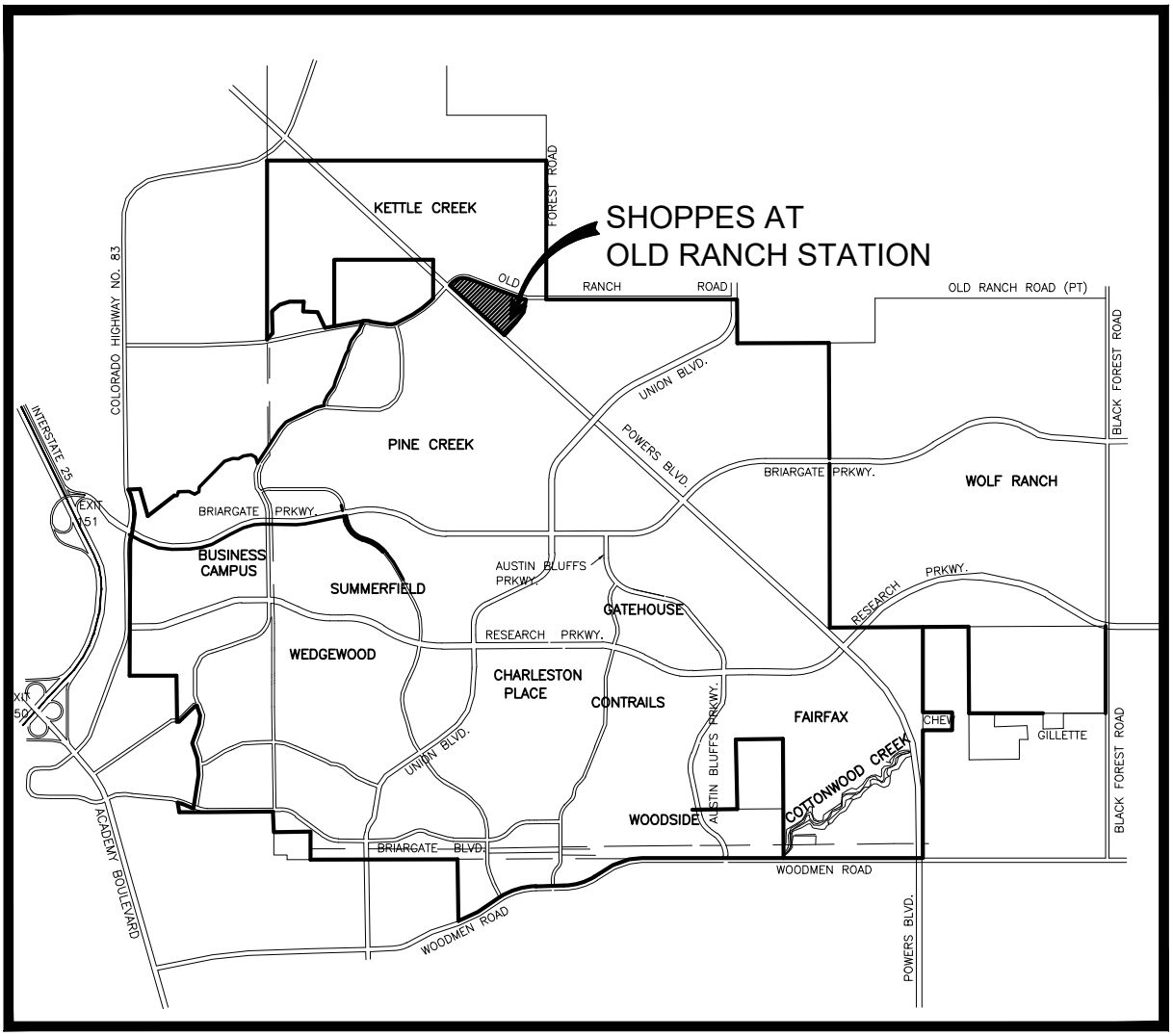
(5) ***Cordera Filing No. 3 Master Development Drainage Plan Update***, prepared by Matrix Design Group, October, 2007.

(6) ***Drainage Basin Planning Study for Kettle Creek Basin,*** prepared by J.R. Engineering, May 5, 2015.

(7) ***Preliminary/Final Drainage Report for Bison Ridge at Kettle Creek Filing No. 1 and Preliminary Drainage Report for Bison Ridge at Kettle Creek Filing No. 2 and Bison Ridge at Kettle Creek Multi-Family and Commercial Sites,*** prepared by J.R. Engineering, revised November, 2003

APPENDIX A

REFERENCE MAPS



VICINITY MAP

NORTH
N.T.S.

Matrix DESIGN GROUP

2435 Research Pkwy, Suite 300,
Colorado Springs, CO 80920
719.575.0100

Map Scale: 1:1,330 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 7, 2016—Aug 17, 2017

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
68	Peyton-Pring complex, 3 to 8 percent slopes	3.2	100.0%
Totals for Area of Interest		**3.2**	**100.0%**

El Paso County Area, Colorado

68—Peyton-Pring complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369f
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Minor Components

Other soils

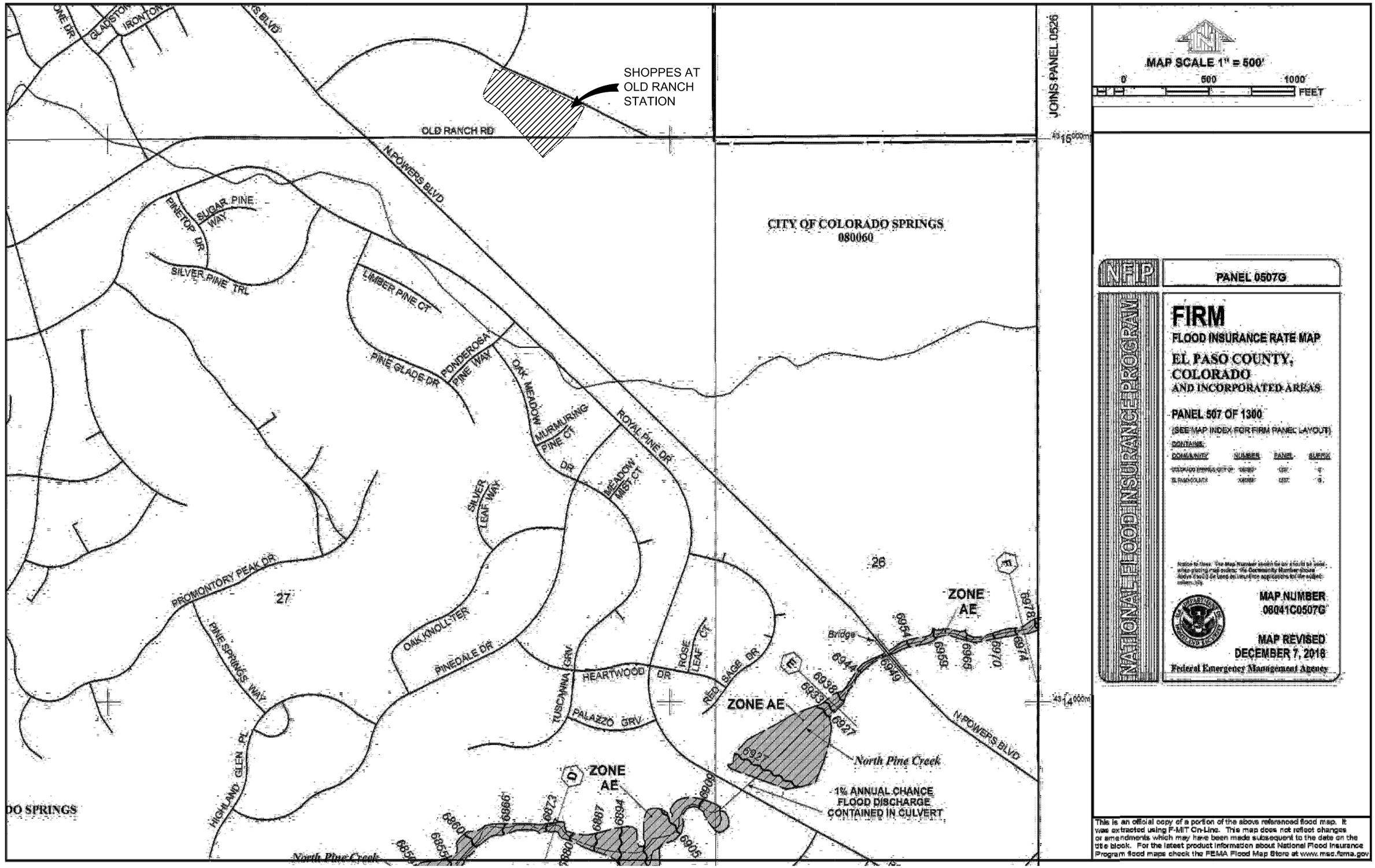
Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018


SHOPPES AT OLD RANCH STATION
OLD RANCH RD
N POWERS BLVD
CITY OF COLORADO SPRINGS
080060
JOINS PANEL 0526
15000m
MAP SCALE 1" = 500'
0
500
1000
FEET
PANEL 0507G
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 507 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY 080059 0507 G
MAP NUMBER
08041C0507G
MAP REVISED
DECEMBER 7, 2018
Federal Emergency Management Agency
NATIONAL FLOOD INSURANCE PROGRAM
NFIP
SUGAR PINE WAY
PINETOP DR
SILVER PINE TRL
LIMBER PINE CT
PINE GLADE DR
PONDEROSA PINE WAY
OAK MEADOW
MURMURING PINE CT
MEADOW MIST CT
ROYAL PINE DR
SILVER LEAF WAY
PROMONTORY PEAK DR
PINE SPRINGS WAY
OAK KNOLL TER
PINEDALE DR
HIGHLAND GLEN PL
TUSCANNA GRV
HEARTWOOD DR
PALAZZO GRV
ROSE LEAF CT
RED SAGE DR
27
26
ZONE AE
Bridge
6944
6949
6954
6959
6965
6970
6974
6978
6938
6933
6927
6922
North Pine Creek
1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
43 14000m
ZONE AE
6869
6872
6880
6887
6894
6905
6909
6860
6850
North Pine Creek
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX B

HYDROLOGIC AND HYDRAULIC CALCULATIONS

Rational Calculations

Project Name:	Shoppes at Old Ranch Station
Project Location:	Colorado Springs
Designer	BAS
Notes:	Existing Conditions

Average Channel Velocity	5	ft/s	(If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow	0.01	ft/ft	(If Elevations are used, this will be ignored)

			Rational 'C' Values								Flow Lengths		Initial Flow				Channel Flow						Rainfall Intensity and Rational Flow Rate						
	Total Area	Total Area	Surface Type 1			Surface Type 2			Composite	Composite	Initial Length	Channel flow	High Point	Low Point	Average	Initial	High Point	Low Point	Average	Flow Master Velocity	Channel	Total	i2	Q2	i5	Q5	i100	Q100
Basin	sf	acres	C10	C100	Area (SF)	C10	C100	Area (SF)	C10	C100	ft	Length ft	Elevation	Elevation	Slope	Tc (min)	Elevation	Elevation	Slope	(ft/s)	Tc (min)	Tc (min)	in/hr	cfs	in/hr	cfs	in/hr	cfs
EK-1	151,133.7	3.470	0.09	0.36	152,137.4	0.90	0.95	0	0.100	0.370	50.00	385.57	6988.73	6984.89	0.077	0.95	6984.89	6965.02	0.052	2.20	2.92	5.00	3.14	**1.10**	4.08	**1.43**	8.6437	**11.19**
OS-1	136,930.9	3.140	0.09	0.36	136,930.9	0.90	0.95	0	0.090	0.360	50.00	510.37	7001.02	6997.65	0.067	0.95	6997.65	6973.26	0.048	1.60	5.32	6.26	2.95	**0.84**	3.84	**1.09**	8.1298	**9.26**

Project Name:	Shoppes at Old Ranch Station
Project Location:	Colorado Springs
Designer	BAS
Notes:	Proposed Conditions

Average Channel Velocity 5 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

		Area		Rational 'C' Values											Flow Lengths			Initial Flow				Channel Flow					Tc	Rainfall Intensity & Rational Flow Rate						
				Surface Type 1			Surface Type 2			Surface Type 3			Composite		Initial	Channel	True Channel	High Point	Low Point	Average	Initial	High Point	Low Point	Average	Velocity	Channel	Total	i2	Q2	i5	Q5	i100	Q100
Basin	**Contributing Basins**	sf	acres	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	ft	ft	Length ft	Elevation	Elevation	Slope	Tc (min)	Elevation	Elevation	Slope	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	in/hr	cfs
PK-1		24493	0.56	0.09	0.36	0	0.90	0.96		0.81	0.88	24493	0.81	0.88	25	359	359	6988	6987	0.040	1.7	6987	6971	0.045	4.2	1.4	5.0	3.1	**1.4**	4.1	**1.9**	8.6	**4.3**
PK-2		65136	1.50	0.09	0.36	0	0.90	0.96	0	0.81	0.88	65136	0.81	0.88	25	457	457	6980	6979	0.040	1.7	6979	6969	0.022	2.9	2.6	5.0	3.1	**3.8**	4.1	**5.0**	8.6	**11.5**
PK-3		12689	0.29	0.09	0.36	0	0.90	0.96	0	0.81	0.88	12,689	0.81	0.88	25	220	220	6971	6970	0.040	1.7	6970	6965	0.023	3.0	1.2	5.0	3.1	**0.7**	4.1	**1.0**	8.6	**2.2**
PK-4		25709	0.59	0.09	0.36	0	0.90	0.96	0	0.81	0.88	25709	0.81	0.88	25	248	248	6971	6970	0.040	1.7	6970	6965	0.020	2.8	1.5	5.0	3.1	**1.5**	4.1	**2.0**	8.6	**4.5**
PK-5		24002	0.55	0.09	0.36	0	0.90	0.96	24,002	0.49	0.62	0	0.90	0.96	25	367	367	6978	6977	0.040	1.2	6977	6964	0.035	3.7	1.7	5.0	3.1	**1.6**	4.1	**2.0**	8.6	**4.6**
PK-6		23131	0.53	0.09	0.36	0	0.90	0.96	23,131	0.49	0.62	0	0.90	0.96	25	367	367	6978	6977	0.040	1.2	6977	6964	0.035	3.7	1.7	5.0	3.1	**1.5**	4.1	**2.0**	8.6	**4.4**
DP1	PK-1	24493	0.56	0.09	0.36	0	0.90	0.96	0	0.81	0.88	24493	0.81	0.88	25	359	359	6988	6987	0.040	1.7	6987	6971	0.045	4.2	1.4	5.0	3.1	**1.4**	4.1	**1.9**	8.6	**4.3**
DP2	PK-2	65136	1.50	0.09	0.36	0	0.90	0.96	0	0.81	0.88	65136	0.81	0.88	25	457	457	6980	6979	0.040	1.7	6979	6969	0.022	2.9	2.6	5.0	3.1	**3.8**	4.1	**5.0**	8.6	**11.5**
DP3	PK-1, PK-2	89629	2.06	0.09	0.36	0	0.90	0.96	0	0.81	0.88	89629	0.81	0.88	25	457	457	6980	6979	0.040	1.7	6979	6969	0.022	2.9	2.6	5.0	3.1	**5.3**	4.1	**6.9**	8.6	**15.8**
DP4	PK-4	25709	0.59	0.09	0.36	0	0.90	0.96	0	0.81	0.88	25709	0.81	0.88	25	248	248	6971	6970	0.040	1.7	6970	6965	0.020	2.8	1.5	5.0	3.1	**1.5**	4.1	**2.0**	8.6	**4.5**
DP5	PK-4, PK-3	38398	0.88	0.09	0.36	0	0.90	0.96	0	0.81	0.88	38,398	0.81	0.88	25	248	248	6971	6970	0.040	1.7	6970	6965	0.020	3.0	1.4	5.0	3.1	**2.3**	4.1	**2.9**	8.6	**6.7**
DP6	DP4, DP5	38398	0.88	0.09	0.36	0	0.90	0.96	0	0.81	0.88	38398	0.81	0.88	25	248	248	6971	6970	0.040	0.0	6970	6965	0.020	2.1	2.0	5.0	3.1	**2.3**	4.1	**2.9**	8.6	**6.7**
DP7	PK-5	24002	0.55	0.09	0.36	0	0.90	0.96	24,002	0.81	0.88	0	0.90	0.96	25	367	367	6978	6977	0.040	1.2	6977	6964	0.035	3.7	1.7	5.0	3.1	**1.6**	4.1	**2.0**	8.6	**4.6**
DP8	PK-5, PK-6	47132	1.08	0.09	0.36	0	0.90	0.96	47,132	0.81	0.88	0	0.90	0.96	25	367	367	6978	6977	0.040	1.2	6977	6964	0.035	3.7	1.7	5.0	3.1	**3.1**	4.1	**4.0**	8.6	**9.0**
DP9	Release from DP3, Release from DP6	128026	2.94	0.09	0.36	0	0.90	0.96	0	0.81	0.88	128026	0.81	0.88	25	687	687	6988	6987	0.040	0.0	6987	6965	0.032	3.5	3.3	5.0	3.1	**7.5**	4.1	**6.4**	8.6	**13.2**
DP10	DP9, release from ORR Pond (D5 of South Tributary)		0.00	0.09	0.36	0	0.90	0.96	0	0.81	0.88	0	#DIV/0!	#DIV/0!	25	852	852	6988	6987	0.040	#DIV/0!	6987	6966	0.025	4.5	3.2	#####	#####	**#####**	####	**40.4**	#####	**125.2**
DP11	2.16/4.43 cfs/acre allowable	46609	1.07	0.09	0.36	0	0.90	0.96	0	0.81	0.88	46609	0.81	0.88	25	400	400	6964	6963	0.040	0.0	6963	6947	0.040	4.0	1.7	5.0	3.1	**2.7**	4.1	**2.3**	8.6	**4.7**
DP12	DP9, release from ORR Pond (D5 of South Tributary)	314069	7.21	0.09	0.36	0	0.90	0.96	0	0.81	0.88	0	0.00	0.00	25	687	687	6988	6987	0.040	0.0	6987	6968	0.028	6.5	1.8	5.0	3.1	**0.0**	4.1	**51.3**	8.6	**148.3**

Note: Q2, Q5 & Q10 are based on C5; Q25, Q50 & Q100 are based on C100

* For ORR Pond: At the offsite tie-in from North Fork's ORR Pond, assumption is made to sum flows of 34 cfs (5-year) and 112 cfs (100-year) to the routed flows from DP10

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Brady Shyrock
Company: Matrix Design Group, Inc
Date: November 7, 2018
Project: Cordera CN-1-Shoppes at Old Ranch Station
Location: Colorado Springs, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	DCIA	DCIA	SPA	SPA								
Area ID	IMP	IMP-2	SPA-1	SPA-2								
Downstream Design Point ID	DF-1	DF-2	DF-1	DF-2								
Downstream BMP Type	EDB	EDB	EDB	EDB								
DCIA (ft^2)	40,075	89,734	--	--								
UIA (ft^2)	--	--	--	--								
RPA (ft^2)	--	--	--	--								
SPA (ft^2)	--	--	4,485	2,004								
HSG A (%)	--	--	0%	0%								
HSG B (%)	--	--	100%	100%								
HSG C/D (%)	--	--	0%	0%								
Average Slope of RPA (ft/ft)	--	--	--	--								
UIA:RPA Interface Width (ft)	--	--	--	--								

CALCULATED RUNOFF RESULTS

Area ID	IMP	IMP-2	SPA-1	SPA-2								
UIA:RPA Area (ft^2)	--	--	--	--								
L / W Ratio	--	--	--	--								
UIA / Area	--	--	--	--								
Runoff (in)	0.50	0.50	0.00	0.00								
Runoff (ft^3)	1670	3739	0	0								
Runoff Reduction (ft^3)	0	0	224	100								

CALCULATED WQCV RESULTS

Area ID	IMP	IMP-2	SPA-1	SPA-2								
WQCV (ft^3)	1670	3739	0	0								
WQCV Reduction (ft^3)	0	0	0	0								
WQCV Reduction (%)	0%	0%	0%	0%								
Untreated WQCV (ft^3)	1670	3739	0	0								

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	DF-1	DF-2										
DCIA (ft^2)	40,075	89,734										
UIA (ft^2)	0	0										
RPA (ft^2)	0	0										
SPA (ft^2)	4,485	2,004										
Total Area (ft^2)	44,560	91,738										
Total Impervious Area (ft^2)	40,075	89,734										
WQCV (ft^3)	1,670	3,739										
WQCV Reduction (ft^3)	0	0										
WQCV Reduction (%)	0%	0%										
Untreated WQCV (ft^3)	1,670	3,739										

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

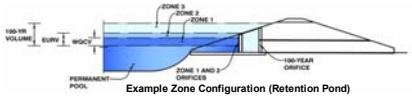
Total Area (ft^2)	136,298
Total Impervious Area (ft^2)	129,809
WQCV (ft^3)	5,409
WQCV Reduction (ft^3)	0
WQCV Reduction (%)	0%
Untreated WQCV (ft^3)	5,409

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Cordera Shoppes at Old Ranch Station, Lot 1

Basin ID: Underground Water Quality & Detention Structure



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	0.92	acres
Watershed Length =	248	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	90.00%	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
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.031	acre-feet
Excess Urban Runoff Volume (EURV) =	0.092	acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.063	acre-feet
5-yr Runoff Volume (P1 = 1.22 in.) =	0.084	acre-feet
10-yr Runoff Volume (P1 = 1.48 in.) =	0.106	acre-feet
25-yr Runoff Volume (P1 = 1.88 in.) =	0.139	acre-feet
50-yr Runoff Volume (P1 = 2.21 in.) =	0.163	acre-feet
100-yr Runoff Volume (P1 = 2.57 in.) =	0.194	acre-feet
500-yr Runoff Volume (P1 = 3.52 in.) =	0.272	acre-feet
Approximate 2-yr Detention Volume =	0.059	acre-feet
Approximate 5-yr Detention Volume =	0.079	acre-feet
Approximate 10-yr Detention Volume =	0.100	acre-feet
Approximate 25-yr Detention Volume =	0.119	acre-feet
Approximate 50-yr Detention Volume =	0.129	acre-feet
Approximate 100-yr Detention Volume =	0.140	acre-feet

Optional User Override 1-hr Precipitation

0.95	inches
1.22	inches
1.48	inches
1.88	inches
2.21	inches
2.57	inches
3.52	inches

Stage-Storage Calculation

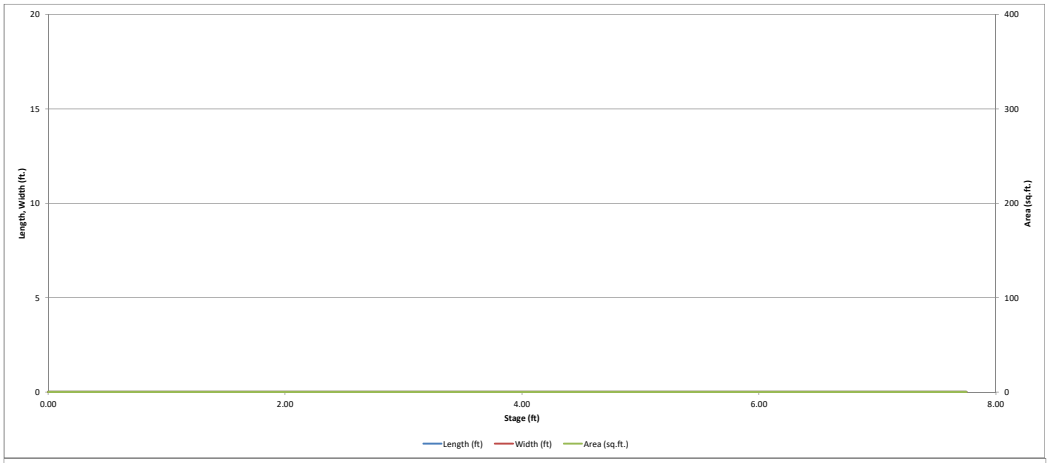
Zone 1 Volume (WQCV) =	0.031	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.062	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.047	acre-feet
Total Detention Basin Volume =	0.140	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

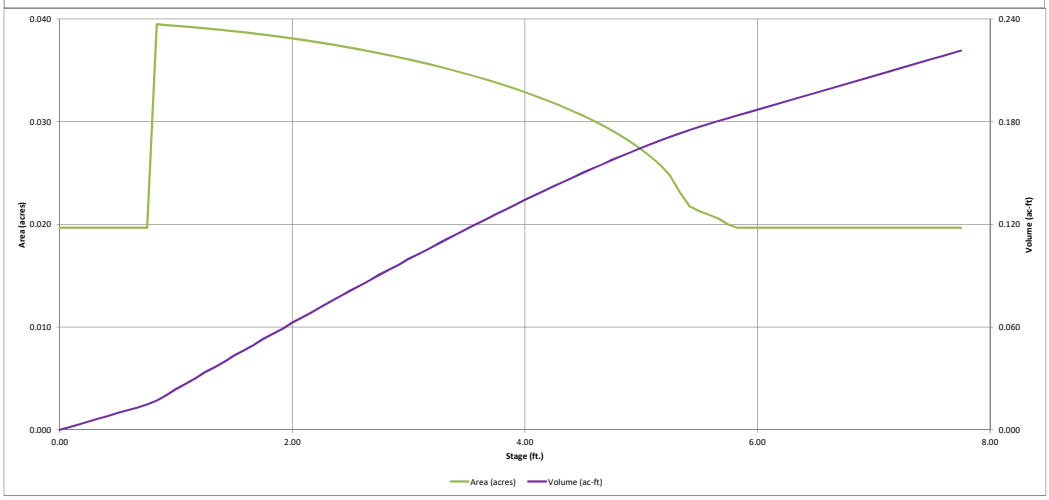
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	857	0.020		
	--	0.08	--	--	--	857	0.020	69	0.002
	--	0.17	--	--	--	857	0.020	137	0.003
	--	0.25	--	--	--	857	0.020	214	0.005
	--	0.33	--	--	--	857	0.020	283	0.006
	--	0.42	--	--	--	857	0.020	351	0.008
	--	0.50	--	--	--	857	0.020	428	0.010
	--	0.58	--	--	--	857	0.020	497	0.011
	--	0.67	--	--	--	857	0.020	565	0.013
	--	0.75	--	--	--	857	0.020	643	0.015
	--	0.83	--	--	--	1,720	0.039	744	0.017
	--	0.92	--	--	--	1,716	0.039	882	0.020
	--	1.00	--	--	--	1,713	0.039	1,036	0.024
	--	1.08	--	--	--	1,710	0.039	1,173	0.027
	--	1.17	--	--	--	1,706	0.039	1,310	0.030
	--	1.25	--	--	--	1,702	0.039	1,463	0.034
	--	1.33	--	--	--	1,699	0.039	1,599	0.037
	--	1.42	--	--	--	1,695	0.039	1,735	0.040
	--	1.50	--	--	--	1,690	0.039	1,887	0.043
	--	1.58	--	--	--	1,686	0.039	2,022	0.046
	--	1.67	--	--	--	1,681	0.039	2,157	0.050
	--	1.75	--	--	--	1,676	0.038	2,308	0.053
	--	1.83	--	--	--	1,671	0.038	2,442	0.056
	--	1.92	--	--	--	1,665	0.038	2,575	0.059
	--	2.00	--	--	--	1,660	0.038	2,725	0.063
	--	2.08	--	--	--	1,654	0.038	2,858	0.066
	--	2.17	--	--	--	1,648	0.038	2,990	0.069
	--	2.25	--	--	--	1,641	0.038	3,138	0.072
	--	2.33	--	--	--	1,635	0.038	3,269	0.075
	--	2.42	--	--	--	1,628	0.037	3,399	0.078
	--	2.50	--	--	--	1,620	0.037	3,545	0.081
	--	2.58	--	--	--	1,613	0.037	3,675	0.084
	--	2.67	--	--	--	1,605	0.037	3,803	0.087
	--	2.75	--	--	--	1,597	0.037	3,948	0.091
	--	2.83	--	--	--	1,588	0.036	4,075	0.094
	--	2.92	--	--	--	1,579	0.036	4,202	0.096
	--	3.00	--	--	--	1,570	0.036	4,344	0.100
	--	3.08	--	--	--	1,561	0.036	4,469	0.103
	--	3.17	--	--	--	1,551	0.036	4,593	0.105
	--	3.25	--	--	--	1,541	0.035	4,733	0.109
	--	3.33	--	--	--	1,531	0.035	4,855	0.111
	--	3.42	--	--	--	1,520	0.035	4,977	0.114
	--	3.50	--	--	--	1,509	0.035	5,114	0.117
	--	3.58	--	--	--	1,497	0.034	5,234	0.120
	--	3.67	--	--	--	1,485	0.034	5,353	0.123
	--	3.75	--	--	--	1,472	0.034	5,487	0.126
	--	3.83	--	--	--	1,459	0.033	5,604	0.129
	--	3.92	--	--	--	1,446	0.033	5,720	0.131
	--	4.00	--	--	--	1,431	0.033	5,850	0.134
	--	4.08	--	--	--	1,417	0.033	5,964	0.137
	--	4.17	--	--	--	1,401	0.032	6,076	0.139
	--	4.25	--	--	--	1,385	0.032	6,202	0.142
	--	4.33	--	--	--	1,368	0.031	6,312	0.145
	--	4.42	--	--	--	1,350	0.031	6,421	0.147
	--	4.50	--	--	--	1,331	0.031	6,541	0.150
	--	4.58	--	--	--	1,312	0.030	6,647	0.153
	--	4.67	--	--	--	1,291	0.030	6,751	0.155
	--	4.75	--	--	--	1,268	0.029	6,867	0.158
	--	4.83	--	--	--	1,244	0.029	6,967	0.160
	--	4.92	--	--	--	1,218	0.028	7,066	0.162
	--	5.00	--	--	--	1,190	0.027	7,174	0.165
	--	5.08	--	--	--	1,158	0.027	7,268	0.167
	--	5.17	--	--	--	1,122	0.026	7,360	0.169
	--	5.25	--	--	--	1,077	0.025	7,459	0.171
	--	5.33	--	--	--	1,007	0.023	7,542	0.173
	--	5.42	--	--	--	947	0.022	7,621	0.175
	--	5.50	--	--	--	926	0.021	7,705	0.177
	--	5.58	--	--	--	911	0.021	7,779	0.179
	--	5.67	--	--	--	895	0.021	7,851	0.180
	--	5.75	--	--	--	870	0.020	7,930	0.182
	--	5.83	--	--	--	857	0.020	8,000	0.184
	--	5.92	--	--	--	857	0.020	8,068	0.185
	--	6.00	--	--	--	857	0.020	8,145	0.187
	--	6.08	--	--	--	857	0.020	8,214	0.189
	--	6.17	--	--	--	857	0.020	8,282	0.190
	--	6.25	--	--	--	857	0.020	8,359	0.192
	--	6.33	--	--	--	857	0.020	8,428	0.193
	--	6.42	--	--	--	857	0.020	8,497	0.195
	--	6.50	--	--	--	857	0.020	8,574	0.197
	--	6.58	--	--	--	857	0.020	8,642	0.198
	--	6.67	--	--	--	857	0.020	8,711	0.200
	--	6.75	--	--	--	857	0.020	8,788	0.202
	--	6.83	--	--	--	857	0.020	8,856	0.203
	--	6.92	--	--	--	857	0.020	8,925	0.205
	--	7.00	--	--	--	857	0.020	9,002	0.207
	--	7.08	--	--	--	857	0.020	9,071	0.208
	--	7.17	--	--	--	857	0.020	9,139	0.210
	--	7.25	--	--	--	857	0.020	9,216	0.212
	--	7.33	--	--	--	857	0.020	9,285	0.213
	--	7.42	--	--	--	857	0.020	9,353	0.215
	--	7.50	--	--	--	857	0.020	9,430	0.216
	--	7.58	--	--	--	857	0.020	9,499	0.218
	--	7.67	--	--	--	857	0.020	9,568	0.220
	--	7.75	--	--	--	857	0.020	9,645	0.221
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



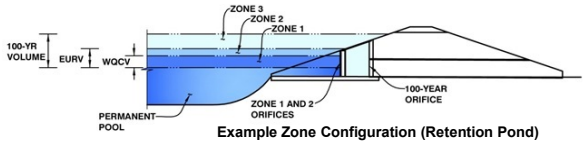


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.18	0.031	Orifice Plate
Zone 2 (EURV)	2.81	0.062	Orifice Plate
Zone 3 (100-year)	4.17	0.047	Weir&Pipe (Circular)
		0.140	Total

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^2
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 =	4.38	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

Calculated Parameters for Plate

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

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	0.85	2.00					
Orifice Area (sq. inches)	0.35	0.50	0.50					

	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	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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.38	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.67	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	0.00	N/A	feet
Overflow Grate Open Area % =	100%	N/A	%, grate open area/total area
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.38	N/A	feet
Over Flow Weir Slope Length =	0.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	0.00	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	0.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	0.00	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

Spillway Design Flow Depth=		feet
Stage at Top of Freeboard =		feet
Basin Area at Top of Freeboard =		acres

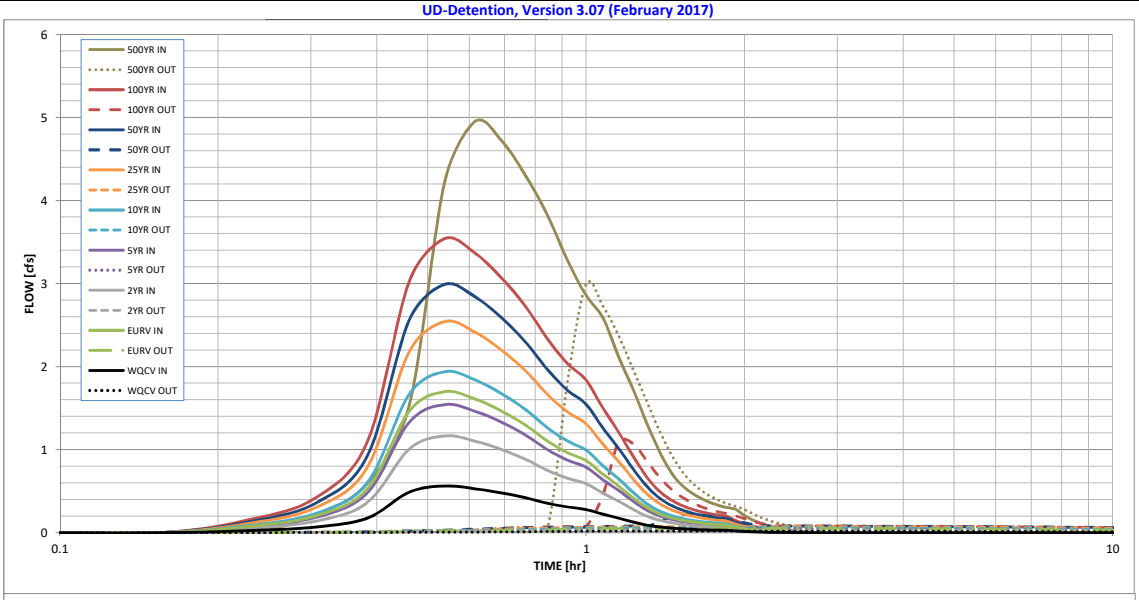
Routed Hydrograph Results

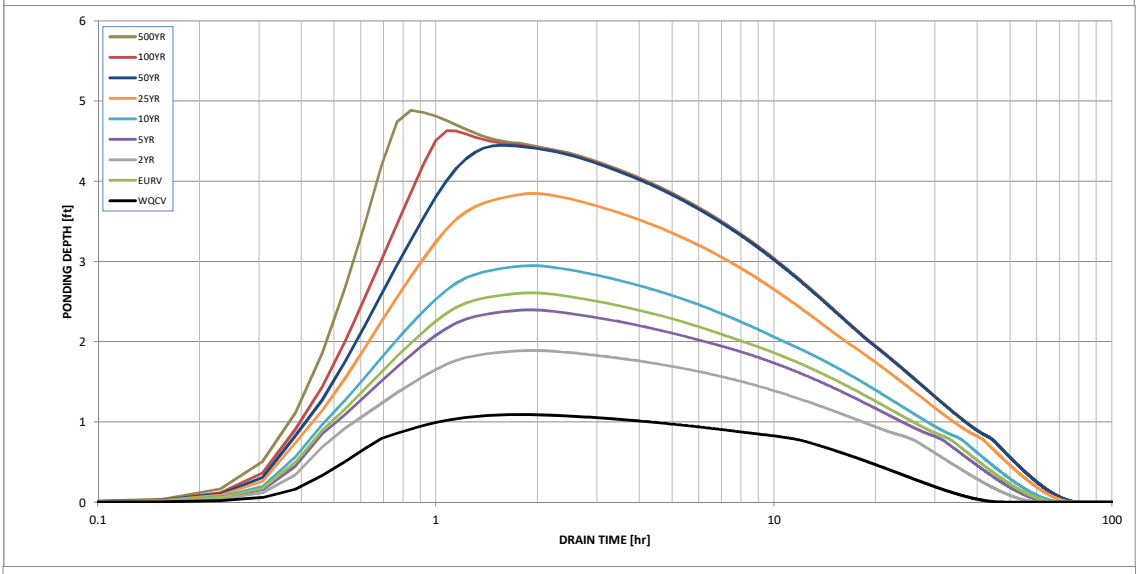
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.95	1.22	1.48	1.88	2.21	2.57	3.52
Calculated Runoff Volume (acre-ft) =	0.031	0.092	0.063	0.084	0.106	0.139	0.163	0.194	0.272
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.030	0.092	0.063	0.083	0.105	0.138	0.163	0.194	0.272
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.19	0.69	0.99	1.38	2.24
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.2	0.6	0.9	1.3	2.1
Peak Inflow Q (cfs) =	0.6	1.7	1.2	1.5	1.9	2.5	3.0	3.5	5.0
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.0	0.1	0.1	0.2	1.1	3.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.9	0.3	0.1	0.2	0.9	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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) =	39	54	49	53	56	59	60	58	54
Time to Drain 99% of Inflow Volume (hours) =	**43**	61	55	59	63	67	69	68	65
Maximum Ponding Depth (ft) =	1.09	2.61	1.89	2.40	2.95	3.85	4.45	4.63	4.89
Area at Maximum Ponding Depth (acres) =	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Maximum Volume Stored (acre-ft) =	0.027	0.085	0.058	0.077	0.098	0.129	0.148	0.154	0.161

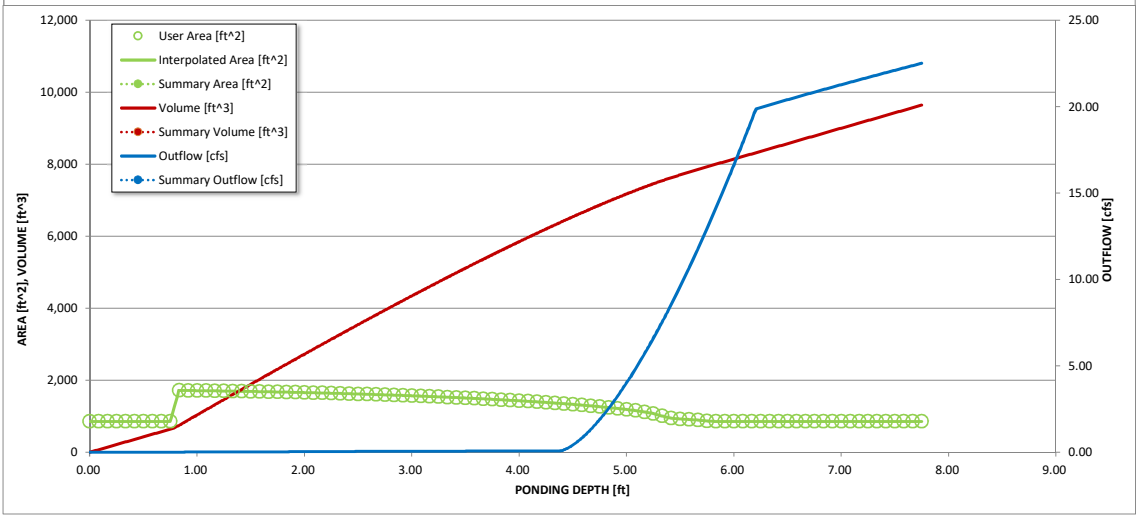
NOTE: 100 -year Peak Outflow meets the MDDP requirement for allowable release rate. See release rate section in report.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

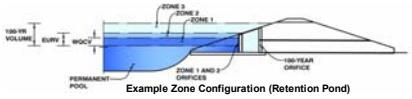
Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.61 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:13:50	0.03	0.08	0.05	0.07	0.09	0.12	0.14	0.16	0.22
1.084	0:18:26	0.07	0.21	0.14	0.19	0.24	0.31	0.36	0.43	0.60
	0:23:03	0.18	0.53	0.37	0.48	0.61	0.79	0.93	1.10	1.53
	0:27:40	0.49	1.46	1.01	1.33	1.67	2.18	2.56	3.03	4.22
	0:32:16	0.56	1.70	1.17	1.54	1.94	2.54	2.99	3.54	4.95
	0:36:53	0.53	1.61	1.10	1.46	1.84	2.42	2.84	3.37	4.72
	0:41:29	0.48	1.46	1.00	1.33	1.67	2.20	2.58	3.06	4.29
	0:46:06	0.42	1.29	0.88	1.17	1.48	1.94	2.29	2.72	3.81
	0:50:43	0.35	1.10	0.75	1.00	1.26	1.66	1.96	2.33	3.27
	0:55:19	0.31	0.96	0.66	0.87	1.10	1.45	1.71	2.03	2.86
	0:59:56	0.28	0.87	0.59	0.79	1.00	1.31	1.55	1.84	2.59
	1:04:32	0.22	0.70	0.48	0.64	0.81	1.07	1.26	1.50	2.12
	1:09:09	0.18	0.56	0.38	0.51	0.65	0.86	1.01	1.21	1.71
	1:13:46	0.13	0.42	0.28	0.38	0.48	0.64	0.76	0.91	1.30
	1:18:22	0.09	0.30	0.20	0.27	0.35	0.46	0.55	0.66	0.95
	1:22:59	0.07	0.22	0.15	0.20	0.26	0.34	0.41	0.49	0.70
	1:27:35	0.05	0.18	0.12	0.16	0.20	0.27	0.32	0.38	0.55
	1:32:12	0.05	0.15	0.10	0.13	0.17	0.22	0.26	0.32	0.45
	1:36:49	0.04	0.12	0.08	0.11	0.14	0.19	0.23	0.27	0.38
	1:41:25	0.03	0.11	0.07	0.10	0.13	0.17	0.20	0.24	0.34
	1:46:02	0.03	0.10	0.07	0.09	0.11	0.15	0.18	0.21	0.30
	1:50:38	0.03	0.09	0.06	0.08	0.11	0.14	0.17	0.20	0.28
	1:55:15	0.02	0.07	0.05	0.06	0.08	0.10	0.12	0.15	0.21
	1:59:52	0.02	0.05	0.03	0.05	0.06	0.08	0.09	0.11	0.15
	2:04:28	0.01	0.04	0.02	0.03	0.04	0.06	0.07	0.08	0.11
	2:09:05	0.01	0.03	0.02	0.02	0.03	0.04	0.05	0.06	0.08
	2:13:41	0.01	0.02	0.01	0.02	0.02	0.03	0.03	0.04	0.06
	2:18:18	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
	2:22:55	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	2:27:31	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	2:32:08	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	2:36:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:41:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:59:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:04:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:09:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:13:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:18:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:22:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:27:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:36:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:41:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:59:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:04:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:13:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:18:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:31:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:36:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:41:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:22:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:31:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Cordera Shoppes at Old Ranch Station, Lot 2

Basin ID: Underground Water Quality & Detention Structure



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	2.06	acres
Watershed Length =	457	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	90.00%	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
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.069	acre-feet
Excess Urban Runoff Volume (EURV) =	0.208	acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.141	acre-feet
5-yr Runoff Volume (P1 = 1.22 in.) =	0.188	acre-feet
10-yr Runoff Volume (P1 = 1.48 in.) =	0.238	acre-feet
25-yr Runoff Volume (P1 = 1.88 in.) =	0.313	acre-feet
50-yr Runoff Volume (P1 = 2.21 in.) =	0.367	acre-feet
100-yr Runoff Volume (P1 = 2.57 in.) =	0.436	acre-feet
500-yr Runoff Volume (P1 = 3.52 in.) =	0.612	acre-feet
Approximate 2-yr Detention Volume =	0.132	acre-feet
Approximate 5-yr Detention Volume =	0.177	acre-feet
Approximate 10-yr Detention Volume =	0.225	acre-feet
Approximate 25-yr Detention Volume =	0.268	acre-feet
Approximate 50-yr Detention Volume =	0.291	acre-feet
Approximate 100-yr Detention Volume =	0.314	acre-feet

Optional User Override 1-hr Precipitation

0.95	inches
1.22	inches
1.48	inches
1.88	inches
2.21	inches
2.57	inches
3.52	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.069	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.139	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.106	acre-feet
Total Detention Basin Volume =	0.314	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

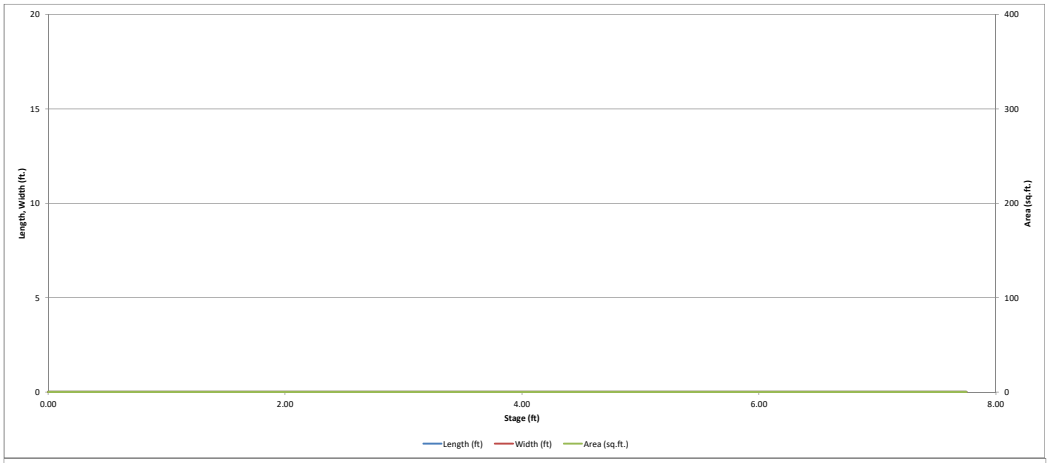
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

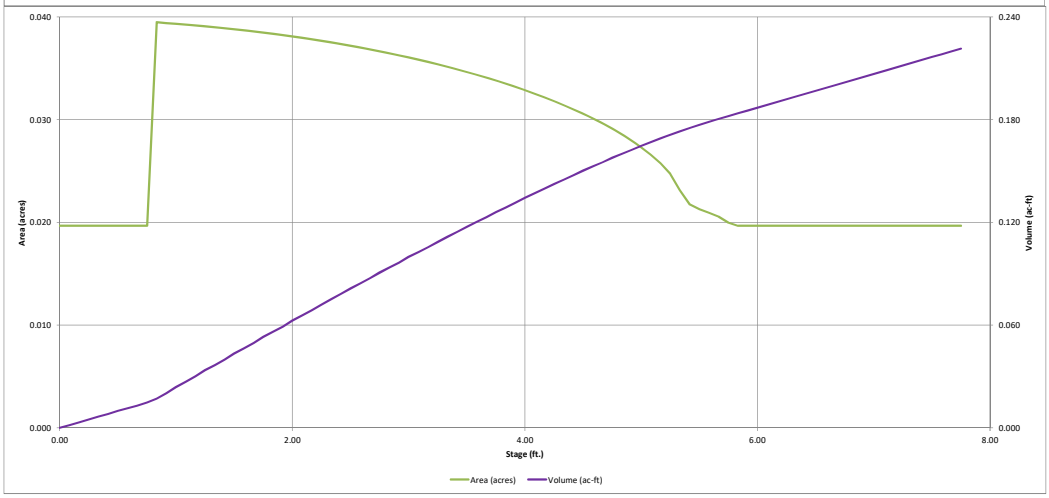
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	857	0.020		
	--	0.08	--	--	--	857	0.020	69	0.002
	--	0.17	--	--	--	857	0.020	137	0.003
	--	0.25	--	--	--	857	0.020	214	0.005
	--	0.33	--	--	--	857	0.020	283	0.006
	--	0.42	--	--	--	857	0.020	351	0.008
	--	0.50	--	--	--	857	0.020	428	0.010
	--	0.58	--	--	--	857	0.020	497	0.011
	--	0.67	--	--	--	857	0.020	565	0.013
	--	0.75	--	--	--	857	0.020	643	0.015
	--	0.83	--	--	--	1,720	0.039	744	0.017
	--	0.92	--	--	--	1,716	0.039	882	0.020
	--	1.00	--	--	--	1,713	0.039	1,036	0.024
	--	1.08	--	--	--	1,710	0.039	1,173	0.027
	--	1.17	--	--	--	1,706	0.039	1,310	0.030
	--	1.25	--	--	--	1,702	0.039	1,463	0.034
	--	1.33	--	--	--	1,699	0.039	1,599	0.037
	--	1.42	--	--	--	1,695	0.039	1,735	0.040
	--	1.50	--	--	--	1,690	0.039	1,887	0.043
	--	1.58	--	--	--	1,686	0.039	2,022	0.046
	--	1.67	--	--	--	1,681	0.039	2,157	0.050
	--	1.75	--	--	--	1,676	0.038	2,308	0.053
	--	1.83	--	--	--	1,671	0.038	2,442	0.056
	--	1.92	--	--	--	1,665	0.038	2,575	0.059
	--	2.00	--	--	--	1,660	0.038	2,725	0.063
	--	2.08	--	--	--	1,654	0.038	2,858	0.066
	--	2.17	--	--	--	1,648	0.038	2,990	0.069
	--	2.25	--	--	--	1,641	0.038	3,138	0.072
	--	2.33	--	--	--	1,635	0.038	3,269	0.075
	--	2.42	--	--	--	1,628	0.037	3,399	0.078
	--	2.50	--	--	--	1,620	0.037	3,545	0.081
	--	2.58	--	--	--	1,613	0.037	3,675	0.084
	--	2.67	--	--	--	1,605	0.037	3,803	0.087
	--	2.75	--	--	--	1,597	0.037	3,948	0.091
	--	2.83	--	--	--	1,588	0.036	4,075	0.094
	--	2.92	--	--	--	1,579	0.036	4,202	0.096
	--	3.00	--	--	--	1,570	0.036	4,344	0.100
	--	3.08	--	--	--	1,561	0.036	4,469	0.103
	--	3.17	--	--	--	1,551	0.036	4,593	0.105
	--	3.25	--	--	--	1,541	0.035	4,733	0.109
	--	3.33	--	--	--	1,531	0.035	4,855	0.111
	--	3.42	--	--	--	1,520	0.035	4,977	0.114
	--	3.50	--	--	--	1,509	0.035	5,114	0.117
	--	3.58	--	--	--	1,497	0.034	5,234	0.120
	--	3.67	--	--	--	1,485	0.034	5,353	0.123
	--	3.75	--	--	--	1,472	0.034	5,487	0.126
	--	3.83	--	--	--	1,459	0.033	5,604	0.129
	--	3.92	--	--	--	1,446	0.033	5,720	0.131
	--	4.00	--	--	--	1,431	0.033	5,850	0.134
	--	4.08	--	--	--	1,417	0.033	5,964	0.137
	--	4.17	--	--	--	1,401	0.032	6,076	0.139
	--	4.25	--	--	--	1,385	0.032	6,202	0.142
	--	4.33	--	--	--	1,368	0.031	6,312	0.145
	--	4.42	--	--	--	1,350	0.031	6,421	0.147
	--	4.50	--	--	--	1,331	0.031	6,541	0.150
	--	4.58	--	--	--	1,312	0.030	6,647	0.153
	--	4.67	--	--	--	1,291	0.030	6,751	0.155
	--	4.75	--	--	--	1,268	0.029	6,867	0.158
	--	4.83	--	--	--	1,244	0.029	6,967	0.160
	--	4.92	--	--	--	1,218	0.028	7,066	0.162
	--	5.00	--	--	--	1,190	0.027	7,174	0.165
	--	5.08	--	--	--	1,158	0.027	7,268	0.167
	--	5.17	--	--	--	1,122	0.026	7,360	0.169
	--	5.25	--	--	--	1,077	0.025	7,459	0.171
	--	5.33	--	--	--	1,007	0.023	7,542	0.173
	--	5.42	--	--	--	947	0.022	7,621	0.175
	--	5.50	--	--	--	926	0.021	7,705	0.177
	--	5.58	--	--	--	911	0.021	7,779	0.179
	--	5.67	--	--	--	895	0.021	7,851	0.180
	--	5.75	--	--	--	870	0.020	7,930	0.182
	--	5.83	--	--	--	857	0.020	8,000	0.184
	--	5.92	--	--	--	857	0.020	8,068	0.185
	--	6.00	--	--	--	857	0.020	8,145	0.187
	--	6.08	--	--	--	857	0.020	8,214	0.189
	--	6.17	--	--	--	857	0.020	8,282	0.190
	--	6.25	--	--	--	857	0.020	8,359	0.192
	--	6.33	--	--	--	857	0.020	8,428	0.193
	--	6.42	--	--	--	857	0.020	8,497	0.195
	--	6.50	--	--	--	857	0.020	8,574	0.197
	--	6.58	--	--	--	857	0.020	8,642	0.198
	--	6.67	--	--	--	857	0.020	8,711	0.200
	--	6.75	--	--	--	857	0.020	8,788	0.202
	--	6.83	--	--	--	857	0.020	8,856	0.203
	--	6.92	--	--	--	857	0.020	8,925	0.205
	--	7.00	--	--	--	857	0.020	9,002	0.207
	--	7.08	--	--	--	857	0.020	9,071	0.208
	--	7.17	--	--	--	857	0.020	9,139	0.210
	--	7.25	--	--	--	857	0.020	9,216	0.212
	--	7.33	--	--	--	857	0.020	9,285	0.213
	--	7.42	--	--	--	857	0.020	9,353	0.215
	--	7.50	--	--	--	857	0.020	9,430	0.216
	--	7.58	--	--	--	857	0.020	9,499	0.218
	--	7.67	--	--	--	857	0.020	9,568	0.220
	--	7.75	--	--	--	857	0.020	9,645	0.221
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				
	--		--	--	--				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



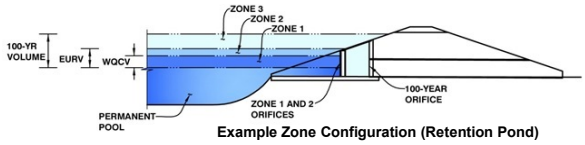


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.18	0.031	Orifice Plate
Zone 2 (EURV)	2.81	0.062	Orifice Plate
Zone 3 (100-year)	4.17	0.047	Weir&Pipe (Circular)
		0.140	Total

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^2
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 =	4.38	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

Calculated Parameters for Plate

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

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	0.85	2.00					
Orifice Area (sq. inches)	0.35	0.50	0.50					

	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	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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.38	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.67	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	0.00	N/A	feet
Overflow Grate Open Area % =	100%	N/A	%, grate open area/total area
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.38	N/A	feet
Over Flow Weir Slope Length =	0.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	0.00	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	0.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	0.00	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

Spillway Design Flow Depth=		feet
Stage at Top of Freeboard =		feet
Basin Area at Top of Freeboard =		acres

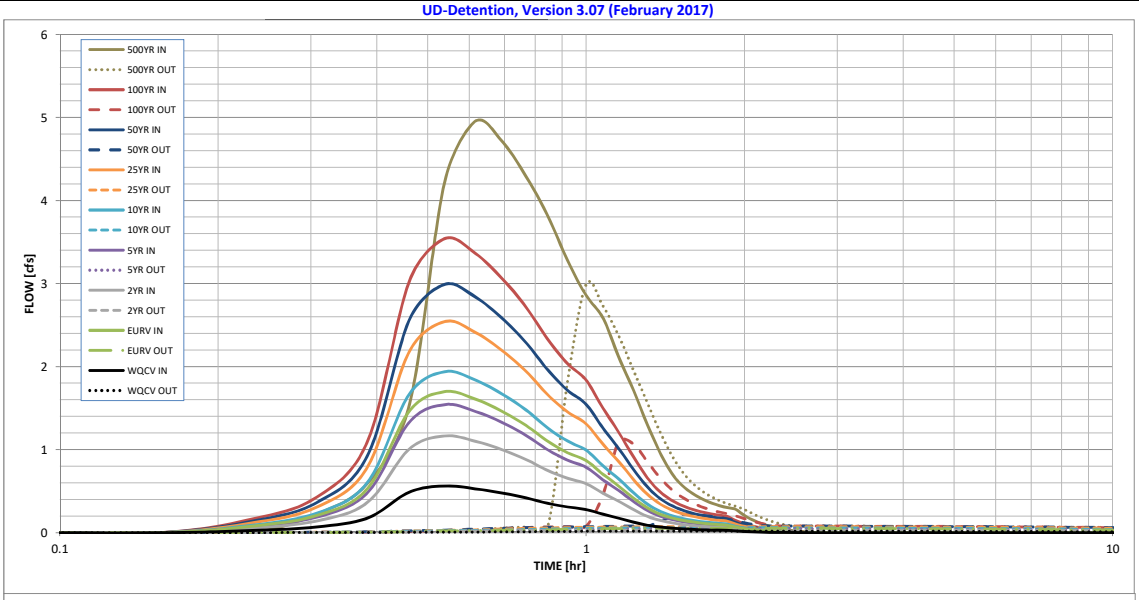
Routed Hydrograph Results

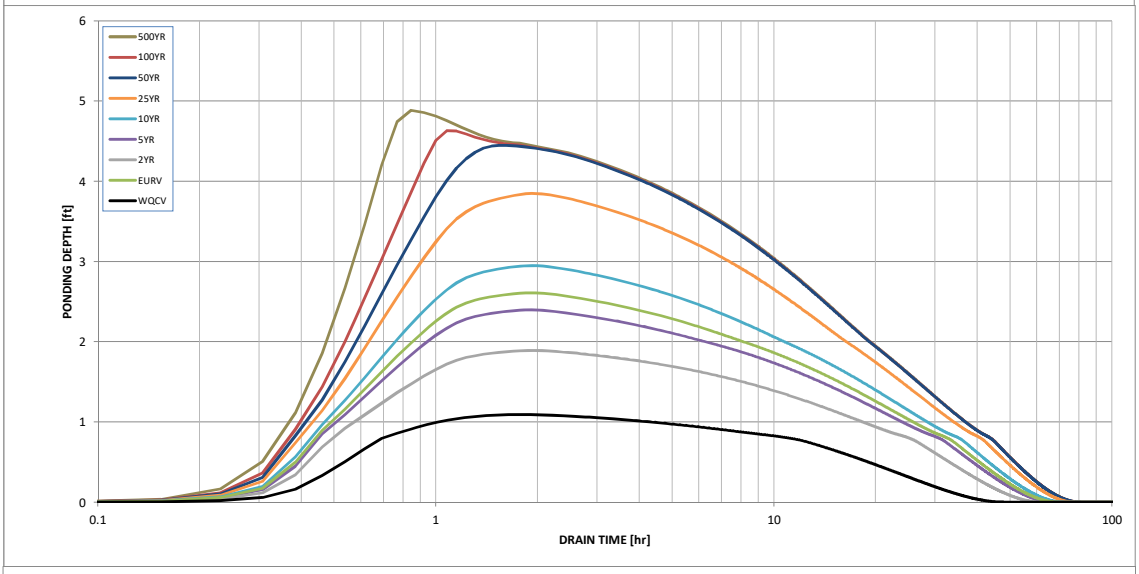
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.95	1.22	1.48	1.88	2.21	2.57	3.52
Calculated Runoff Volume (acre-ft) =	0.031	0.092	0.063	0.084	0.106	0.139	0.163	0.194	0.272
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.030	0.092	0.063	0.083	0.105	0.138	0.163	0.194	0.272
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.19	0.69	0.99	1.38	2.24
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.2	0.6	0.9	1.3	2.1
Peak Inflow Q (cfs) =	0.6	1.7	1.2	1.5	1.9	2.5	3.0	3.5	5.0
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.0	0.1	0.1	0.2	1.1	3.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.9	0.3	0.1	0.2	0.9	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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) =	39	54	49	53	56	59	60	58	54
Time to Drain 99% of Inflow Volume (hours) =	**43**	61	55	59	63	67	69	68	65
Maximum Ponding Depth (ft) =	1.09	2.61	1.89	2.40	2.95	3.85	4.45	4.63	4.89
Area at Maximum Ponding Depth (acres) =	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Maximum Volume Stored (acre-ft) =	0.027	0.085	0.058	0.077	0.098	0.129	0.148	0.154	0.161

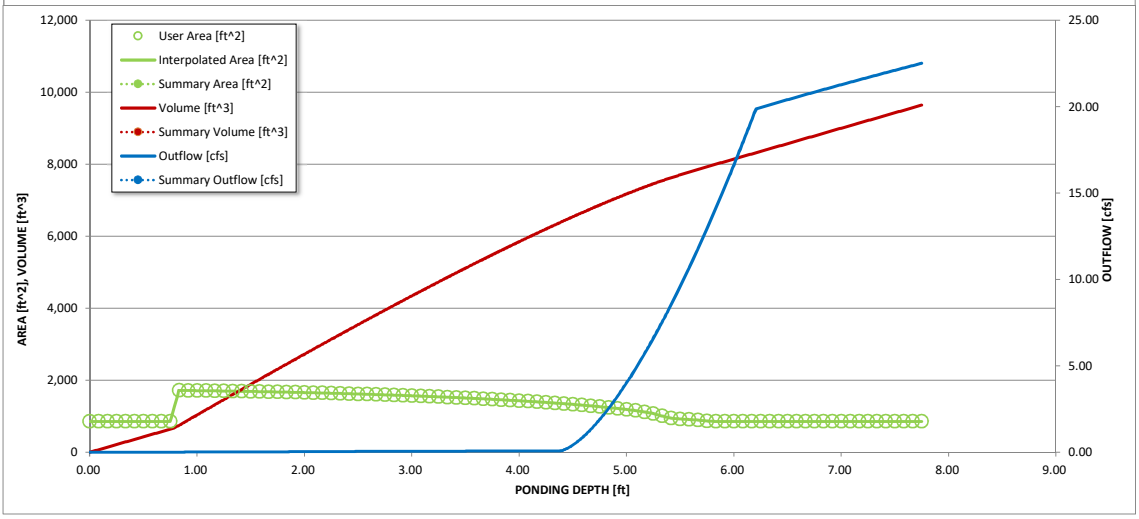
NOTE: 100 -year Peak Outflow meets the MDDP requirement for allowable release rate. See release rate section in report.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	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]
4.61 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:13:50	0.03	0.08	0.05	0.07	0.09	0.12	0.14	0.16	0.22
1.084	0:18:26	0.07	0.21	0.14	0.19	0.24	0.31	0.36	0.43	0.60
	0:23:03	0.18	0.53	0.37	0.48	0.61	0.79	0.93	1.10	1.53
	0:27:40	0.49	1.46	1.01	1.33	1.67	2.18	2.56	3.03	4.22
	0:32:16	0.56	1.70	1.17	1.54	1.94	2.54	2.99	3.54	4.95
	0:36:53	0.53	1.61	1.10	1.46	1.84	2.42	2.84	3.37	4.72
	0:41:29	0.48	1.46	1.00	1.33	1.67	2.20	2.58	3.06	4.29
	0:46:06	0.42	1.29	0.88	1.17	1.48	1.94	2.29	2.72	3.81
	0:50:43	0.35	1.10	0.75	1.00	1.26	1.66	1.96	2.33	3.27
	0:55:19	0.31	0.96	0.66	0.87	1.10	1.45	1.71	2.03	2.86
	0:59:56	0.28	0.87	0.59	0.79	1.00	1.31	1.55	1.84	2.59
	1:04:32	0.22	0.70	0.48	0.64	0.81	1.07	1.26	1.50	2.12
	1:09:09	0.18	0.56	0.38	0.51	0.65	0.86	1.01	1.21	1.71
	1:13:46	0.13	0.42	0.28	0.38	0.48	0.64	0.76	0.91	1.30
	1:18:22	0.09	0.30	0.20	0.27	0.35	0.46	0.55	0.66	0.95
	1:22:59	0.07	0.22	0.15	0.20	0.26	0.34	0.41	0.49	0.70
	1:27:35	0.05	0.18	0.12	0.16	0.20	0.27	0.32	0.38	0.55
	1:32:12	0.05	0.15	0.10	0.13	0.17	0.22	0.26	0.32	0.45
	1:36:49	0.04	0.12	0.08	0.11	0.14	0.19	0.23	0.27	0.38
	1:41:25	0.03	0.11	0.07	0.10	0.13	0.17	0.20	0.24	0.34
	1:46:02	0.03	0.10	0.07	0.09	0.11	0.15	0.18	0.21	0.30
	1:50:38	0.03	0.09	0.06	0.08	0.11	0.14	0.17	0.20	0.28
	1:55:15	0.02	0.07	0.05	0.06	0.08	0.10	0.12	0.15	0.21
	1:59:52	0.02	0.05	0.03	0.05	0.06	0.08	0.09	0.11	0.15
	2:04:28	0.01	0.04	0.02	0.03	0.04	0.06	0.07	0.08	0.11
	2:09:05	0.01	0.03	0.02	0.02	0.03	0.04	0.05	0.06	0.08
	2:13:41	0.01	0.02	0.01	0.02	0.02	0.03	0.03	0.04	0.06
	2:18:18	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
	2:22:55	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	2:27:31	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	2:32:08	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	2:36:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:41:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:59:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:04:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:09:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:13:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:18:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:22:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:27:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:36:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:41:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:59:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:04:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:13:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:18:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:31:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:36:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:41:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:22:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:31:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	EPM NAME EPM NUMBER EPM EMAIL
ADS SALES REP	SALES NAME SALES NUMBER SALES EMAIL
PROJECT NO.	

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST™ by StormTech

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CORDERA SHOPPES AT OLD RANCH STATION - LOT 1

COLORADO SPRINGS, CO

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm).
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

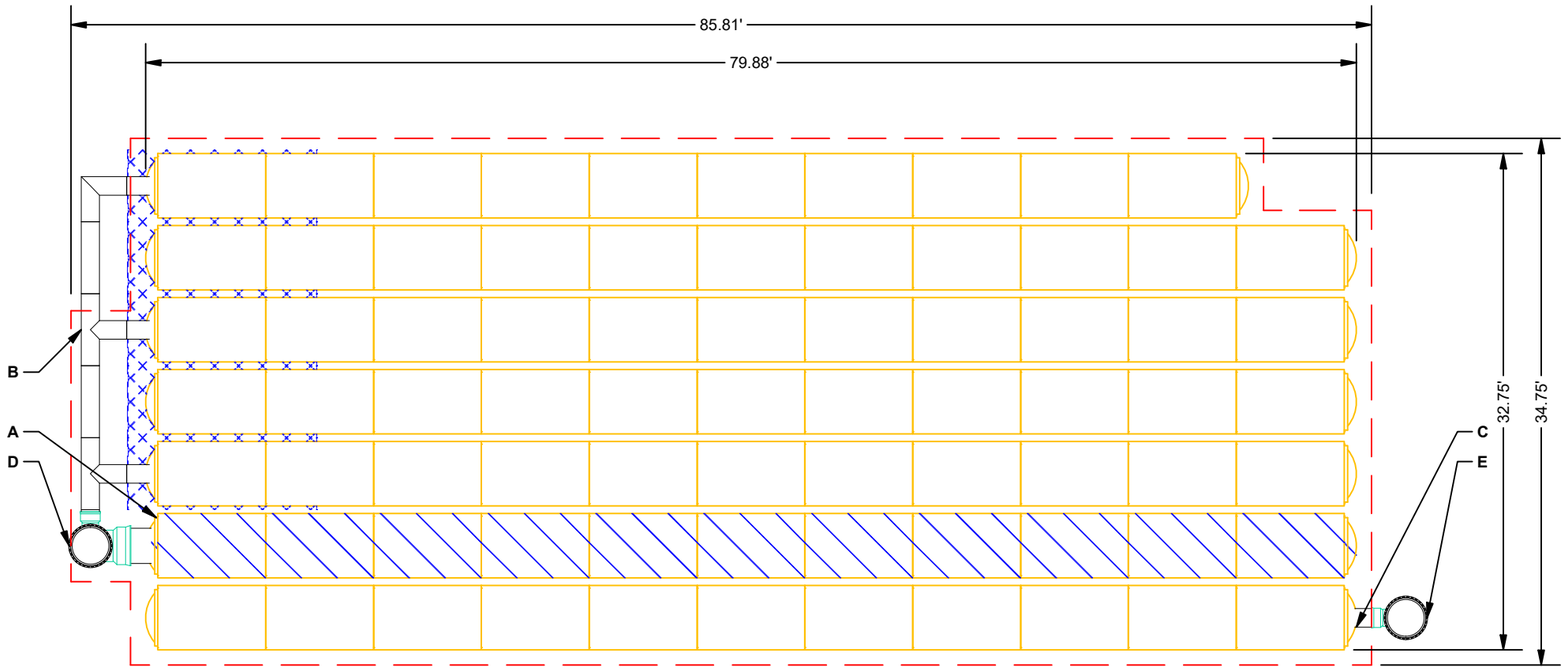
76	STORMTECH SC-740 CHAMBERS
14	STORMTECH SC-740 END CAPS
6	STONE ABOVE (in)
6	STONE BELOW (in)
40	% STONE VOID
6128	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
2882	SYSTEM AREA (SF)
241.13	SYSTEM PERIMETER (ft)

PROPOSED ELEVATIONS

MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	6972.13
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6966.13
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6965.63
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6965.63
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6965.63
TOP OF STONE:	6964.63
TOP OF SC-740 CHAMBER:	6964.13
12" x 12" TOP MANIFOLD INVERT:	6962.67
12" BOTTOM CONNECTION INVERT:	6961.73
24" ISOLATOR ROW INVERT:	6961.64
BOTTOM OF SC-740 CHAMBER:	6961.63
BOTTOM OF STONE:	6961.13

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PREFABRICATED END CAP/TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR ROWS	0.10"	
MANIFOLD	B	12" X 12" TOP, ADS N-12	12.50"	
PIPE CONNECTION	C	12" BOTTOM CONNECTION	1.20"	
NYLOPLAST (INLET W/ ISO ROW)	D	30" DIAMETER (24" SUMP MIN)		5.7 CFS IN
NYLOPLAST (OUTLET)	E	30" DIAMETER (DESIGN BY ENGINEER)		2.0 CFS OUT



ISOLATOR ROW
(SEE DETAIL)

PLACE MINIMUM 12.50' OF ADS GEOSYNTHETICS 315WTK WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

DRAWN: EF
CHECKED: N/A
DATE:
PROJECT #:

REV	DRW	CHK	DESCRIPTION

StormTech®
Detention - Retention - Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

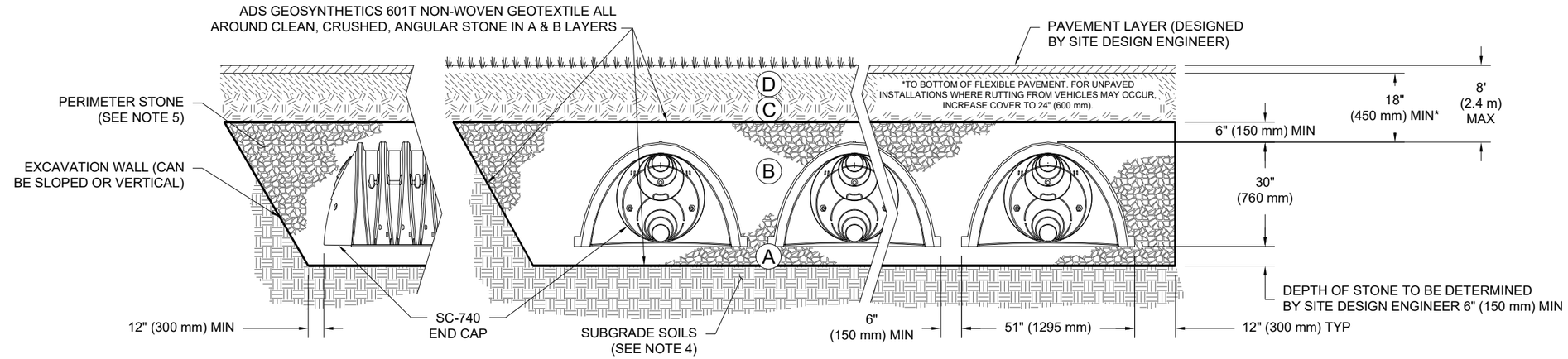
ADS®
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

0 10' 20'

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

DRAWN: EF
CHECKED: N/A
DATE:
PROJECT #:

REV	DRW	CHK	DESCRIPTION

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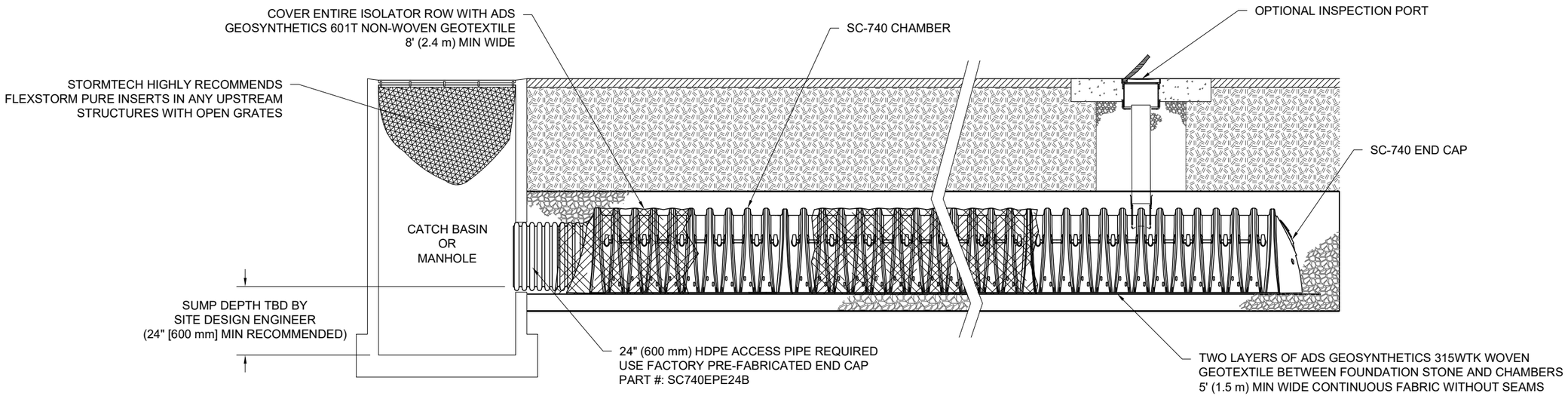

SC-740 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

DATE:
DRAWN: EF
PROJECT #:
CHECKED: N/A

REV	DRW	CHK	DESCRIPTION

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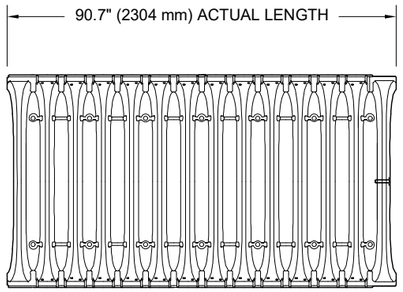
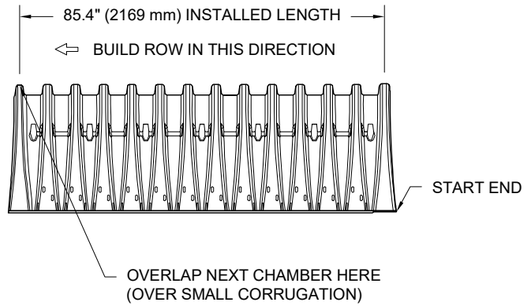
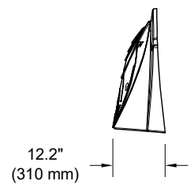
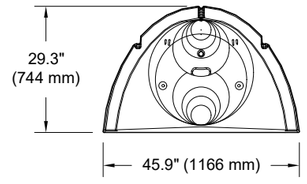
SC-740 TECHNICAL SPECIFICATION

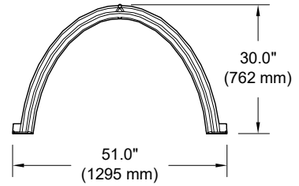
NTS







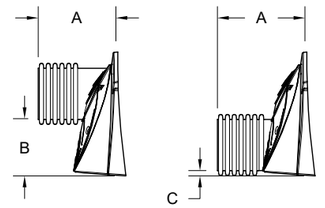




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

CORDERA SHOPPES AT OLD RANCH STATION - L
COLORADO SPRINGS, CO

DATE:
DRAWN: EF
PROJECT #:
CHECKED: N/A

REV | DRW | CHK | DESCRIPTION

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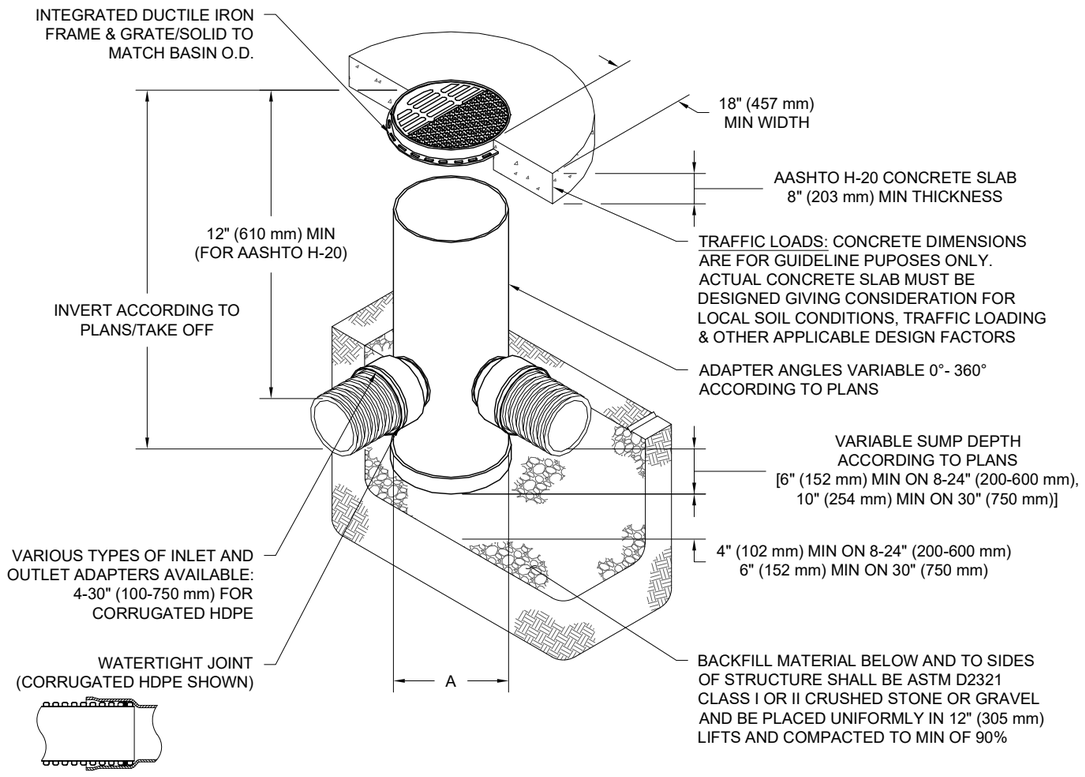
NYLOPLAST DRAIN BASIN

NTS



NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

DESCRIPTION | REV | DRW | CHK

DATE:
PROJECT #:
DRAWN: EF
CHECKED: N/A

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BUFORD, GA 30518
PHN (770) 932-2443
FAX (770) 932-2490
www.nyloplast-us.com

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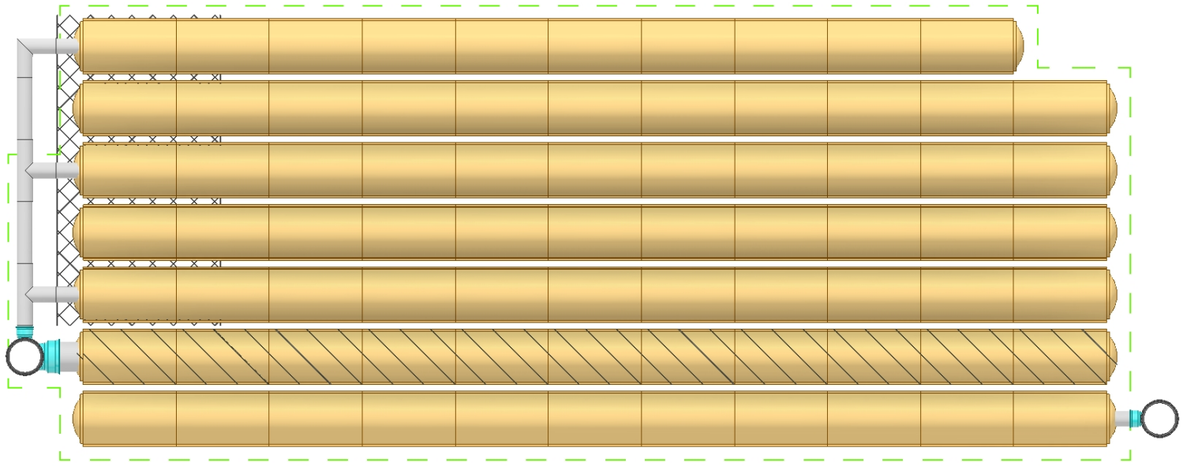
Z
X

Project:

Chamber Model -	SC-740	
Units -	Imperial	Click Here for Metric
Number of chambers -	76	
Voids in the stone (porosity) -	40	%
Base of STONE Elevation -	6961.13	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
Area of system -	2882	sf Min. Area - 2569 sf min. area

☑ Include Perimeter Stone in Calculations

WQCV = 0.031 AC-FT

ERRV = 0.0922 AC-FT (4007.52 FT³)

100-YR = 0.140 AC-FT (6098.40 FT³)

StormTech SC-740 Cumulative Storage Volumes

Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Total Chamber (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch & St (cubic feet)	Cumulative Chamber (cubic feet)	Elevation (feet)
42	0.00	0.00	96.07	96.07	6130.16	6964.63
41	0.00	0.00	96.07	96.07	6034.09	6964.55
40	0.00	0.00	96.07	96.07	5938.03	6964.46
39	0.00	0.00	96.07	96.07	5841.96	6964.38
38	0.00	0.00	96.07	96.07	5745.89	6964.30
37	0.00	0.00	96.07	96.07	5649.83	6964.21
36	0.05	4.18	94.39	98.57	5553.76	6964.13
35	0.16	12.38	91.11	103.50	5455.18	6964.05
34	0.28	21.43	87.50	108.92	5351.69	6963.96
33	0.60	45.90	77.71	123.61	5242.76	6963.88
32	0.80	60.93	71.69	132.62	5119.16	6963.80
31	0.95	72.25	67.17	139.42	4986.53	6963.71
30	1.07	81.66	63.40	145.06	4847.12	6963.63
29	1.18	89.72	60.18	149.90	4702.05	6963.55
28	1.27	96.19	57.59	153.78	4552.15	6963.46
27	1.36	102.98	54.87	157.86	4398.37	6963.38
26	1.45	110.51	51.86	162.37	4240.52	6963.30
25	1.52	115.88	49.71	165.59	4078.14	6963.21
24	1.58	120.26	47.96	168.22	3912.55	6963.13
23	1.64	124.81	46.14	170.95	3744.33	6963.05
22	1.70	129.16	44.40	173.56	3573.37	6962.96
21	1.75	133.22	42.78	176.00	3399.81	6962.88
20	1.80	137.01	41.26	178.27	3223.81	6962.80
19	1.85	140.98	39.67	180.65	3045.54	6962.71
18	1.89	143.87	38.52	182.39	2864.88	6962.63
17	1.93	146.98	37.27	184.26	2682.49	6962.55
16	1.97	150.10	36.03	186.13	2498.23	6962.46
15	2.01	152.75	34.97	187.72	2312.11	6962.38
14	2.04	155.42	33.90	189.32	2124.39	6962.30
13	2.07	157.70	32.99	190.68	1935.07	6962.21
12	2.10	159.97	32.08	192.05	1744.38	6962.13
11	2.13	162.02	31.26	193.28	1552.33	6962.05
10	2.15	163.69	30.59	194.28	1359.06	6961.96
9	2.18	165.46	29.88	195.34	1164.77	6961.88
8	2.20	167.08	29.24	196.31	969.43	6961.80
7	2.21	167.76	28.96	196.72	773.12	6961.71
6	0.00	0.00	96.07	96.07	576.40	6961.63
5	0.00	0.00	96.07	96.07	480.33	6961.55
4	0.00	0.00	96.07	96.07	384.27	6961.46
3	0.00	0.00	96.07	96.07	288.20	6961.38
2	0.00	0.00	96.07	96.07	192.13	6961.30
1	0.00	0.00	96.07	96.07	96.07	6961.21

100 YR = 6964.663

ERRV = 6963.176

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	EPM NAME EPM NUMBER EPM EMAIL
ADS SALES REP	SALES NAME SALES NUMBER SALES EMAIL
PROJECT NO.	

ADVANCED DRAINAGE SYSTEMS, INC.

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CORDERA SHOPPES AT OLD RANCH STATION - LOT 2

COLORADO SPRINGS, CO

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm).
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

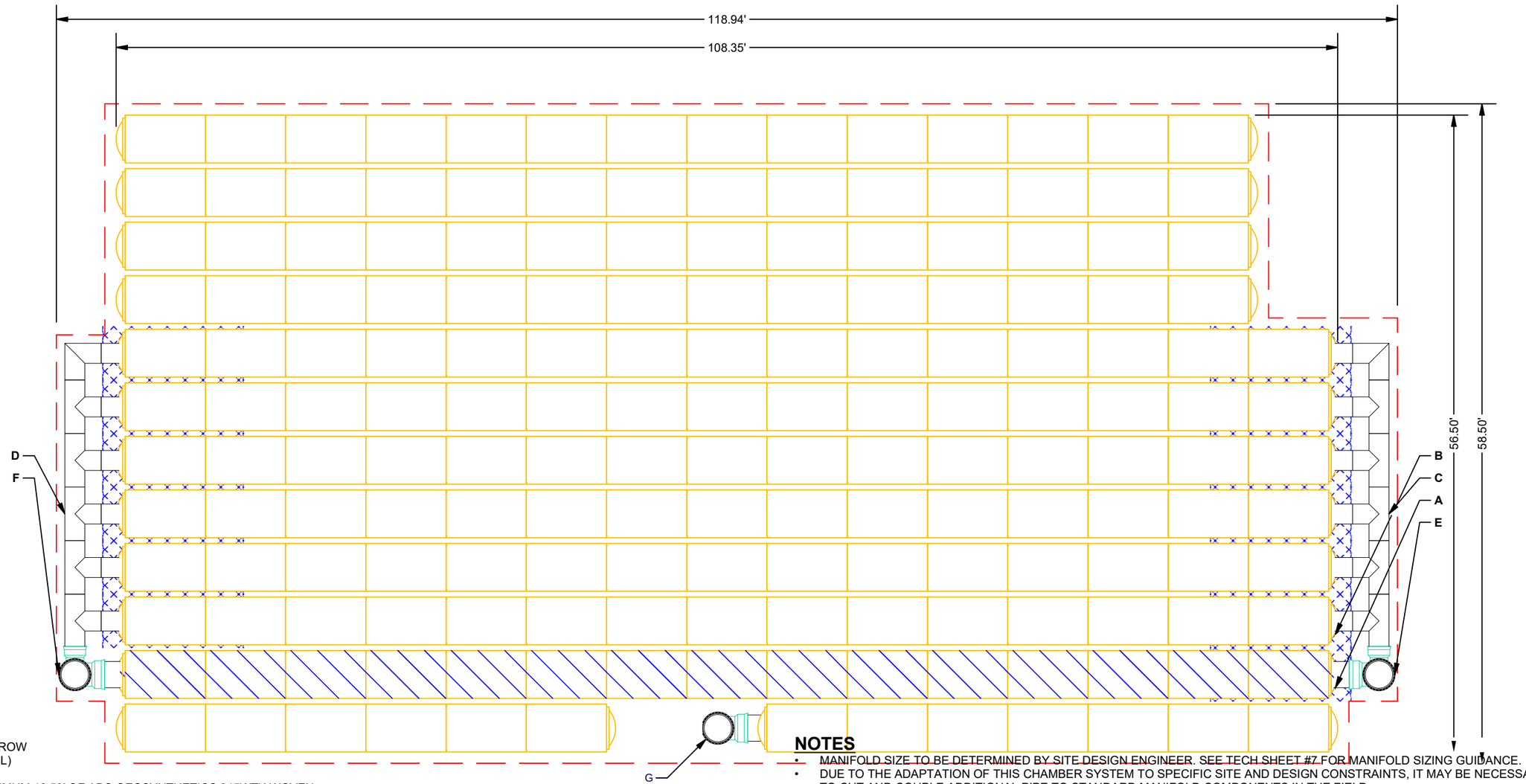
174	STORMTECH SC-740 CHAMBERS
26	STORMTECH SC-740 END CAPS
6	STONE ABOVE (in)
6	STONE BELOW (in)
40	% STONE VOID
14040	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
6606	SYSTEM AREA (SF)
354.88	SYSTEM PERIMETER (ft)

PROPOSED ELEVATIONS

MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	6976.09
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6970.09
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6969.59
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6969.59
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6969.59
TOP OF STONE:	6968.59
TOP OF SC-740 CHAMBER:	6968.09
18" x 18" TOP MANIFOLD INVERT:	6966.01
18" x 18" TOP MANIFOLD INVERT:	6966.01
24" ISOLATOR ROW INVERT:	6965.60
24" ISOLATOR ROW INVERT:	6965.60
BOTTOM OF SC-740 CHAMBER:	6965.59
BOTTOM OF STONE:	6965.09

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PREFABRICATED END CAP/TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR ROWS	0.10"	
PREFABRICATED END CAP	B	18" TOP PREFABRICATED END CAP/TYP OF ALL 18" TOP CONNECTIONS	5.00"	
MANIFOLD	C	18" X 18" TOP, ADS N-12	5.00"	
MANIFOLD	D	18" X 18" TOP, ADS N-12	5.00"	
NYLOPLAST (INLET W/ ISO ROW)	E	30" DIAMETER (24" SUMP MIN)		14.4 CFS IN
NYLOPLAST (INLET W/ ISO ROW)	F	30" DIAMETER (24" SUMP MIN)		14.4 CFS IN
NYLOPLAST (OUTLET)	G	30" DIAMETER (DESIGN BY ENGINEER)		2.0 CFS OUT



ISOLATOR ROW
(SEE DETAIL)

PLACE MINIMUM 12.50' OF ADS GEOSYNTHETICS 315WTK WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.

CORDERA SHOPPES AT OLD RANCH STATION - L
COLORADO SPRINGS, CO

DRAWN: EF
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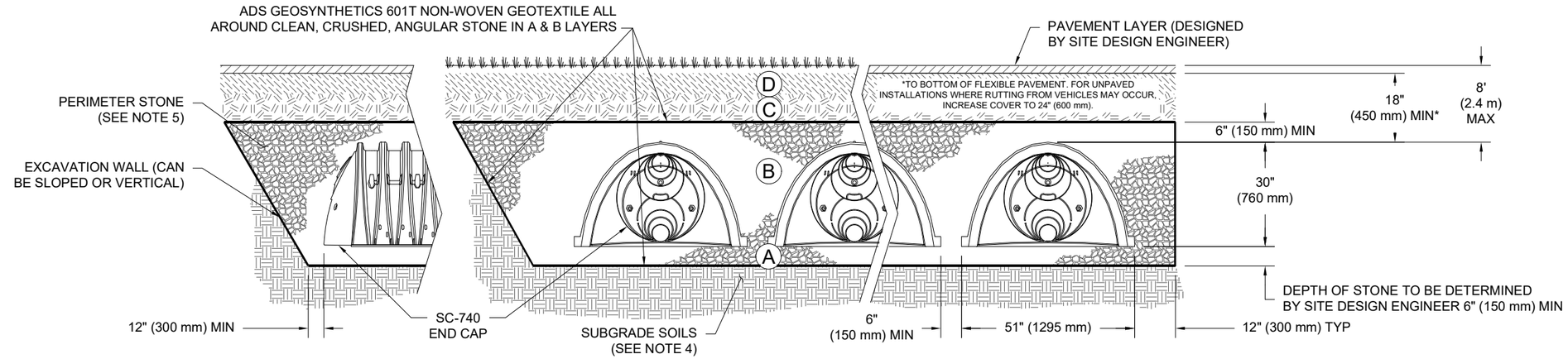
20'
10'
0

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

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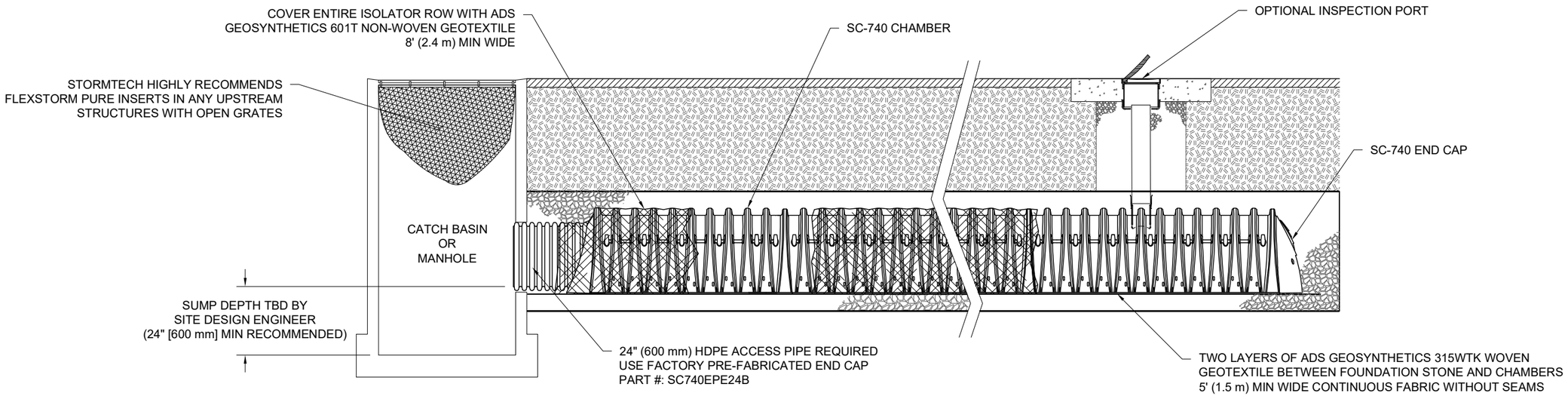

SC-740 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

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SC-740 TECHNICAL SPECIFICATION

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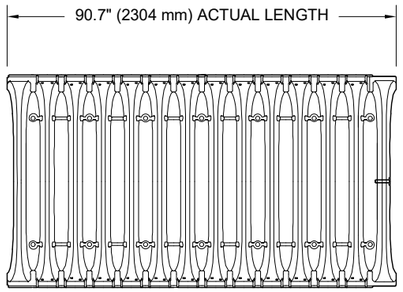
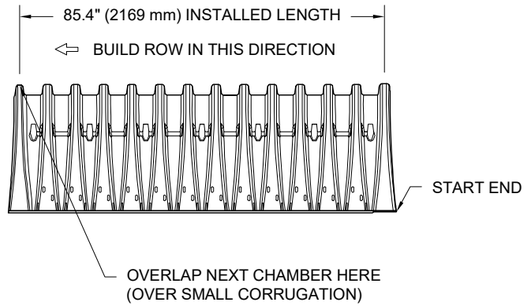
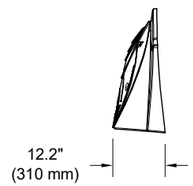
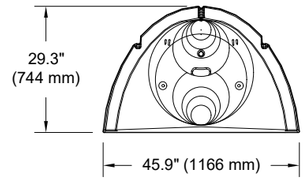
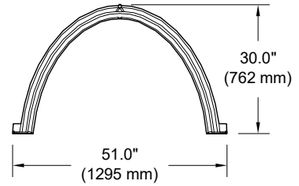






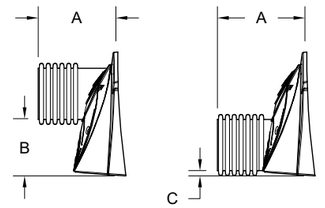




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

CORDERA SHOPPES AT OLD RANCH STATION - L
COLORADO SPRINGS, CO

DATE:
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NYLOPLAST DRAIN BASIN

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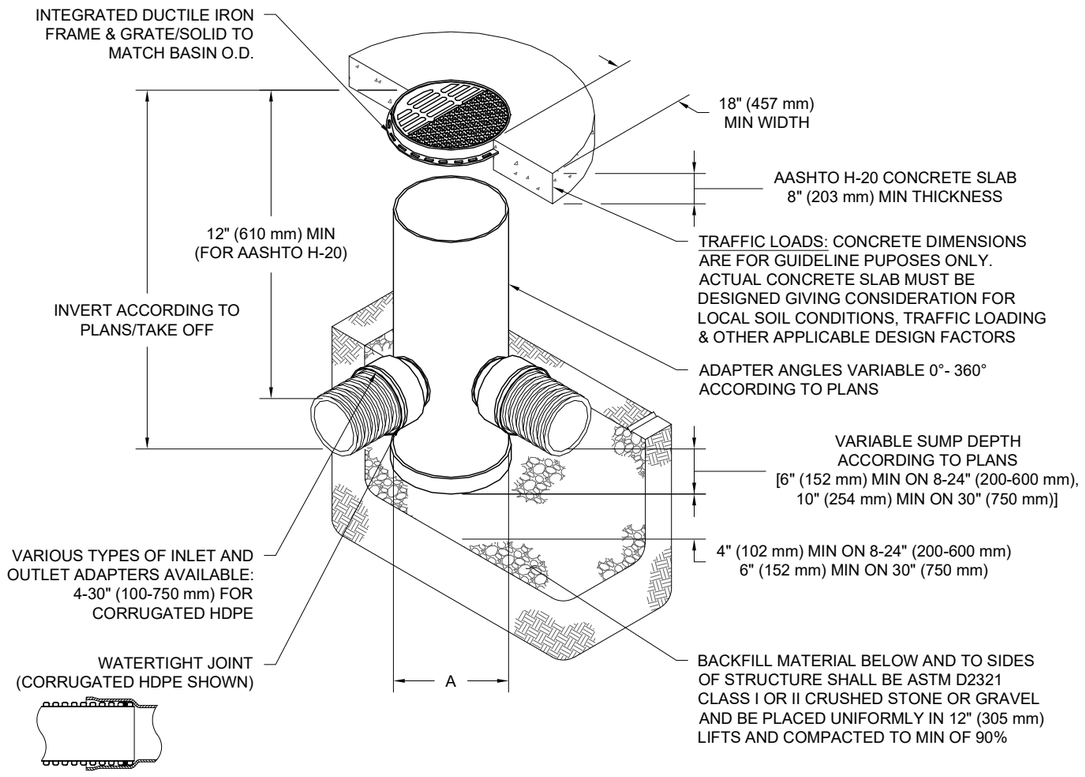

NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

CORDERA SHOPPES AT OLD RANCH STATION - LOT 1
COLORADO SPRINGS, CO

DESCRIPTION | REV | DRW | CHK

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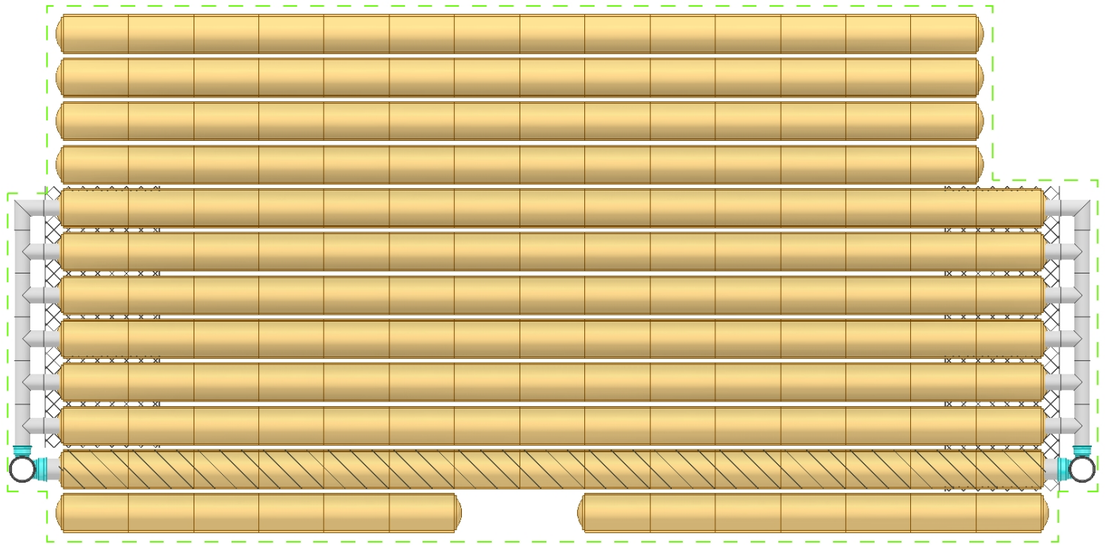


Project:

Chamber Model -	SC-740	
Units -	Imperial	Click Here for Metric
Number of chambers -	174	
Voids in the stone (porosity) -	40	%
Base of STONE Elevation -	6965.09	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
Area of system -	6606	sf Min. Area - 5882 sf min. area

☑ Include Perimeter Stone in Calculations

WQCV = 0.069 Ac-Ft

EURV = 0.208 Ac-Ft (9060.48 Ft³)

100-YR = 0.314 Ac-Ft (13,677.84 Ft³)

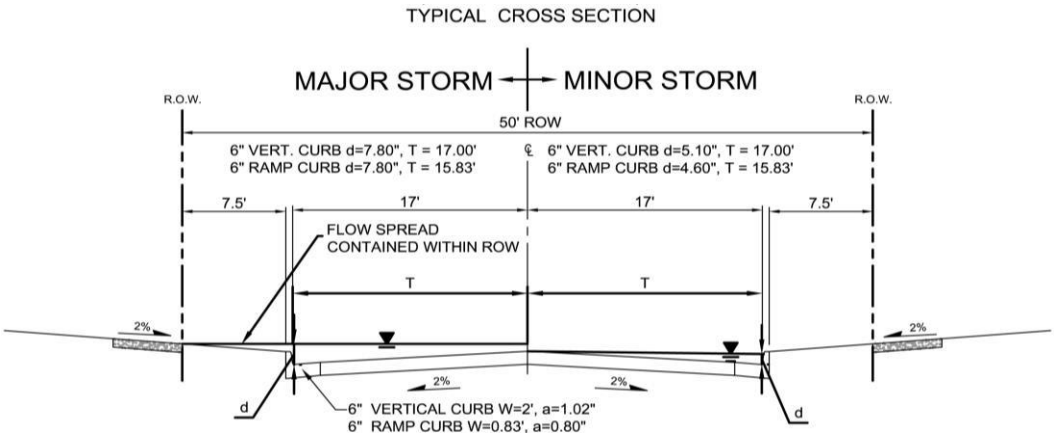
StormTech SC-740 Cumulative Storage Volumes

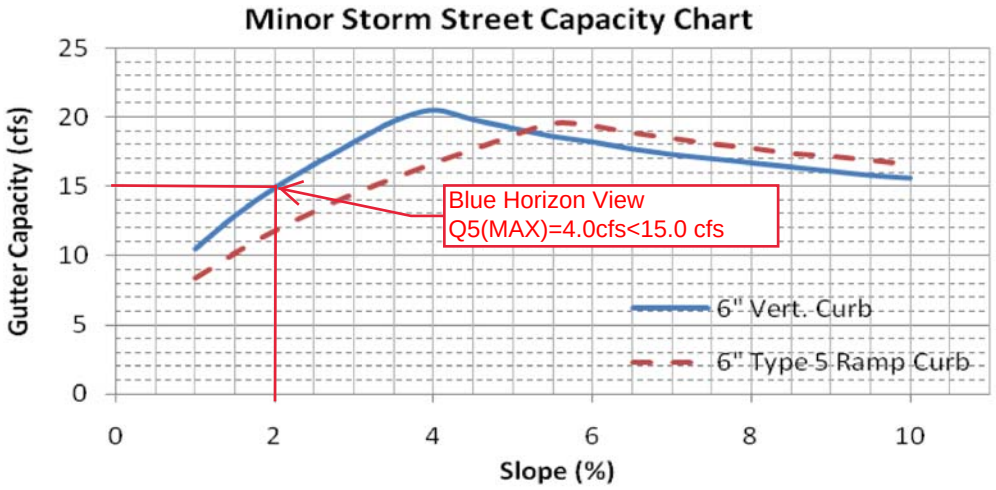
Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Total Chamber (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch & St (cubic feet)	Cumulative Chamber (cubic feet)	Elevation (feet)
42	0.00	0.00	220.20	220.20	14045.67	6968.59
41	0.00	0.00	220.20	220.20	13825.47	6968.51
40	0.00	0.00	220.20	220.20	13605.27	6968.42
39	0.00	0.00	220.20	220.20	13385.07	6968.34
38	0.00	0.00	220.20	220.20	13164.87	6968.26
37	0.00	0.00	220.20	220.20	12944.67	6968.17
36	0.05	9.57	216.37	225.94	12724.47	6968.09
35	0.16	28.35	208.86	237.21	12498.53	6968.01
34	0.28	49.06	200.58	249.63	12261.32	6967.92
33	0.60	105.09	178.16	283.25	12011.68	6967.84
32	0.80	139.50	164.40	303.90	11728.43	6967.76
31	0.95	165.42	154.03	319.45	11424.53	6967.67
30	1.07	186.97	145.41	332.38	11105.08	6967.59
29	1.18	205.41	138.04	343.44	10772.70	6967.51
28	1.27	220.22	132.11	352.33	10429.26	6967.42
27	1.36	235.77	125.89	361.66	10076.92	6967.34
26	1.45	253.01	118.99	372.01	9715.26	6967.26
25	1.52	265.30	114.08	379.38	9343.25	6967.17
24	1.58	275.32	110.07	385.39	8963.87	6967.09
23	1.64	285.76	105.90	391.65	8578.48	6967.01
22	1.70	295.72	101.91	397.63	8186.82	6966.92
21	1.75	305.01	98.20	403.21	7789.19	6966.84
20	1.80	313.69	94.72	408.41	7385.99	6966.76
19	1.85	322.77	91.09	413.86	6977.57	6966.67
18	1.89	329.40	88.44	417.84	6563.71	6966.59
17	1.93	336.52	85.59	422.11	6145.87	6966.51
16	1.97	343.65	82.74	426.39	5723.76	6966.42
15	2.01	349.73	80.31	430.04	5297.37	6966.34
14	2.04	355.83	77.87	433.70	4867.34	6966.26
13	2.07	361.04	75.78	436.83	4433.64	6966.17
12	2.10	366.25	73.70	439.95	3996.81	6966.09
11	2.13	370.93	71.83	442.76	3556.86	6966.01
10	2.15	374.77	70.29	445.06	3114.10	6965.92
9	2.18	378.81	68.68	447.49	2669.04	6965.84
8	2.20	382.51	67.19	449.71	2221.55	6965.76
7	2.21	384.07	66.57	450.64	1771.84	6965.67
6	0.00	0.00	220.20	220.20	1321.20	6965.59
5	0.00	0.00	220.20	220.20	1101.00	6965.51
4	0.00	0.00	220.20	220.20	880.80	6965.42
3	0.00	0.00	220.20	220.20	660.60	6965.34
2	0.00	0.00	220.20	220.20	440.40	6965.26
1	0.00	0.00	220.20	220.20	220.20	6965.17

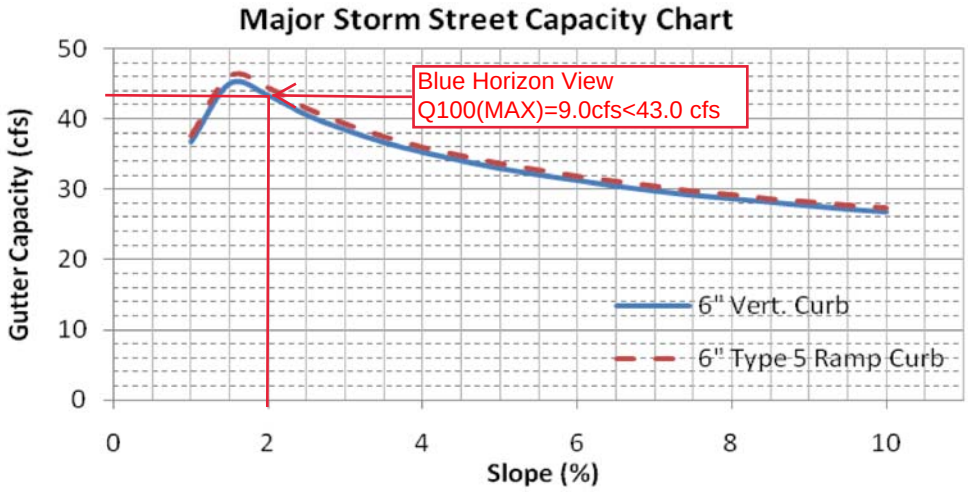
100-YR = 6968.450

EURV = 6967.110

Figure 7-7. Street Capacity Charts Residential (Detached Sidewalk)

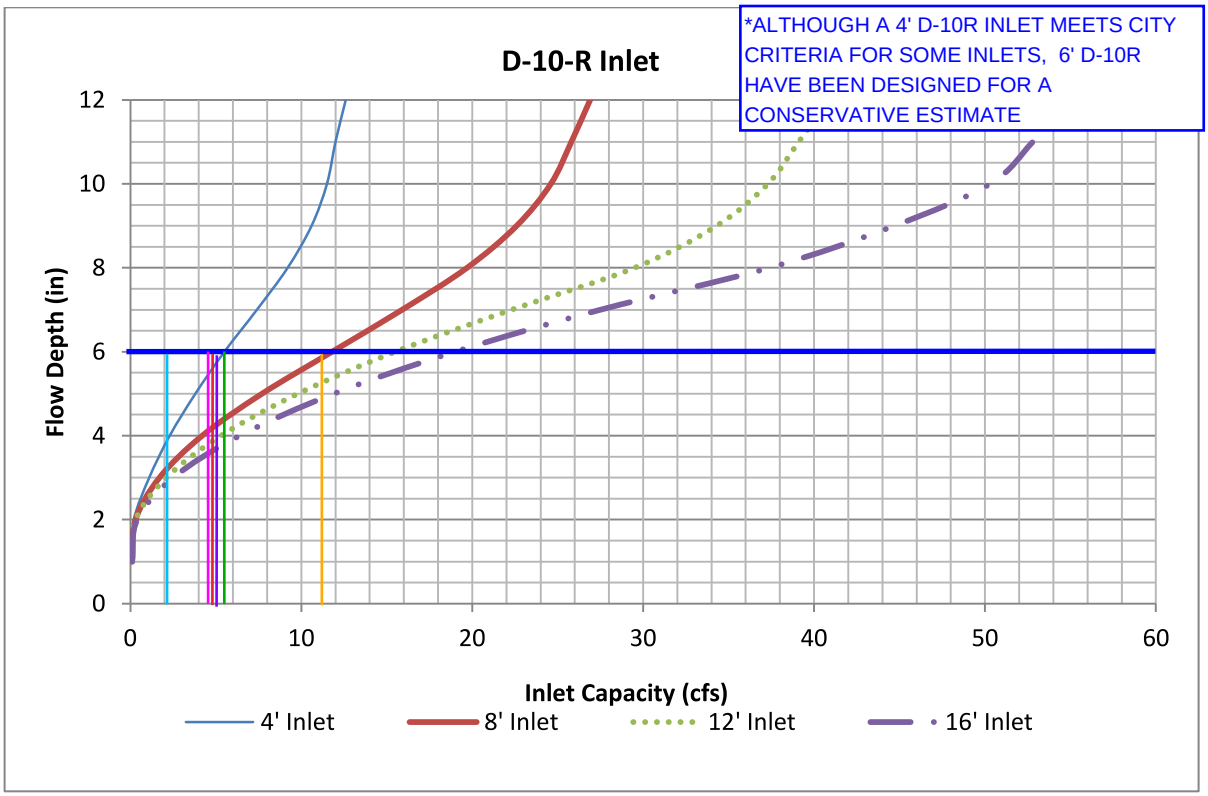






These charts shall only be used for the standard street sections as shown. The capacity shown is based on ½ the street section as calculated by the UD-Inlet spreadsheets. Minor storm capacities are based on no crown overtopping, curb height or maximum allowable spread widths. Major storm capacities are based on flow being containing within the public right-of-way, including conveyance capacity behind the curb. The UDFCD Safety Reduction Factor was applied. An 'n_{STREET}' of 0.016 and 'n_{BACK}' of 0.020 was used. Calculations were done using UD-Inlet 3.00.xls, March, 2011.

Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet



INLET 1: Q(5) = 1.9 cfs; Q(100) = 4.3 cfs>> **6' D-10R1**
INLET 2: Q(5) = 5.0 cfs; Q(100) = 11.5 cfs>> **8' D-10R**
INLET 3: Q(5) = 1.0 cfs; Q(100) = 2.2 cfs>> **6' D-10R**
INLET 4: Q(5) = 2.0 cfs; Q(100) = 4.5 cfs>> **6' D-10R**
INLET 5: Q(5) = 2.0 cfs; Q(100) = 4.8 cfs>> **6' D-10R**
INLET 6: Q(5) = 2.0 cfs; Q(100) = 4.4 cfs>> **6' D-10R**

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

EX-1

Circular

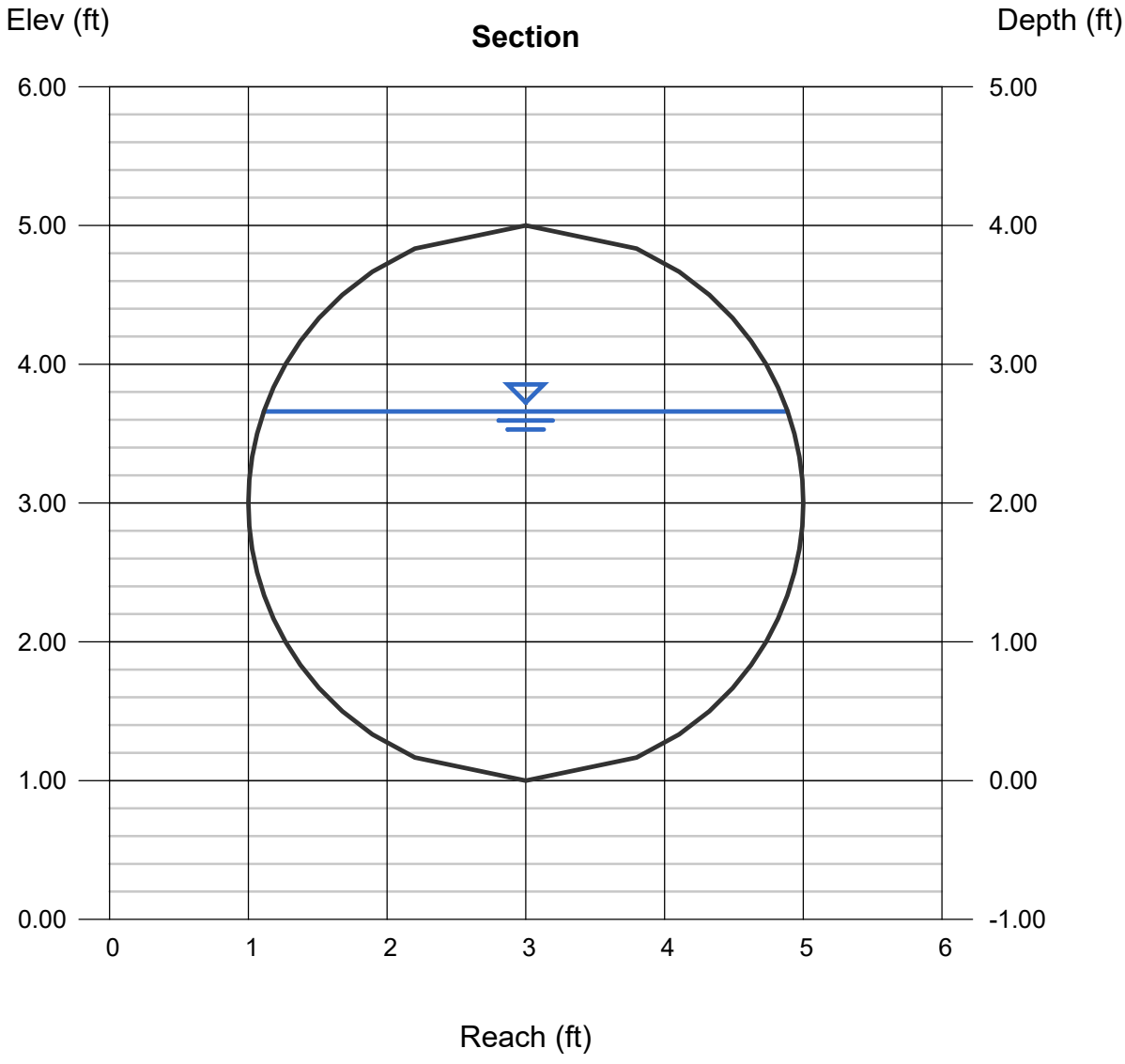
Diameter (ft)	= 4.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 112.00

Highlighted

Depth (ft)	= 2.66
Q (cfs)	= 112.00
Area (sqft)	= 8.90
Velocity (ft/s)	= 12.59
Wetted Perim (ft)	= 7.64
Crit Depth, Yc (ft)	= 3.20
Top Width (ft)	= 3.77
EGL (ft)	= 5.12



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-1

Circular

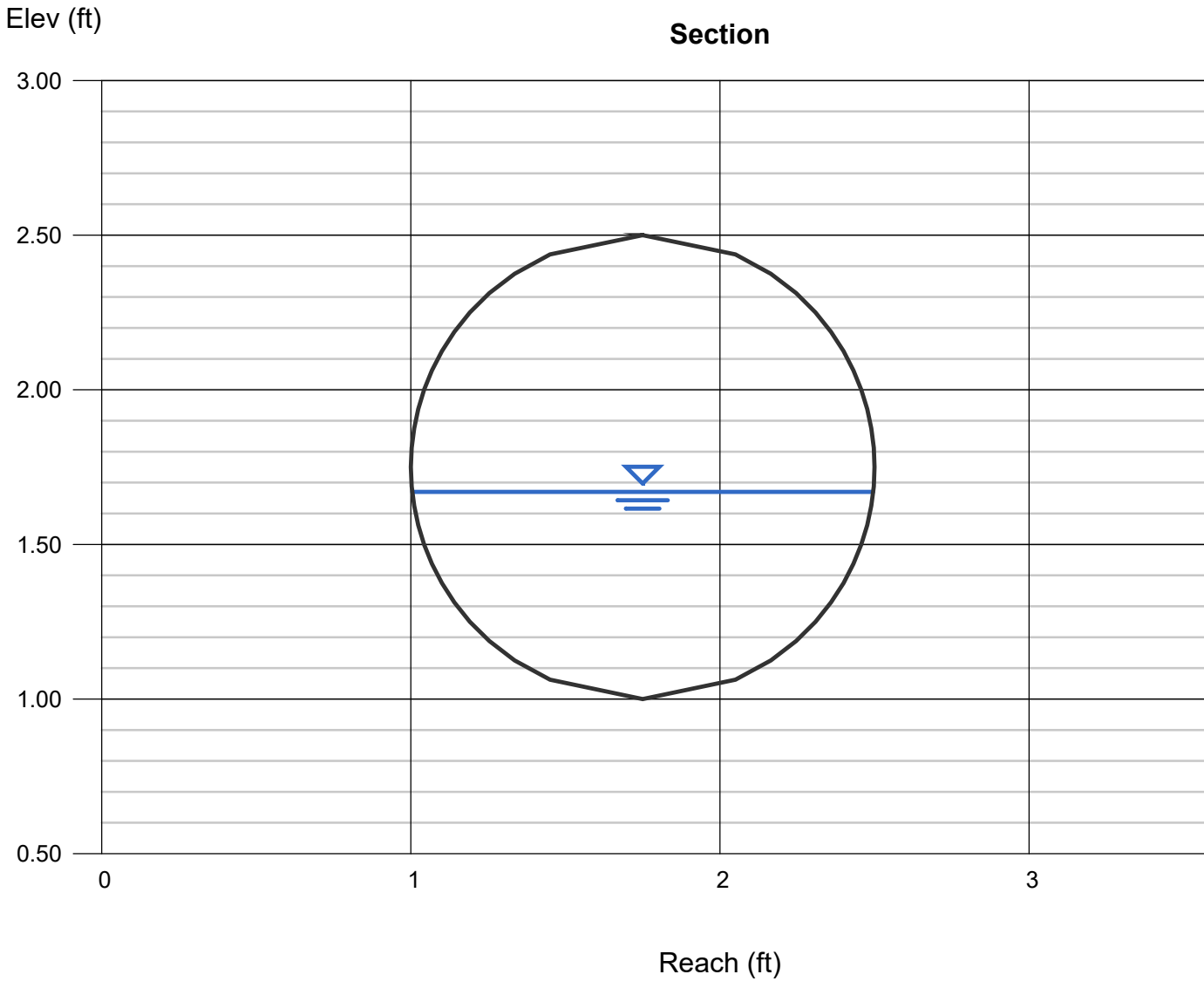
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.30

Highlighted

Depth (ft)	= 0.67
Q (cfs)	= 4.300
Area (sqft)	= 0.76
Velocity (ft/s)	= 5.62
Wetted Perim (ft)	= 2.20
Crit Depth, Yc (ft)	= 0.80
Top Width (ft)	= 1.49
EGL (ft)	= 1.16



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-2

Circular

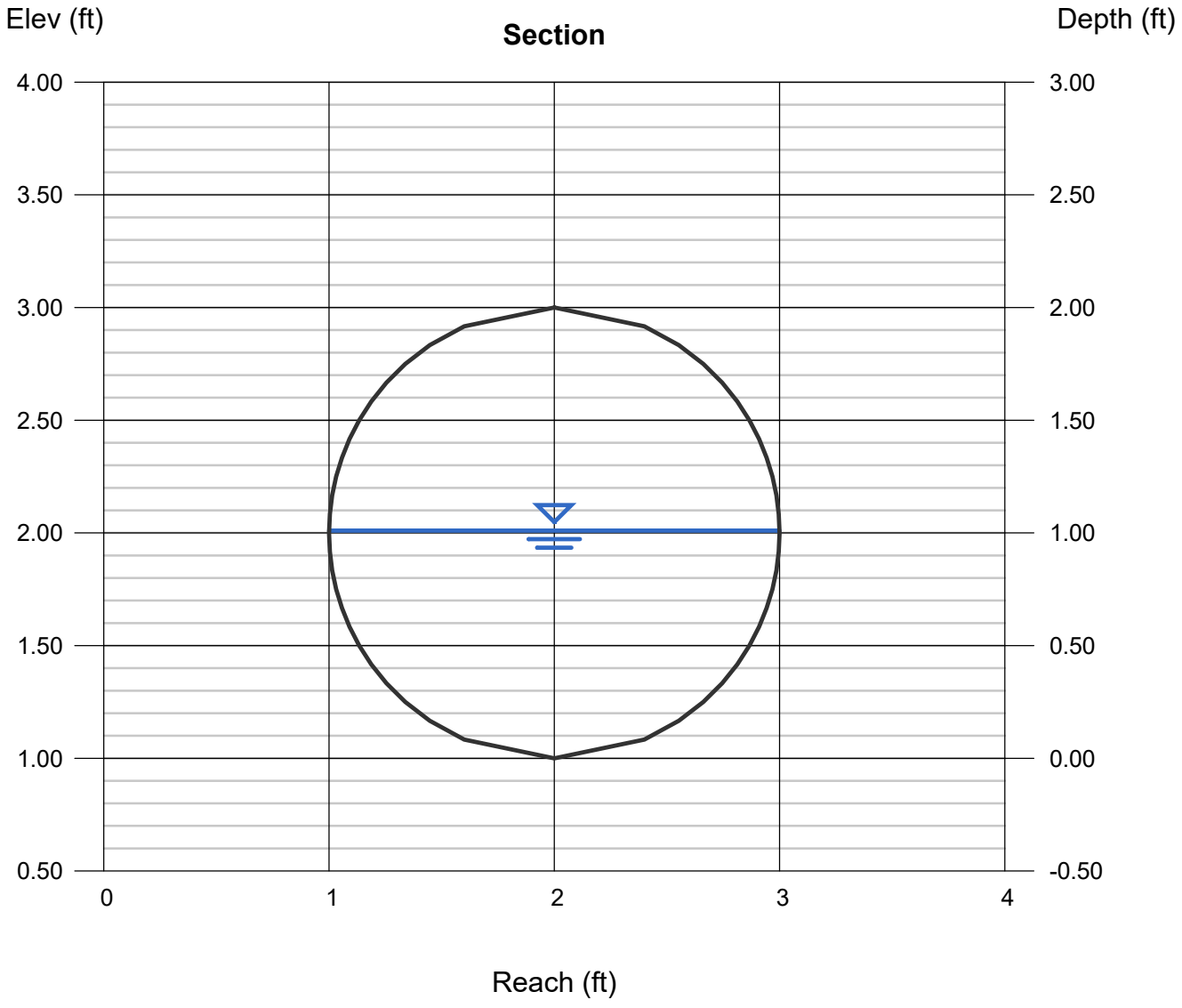
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.50

Highlighted

Depth (ft)	= 1.01
Q (cfs)	= 11.50
Area (sqft)	= 1.60
Velocity (ft/s)	= 7.19
Wetted Perim (ft)	= 3.17
Crit Depth, Yc (ft)	= 1.22
Top Width (ft)	= 2.00
EGL (ft)	= 1.81



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-3

Circular

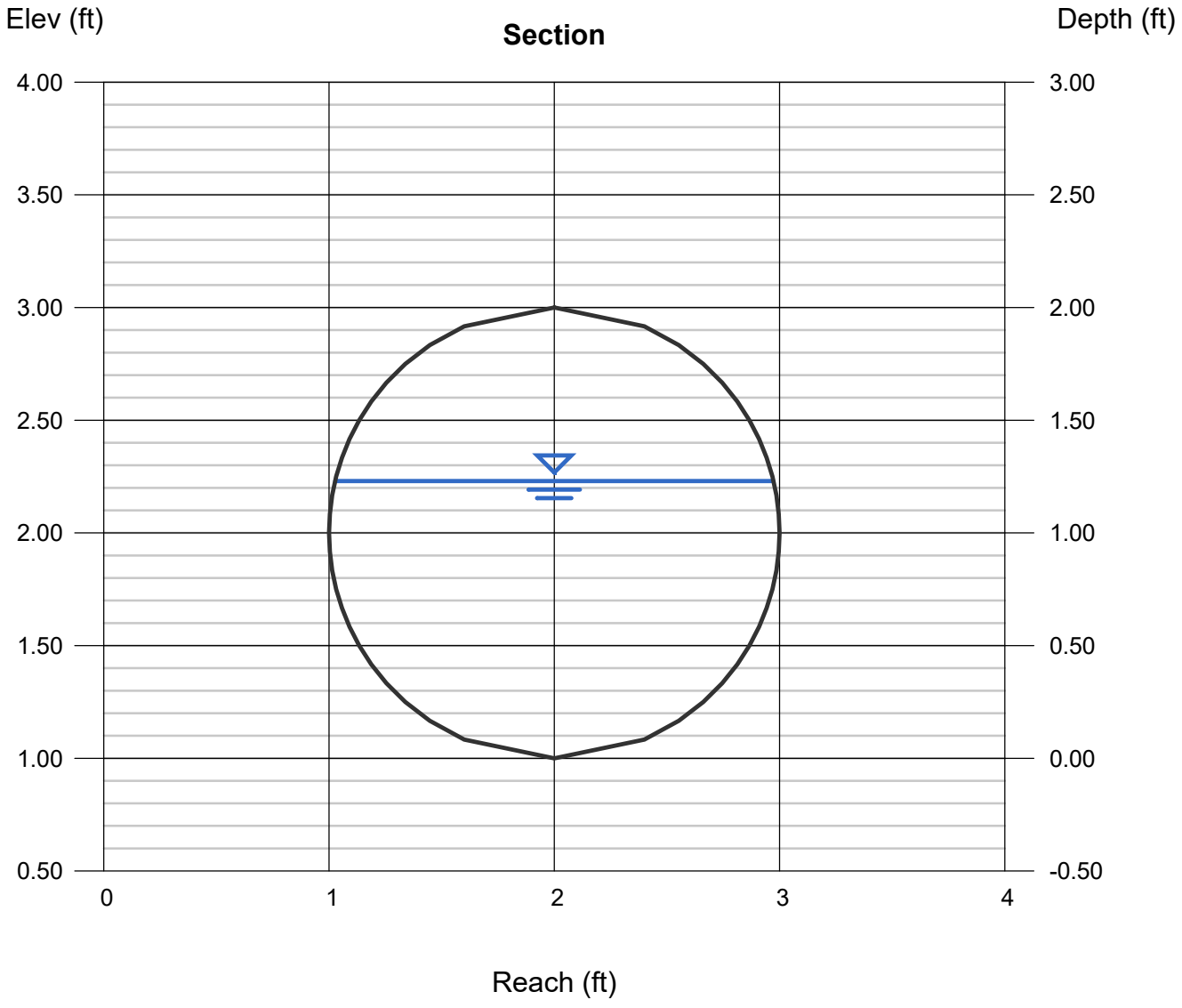
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 15.80

Highlighted

Depth (ft)	= 1.23
Q (cfs)	= 15.80
Area (sqft)	= 2.03
Velocity (ft/s)	= 7.78
Wetted Perim (ft)	= 3.61
Crit Depth, Yc (ft)	= 1.43
Top Width (ft)	= 1.95
EGL (ft)	= 2.17



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-4

Circular

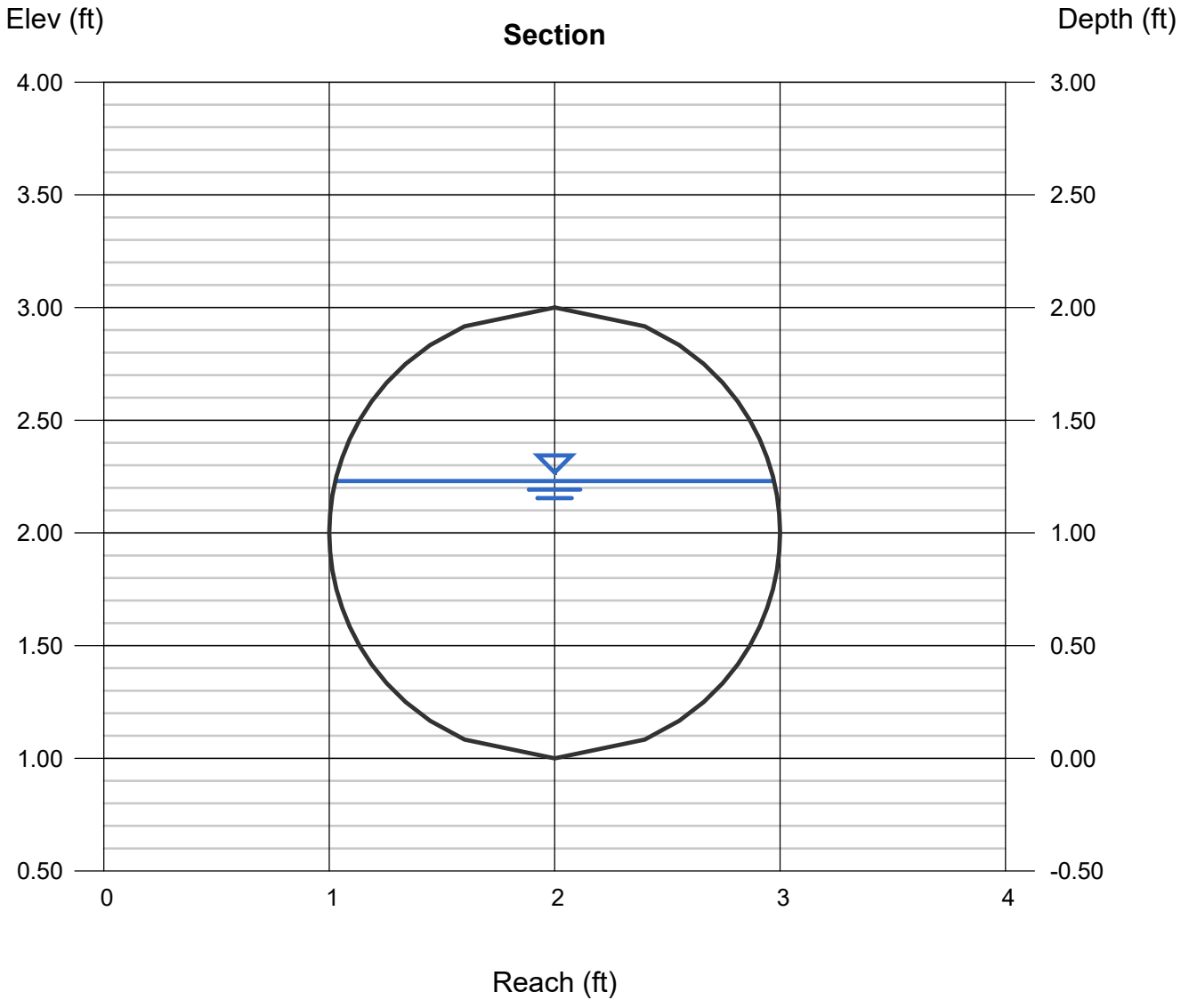
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 15.80

Highlighted

Depth (ft)	= 1.23
Q (cfs)	= 15.80
Area (sqft)	= 2.03
Velocity (ft/s)	= 7.78
Wetted Perim (ft)	= 3.61
Crit Depth, Yc (ft)	= 1.43
Top Width (ft)	= 1.95
EGL (ft)	= 2.17



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-5

Circular

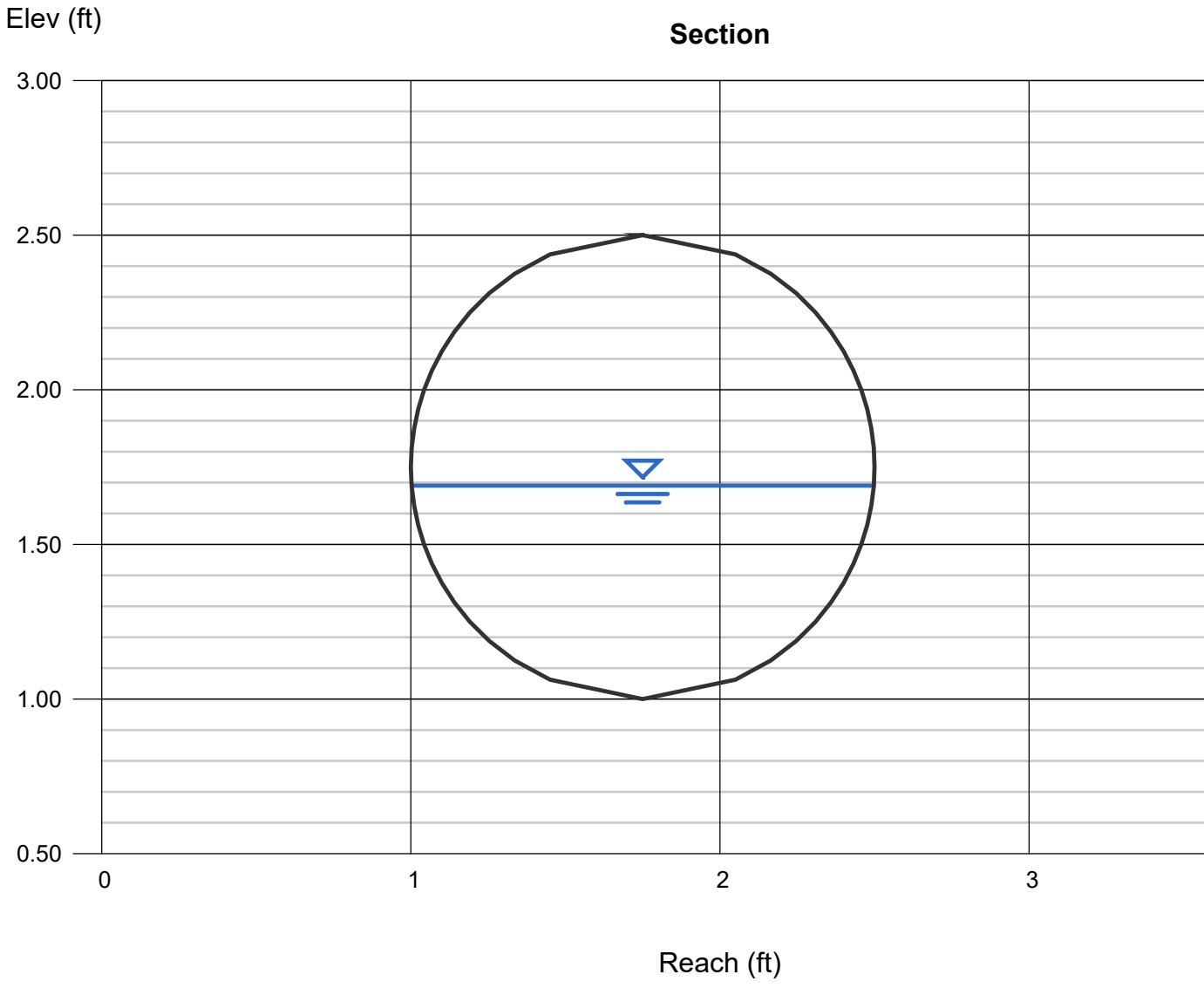
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.50

Highlighted

Depth (ft)	= 0.69
Q (cfs)	= 4.500
Area (sqft)	= 0.80
Velocity (ft/s)	= 5.64
Wetted Perim (ft)	= 2.24
Crit Depth, Yc (ft)	= 0.82
Top Width (ft)	= 1.50
EGL (ft)	= 1.18



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-6

Circular

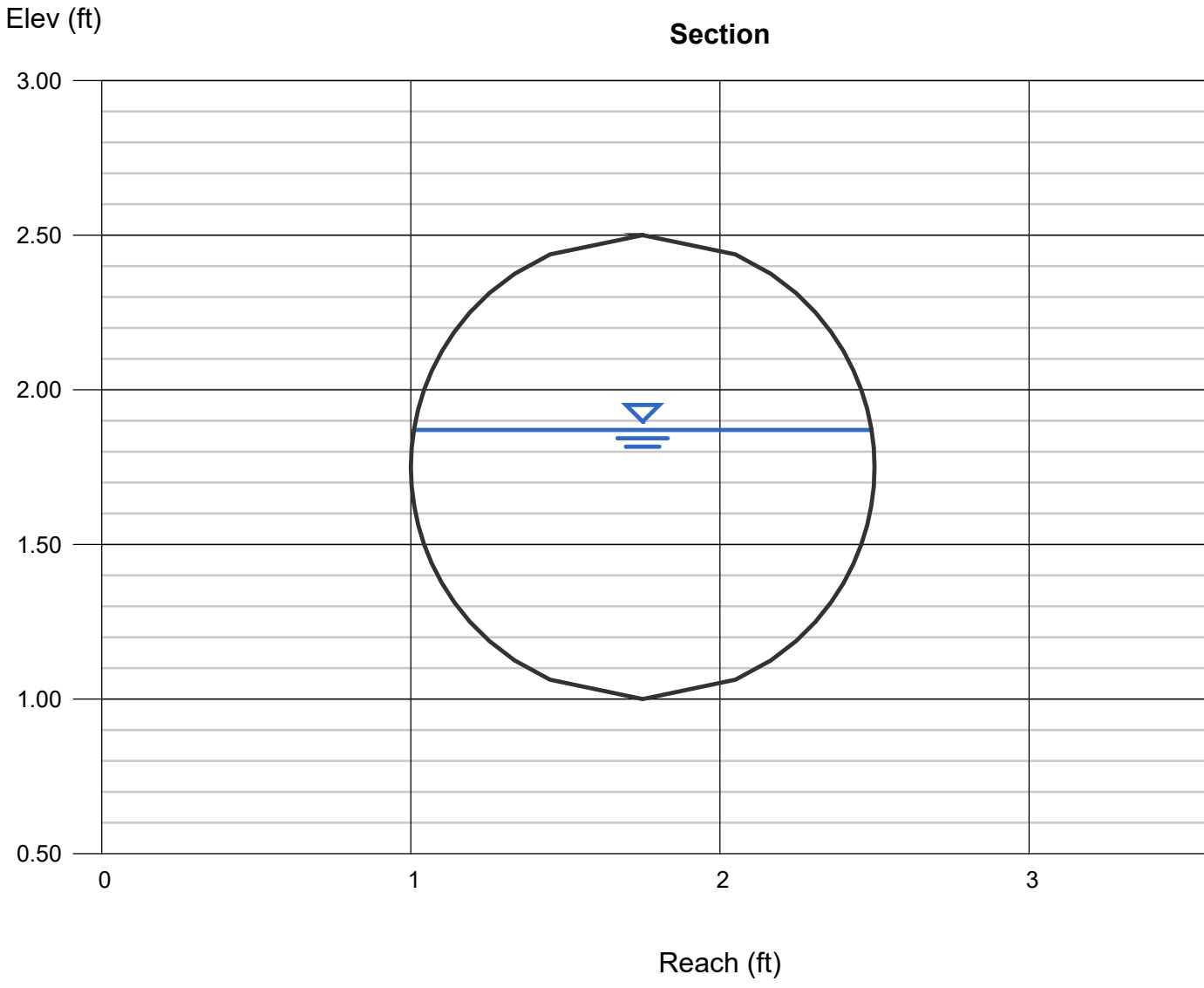
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.70

Highlighted

Depth (ft)	= 0.87
Q (cfs)	= 6.700
Area (sqft)	= 1.07
Velocity (ft/s)	= 6.28
Wetted Perim (ft)	= 2.60
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 1.48
EGL (ft)	= 1.48



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-7

Circular

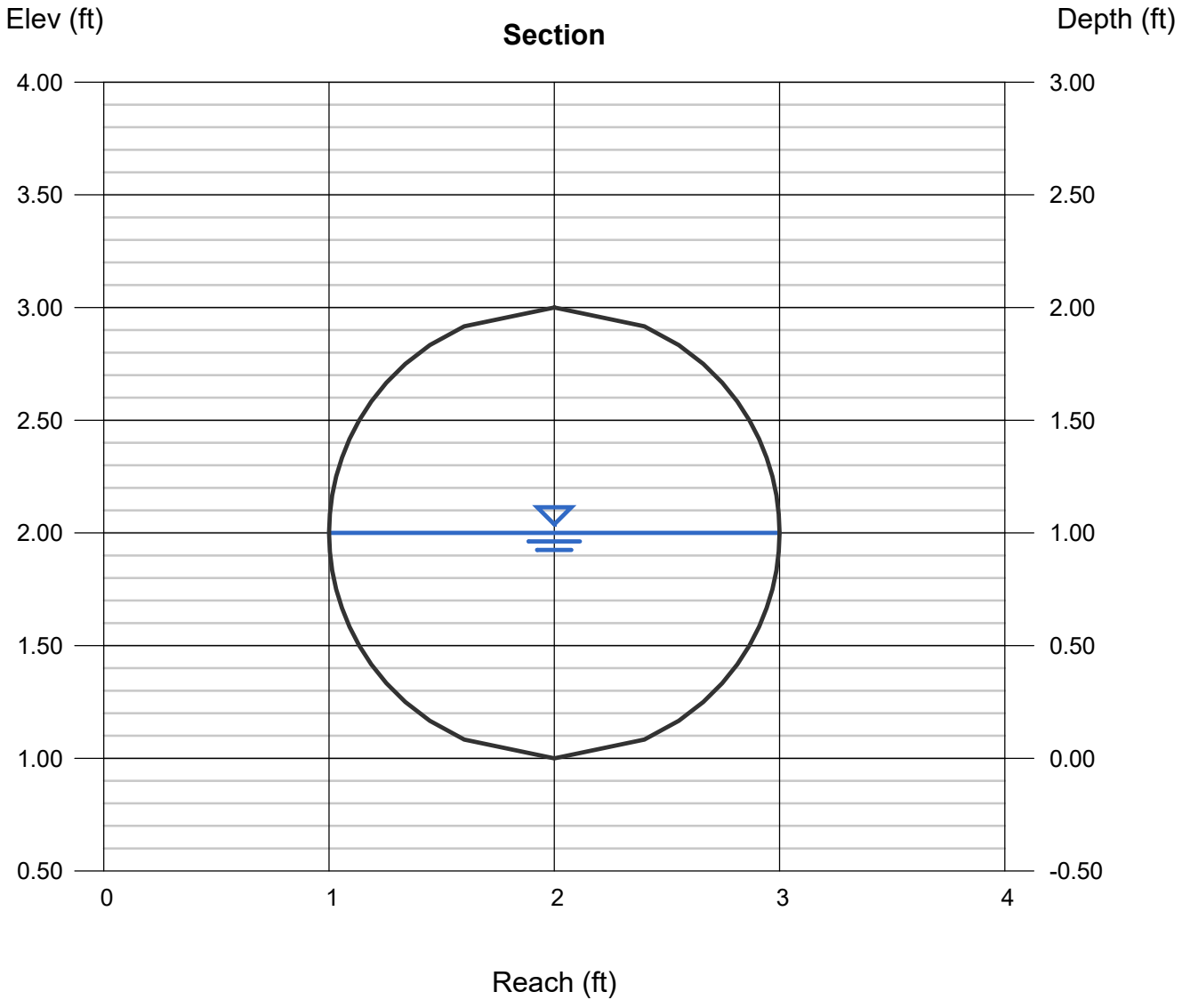
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.30

Highlighted

Depth (ft)	= 1.00
Q (cfs)	= 11.30
Area (sqft)	= 1.58
Velocity (ft/s)	= 7.16
Wetted Perim (ft)	= 3.15
Crit Depth, Yc (ft)	= 1.21
Top Width (ft)	= 2.00
EGL (ft)	= 1.80



Channel Report

PR-8

Circular

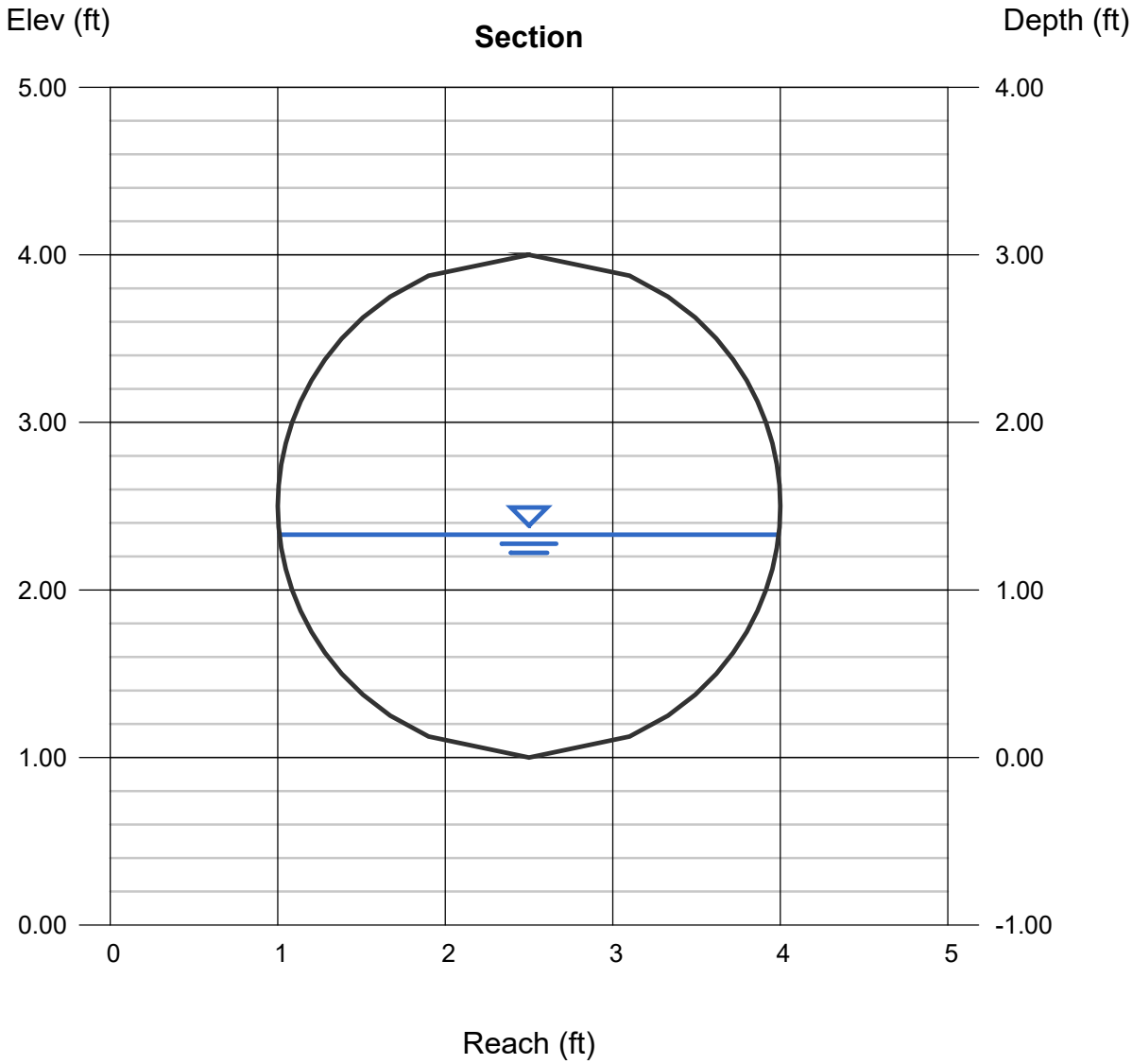
Diameter (ft)	= 3.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 27.10

Highlighted

Depth (ft)	= 1.33
Q (cfs)	= 27.10
Area (sqft)	= 3.04
Velocity (ft/s)	= 8.92
Wetted Perim (ft)	= 4.38
Crit Depth, Yc (ft)	= 1.68
Top Width (ft)	= 2.98
EGL (ft)	= 2.57



Channel Report

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PR-9

Circular

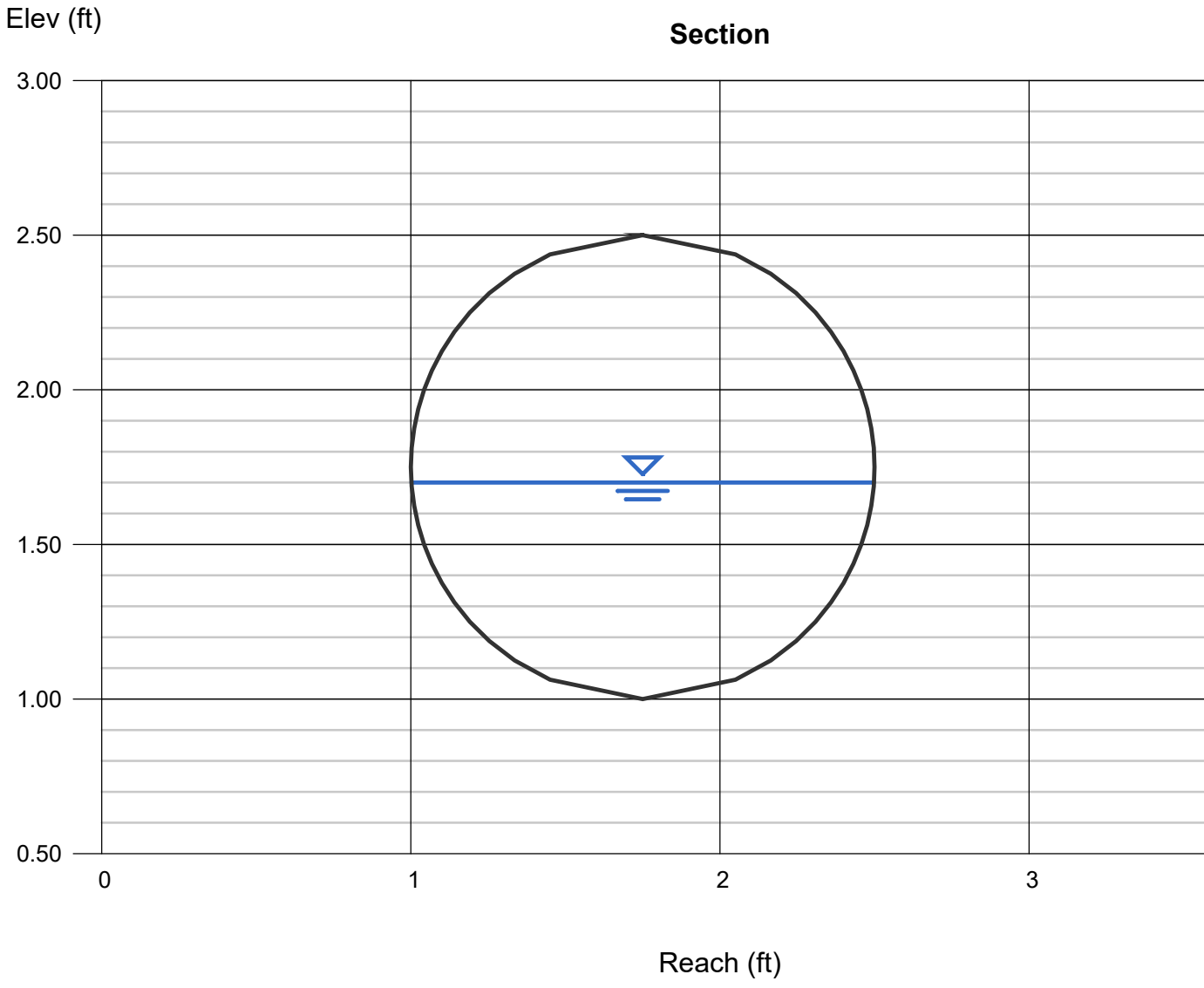
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.60

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 4.600
Area (sqft)	= 0.81
Velocity (ft/s)	= 5.68
Wetted Perim (ft)	= 2.26
Crit Depth, Yc (ft)	= 0.83
Top Width (ft)	= 1.50
EGL (ft)	= 1.20



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-10

Circular

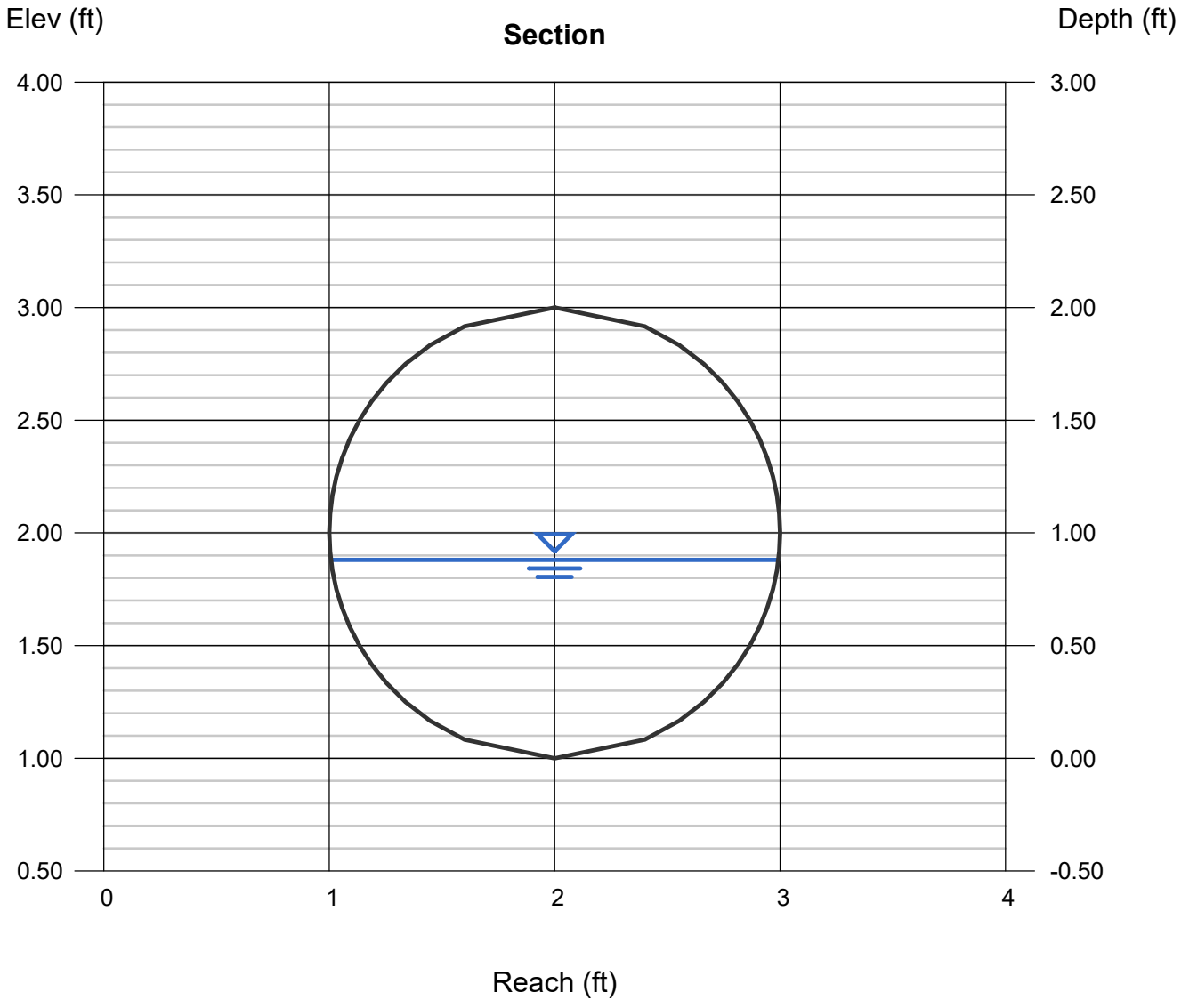
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.00

Highlighted

Depth (ft)	= 0.88
Q (cfs)	= 9.000
Area (sqft)	= 1.34
Velocity (ft/s)	= 6.72
Wetted Perim (ft)	= 2.91
Crit Depth, Yc (ft)	= 1.07
Top Width (ft)	= 1.99
EGL (ft)	= 1.58



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-11

Circular

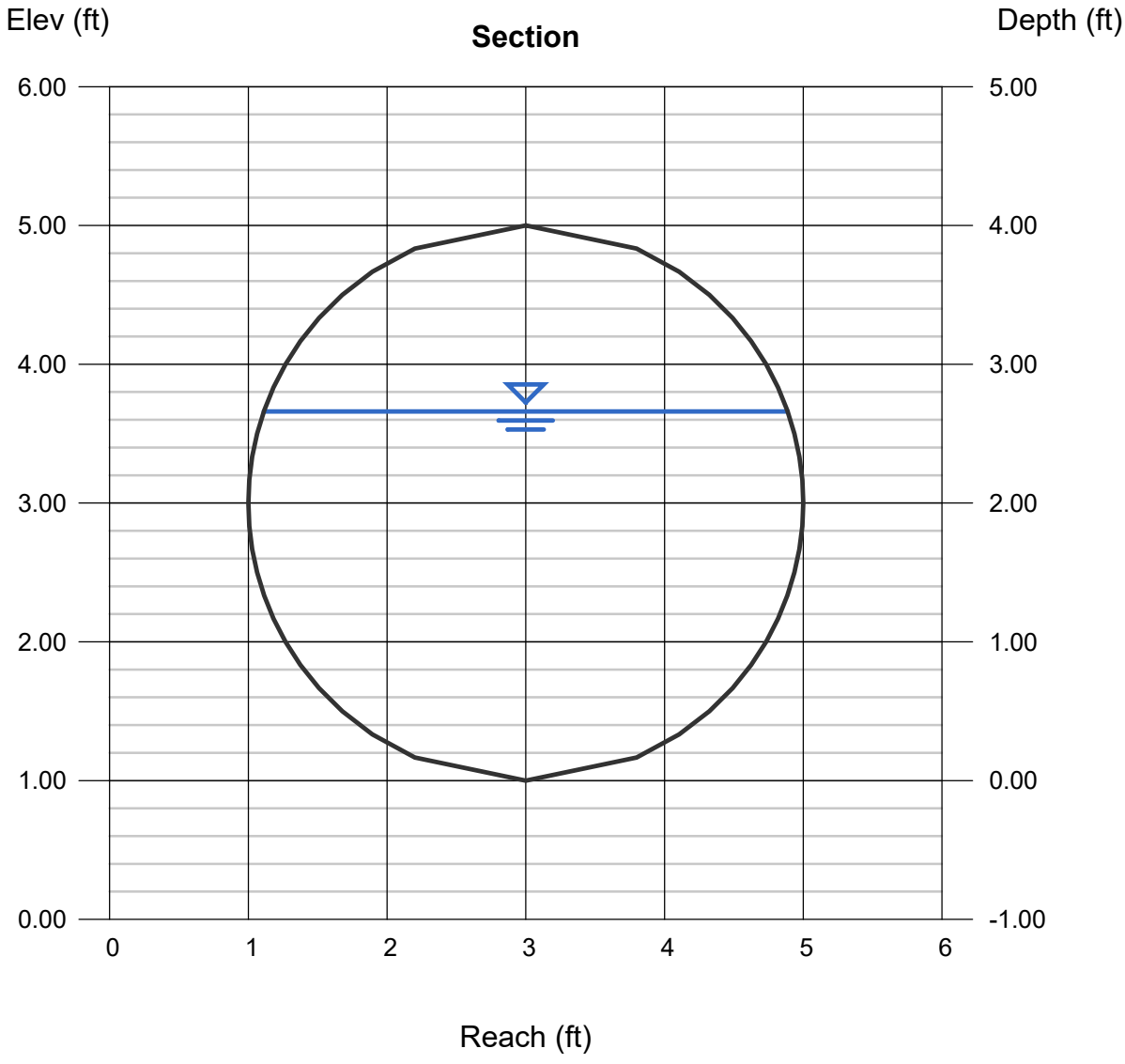
Diameter (ft)	= 4.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 112.00

Highlighted

Depth (ft)	= 2.66
Q (cfs)	= 112.00
Area (sqft)	= 8.90
Velocity (ft/s)	= 12.59
Wetted Perim (ft)	= 7.64
Crit Depth, Yc (ft)	= 3.20
Top Width (ft)	= 3.77
EGL (ft)	= 5.12



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-12

Circular

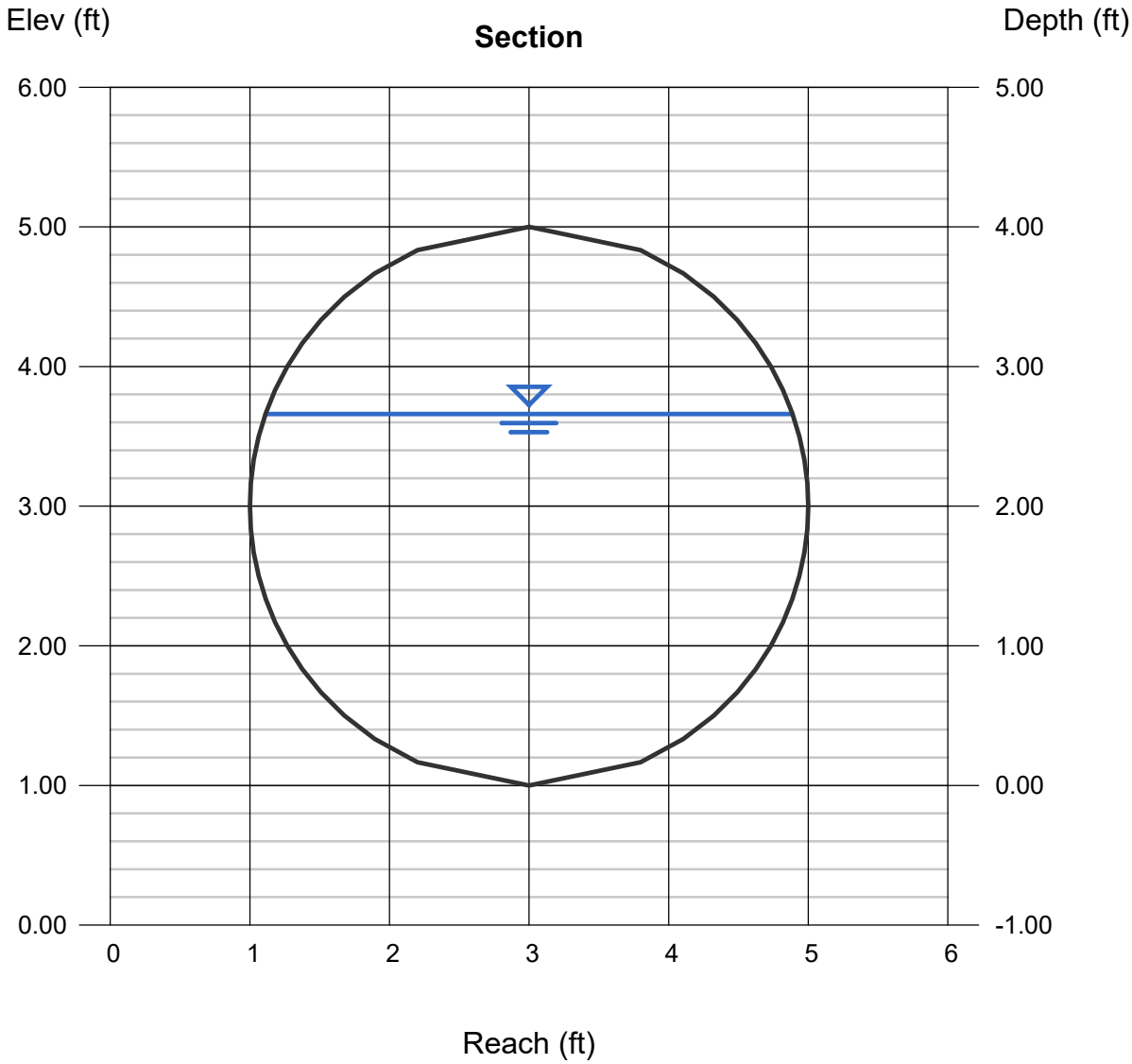
Diameter (ft)	= 4.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 112.00

Highlighted

Depth (ft)	= 2.66
Q (cfs)	= 112.00
Area (sqft)	= 8.90
Velocity (ft/s)	= 12.59
Wetted Perim (ft)	= 7.64
Crit Depth, Yc (ft)	= 3.20
Top Width (ft)	= 3.77
EGL (ft)	= 5.12



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-13

Circular

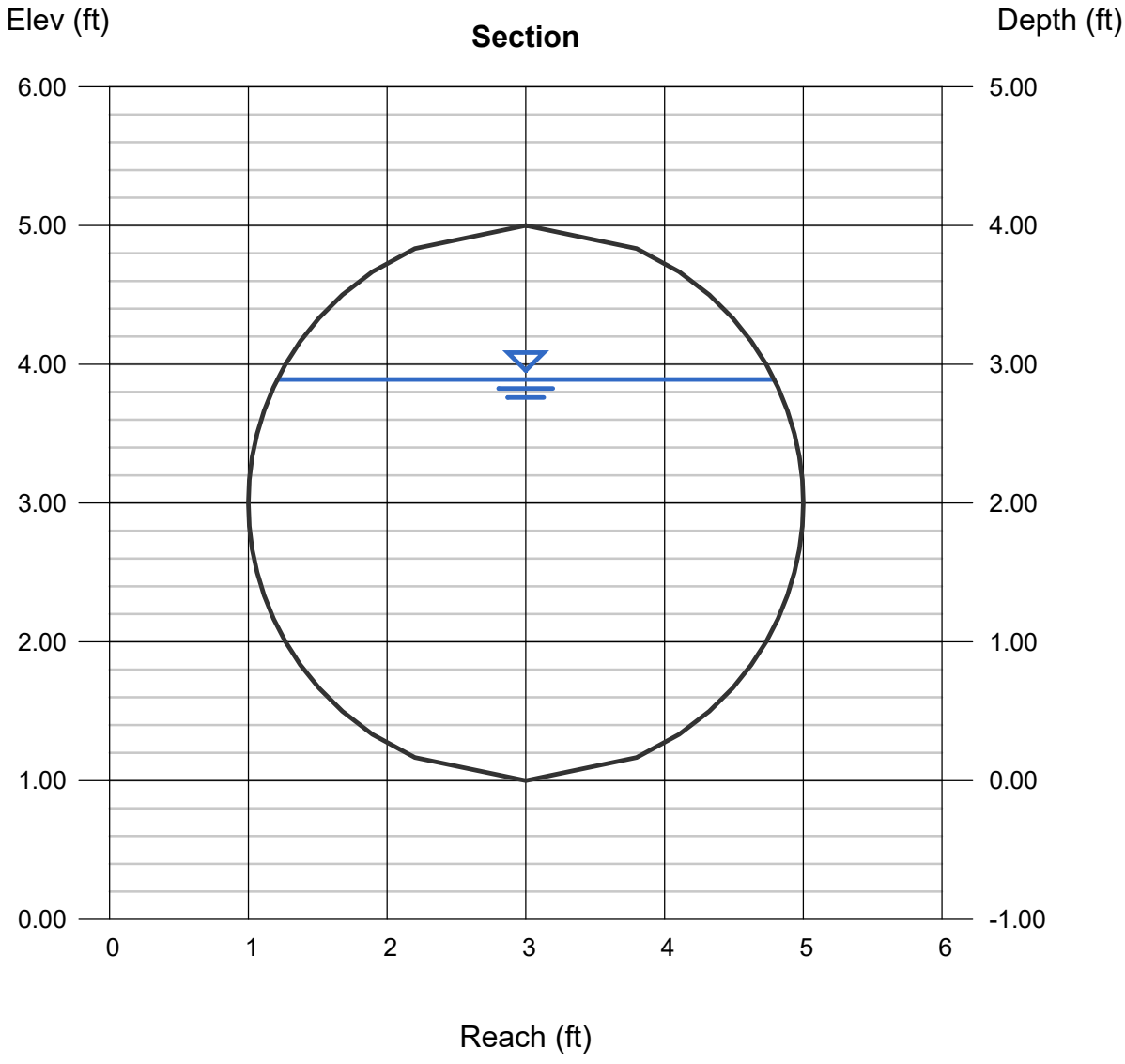
Diameter (ft)	= 4.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 125.20

Highlighted

Depth (ft)	= 2.89
Q (cfs)	= 125.20
Area (sqft)	= 9.74
Velocity (ft/s)	= 12.85
Wetted Perim (ft)	= 8.14
Crit Depth, Yc (ft)	= 3.36
Top Width (ft)	= 3.58
EGL (ft)	= 5.46



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-14

Circular

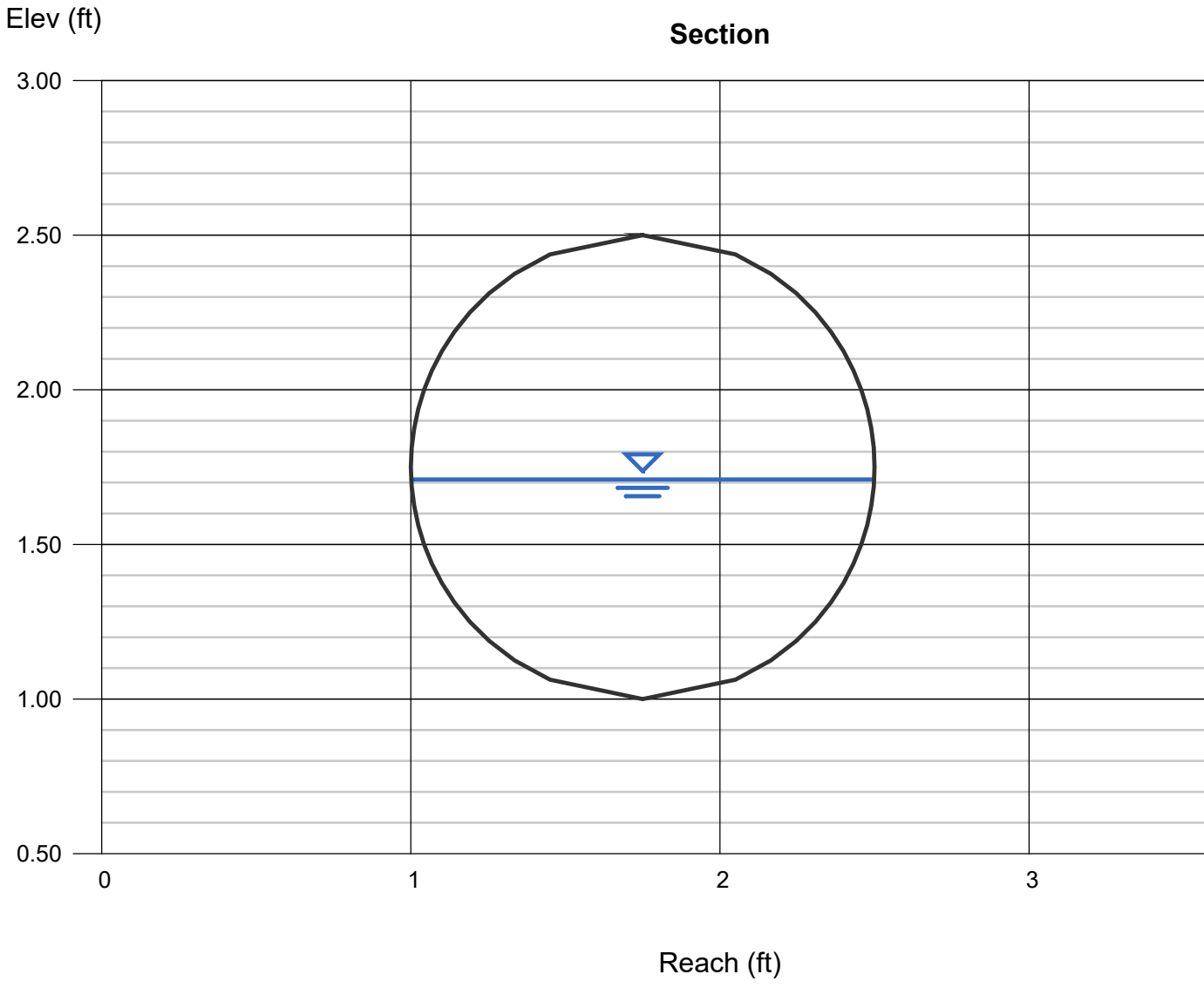
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.70

Highlighted

Depth (ft)	= 0.71
Q (cfs)	= 4.700
Area (sqft)	= 0.83
Velocity (ft/s)	= 5.69
Wetted Perim (ft)	= 2.28
Crit Depth, Yc (ft)	= 0.84
Top Width (ft)	= 1.50
EGL (ft)	= 1.21



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

PR-17

Circular

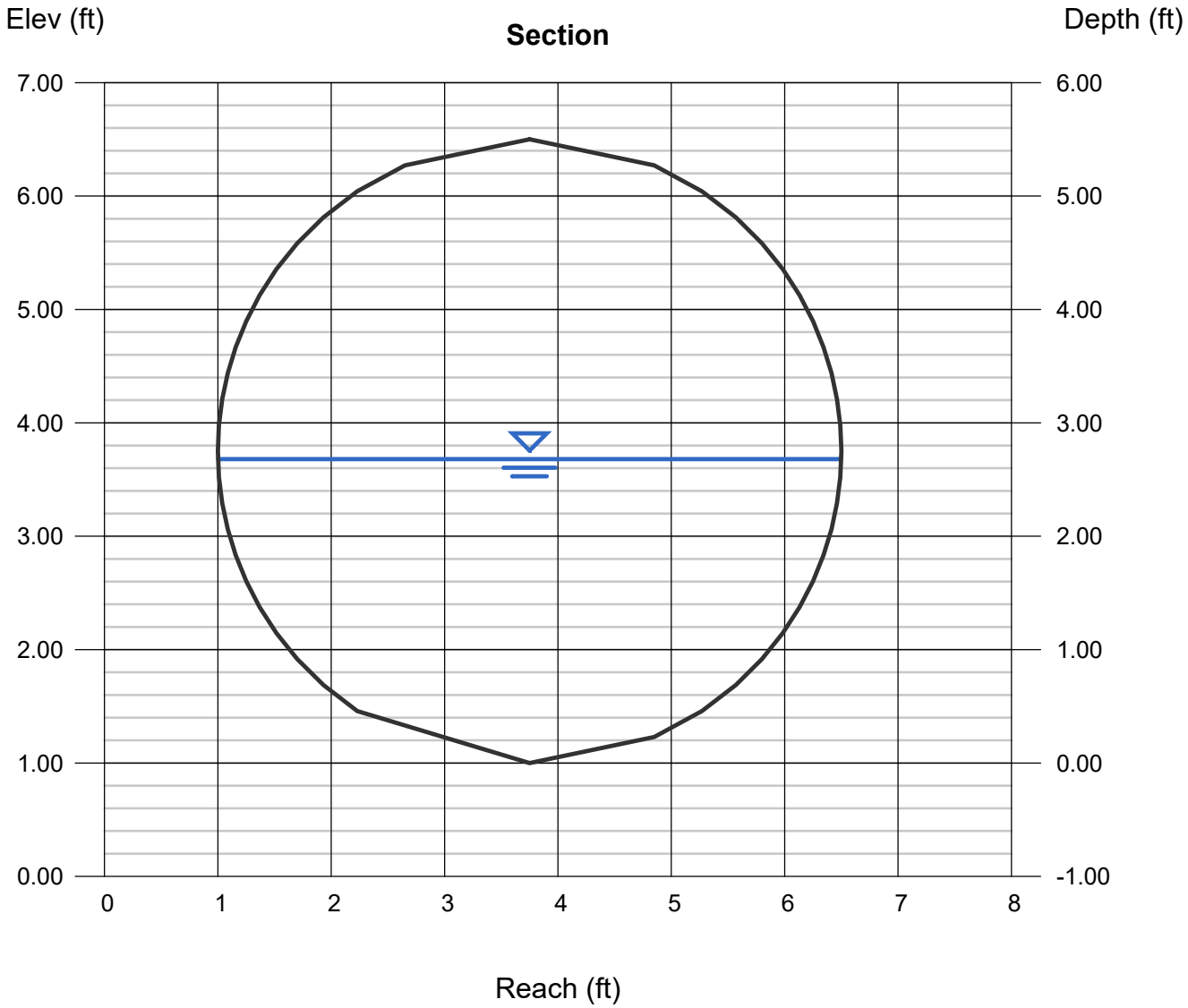
Diameter (ft)	= 5.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 161.50

Highlighted

Depth (ft)	= 2.68
Q (cfs)	= 161.50
Area (sqft)	= 11.56
Velocity (ft/s)	= 13.97
Wetted Perim (ft)	= 8.52
Crit Depth, Yc (ft)	= 3.55
Top Width (ft)	= 5.50
EGL (ft)	= 5.71



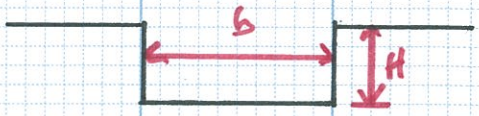
Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

Job. No. 18.1036.001
Date Nov / 05 / 2018
Sheet 1 of 2
By BAS

Project CORDERA SHOPPES AT OLD RANCH STATION
Subject OUTLET STRUCTURE WEIR CALCS

(3) $Q_2 = 5.3$ cfs, $Q_5 = 6.9$ cfs, $Q_{100} = 15.8$ cfs

(6) $Q_2 = 2.3$ cfs, $Q_5 = 2.9$ cfs, $Q_{100} = 6.7$ cfs



$Q = \frac{2}{3} C b \sqrt{2g} H^{3/2}$
WHERE $C = 0.61$

(3) 2-YR: FOR $b = 1.75'$
$5.3 = \frac{2}{3}(0.61)(1.75)(8.025) H^{3/2} \rightarrow H = 0.95'$

5-YR: @ $H = 1.25'$; $b_5 = \frac{6.9}{\frac{2}{3}(0.61)(8.025)(1.25)^{3/2}} = 1.51'$

NEED TO FACTOR IN b_2 WEIR HEIGHT
$6.9 - \left[\frac{2}{3}(0.61)(1.75)(8.025)(0.95)^{3/2}\right] = 1.612$ cfs $\div 2 = 0.8059$

$b = \frac{0.8059}{\frac{2}{3}(0.61)(8.025)(1.25)^{3/2}} = 0.177'$

$\therefore b_5 = 0.177 + 0.177 + 1.75 = 2.10'$

100-YR: @ $H = 1.50'$, $b_{100} = \frac{15.8}{\frac{2}{3}(0.61)(8.025)(1.50)^{3/2}} = 2.635'$

CHECK
$15.8 - \left[\frac{2}{3}(0.61)(2.10)(8.025)(1.50)^{3/2}\right] = 3.21$ cfs $\div 2 = 1.605$ cfs

$b = \frac{1.605}{\frac{2}{3}(0.61)(8.025)(1.50)^{3/2}} = 0.268$

$\therefore b_{100} = 0.268 + 0.268 + 2.10 = 2.635'$

Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

Job. No. _____

Date _____ / _____ / _____

Sheet 2 of 2

Project _____

By _____

Subject _____

(6) 2 YR: FOR $b = 1.25$

$2.3 = \frac{2}{3}(0.61)(1.25)(8.025)H^{3/2} \rightarrow H = 0.682'$

5 YR: @ $H = 1.0'$, $b_5 = \frac{2.9}{\frac{2}{3}(0.61)(8.025)(1)^{3/2}} = 0.889'$

* CHECK *

$2.9 - \left[\frac{2}{3}(0.61)(1.25)(8.025)(0.682)^{3/2}\right] = 0.602 \div 2 = 0.301$

$b = \frac{0.301}{\frac{2}{3}(0.61)(8.025)(1.0)^{3/2}} = 0.0923$

$\therefore b_5 = 0.0923 + 0.0923 + 1.25 = 1.43'$

100 YR: @ $H = 1.25'$, $b_{100} = \frac{6.7}{\frac{2}{3}(0.61)(8.025)(1.25)^{3/2}} = 1.4169'$

* CHECK *

$6.7 - \left[\frac{2}{3}(0.61)(1.43)(8.025)(1.25)^{3/2}\right] = 0.178 \text{ cfs} \div 2 = 0.089$

$b = \frac{0.089}{\frac{2}{3}(0.61)(8.025)(1.25)^{3/2}} = 0.0195$

$\therefore b_{100} = 0.0195 + 0.0195 + 1.43 = 1.469'$

APPENDIX C

STANDARD DESIGN CHARTS AND TABLES

NOAA Atlas 14, Volume 8, Version 2
Location name: Colorado Springs, Colorado, USA*
Latitude: 38.9847°, Longitude: -104.7618°
Elevation: 6962.09 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.234** (0.193-0.285)	**0.288** (0.238-0.352)	**0.382** (0.314-0.468)	**0.465** (0.379-0.572)	**0.585** (0.463-0.752)	**0.683** (0.526-0.887)	**0.786** (0.583-1.05)	**0.895** (0.635-1.22)	**1.05** (0.711-1.47)	**1.17** (0.770-1.65)
10-min	**0.343** (0.282-0.418)	**0.422** (0.348-0.516)	**0.560** (0.460-0.686)	**0.681** (0.555-0.837)	**0.857** (0.677-1.10)	**1.00** (0.770-1.30)	**1.15** (0.853-1.53)	**1.31** (0.929-1.79)	**1.53** (1.04-2.15)	**1.71** (1.13-2.42)
15-min	**0.418** (0.344-0.510)	**0.515** (0.424-0.629)	**0.683** (0.560-0.836)	**0.830** (0.677-1.02)	**1.05** (0.826-1.34)	**1.22** (0.939-1.59)	**1.40** (1.04-1.87)	**1.60** (1.13-2.18)	**1.87** (1.27-2.62)	**2.08** (1.37-2.95)
30-min	**0.594** (0.490-0.725)	**0.731** (0.602-0.893)	**0.968** (0.794-1.19)	**1.18** (0.959-1.45)	**1.48** (1.17-1.90)	**1.73** (1.33-2.24)	**1.99** (1.47-2.64)	**2.26** (1.61-3.09)	**2.65** (1.80-3.71)	**2.95** (1.95-4.18)
60-min	**0.767** (0.632-0.935)	**0.922** (0.759-1.13)	**1.20** (0.986-1.47)	**1.46** (1.19-1.80)	**1.85** (1.47-2.40)	**2.18** (1.68-2.85)	**2.54** (1.89-3.39)	**2.92** (2.08-4.01)	**3.47** (2.37-4.89)	**3.92** (2.59-5.56)
2-hr	**0.939** (0.779-1.14)	**1.11** (0.922-1.35)	**1.44** (1.19-1.75)	**1.74** (1.43-2.13)	**2.22** (1.78-2.87)	**2.63** (2.05-3.43)	**3.08** (2.32-4.11)	**3.58** (2.57-4.90)	**4.30** (2.96-6.04)	**4.89** (3.25-6.89)
3-hr	**1.04** (0.868-1.26)	**1.21** (1.01-1.47)	**1.55** (1.28-1.87)	**1.88** (1.54-2.28)	**2.40** (1.95-3.11)	**2.87** (2.25-3.74)	**3.39** (2.56-4.52)	**3.97** (2.87-5.43)	**4.82** (3.33-6.76)	**5.53** (3.69-7.76)
6-hr	**1.23** (1.03-1.48)	**1.41** (1.18-1.70)	**1.78** (1.49-2.14)	**2.16** (1.79-2.61)	**2.77** (2.27-3.58)	**3.33** (2.63-4.32)	**3.95** (3.01-5.25)	**4.65** (3.39-6.34)	**5.69** (3.97-7.94)	**6.56** (4.41-9.16)
12-hr	**1.44** (1.22-1.72)	**1.67** (1.40-1.99)	**2.11** (1.77-2.52)	**2.55** (2.13-3.06)	**3.26** (2.67-4.16)	**3.88** (3.09-4.99)	**4.58** (3.51-6.03)	**5.36** (3.93-7.24)	**6.51** (4.57-9.01)	**7.46** (5.05-10.3)
24-hr	**1.68** (1.43-1.99)	**1.97** (1.67-2.34)	**2.52** (2.12-2.99)	**3.03** (2.54-3.61)	**3.82** (3.14-4.81)	**4.50** (3.59-5.71)	**5.24** (4.03-6.82)	**6.06** (4.45-8.09)	**7.24** (5.10-9.91)	**8.20** (5.59-11.3)
2-day	**1.96** (1.67-2.30)	**2.32** (1.98-2.72)	**2.96** (2.51-3.49)	**3.54** (2.99-4.18)	**4.40** (3.62-5.46)	**5.13** (4.10-6.43)	**5.90** (4.55-7.58)	**6.73** (4.97-8.89)	**7.91** (5.60-10.7)	**8.86** (6.08-12.1)
3-day	**2.15** (1.84-2.52)	**2.54** (2.17-2.97)	**3.22** (2.75-3.78)	**3.84** (3.25-4.52)	**4.75** (3.92-5.86)	**5.51** (4.42-6.87)	**6.31** (4.88-8.07)	**7.17** (5.32-9.43)	**8.39** (5.97-11.3)	**9.37** (6.46-12.8)
4-day	**2.32** (1.99-2.70)	**2.72** (2.33-3.17)	**3.43** (2.93-4.01)	**4.06** (3.45-4.77)	**5.00** (4.14-6.15)	**5.79** (4.66-7.20)	**6.62** (5.14-8.44)	**7.51** (5.58-9.84)	**8.77** (6.26-11.8)	**9.78** (6.77-13.3)
7-day	**2.73** (2.36-3.16)	**3.16** (2.72-3.66)	**3.91** (3.36-4.55)	**4.59** (3.92-5.36)	**5.59** (4.65-6.83)	**6.43** (5.20-7.94)	**7.32** (5.71-9.27)	**8.27** (6.18-10.8)	**9.62** (6.90-12.9)	**10.7** (7.44-14.5)
10-day	**3.10** (2.68-3.58)	**3.56** (3.08-4.11)	**4.36** (3.76-5.06)	**5.08** (4.35-5.92)	**6.15** (5.12-7.47)	**7.03** (5.70-8.64)	**7.96** (6.23-10.0)	**8.96** (6.71-11.6)	**10.4** (7.46-13.8)	**11.5** (8.02-15.5)
20-day	**4.14** (3.60-4.74)	**4.74** (4.13-5.44)	**5.76** (5.00-6.63)	**6.64** (5.73-7.67)	**7.90** (6.60-9.47)	**8.91** (7.26-10.8)	**9.95** (7.83-12.4)	**11.0** (8.32-14.2)	**12.5** (9.07-16.5)	**13.7** (9.64-18.3)
30-day	**5.00** (4.37-5.70)	**5.73** (5.00-6.54)	**6.95** (6.04-7.95)	**7.96** (6.89-9.16)	**9.38** (7.84-11.1)	**10.5** (8.56-12.6)	**11.6** (9.14-14.4)	**12.7** (9.62-16.2)	**14.3** (10.4-18.7)	**15.4** (10.9-20.6)
45-day	**6.07** (5.33-6.90)	**6.97** (6.11-7.93)	**8.43** (7.36-9.61)	**9.61** (8.35-11.0)	**11.2** (9.38-13.2)	**12.4** (10.2-14.9)	**13.6** (10.8-16.7)	**14.8** (11.2-18.7)	**16.3** (11.9-21.3)	**17.5** (12.4-23.2)
60-day	**6.98** (6.14-7.90)	**8.02** (7.05-9.09)	**9.67** (8.47-11.0)	**11.0** (9.57-12.6)	**12.7** (10.7-14.9)	**14.0** (11.5-16.7)	**15.3** (12.1-18.7)	**16.5** (12.5-20.7)	**18.0** (13.1-23.3)	**19.1** (13.6-25.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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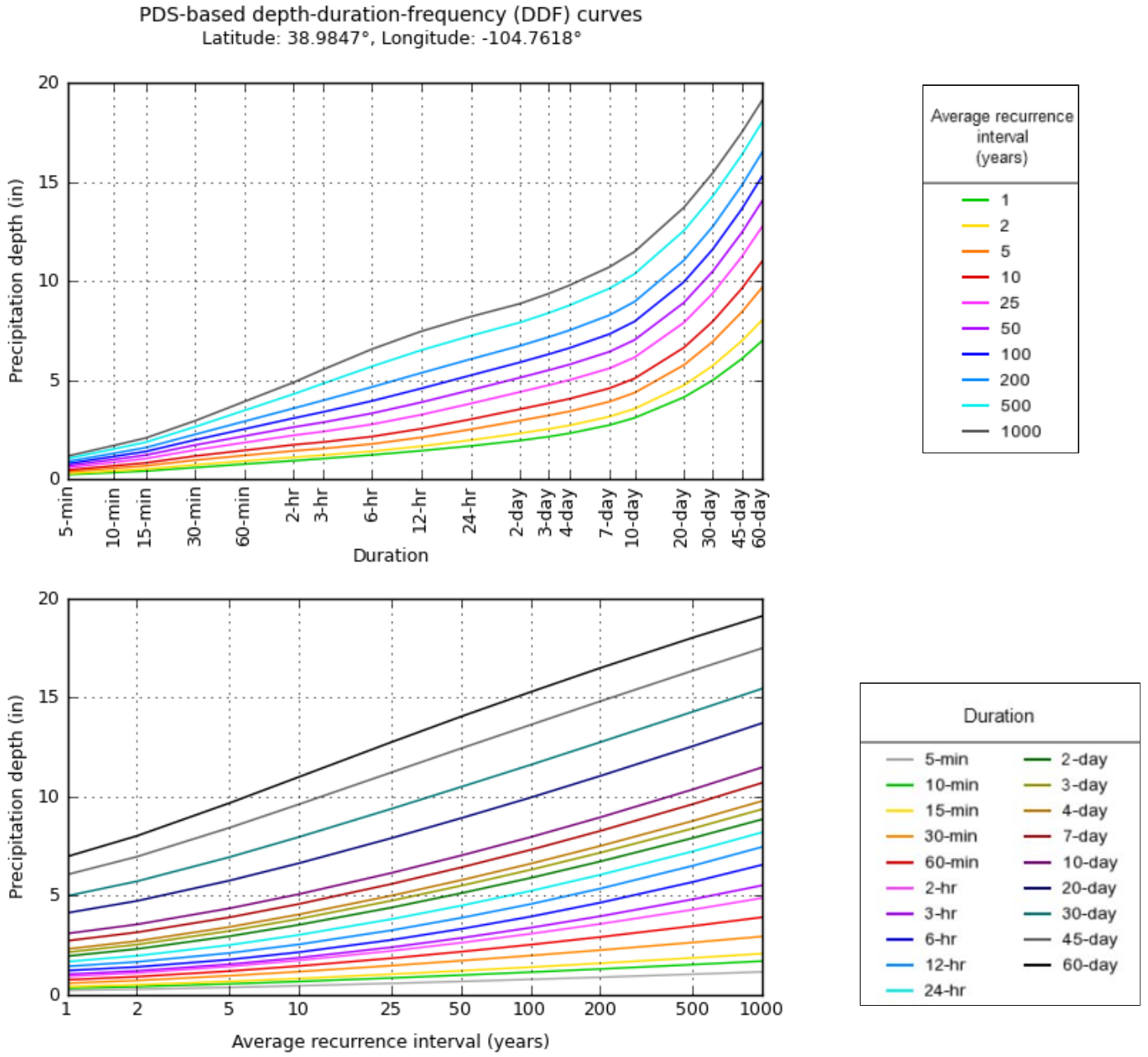
PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Fri Oct 12 14:05:17 2018

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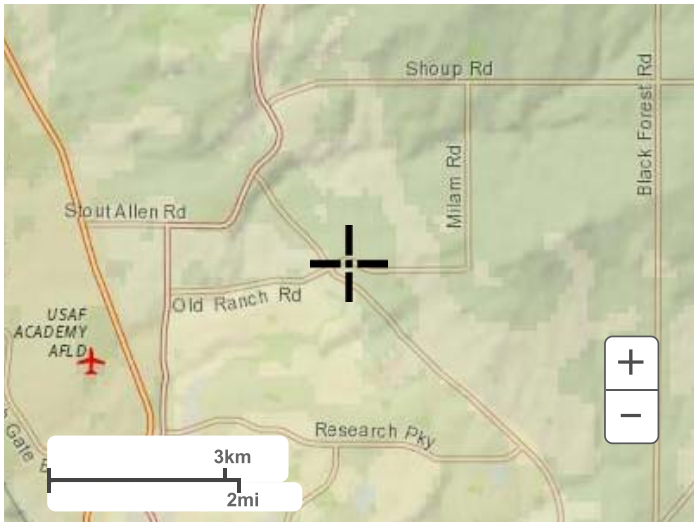
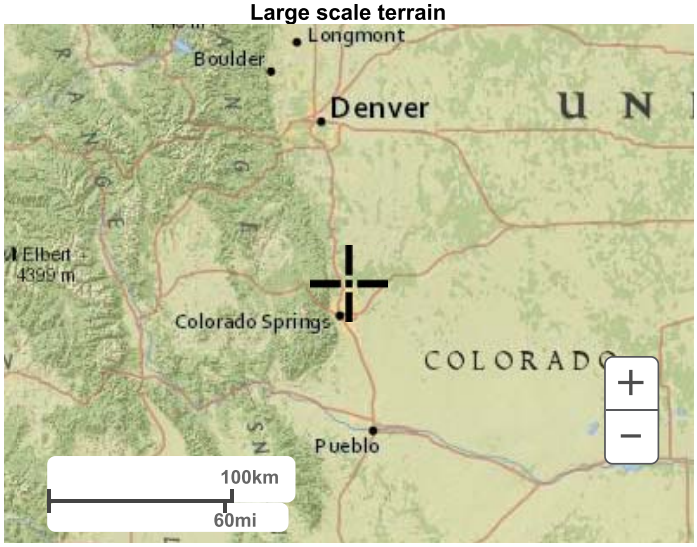
Maps & aerials

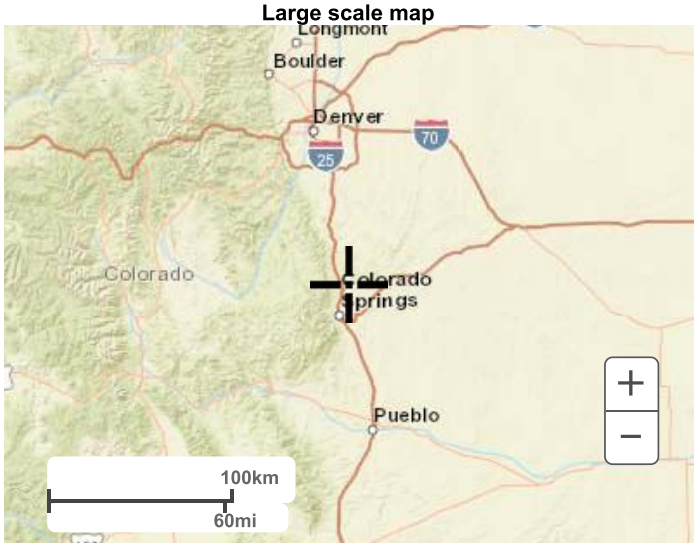
Small scale terrain



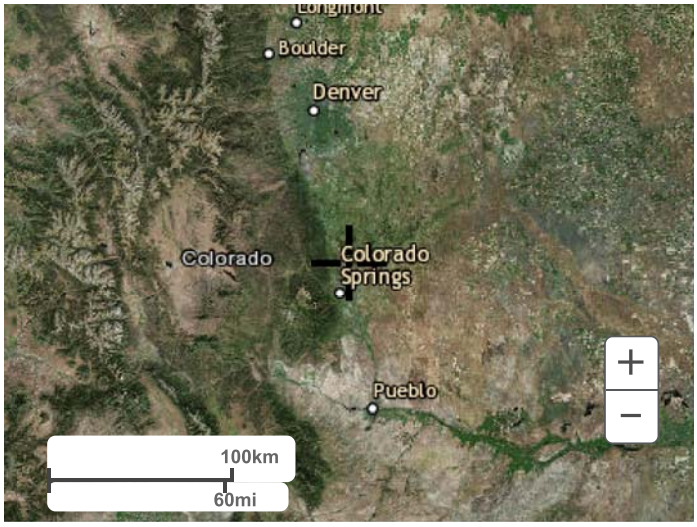
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

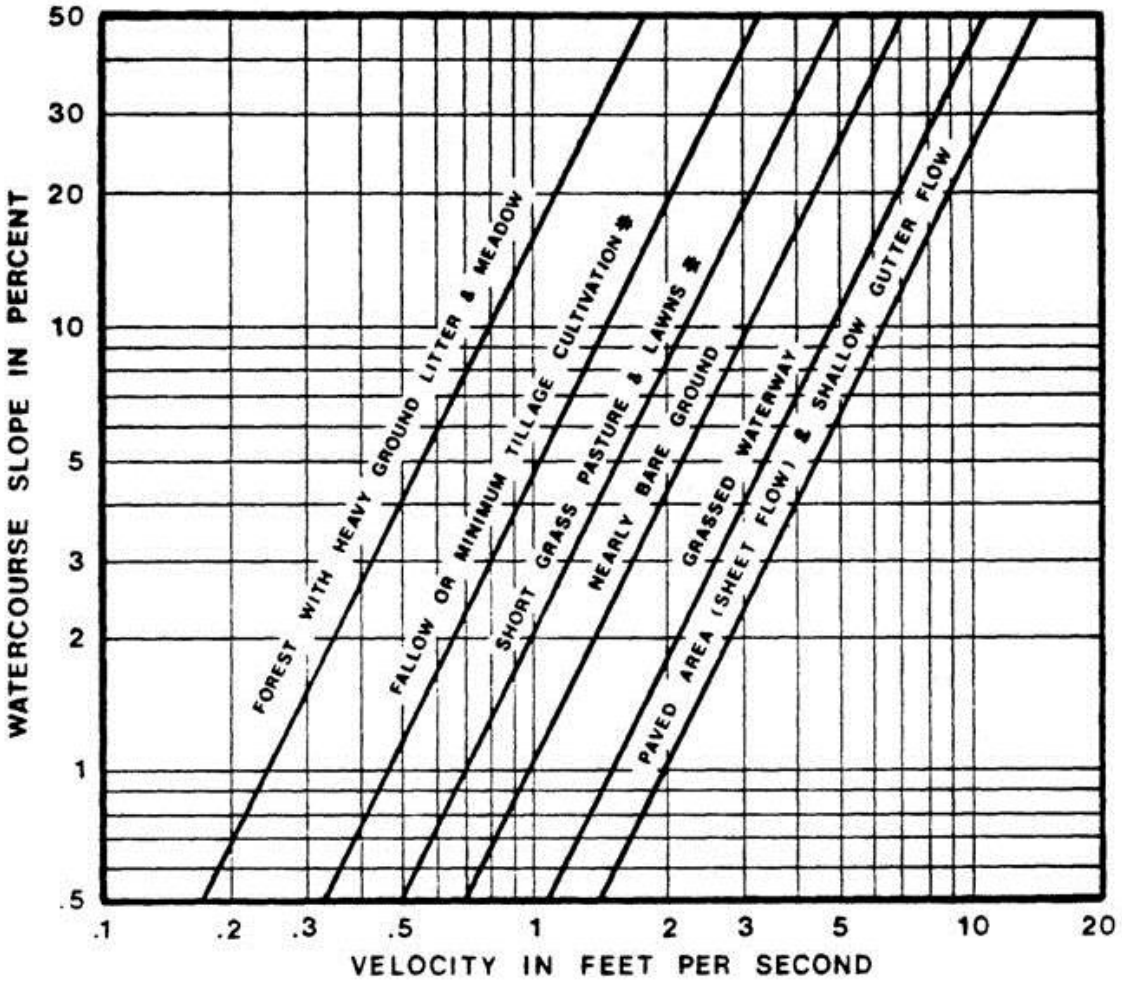
Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Figure 6-25. Estimate of Average Concentrated Shallow Flow



2019 DRAINAGE, BRIDGE AND POND FEES
CITY OF COLORADO SPRINGS

Basin Name	DBPS Year	Drainage Fee/Acre	Bridge Fee/Acre	Pond Land Fee/Acre	Pond Facility Fee/Acre	Surcharge/ Acre
19th Street	1964	$4,030				
21st Street	1977	$6,151				
Bear Creek	1980	$3,959	$373			
Big Johnson, Crews	1991	$15,316	$1,259	$241		
Black Squirrel Creek	1989	$14,302	$1,603	$789		
Camp Creek	1964	$2,270				
Cottonwood Creek[1] ,[2]	2000	$13,923	$1,130			$723
Douglas Creek	1981	$12,728	$285			
Dry Creek[3]	1966	$0.00				
Elkhorn Basin[4]	n/a	$0.00				
Fishers Canyon[5]	1991	$0.00				
Fountain Creek[6]	n/a	VAR				
Jimmy Camp Creek	2015	$7,975			$2,599	
Kettle Creek[7] Old Ranch Trib.	2001	$0.00				
Little Johnson	1988	$13,367		$1,227		
Mesa	1986	$10,699				
Middle Tributary	1987	$6,995		$1,121		
Miscellaneous[8]	n/a	$11,905				
Monument Branch[12]	1987	$0.00				
North Rockrimmon	1973	$6,152				
Park Vista (MDDP)	2004	$17,135				
Peterson Field	1984	$12,925	$595			
Pine Creek[9]	1988	$0.00				
Pope's Bluff	1976	$4,096	$701			
Pulpit Rock	1968	$6,784				
Sand Creek[10]	1996	$12,645	$761	$1,070	$3,676	$1,333
Shooks Run[11]	1994	$0.00				
Smith Creek[12]	2002	$0.00				
South Rockrimmon	1976	$4,810				
Southwest Area	1984	$13,467				
Spring Creek	1968	$10,609				
Templeton Gap	1977	$6,997	$77			
Windmill Gulch	1992	$14,594	$271	$3,055		

All Drainage, Bridge and Detention Pond Facilities Fees adjusted by 6.7% over 2018 by City Council Resolution No. 159-18 on December 11, 2018 to be effective on January 1, 2019. Land Fees are based on the Park Land Dedication Fee which is currently $76,602/acre (0% change for inflation in 2018).

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[1] The 2018 Cottonwood Creek drainage fee consists of a capital improvement fee of $10,853 per acre and land fee of $3,069 per acre for a total of $13,923 per acre. These fees are adjusted annually using different procedures but are combined for collection purposes. **The surcharge fee of $723/ac is due in cash; credits for prior facility construction cannot be used to offset this fee,** which is deposited into a separate City fund known as the "Cottonwood Creek Surcharge" fund.

[2] The Wolf Ranch portion of the Cottonwood Creek Drainage Basin was approved as a "no fee" basin **as to Drainage Fees only** by City Council on August 28, 2018 by Resolution No. 96-18

[3] Dry Creek is a closed basin per City Council Resolution No.118-08 on June 24, 2008

[4] Elkhorn Basin is a closed basin per the Annexation Agreements for the area.

[5] Fishers Canyon is a closed basin per City Council Resolution No. 74-08 on April 22, 2008.

[6] Pursuant to the recommendation of the Subdivision Storm Drainage Board adopted at its meeting of September 15, 1977, there are exempted and excluded from the provisions of this part construction of the main Fountain Creek Channel from the confluence of Fountain Creek with Monument Creek northwest to the City limits. Land developments taking place adjacent to Fountain Creek shall remain responsible for dedicating rights of way necessary for the channelization of Fountain Creek, and the developers shall continue to pay to the City as a condition of subdivision plat approval the applicable drainage fees. Drainage fees are required in accordance with the appropriate basin study.

[7] Kettle Creek Old Ranch Tributary is a closed basin per City Council Resolution 139-02 on August 27, 2002.

[8] Miscellaneous fee is assessed on unstudied areas and the Roswell and Westside Basins.

[9] Pine Creek is a closed basin per City Council Resolution No.236-88 on December 13, 1988.

[10] Sand Creek Detention Pond #2 Surcharge (Ridgeview and Indigo Ranch) = $1,333/ac. for 2019. Sand Creek Pond fees include two components, one for facility construction costs ($3,676) and one for land dedication costs ($1,070), the total Pond fee within Sand Creek is $4,746/ac.

[11] Shooks Run is a closed basin pursuant to the recommendation of the Drainage Board, adopted at its meeting on October 15, 1963.

[12] Smith Creek is a closed basin per City Council Resolution 140-02 on August 27, 2002

[12] Monument Branch Basin is a closed basin per City Council Res. 177-10 on October 12, 2010

APPENDIX D

MAPS

REGIONAL DETENTION FACILITY "E"
Stage Storage Discharge Data

Water Surface Elevation (Feet)	Cumulative Storage Volume (AC/FT)	Normal Outlet to Storm Drain Discharge (cfs)	Normal Outlet to Natural Channel Discharge (cfs)
22.5	0.0	0	0
23.0	0.1	0	0.7
24.0	0.7	0	1.2
26.0	2.8	18.0	1.8
28.0	5.1	32.5	2.2
30.0	7.8	42.3	2.6
32.0	10.8	50.2	5.4
33.0	12.5	53.7	17
34.0	14.2	57	41
35.0	16.0	60	81
36.0	18.0	63	138
37.0	19.8	66	170
38.0	22.0	69	240
39.0	24.1	71	364
40.0	26.4	74	456
41.0	28.8	76	556
42.0	31.2	79	671
43.0	33.8	81	796
44.0	36.4	83	933

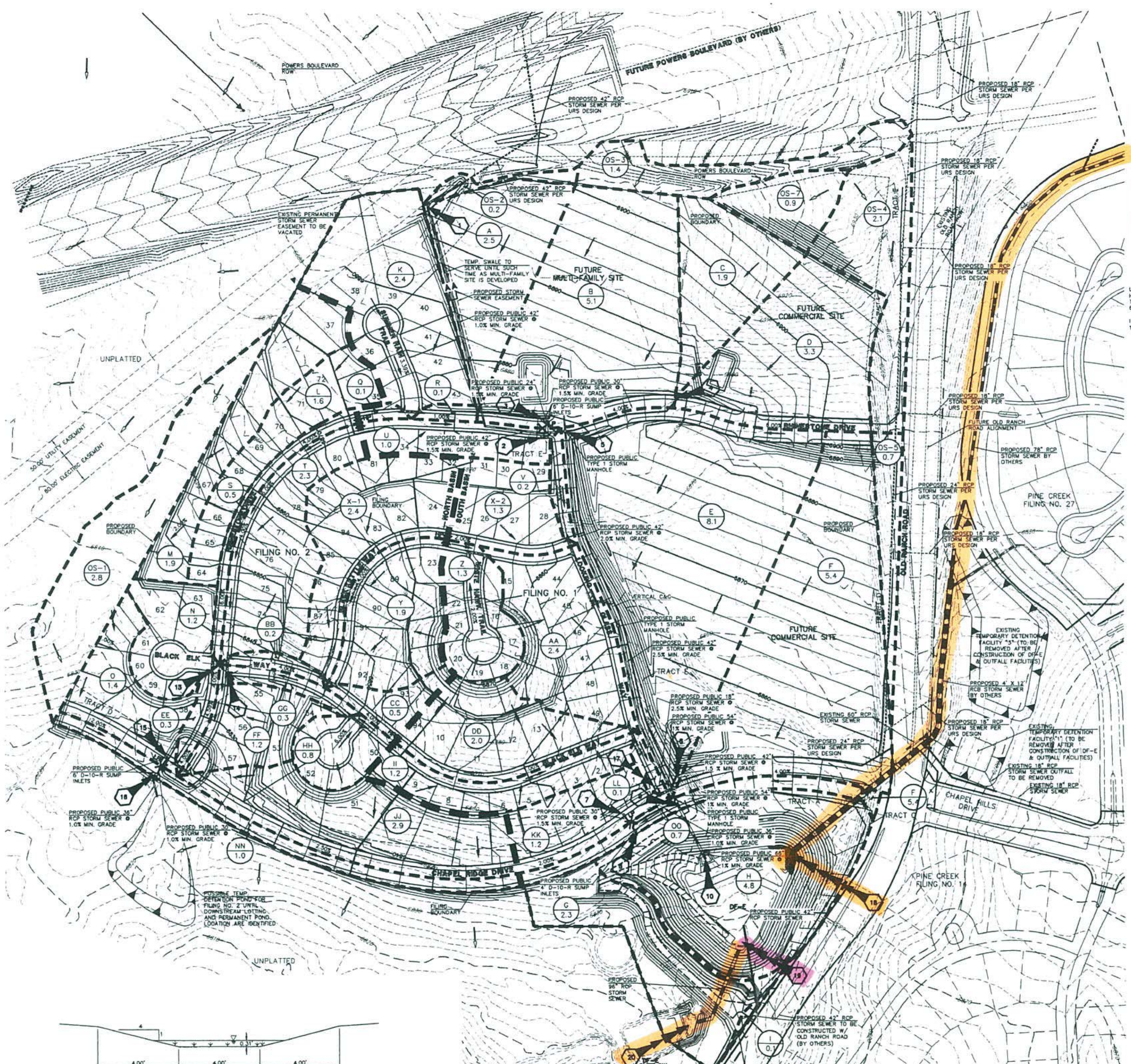
Normal Outlet To Old Ranch Road Storm Drain

Outlet: 2.25' Diameter Vertical Orifice, Invert = 6824.0

Normal Outlet Staged To Natural Channel

Low Stage: 6" Diameter Vertical Orifice, Invert = 6822.25+/-
High Stage: 12" x 12' I.D. Reinforced Concrete Riser with 8' Diameter Outfall to the South Tributary Natural Channel, to Incorporate a 90° V-Notch Weir at Elevation 6831.0, Vertical at 6836.0 Forming a Broadcrested Weir to 6840.7, the Peak 100-year W.S.E.

In the emergency overflow condition the Q_{100} inflow of 1078 cfs is planned to enter the 12' x 12' riser and outfall to the South Tributary through a proposed 8' diameter R.C.P.



SECTION A-A
TEMPORARY GRASS-LINED SWALE
SCALE: 1"=2'

NOTES:
1. THIS MAP IS TO BE USED FOR DRAINAGE PURPOSES ONLY. SEE GRADING PLAN FOR APPROPRIATE GRADING INFORMATION.
2. POND AND STORM SEWER ARE SUBJECT TO FINAL DESIGN.

SCALE: 1" = 100'

REGIONAL DETENTION FACILITY "E"

STAGE STORAGE DISCHARGE DATA

WATER SURFACE ELEVATION (FEET)	CUMULATIVE STORAGE VOLUME (AC/FT)	NORMAL OUTLET TO STORM DRAIN DISCHARGE (CFS)	NORMAL OUTLET TO NATURAL CHANNEL DISCHARGE (CFS)
22.5	0.0	0	0
23.0	0.1	0	0.7
24.0	0.7	0	1.2
26.0	2.8	18.0	1.8
28.0	5.1	32.5	2.2
30.0	7.8	42.3	2.6
32.0	10.8	50.2	5.4
33.0	12.5	53.7	17
34.0	14.2	57	41
35.0	16.0	60	81
36.0	18.0	63	138
37.0	19.8	66	170
38.0	22.0	69	240
39.0	24.1	71	364
40.0	26.4	74	456
41.0	28.8	76	556
42.0	31.2	79	671
43.0	33.8	81	796
44.0	36.4	83	933

NORMAL OUTLET TO OLD RANCH ROAD STORM DRAIN

OUTLET: 2.25' DIAMETER VERTICAL ORIFICE, INVERT = 6824.0

NORMAL OUTLET STAGED TO NATURAL CHANNEL

LOW STAGE: 6" DIAMETER VERTICAL ORIFICE, INVERT = 6822.25±
HIGH STAGE: 12" X 12' I.D. REINFORCED CONCRETE RISER WITH 8' DIAMETER OUTFALL TO THE SOUTH TRIBUTARY NATURAL CHANNEL, TO INCORPORATE A 90° V-NOTCH WEIR AT ELEVATION 6831.0, VERTICAL AT 6836.0 FORMING A BROADCRESTED WEIR TO 6840.7, THE PEAK 100-YEAR W.S.E.

IN THE EMERGENCY OVERFLOW CONDITION THE Q100 INFLOW OF 1078 CFS IS PLANNED TO ENTER THE 12' X 12' RISER AND OUTFALL TO THE SOUTH TRIBUTARY THROUGH A PROPOSED 8' DIAMETER R.C.P.

HISTORIC CONDITION VERSUS DEVELOPED CONDITION FLOW COMPARISON

(FROM KETTLE CREEK DRAINAGE BASIN OLD RANCH TRIBUTARY DBPS/MDDP)

STORM	ANALYSIS POINT – PEAK FLOW (cfs)		
FREQUENCY YEARS	AP-H9	AP-D12	NET DIFF
2	31	9	-22
5	107	77	-30
10	178	148	-30
25	320	297	-23
50	432	417	-15
100	557	525	-32

WHERE AP-H9 IS THE HISTORIC DISCHARGE TO THE CHANNEL DOWNSTREAM OF DF-E AND AP-D12 IS THE DEVELOPED DISCHARGE TO THE NATURAL CHANNEL FROM DF-E

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6810
PROPOSED FINISHED CONTOUR	6810
SUBDIVISION BOUNDARY	
LOT LINE	
BASIN BOUNDARY	
BASIN IDENTIFIER / AREA IN ACRES	E / 8.1
PROPOSED STORM SEWER	
EXISTING STORM SEWER	
STREET GRADE	4.00%
EXISTING DRAINAGE ARROW	

BASIN SUMMARY:

BASIN	Q(5)-CFS	Q(100)-CFS
A	8	15
B	17	32
C	8	15
D	14	25
E	34	62
F	22	41
G	4	8
H	3	8
I	0.1	0.2
K	5	10
L	3	6
M	4	8
N	2	4
O	3	6
Q	0.4	1
R	0.4	1
S	2	4
T	4	8
U	2	4
V	1	2
X-1	4	8
X-2	2	4
Y	3	6
Z	3	7
AA	4	7
BB	1	2
CC	1	2
DD	4	7
EE	1	2
FF	2	4
GG	1	2
HH	2	4
II	3	5
JJ	5	10
KK	2	5
LL	0.5	1
MM	0.5	1
NN	5	9
OO	3	6
OS-1	2	4
OS-2	0.2	1
OS-3	3	6
OS-4	3	7
OS-5	1	3
OS-6	0.2	0.5
OS-7	1	3
A (Undeveloped)	2	4
B (Undeveloped)	4	9
C (Undeveloped)	1	3
D (Undeveloped)	2	6
E (Undeveloped)	6	14
F (Undeveloped)	4	9

DESIGN POINT	FLOW (CFS)
1*	Q_5 = 25 CFS, Q_{100} = 65 CFS
2	Q_5 = 2 CFS, Q_{100} = 4 CFS
3	Q_5 = 21 CFS, Q_{100} = 48 CFS
4	Q_5 = 22 CFS, Q_{100} = 40 CFS
5	Q_5 = 81 CFS, Q_{100} = 142 CFS
6	Q_5 = 56 CFS, Q_{100} = 103 CFS
7	Q_5 = 18 CFS, Q_{100} = 41 CFS
8	Q_5 = 3 CFS, Q_{100} = 6 CFS
9	Q_5 = 126 CFS, Q_{100} = 222 CFS
10	Q_5 = 129 CFS, Q_{100} = 229 CFS
13	Q_5 = 6 CFS, Q_{100} = 12 CFS
14	Q_5 = 14 CFS, Q_{100} = 26 CFS
15	Q_5 = 28 CFS, Q_{100} = 54 CFS
16	Q_5 = 5 CFS, Q_{100} = 9 CFS
17	Q_5 = 14 CFS, Q_{100} = 26 CFS
18*	Q_5 = 337 CFS, Q_{100} = 803 CFS
PEAK INFLOW DF-E 19*	Q_5 = 470 CFS, Q_{100} = 1,079 CFS
PEAK OUTFLOW DF-E 20*	Q_5 = 137 CFS, Q_{100} = 600 CFS

* Q'S FROM KETTLE CREEK DBPS & MDDP

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
VINTAGE COMMUNITIES
116 NORTH NEVADA AVENUE
COLORADO SPRINGS, CO 80903
719-528-5000

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613
www.jrengineering.com

No.	REVISION	BY	DATE
1	REVISED PER UPDATED PIPE SIZING	SMF	11/26/03

H-SCALE	1"=100'
V-SCALE	N/A
DATE	10/14/02
DESIGNED BY	TEM
DRAWN BY	MLW
CHECKED BY	

BISON RIDGE AT KETTLE CREEK
PRELIMINARY/FINAL DRAINAGE REPORT
DRAINAGE MAP

SHEET 1 OF 1
JOB NO. 8906.00

Design point K8 (design point K10 of the interim developed conditions) collects runoff from sub-basins KP-10 and KP-13 through KP-15 and design point K7; an area totaling 60.12 acres. Runoff rates of Q(5) = 15.4 cfs and Q(100) = 89.8 cfs are routed through a 30" RCP to design point K15.

Design point K15 (design point K11 of the interim developed conditions) collects runoff from sub-basins KP-16, KP-23 through KP-25, and KP-27 and design point K8; an area totaling 64.18 acres. Runoff rates of Q(5) = 22.0 cfs and Q(100) = 101.8 cfs are routed through a 42" RCP to design point K13.

Design point K13 (design point K13 of the interim developed conditions) collects runoff from design points K12 and K15; an area totaling 247.22 acres. Runoff rates of Q(5) = 60.6 cfs and Q(100) = 316.0 cfs are routed through a 66" RCP to Detention Pond DF-6.

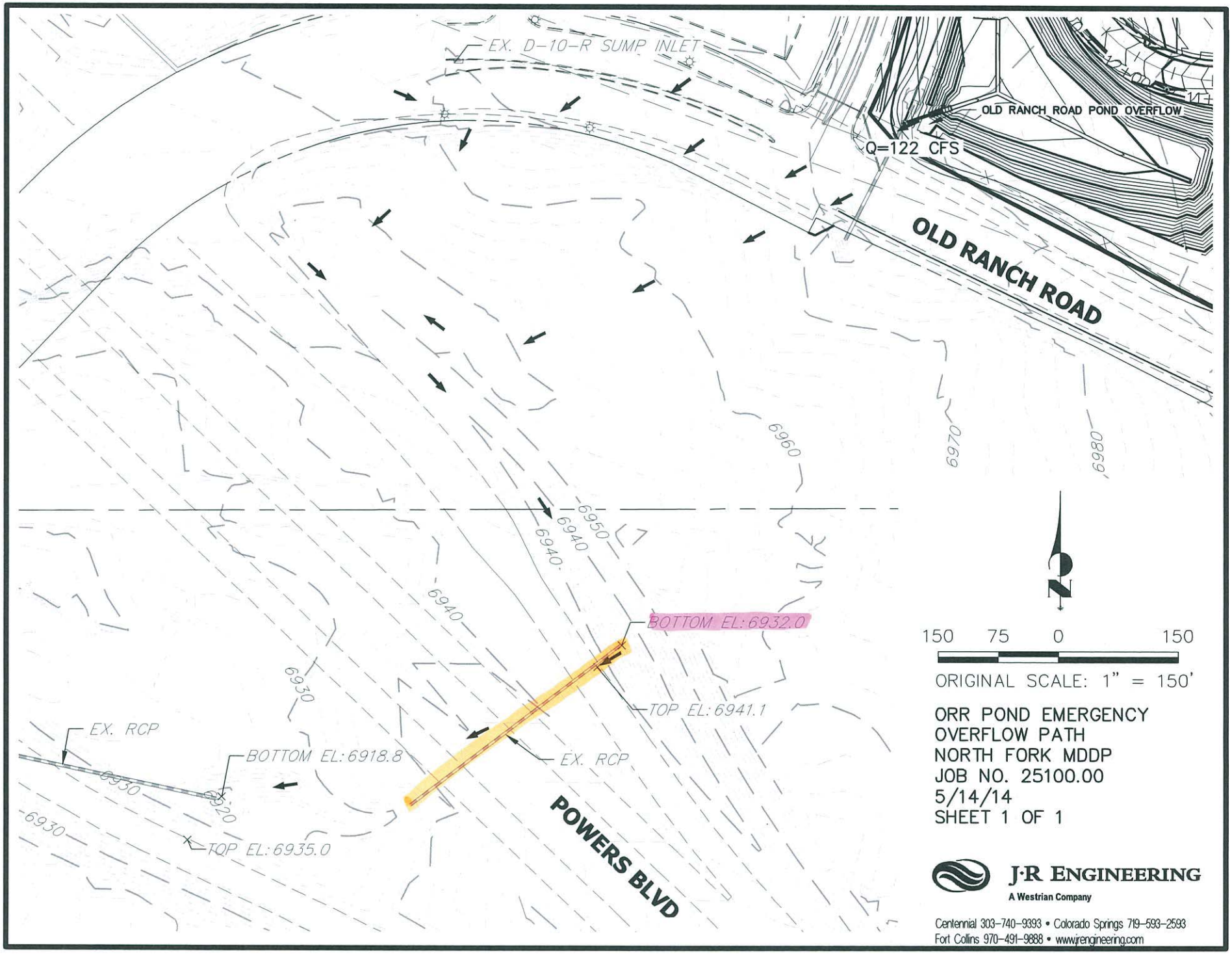
Sub-basin OK-5 consists of 16.50 acres of future commercial development located in the western portion of the site. The area generates runoff rates of Q(5) = 41.6 cfs and Q(100) = 79.2 cfs and are routed to detention pond DF-6.

Sub-basin OK-6 consists of 5.25 acres of dedicated open space where detention facility DF-6 is located. The area generates runoff rates of Q(5) = 1.0 cfs and Q(100) = 7.2 cfs that are collected by detention facility DF-6. Allowable discharge rates for this detention facility have been established by the Kettle Creek DBPS. The table below summarizes the flowrates discharged into Kettle Creek under fully developed conditions and the allowable discharge rates.

Table 4.5
Allowable and Proposed Discharge Rates for Detention Facility 6

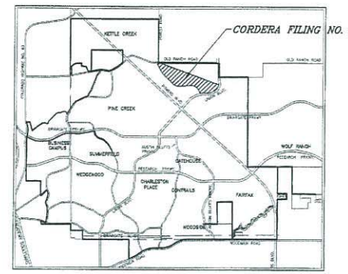
Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
2-year	60.2 cfs	44.3 cfs	45 cfs
5-year	102.1 cfs	57.1 cfs	60 cfs
10-year	149.1 cfs	64.6 cfs	66 cfs
25-year	243.0 cfs	74.4 cfs	75 cfs
50-year	315.9 cfs	79.8 cfs	81 cfs
100-year	394.7 cfs	84.5 cfs	86 cfs

Sub-basin OK-7 consists of 26.76 acres of future commercial development located in the northwestern portion of the site. The area generates runoff rates of Q(5) = 57.8 cfs and Q(100) = 118.5 cfs that are routed to an existing 72" RCP located underneath Powers Boulevard. Sub-basin OK-7 is located within sub-basin D13 of the Kettle Creek DBPS (Fully Developed Condition Basin Map). Sub-basin D13 consisted of 42.9 acres that generated flowrates of Q(5) = 115 cfs and Q(100) = 219 cfs. To compare, OK-7 generates 2.16 cfs/acre and 4.43 cfs/acre for the minor and major storm events, while D13 generated 2.68 cfs/acre and 5.10 cfs/acre for the minor and major storm events. Once sub-basin OK-7 is developed, the development plan must comply with this drainage report or the cfs/acre per the Kettle Creek DBPS.


EX. D-10-R SUMP INLET
OLD RANCH ROAD POND OVERFLOW
Q=122 CFS
OLD RANCH ROAD
6960
6970
6980
6950
6940
6940
6940
6930
BOTTOM EL: 6932.0
TOP EL: 6941.1
EX. RCP
BOTTOM EL: 6918.8
EX. RCP
6930
6920
6930
TOP EL: 6935.0
POWERS BLVD
N
150 75 0 150
ORIGINAL SCALE: 1" = 150'
ORR POND EMERGENCY
OVERFLOW PATH
NORTH FORK MDDP
JOB NO. 25100.00
5/14/14
SHEET 1 OF 1
J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

GRAPHIC SCALE

(IN FEET)
1 inch = 200 ft.



VICINITY MAP

NORTH
N.T.S.

PINE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
J1	(NOT USED)		
J2			OP2,OP3, OP6 OP7
J3	5.58	17.21	PP22, PP23
J4	(NOT USED)		
J5	(NOT USED)		
J6	(NOT USED)		
J7	(NOT USED)		
J8	(NOT USED)		
J9	(NOT USED)		
J10	(NOT USED)		
J11			PP10, PP14,PP15,PP21,OP8,OP9
J12	24.20	238.64	PP16, PP17, DF7
J13	24.41	239.51	PP18, J12
J14	27.77	243.04	PP19, PP27, J13
J15	68.96	297.49	PP20, PP33, J14, J17
J16	14.82	44.05	PP24, PP25, PP26, PP34, PP37
J17	35.86	114.32	PP26, J11, J16
J18	94.91	331.27	PP28, PP31, PP35, PP36, J15, J19
J19	17.11	54.21	PP29, PP30, PP32, PP32A
J20	47.14	308.69	OP11, OP12, DF5
J21	71.54	363.88	OP1, PP1, J1

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
K1	(NOT USED)		
K2	(NOT USED)		
K3	22.84	152.01	KP1, OK1, OK2
K4	(NOT USED)		
K5	6.16	37.43	KP11, KP20
K6	(NOT USED)		
K7	9.91	58.27	KP8, OK3
K8	15.44	89.82	KP10, KP13, KP14, KP15, K7
K9	27.51	166.15	KP12, KP12A, KP26, K3
K10	29.91	172.76	KP19, K9
K11	30.89	175.16	KP18, K10
K12	39.48	216.68	KP17, KP22, K5, K11
K13	60.56	315.99	K12, K15
K14	(NOT USED)		
K15	22.04	101.78	KP16, KP23, KP24, KP25, KP27, K8

LEGEND

- SUB-BASIN BOUNDARY
- 4900 EXISTING CONTOUR
- FLOW DIRECTION
- FLOODPLAIN WAY
- LOT LINE
- DESIGN POINT
- SUB BASIN DESIGNATION
- SUB BASIN CURVE NUMBER
- SUB BASIN AREA (AC.)
- 0.0 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 0.0 100-YEAR STORM EVENT PEAK FLOW (CFS)

DETENTION POND DF-6

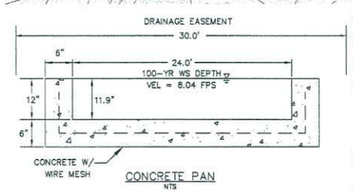
Storm Event	Fully Developed Conditions Peak Inflow (cfs)	Fully Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
5-year	96.3	45.1	45.7
100-year	337.7	301.1	370.0

DETENTION POND DF-6

Storm Event	Fully Developed Conditions Peak Inflow (cfs)	Fully Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
2-year	60.2	44.3	45 cfs
5-year	102.1	57.1	60 cfs
10-year	149.1	64.6	66 cfs
25-year	243	74.4	75 cfs
50-year	315.9	79.8	81 cfs
100-year	394.7	84.5	86 cfs

DETENTION POND DF-7

Storm Event	Fully Developed Conditions Peak Inflow (cfs)	Fully Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
5-year	71.5	23.6	N/A
100-year	363.9	236.0	N/A



CONCRETE PAN
NTS

x-ex-topo
x-Elite-Drainage
x-topoF2B
x-baseF3
X-TOPO-F3
x-utF3
x-utilunion gc
x-utilF2B
x-utilF2A
x-utilF2D1
X-topoF2A
x-topo
x-base-CP
X-BASE
x-topo-union gc

NO.	DATE	DESCRIPTION REVISIONS	BY

NAME: S:\06104.070\dwg\Drainage\DR03-PP-Analysis.dwg
PCP: Matrix.ctb
PLOT DATE: Oct 11, 2007 9:30am

BENCHMARK DATA(ELEV.)
(DATUM)
(DESCRIPTION/LOCATION)

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

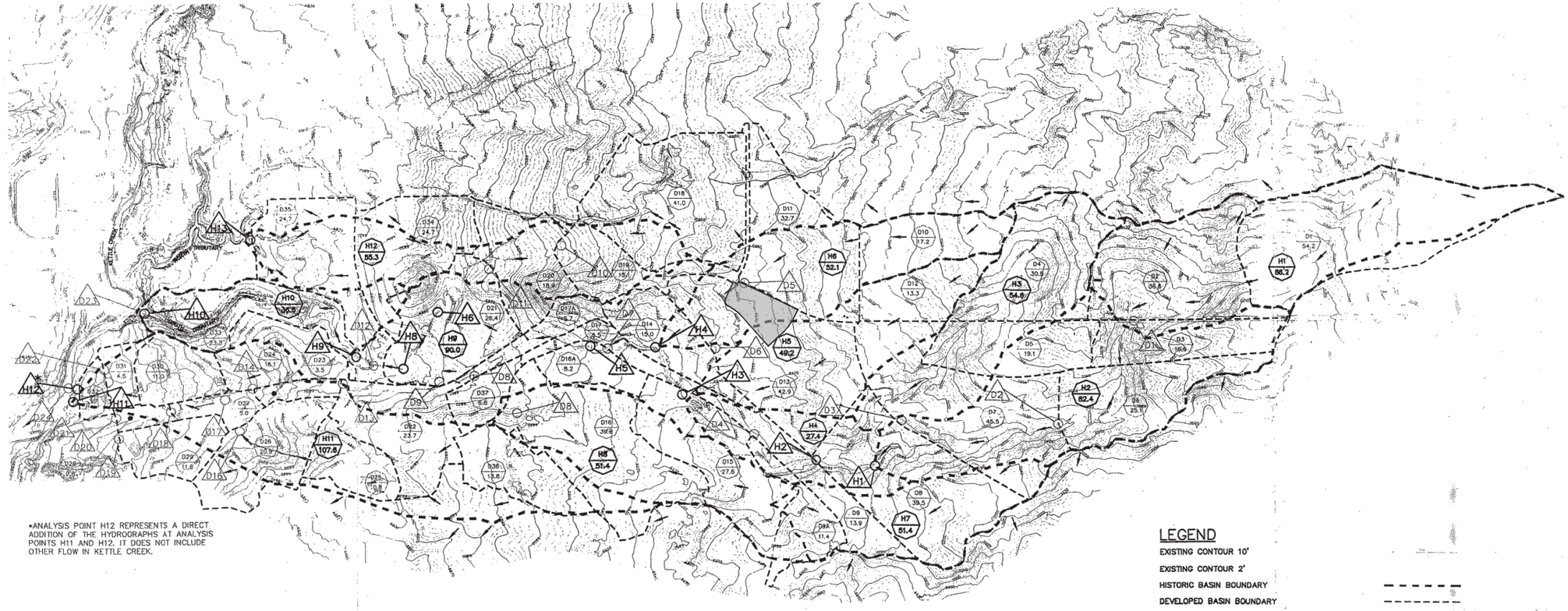
CORDERA FILING NO. 3

MASTER DEVELOPMENT DRAINAGE PLAN

FULLY DEVELOPED DRAINAGE MAP

DESIGNED BY:	BAS	SCALE	DATE ISSUED	OCTOBER 2007	DP03
DRAWN BY:	BAS	HORIZ: 1"=200'			
CHECKED BY:	ROG	VERT: N/A	SHEET NO.	OF SHEETS	

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN
HISTORIC CONDITION DRAINAGE BASIN MAP



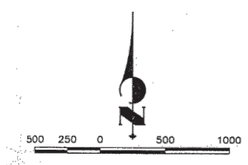
*ANALYSIS POINT H12 REPRESENTS A DIRECT ADDITION OF THE HYDROGRAPHS AT ANALYSIS POINTS H11 AND H12. IT DOES NOT INCLUDE OTHER FLOW IN KETTLE CREEK.

(HISTORIC) UNDEVELOPED CONDITION
BASIN DATA AND FLOW RATE SUMMARY

SUBBASIN ID ⊖	AREA (acres)	AREA (sq mi)	CN	LAG (hrs)	Q10 (cfs)	q10 (cfs/ac)	Q100 (cfs)	q100 (cfs/ac)
H1	86.2	0.135	66	0.420	35	0.4	99	1.1
H2	82.4	0.129	66	0.303	43	0.5	118	1.4
H3	54.6	0.085	66	0.314	27	0.5	76	1.4
H4	27.4	0.043	66	0.188	19	0.7	51	1.9
H5	49.2	0.077	66	0.286	27	0.5	72	1.5
H6	52.1	0.081	66	0.392	22	0.4	62	1.2
H7	37.8	0.059	66	0.359	17	0.4	48	1.3
H8	51.4	0.080	66	0.346	24	0.5	67	1.3
H9	90.0	0.141	66	0.359	47	0.5	130	1.4
H10	36.6	0.057	66	0.215	24	0.7	63	1.7
H11	107.6	0.168	66	0.411	45	0.4	125	1.2
H12	55.3	0.086	66	0.397	23	0.4	65	1.2

(HISTORIC) UNDEVELOPED CONDITION
ANLYSIS POINT WATERSHED AREA AND FLOW RATE SUMMARY

ANALYSIS POINT △	AREA (acres)	AREA (sq mi)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)
H1	166	0.26	11	36	60	105	140	179
H2	224	0.35	14	48	81	144	193	247
H3	301	0.47	18	60	99	181	246	317
H4	352	0.55	22	73	121	217	294	376
H5	352	0.55	22	72	121	216	291	376
H6	352	0.55	22	73	120	215	291	374
H7	90	0.14	7	23	36	60	81	103
H8	442	0.69	27	94	155	274	371	477
H9	531	0.83	31	107	178	320	432	557
H10	570	0.89	32	110	184	331	448	577
H11	109	0.17	9	28	45	76	99	125
H12	678	1.06	37	129	219	398	535	693
H13	58	0.09	5	14	23	40	52	65



LEGEND
- EXISTING CONTOUR 10'
- EXISTING CONTOUR 2'
- HISTORIC BASIN BOUNDARY
- DEVELOPED BASIN BOUNDARY
- DRAINAGE FLOW ARROW
- DEVELOPED BASIN IDENTIFIER / AREA IN ACRES (D15 / 33.2)
- HISTORIC BASIN IDENTIFIER / AREA IN ACRES (H4 / 27.4)
- HISTORIC ANALYSIS POINT (H2)
- DEVELOPED ANALYSIS POINT (H2)

NOTES:
1. PEAK FLOW RATES WERE ESTIMATED WITH HEC-1 COMPUTER MODEL USING THE SCS UNIT HYDROGRAPH METHOD.
2. HISTORIC FLOW RATES WERE ESTIMATED BASED ON AN ASSUMED CONDITION PRIOR TO ANY DEVELOPMENT IN THE WATERSHED. TOPO SHOWN ON THIS MAP REFLECTS SOME CHANGES CAUSED BY DEVELOPMENT. HOWEVER, FLOW PATHS UTILIZED IN THIS ANALYSIS WERE ESTIMATED BASED ON PRE-DEVELOPMENT CONDITIONS TO THE EXTENT POSSIBLE.

SHOPPES AT OLD RANCH STATION

FOR REFERENCE ONLY

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, THEY SHALL BE CONSIDERED PRELIMINARY AND ARE ISSUED ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR

JR ENGINEERING
A Subsidiary of Westrian
4351 Arrowhead Drive • Colorado Springs, CO 80907
719-593-0593 • Fax 719-593-0603
www.jrengineering.com

BY	DATE	No.	REVISION

H-SCALE 1"=500' | V-SCALE N/A | DATE 04/18/01 | DESIGNED BY VSF | DRAWN BY SDG | CHECKED BY

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY

DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN

HISTORIC DRAINAGE BASIN MAP

SHEET 1 OF 1

JOB NO. 8877.10

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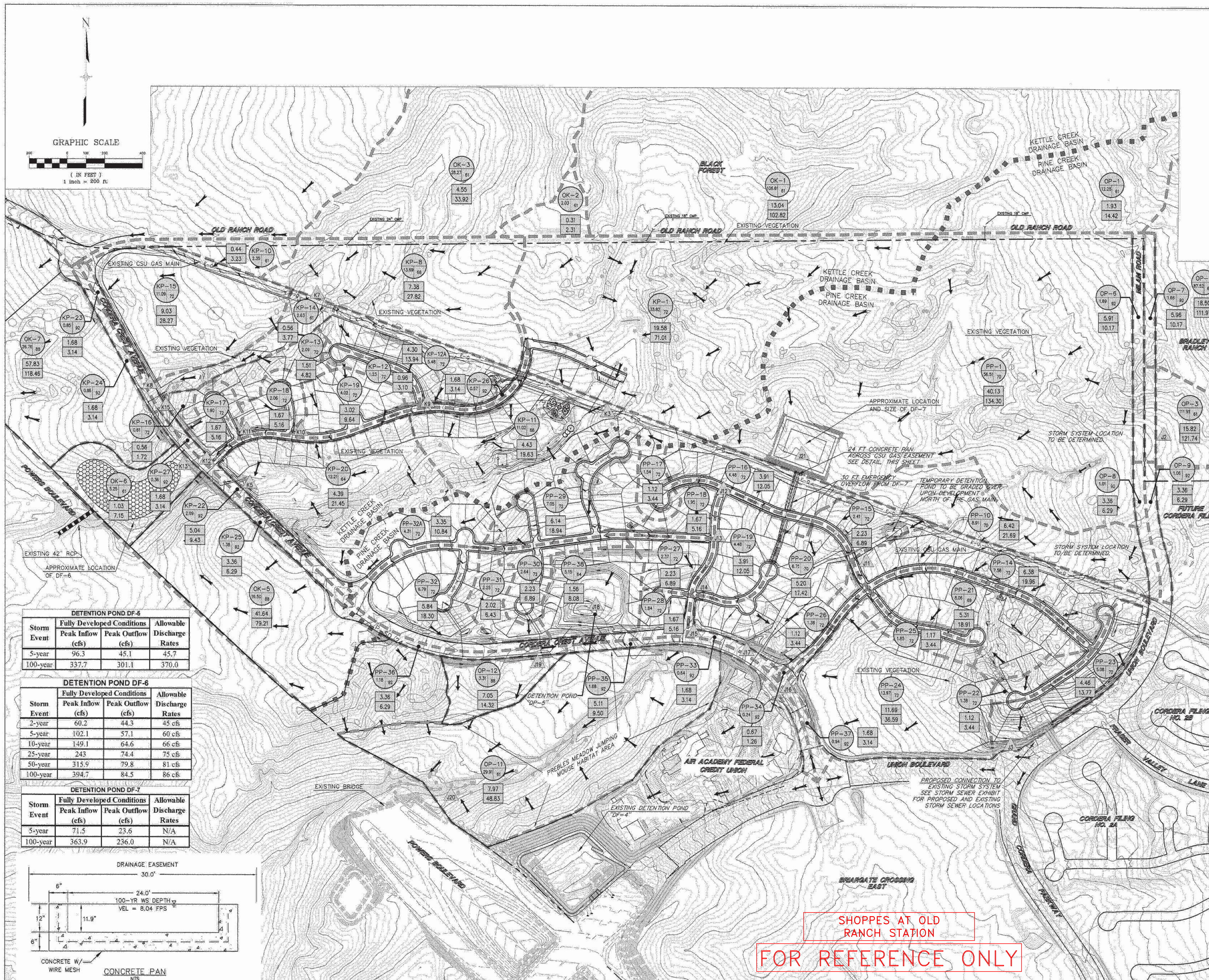
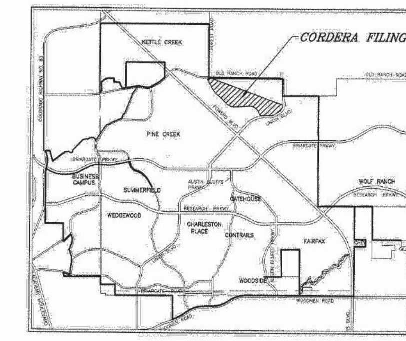
SHEET NO. 3





VICINITY MAP

NORTH
N.T.S.

PINE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
J1	(NOT USED)		
J2			OP2,OP3, OP6 OP7
J3	5.58	17.21	PP22, PP23
J4	(NOT USED)		
J5	(NOT USED)		
J6	(NOT USED)		
J7	(NOT USED)		
J8	(NOT USED)		
J9	(NOT USED)		
J10	(NOT USED)		
J11			PP10, PP14,PP15,PP21,OP8,OP9
J12	24.20	238.64	PP16, PP17, DF7
J13	24.41	239.51	PP18, J12
J14	27.77	243.04	PP19, PP27, J13
J15	68.96	297.49	PP20, PP33, J14, J17
J16	14.82	44.05	PP24, PP25, PP26, PP34, PP37
J17	35.86	114.32	PP26, J11, J16
J18	94.91	331.27	PP28, PP31, PP35, PP36, J15, J19
J19	17.11	54.21	PP29, PP30, PP32, PP32A
J20	47.14	308.69	OP11, OP12, DF5
J21	71.54	363.88	OP1, PP1, J1

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
K1	(NOT USED)		
K2	(NOT USED)		
K3	22.84	152.01	KP1, OK1, OK2
K4	(NOT USED)		
K5	6.16	37.43	KP11, KP20
K6	(NOT USED)		
K7	9.91	58.27	KP8, OK3
K8	15.44	89.82	KP10, KP13, KP14, KP15, K7
K9	27.51	166.15	KP12, KP12A, KP26, K3
K10	29.91	172.76	KP19, K9
K11	30.89	175.16	KP18, K10
K12	39.48	216.68	KP17, KP22, K5, K11
K13	60.56	315.99	K12, K15
K14	(NOT USED)		
K15	22.04	101.78	KP16, KP23, KP24, KP25, KP27, K8

LEGEND

- SUB-BASIN BOUNDARY
- 4900 — EXISTING CONTOUR
- FLOW DIRECTION
- FLOODPLAIN WAY
- LOT LINE
- DESIGN POINT
- SUB BASIN DESIGNATION
- SUB BASIN CURVE NUMBER
- SUB BASIN AREA (AC.)
- 0.0 — 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 0.0 — 100-YEAR STORM EVENT PEAK FLOW (CFS)

DETENTION POND DF-5

Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
5-year	96.3	45.1	45.7
100-year	337.7	301.1	370.0

DETENTION POND DF-6

Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
2-year	60.2	44.3	45 cfs
5-year	102.1	57.1	60 cfs
10-year	149.1	64.6	66 cfs
25-year	243	74.4	75 cfs
50-year	315.9	79.8	81 cfs
100-year	394.7	84.5	86 cfs

DETENTION POND DF-7

Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
5-year	71.5	23.6	N/A
100-year	363.9	236.0	N/A

CONCRETE PAN
NTS

NO.	DATE	DESCRIPTION	BY

REVISIONS

BENCHMARK DATA(ELEV.)
(DATUM)
(DESCRIPTION/LOCATION)

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

CORDERA FILING NO. 3

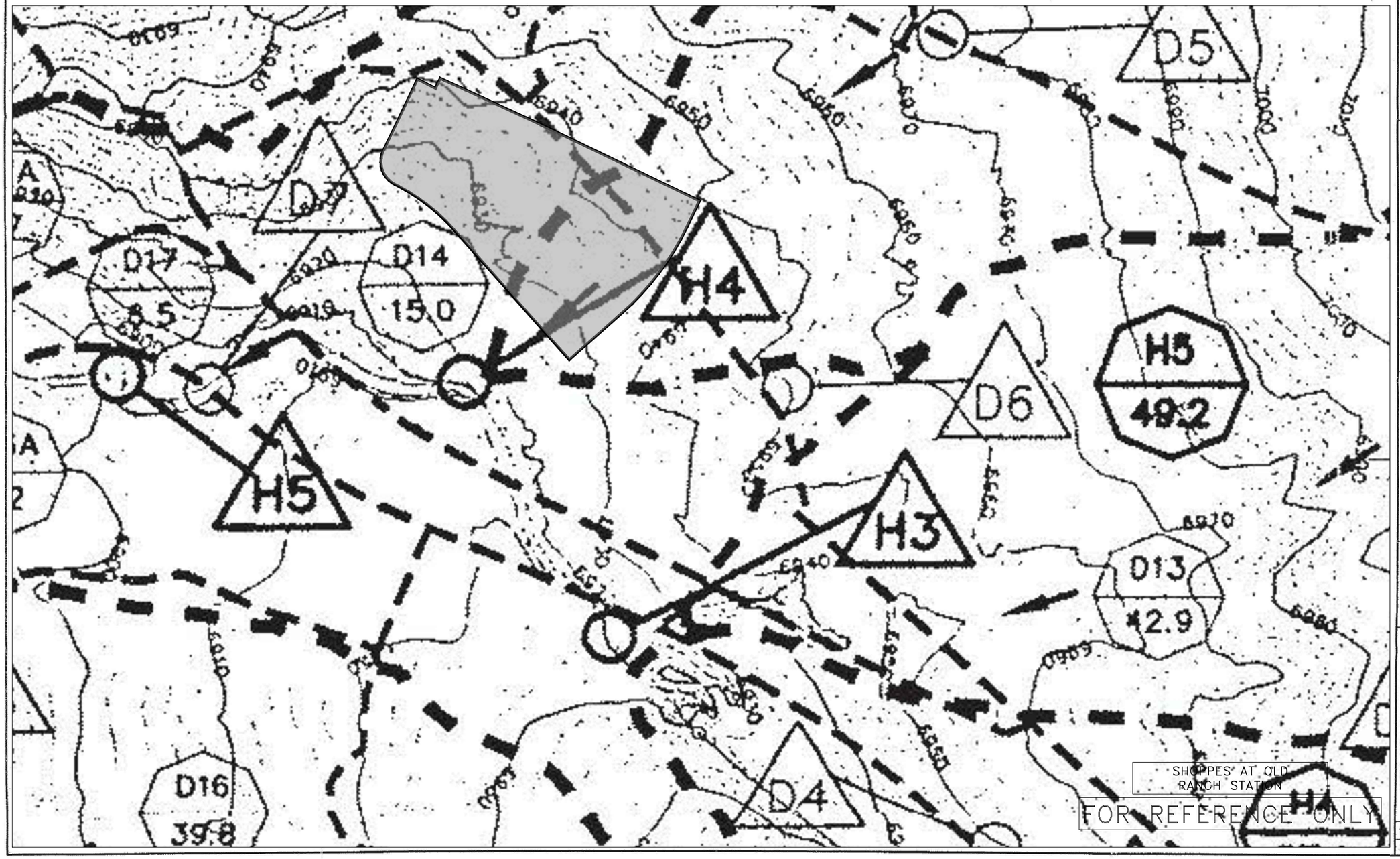
MASTER DEVELOPMENT DRAINAGE PLAN

FULLY DEVELOPED DRAINAGE MAP

DESIGNED BY: BAS — DRAWN BY: BAS — CHECKED BY: RGG
SCALE HORIZ: 1"=200' VERT: N/A
DATE ISSUED: OCTOBER 2007
SHEET NO. OF SHEETS
DP03

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN

HISTORIC CONDITION DRAINAGE BASIN MAP



UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AUTHORITIES, THEY ARE NOT APPROVED FOR CONSTRUCTION ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR

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BY	DATE	No.	REVISION

H-SCALE	1"=500'
V-SCALE	N/A
DATE	04/18/01
DESIGNED BY	VSF
DRAWN BY	SDC
CHECKED BY	

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN
HISTORIC DRAINAGE BASIN MAP

SHEET 1 OF 1
JOB NO. 8877.10

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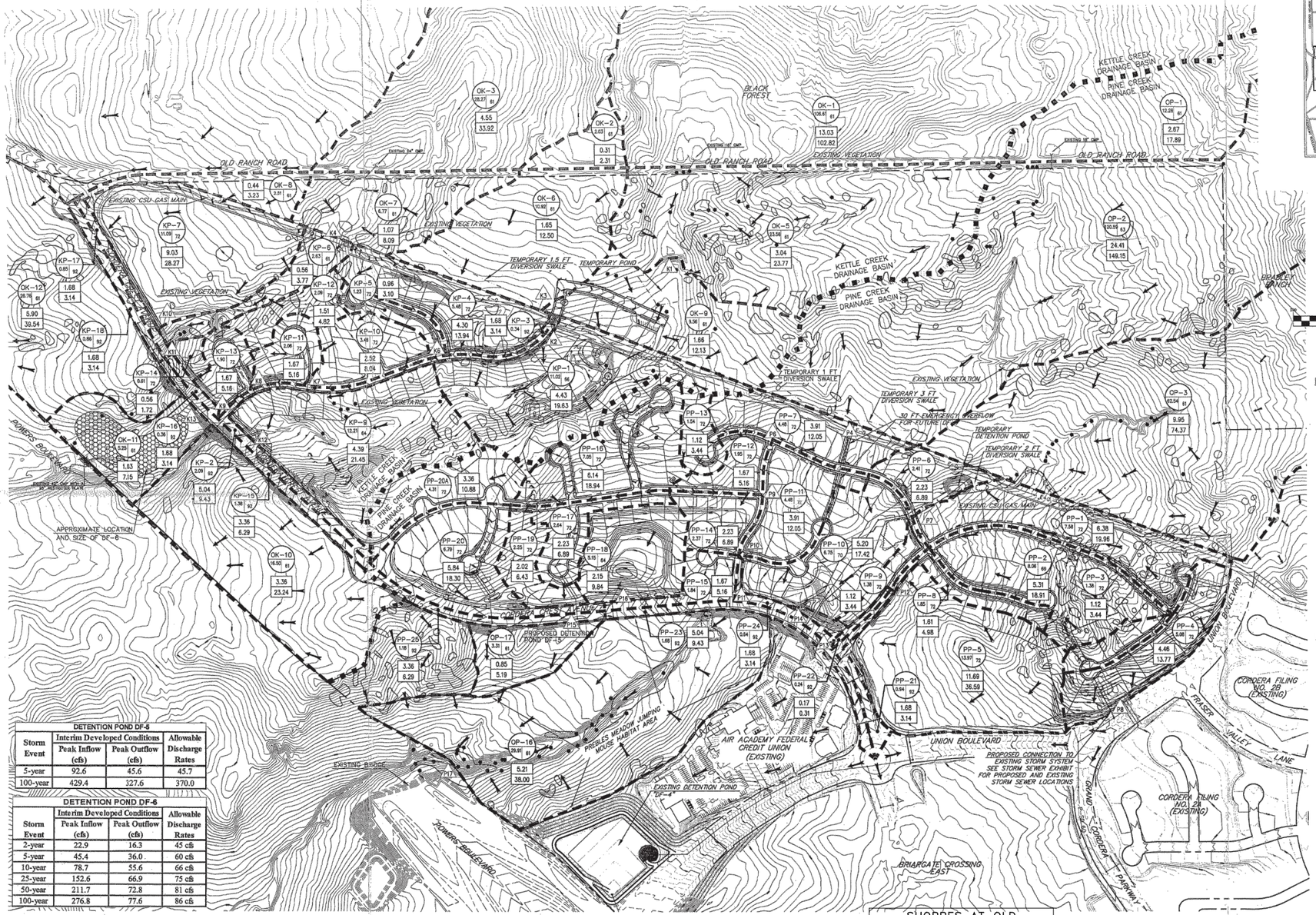
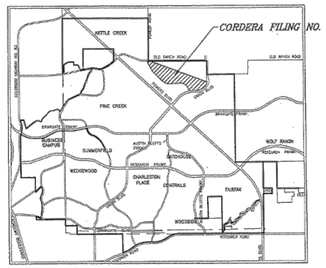


DETENTION POND DF-5			
Storm Event	Interim Developed Conditions Peak Inflow (cfs)	Interim Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
5-year	92.6	45.6	45.7
100-year	429.4	327.6	370.0

DETENTION POND DF-6			
Storm Event	Interim Developed Conditions Peak Inflow (cfs)	Interim Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
2-year	22.9	16.3	45 cfs
5-year	45.4	36.0	60 cfs
10-year	78.7	55.6	66 cfs
25-year	152.6	66.9	75 cfs
50-year	211.7	72.8	81 cfs
100-year	276.8	77.6	86 cfs



VICINITY MAP

N

NORTH
N.T.S.

GRAPHIC SCALE

(IN FEET)
1 inch = 200 ft.

PINE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
P1	(NOT USED)		
P2	(NOT USED)		
P3	(NOT USED)		
P4	24.91	166.33	OP1, OP2
P5	(NOT USED)		
P6	26.51	174.49	PP7, PP13, P4
P7	19.07	111.55	OP3, PP1, PP2, PP6
P8	5.58	17.21	PP3, PP4
P9	27.06	176.92	PP12, P6
P10	29.39	186.93	PP11, PP14, P9
P11	66.16	352.95	PP24, P10, P14
P12	2.73	8.42	PP8, PP9
P13	16.06	48.25	PP5, PP21, PP22, P12
P14	38.36	171.90	PP10, P7, P13
P15	17.12	54.19	PP16, PP17, PP20, PP20A
P16	74.53	372.20	PP15, PP19, PP23, PP25, P11
P17	47.94	359.98	OP16, OP17, DF5

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
K1	15.96	126.13	OK1, OK5
K2	18.42	148.09	OK9, K1, K3
K3	1.79	14.65	OK2, OK6
K4	5.61	41.94	OK3, OK7
K5	(NOT USED)		
K6	20.39	158.22	KP3, KP4, KP5, K2
K7	21.08	161.77	KP10, K6
K8	21.33	163.04	KP11, K7
K9	26.77	194.45	KP2, KP13, K8, K12
K10	11.95	72.85	OK8, KP6, KP7, K4
K11	19.89	85.71	KP14, KP15, KP16, KP17, KP18, K10
K12	7.65	39.24	KP1, KP9
K13	44.49	270.77	K9, K11

LEGEND

- SUB-BASIN BOUNDARY
- 4900 EXISTING CONTOUR
- FLOW DIRECTION
- FLOODPLAIN WAY
- LOT LINE
- DESIGN POINT
- SUB BASIN DESIGNATION
- SUB BASIN CURVE NUMBER
- SUB BASIN AREA (AC.)
- 6.0 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 6.0 100-YEAR STORM EVENT PEAK FLOW (CFS)

SHOPPES AT OLD RANCH STATION

FOR REFERENCE ONLY

x-title-drainage
x-topoF2B
x-vege
x-baseF3
x-ex-topo
X-TOPO-F3
x-topo-union goordera
X-topoF2A
x-utl-union gc
x-utlF3
X-BASE
x-base-CP
x-topo
X-BASE Cordera Crest

NO.	DATE	DESCRIPTION	BY
		REVISIONS	

NAME: S:\06.104.070\dwg\Drainage\DR02.dwg
POP: Matrix.ctb
PLOT DATE: Aug 24, 2007 1:20pm

BENCHMARK DATA(ELEV.)
(DATUM)
(DESCRIPTION/LOCATION)

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
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CORDERA FILING NO. 3

MASTER DEVELOPMENT DRAINAGE PLAN

INTERIM DEVELOPED DRAINAGE MAP

DESIGNED BY:	BAS	SCALE		DATE ISSUED:	AUGUST 2007
DRAWN BY:	BAS	HORIZ:	1"=200'		
CHECKED BY:	RGG	VERT:	N/A	SHEET NO. OF SHEETS	DP02

SOUTH TRIBUTARY

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN
FULLY DEVELOPED CONDITION BASIN MAP AND MASTER PLAN

KEYED NOTES

1. ANALYSIS POINT D24 REPRESENTS A DIRECT ADDITION OF THE HYDROGRAPHS AT ANALYSIS POINT D23 AND THE OUTLET HYDROGRAPH FROM THE CREEKSIDE ESTATES REGIONAL DETENTION FACILITY. IT DOES NOT REFLECT ANY OTHER FLOW IN KETTLE CREEK.
2. NATURAL CHANNEL IS PROPOSED TO BE ELIMINATED IN THIS AREA. STORM WATER TO BE CONVEYED IN A PROPOSED STORM DRAIN.
3. REMOVE EXISTING EMBANKMENT DOWN TO LEVEL OF PERMANENT POOL. PROTECT REMAINING EMBANKMENT IF PRUDENT TO DO SO IN ORDER TO PROTECT AGAINST EXCESSIVE EROSION.
4. NATURAL CHANNEL PROPOSED TO REMAIN UNIMPROVED IN THIS AREA.
5. DETENTION FACILITY OUTLET AND SPILLWAY ARE PROPOSED TO BE REVISED.

GENERAL NOTES:

1. PROPOSED STORM DRAINS SHOWN ON THIS PLAN ARE ONLY INTENDED TO INDICATE GENERAL LOCATIONS AND APPROXIMATE SIZES OF FUTURE FACILITIES. ACTUAL STORM DRAIN SIZES AND LOCATIONS SHALL BE DETERMINED WITH MORE DETAILED ANALYSIS AT THE TIME OF DETAILED DESIGN OF THE FACILITIES. IT IS LIKELY THAT ADDITIONAL FACILITIES NOT SHOWN ON THIS PLAN WILL BE REQUIRED.
2. PROPOSED DETENTION FACILITIES SHOWN ON THIS PLAN ARE ONLY INTENDED TO INDICATE GENERAL LOCATIONS AND LAND AREA REQUIRED FOR THESE FACILITIES. ACTUAL LOCATIONS AND LAND AREA REQUIRED SHALL BE DETERMINED AT THE TIME OF DETAILED DESIGN OF THE FACILITIES.
3. EXCEPT AS OTHERWISE NOTED, THIS PLAN SHALL NOT MODIFY THE REQUIREMENTS OF PREVIOUSLY APPROVED MASTER DEVELOPMENT DRAINAGE PLANS AND FINAL DRAINAGE REPORTS.

SUB-BASIN DATA SUMMARY
FULLY DEVELOPED CONDITION

SUB BASIN I.D.	AREA (sq miles)	AREA (acres)	PERCENT IMPERVIOUS	CN	LAG (hours)	Q5 (cfs)	Q100 (cfs)
D1	0.085	54.2	5.0	67.5	0.383	17	72
D2	0.057	36.6	10.0	69.0	0.225	20	72
D3	0.026	16.6	13.3	70.2	0.207	13	40
D4	0.048	30.5	9.2	68.2	0.245	14	56
D5	0.030	19.1	30.3	74.5	0.238	16	47
D6	0.039	25.1	42.7	79.2	0.164	34	88
D7	0.071	45.5	49.8	79.8	0.173	62	157
D8	0.062	39.5	72.5	82.2	0.111	111	208
D9	0.022	13.9	41.1	77.0	0.091	14	37
D9A	0.018	11.4	31.8	74.5	0.213	10	30
D10	0.027	17.2	8.3	68.0	0.309	7	27
D11	0.051	32.7	29.6	74.2	0.231	27	81
D12	0.021	13.3	34.2	74.8	0.229	10	31
D13	0.067	42.9	72.6	81.5	0.123	115	219
D14	0.023	15.0	38.7	78.0	0.158	19	49
D15	0.042	27.6	31.0	75.0	0.209	26	75
D16	0.062	39.8	21.7	72.5	0.197	31	98
D16A	0.013	8.2	36.0	78.0	0.143	11	28
D17	0.013	8.5	37.5	78.5	0.117	10	25
D17A	0.011	6.7	80.9	93.0	0.120	21	58
D18	0.064	41.0	33.0	76.3	0.222	38	108
D19	0.024	15.1	40.4	80.9	0.122	23	59
D20	0.030	18.9	80.4	95.5	0.108	62	107
D21	0.041	26.4	62.5	86.5	0.137	56	117
D22	0.037	23.7	40.9	78.5	0.156	31	81
D23	0.005	3.5	58.7	88.0	0.110	8	15
D24	0.025	16.1	75.7	74.5	0.151	16	48
D25	0.017	10.8	53.2	82.2	0.156	18	42
D26	0.033	20.9	30.0	75.5	0.145	24	66
D27	0.008	5.0	45.3	80.0	0.123	8	19
D28	0.004	2.8	49.6	84.0	0.137	5	11
D29	0.018	11.6	37.8	78.2	0.146	15	40
D30	0.017	11.0	25.5	74.4	0.157	11	32
D31	0.007	4.5	40.0	78.5	0.146	6	16
D32	0.006	3.7	5.0	68.0	0.114	3	9
D33	0.036	23.3	10.4	70.2	0.138	16	59
D34	0.039	24.7	36.5	77.0	0.159	30	80
D35	0.039	24.7	40.0	78.0	0.161	32	83
D36	0.024	15.2	19.5	72.0	0.237	16	34
D37	0.011	6.8	93.1	99.0	0.124	23	40
TOTAL	1.265	812.0					

ANALYSIS POINT DATA SUMMARY
FULLY DEVELOPED CONDITION

ANALYSIS POINT	WATERSHED AREA (acres)	WATERSHED AREA (sm)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)	POINT DESCRIPTION
D1	30.8	0.14	11	31	48	79	102	127	TOTAL FLOW
DFA	107.4	0.17	17	44	66	105	134	165	TOTAL POND INFLOW
D2	132.5	0.21	30	64	81	101	116	131	TOTAL FLOW
DFB	49.6	0.08	13	30	44	68	85	103	TOTAL POND INFLOW
D3	227.6	0.36	73	148	198	254	291	330	TOTAL FLOW
DFC	267.1	0.42	139	237	311	405	465	524	TOTAL POND INFLOW
D4	278.5	0.44	47	84	73	85	93	102	TOTAL FLOW
D5	63.2	0.10	19	40	58	88	110	133	TOTAL FLOW
D6	106.1	0.17	50	91	141	178	238	280	TOTAL FLOW
D7	441.1	0.69	153	244	311	418	492	567	TOTAL FLOW
D7A	447.6	0.70	164	263	335	451	532	614	TOTAL FLOW
D8	502.3	0.78	191	310	398	538	637	739	TOTAL FLOW
D9	524.3	0.82	208	337	433	585	692	803	TOTAL FLOW
D10	56.1	0.09	15	25	32	44	54	65	TOTAL FLOW
D11	75.0	0.12	20	35	45	60	73	87	TOTAL FLOW
DFE	625.7	0.98	299	470	596	796	935	1079	TOTAL POND INFLOW
D12	**	0.98	9	77	148	297	417	525	OUTFLOW TO NAT. CHANNEL
D13	+ 649.4	1.02	55	79	95	118	132	148	TOTAL FLOW
D14	+ 652.9	1.02	58	84	101	127	144	161	TOTAL FLOW
DFF	+ 659.0	1.05	65	100	123	159	184	208	TOTAL POND INFLOW
D15	+ 31.7	0.05	23	41	55	77	92	108	TOTAL FLOW
D17	+ 700.7	1.10	48	59	64	85	101	117	TOTAL FLOW
D18	+ 705.7	1.10	49	59	72	98	116	135	TOTAL FLOW
D19	+ 11.6	0.02	8	15	22	20	20	20	INTERCEPTED FLOW
D20	+ 720.1	1.13	49	74	97	125	145	165	TOTAL FLOW
D21	+ 731.1	1.14	49	84	111	146	171	196	TOTAL FLOW IN STORM DRAIN
D22	+ 735.8	1.15	52	90	119	158	186	211	TOTAL FLOW
DFG	+ 739.3	1.16	53	93	123	164	192	221	TOTAL POND INFLOW
D23	**	0.04	9	80	152	307	440	544	TOTAL FLOW
D24	762.6	1.19	40	111	188	348	501	630	TOTAL FLOW FROM "DFG" & D23
DFG	49.4	0.08	33	60	81	115	138	162	TOTAL POND INFLOW

* WATERSHED AREAS DO NOT REFLECT THE TRIBUTARY AREA REDUCTION DUE TO THE DIVERSION OF FLOW Q's ARE COMPUTED BASED ON THE ACTUAL BASIN AREAS.

** PEAK FLOW DIVERTED TO NATURAL CHANNEL DURING INFREQUENT RUNOFF EVENTS.

LEGEND

- 5560 — EXISTING CONTOUR 10'
- EXISTING CONTOUR 2'
- DEVELOPED BASIN BOUNDARY
- EXISTING STORM DRAIN
- 48" — ESTIMATED STORM DRAIN SIZE PROPOSED STORM DRAIN
- RBC — PROPOSED REINFORCED BOX CULVERT
- DRAINAGE DIRECTION
- D8 / 39.5 — BASIN IDENTIFIER / BASIN AREA (ACRES)
- D4 — ANALYSIS POINT
- ① — KEYED NOTE REFERENCE

DETENTION FACILITY DATA SUMMARY

DETENTION FACILITY I.D.	PEAK INFLOW (CFS) Q2	Q5	Q10	Q25	Q50	Q100	PEAK OUTFLOW (CFS) Q2	Q5	Q10	Q25	Q50	Q100	ESTIMATED PEAK STORAGE (ACRE-FEET) V2	V5	V10	V25	V50	V100
A	17	44	66	105	134	165	17	38	45	54	60	65	0	0.1	1	2	3	4
B	13	30	44	68	85	103	13	30	39	47	52	57	0	0.0	0.1	0.4	1	1
C	139	237	311	405	465	524	45	60	66	75	81	85	3	7	10	14	18	21
E	289	470	596	796	935	1079	60	137	213	366	489	600	11	18	19	23	25	28
F	66	100	123	159	184	208	48	57	61	66	71	76	8	8	8	8	8	9
G	33	60	81	115	138	162	2	11	23	31	36	41	1	2	2	3	4	4
CREEKSIDE	53	93	123	164	192	221	37	55	61	73	79	90	3	5	5	5	5	5
P.C. HIGH SCHOOL	19	38	51	74	90	106	1	6	14	29	33	38	1	1	2	2	3	3

PREPARED FOR

J.R. ENGINEERING
A Subsidiary of Wantzen
430 Arrowfield Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6815
www.jrengineering.com

No.	REVISED ROYAL PINE DRIVE STORM SEWER AT POWERS RAMP "D"	BY	DATE
1		VSF	10/2002

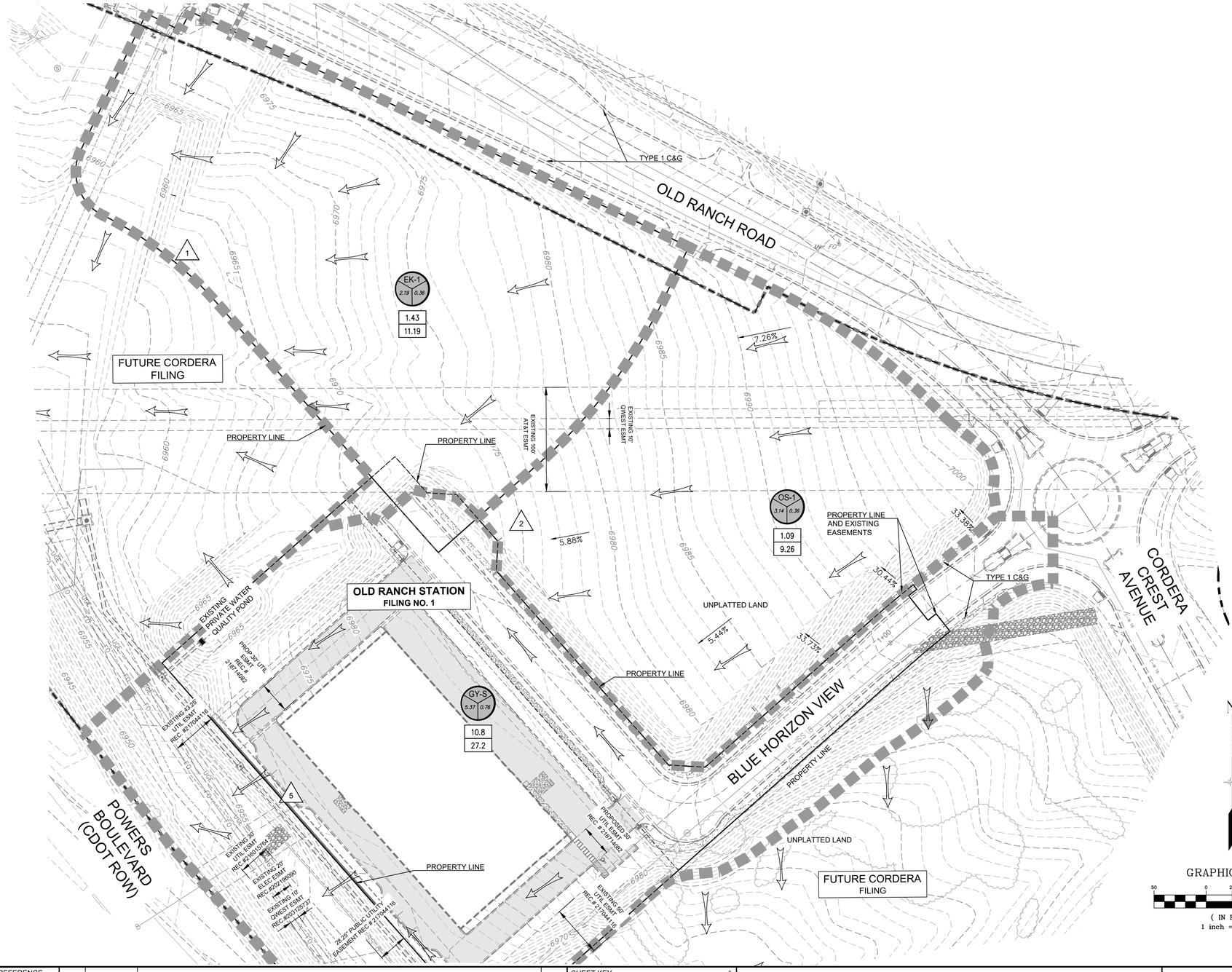
H-SCALE 1"=400' | V-SCALE N/A | DATE 03/26/01 | DESIGNED BY VSF | DRAWN BY ELY | CHECKED BY

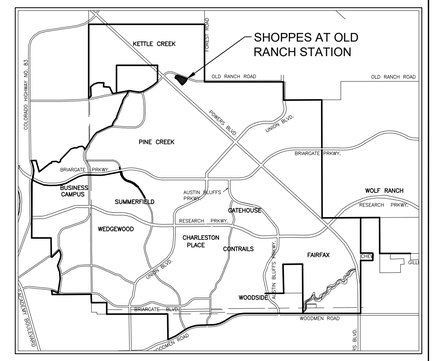
KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN
FULLY DEVELOPED CONDITION BASIN MAP AND MASTER PLAN

SHEET 1 OF 1

JOB NO. 28877.10

811 Know what's **below.** **Call** before you dig.





VICINITY MAP

NORTH
N.T.S.

LEGEND

- SUB-BASIN BOUNDARY
- 4900 EXISTING CONTOUR
- FLOW DIRECTION
- PROPERTY LINE
- LOT LINE
- FLOODPLAIN WAY
- TIME OF CONCENTRATION PATHS
- x DESIGN POINT
- X / x.xx / x.xx SUB BASIN DESIGNATION / SUB BASIN CURVE NUMBER / SUB BASIN AREA (AC.)
- 0.0 / 0.0 5-YEAR STORM EVENT PEAK FLOW (CFS) / 100-YEAR STORM EVENT PEAK FLOW (CFS)

KETTLE CREEK SUMMARY TABLE

BASIN ID	AREA (AC.)	Q(5) (CFS)	Q(100) (CFS)
EK-1	3.47	1.43	11.19
OS-1	3.14	1.09	9.26
GY-S	5.03	10.8	27.2

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	AREA (AC.)	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
1	3.47	1.43	11.19	EK-1
2	3.14	1.09	9.26	OS-1
5	5.03	10.8	27.2	GY-S

REFERENCE DRAWINGS

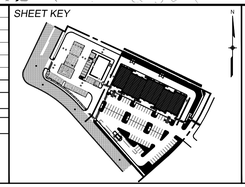
No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT

FILE NAME: S:\18.1036.001 (Shops at Cordera)\200 Drainage\204 DWG\DR01.dwg
CTB FILE: ----
PLOT DATE: 11/7/2018 11:09 AM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

SHEET KEY



PREPARED BY:
Matrix DESIGN GROUP
2435 Research Parkway, Suite
300 Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

SEAL

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 18.1036.001

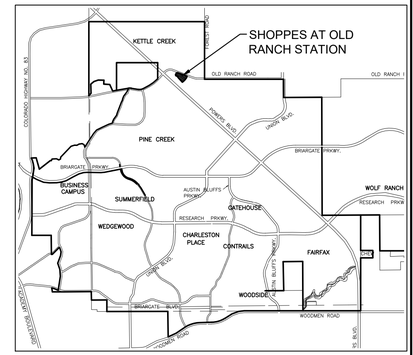
SHOPPES AT OLD RANCH STATION

CITY OF COLORADO SPRINGS

EXISTING CONDITIONS

DESIGNED BY:	BAS	SCALE		DATE ISSUED: November 8	DRAWING No.
DRAWN BY:	BAS	HORIZ.	1"=50'		
CHECKED BY:	GGS	VERT.	N/A	SHEET 1 OF 2	DR01

811 Know what's below. Call before you dig.



VICINITY MAP

NORTH
N.T.S.

LEGEND

- SUB-BASIN BOUNDARY
- 4900 EXISTING CONTOUR
- FLOW DIRECTION
- PROPERTY LINE
- LOT LINE
- FLOODPLAIN WAY
- TIME OF CONCENTRATION PATHS
- x DESIGN POINT
- X / x.xx / x.xx SUB BASIN DESIGNATION / SUB BASIN CURVE NUMBER / SUB BASIN AREA (AC.)
- 0.0 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 0.0 100-YEAR STORM EVENT PEAK FLOW (CFS)

KETTLE CREEK SUMMARY TABLE

BASIN ID	AREA (AC.)	Q(5) (CFS)	Q(100) (CFS)
PK-1	0.56	1.9	4.3
PK-2	1.50	5.0	11.5
PK-3	0.29	1.0	2.2
PK-4	0.59	2.0	4.5
PK-5	0.55	2.0	4.6
PK-6	0.53	2.0	4.4

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	AREA (AC.)	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
1	0.56	1.9	4.3	PK-1
2	1.50	5.0	11.5	PK-2
3	2.06	6.9	15.8	PK-1, PK-2
4	0.59	2.0	4.5	PK-4
5	0.88	2.9	6.7	PK-4, PK-3
6	0.88	2.9	6.7	PK-4, PK-3
7	0.55	2.0	4.6	PK-5
8	1.08	4.0	9.0	PK-5, PK-6
9	2.94	6.4	13.2	DP3, DP6
10	2.94*	40.4	125.2	ORR*, DP9
11	1.07	2.3	4.7	OS-2
12	7.21*	51.3	148.3	DP8, DP10*, DP11

REFERENCE DRAWINGS

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT

FILE NAME: S:\18.1036.001 (Shops at Cordera)\200 Drainage\204 DWG\DR02-BAS.dwg
CTB FILE: ----
PLOT DATE: 5/16/2019 1:07 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

SHEET KEY

PREPARED BY:
Matrix DESIGN GROUP
2435 Research Parkway, Suite
300 Colorado Springs, CO 80920
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Fax 719-575-0208

SEAL

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 18.1036.001

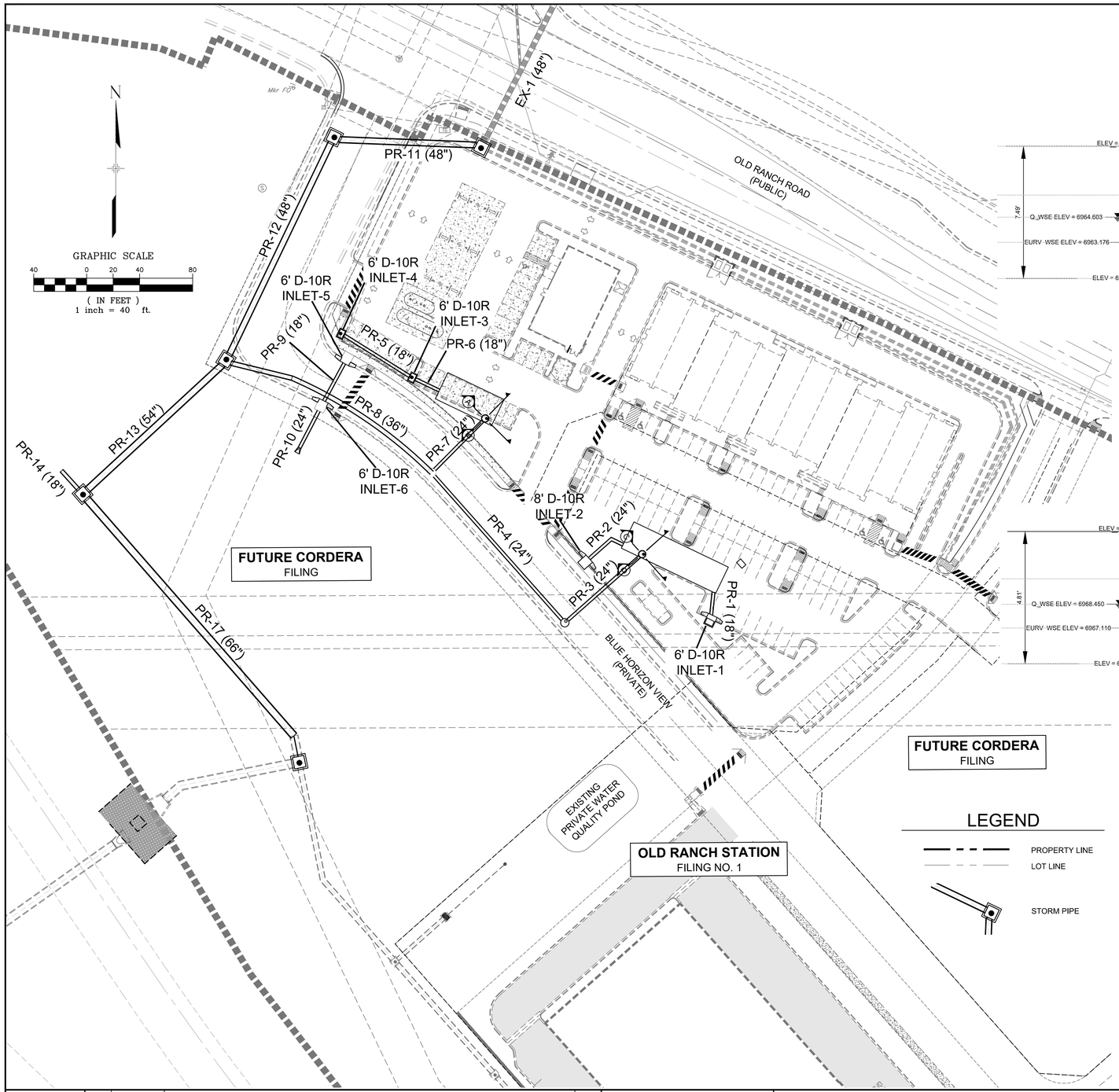
SHOPPES AT OLD RANCH STATION

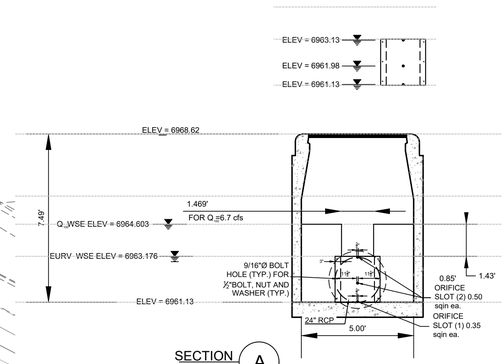
CITY OF COLORADO SPRINGS

FULLY DEVELOPED CONDITIONS

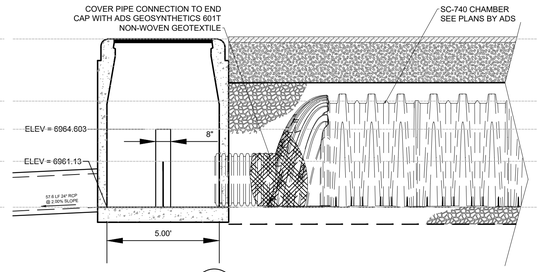
DESIGNED BY:	BAS	SCALE		DATE ISSUED:	November 18
DRAWN BY:	BAS	HORIZ.	1"=40'	DRAWING No.	DR02
CHECKED BY:	GGS	VERT.	N/A	SHEET	2 OF 2

Know what's below. Call before you dig.

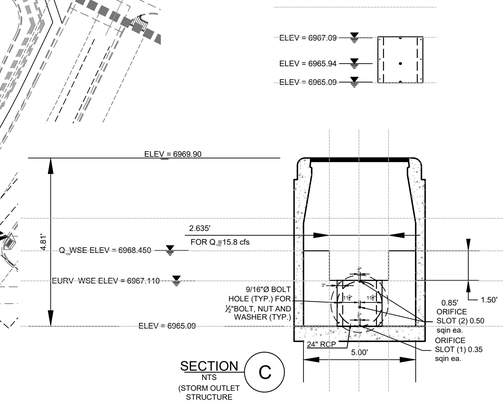




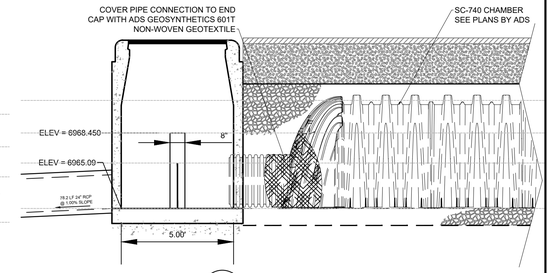
SECTION A
NTS
(STORM OUTLET STRUCTURE SEE THIS SHEET)



SECTION B
NTS
(STORM OUTLET STRUCTURE SEE THIS SHEET)



SECTION C
NTS
(STORM OUTLET STRUCTURE SEE THIS SHEET)



SECTION D
NTS
(STORM OUTLET STRUCTURE SEE THIS SHEET)

STORM PIPE SUMMARY TABLE

PIPE LABEL	PIPE DIAMETER (IN)	PIPE LENGTH (FT)
PR-1	18"	21
PR-2	24"	37
PR-3	24"	78
PR-4	24"	152
PR-5	18"	59
PR-6	18"	21
PR-7	24"	58
PR-8	36"	170
PR-9	18"	41
PR-10	24"	17
PR-11	48"	97
PR-12	48"	186
PR-13	54"	194
PR-14	18"	285
PR-17	66"	61

STORM INLET SUMMARY TABLE

INLET LABEL	INLET OPENING (FT)	FLOW CAPTURED (CFS)
INLET-1 (D10R)	6'	4.3
INLET-2 (D10R)	8'	11.5
INLET-3 (D10R)	6'	2.2
INLET-4 (D10R)	6'	4.5
INLET-5 (D10R)	6'	4.8
INLET-6 (D10R)	6'	4.4

LEGEND

PROPERTY LINE
LOT LINE
STORM PIPE

REFERENCE DRAWINGS

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT

FILE NAME: S:\18.1036.001 (Shops at Cordera)\200 Drainage\204 DWG\DR03.dwg
CTB FILE: ----
PLOT DATE: 5/16/2019 12:55 PM
THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

SHEET KEY

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PROJECT No. 18.1036.001

SHOPPES AT OLD RANCH STATION

CITY OF COLORADO SPRINGS

STORM SEWER EXHIBIT

DESIGNED BY:	BAS	SCALE		DATE ISSUED:	November 18
DRAWN BY:	BAS	HORIZ.	1"=40'	SHEET	3 OF 3
CHECKED BY:	GGS	VERT.	N/A		

DRAWING No. DR02