MASTER DEVELOPMENT DRAINAGE PLAN
for
WESTCREEK AT WOLF RANCH PHASE 3
and
FINAL DRAINAGE REPORT
for
WESTCREEK AT WOLF RANCH SUBDIVISION FILINGS 13 and 14
November 2017

Prepared for:

Villages at Wolf Ranch, LLC (Nor`wood Development)
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Project# 17-025

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Westcreek at Wolf Ranch Phase 3
and
Westcreek at Wolf Ranch Subdivision Filings 13 and 14

Engineer's Statement
This report and plan for the drainage design of Westcreek at Wolf Ranch Phase 3 and Westcreek at Wolf Ranch Subdivision Filings 13 and 14 was prepared by me (or under my direction supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

SIGNATURE (Affix Seal) K.D. Rockwell, PE
Colorado P.E. No. 25086

COLORADO LICENSED
KENT D. ROCKWELL
25086
PROFESSIONAL ENGINEER

Date 12-13-17

Developer's Statement
Villages at Wolf Ranch, LLC hereby certifies that the drainage facilities for Westcreek at Wolf Ranch Phase 3 and Westcreek at Wolf Ranch Subdivision Filings 13 and 14 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 are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Westcreek at Wolf Ranch Phase 3 and Westcreek at Wolf Ranch Subdivision Filings 13 and 14, guarantee that final drainage design review will absolve Villages at Wolf Ranch 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.

Development Management, Inc.
Name of Developer

[signature] 12/12/17
Authorized Signature Date

Ralph Braden
Printed Name

VP
Title

111 S. Tejon #222, CS 80903
Address

City of Colorado Springs Statement:
Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

[signature] 12/18/17
For City Engineer DATE

Conditions:
~~12/13/17~~ PCD AND JMH CERT

MASTER DEVELOPMENT DRAINAGE PLAN
for
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PURPOSE

The purpose of this report is to identify the existing and proposed runoff patterns and drainage facilities required for the Westcreek at Wolf Ranch Phase 3 Development consisting of approximately 32.8 acres of residential development. The proposed development will consist of two filings, Westcreek at Wolf Ranch Subdivision Filings 13 and 14. This report acts as the Master Development Drainage Plan (MDDP) and the Final Drainage Report for Villages at Wolf Ranch Filings 13and 14.

Westcreek at Wolf Ranch Phase 3 is located south of Research Parkway approximately 1500 feet and extends west of Tributary 4 of Cottonwood Creek approximately 800 feet. (See Figure 1-Vicinity Map). Future Tutt Boulevard will be extended along the westerly boundary line of Westcreek Phase 3.

SUMMARY OF DATA

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs Drainage Criteria Manual, May, 2014.

2. Soil Survey for El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

3. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 1985.

4. "Cottonwood Creek Drainage Basin Planning Study" by URS Consultants, Inc., August 1995.

5. "Cottonwood Creek Prudent Line Study" by Ayres & Associates, 1996.

6. "Preliminary/Final Drainage Report for Power Boulevard (Research Parkway to Woodmen Road" by JR Engineering, July, 2000.

7. "Preliminary/Final Drainage Report for Research Parkway (Scarborough Drive to Powers Blvd.) including Research Parkway Subdivision Filing No. 6, by JR Engineering, April, 2000.

8. "Master Development Drainage Plan for Wolf Ranch, Colorado Springs, Colorado," prepared by Kiowa Engineering, 2013.

9. "Westcreek at Wolf Ranch Subdivision Master Development Drainage Report & Final Drainage Report for Westcreek at Wolf Ranch Subdivision Filings 1, 2, 3, 4 and 5" prepared by Rockwell Minchow Consultants, Inc., dated July, 2004.

GENERAL LOCATION AND DESCRIPTION

The Westcreek at Wolf Ranch Phase 3 Development is located within the northeastern portion of the City of Colorado Springs, El Paso County, Colorado. (see Vicinity Map - Figure 1). The site is within a portion of the Southwest Quarter of Section 31, Township 12 South, Range 65 West of the 6th P.M., together with a portion of the Northwest Quarter of Section 6, Township 13 South, Ranch 65 West of the 6th P.M., City of Colorado Springs, El Paso County, Colorado. The site is bound on the west by future Tutt Boulevard, on the south and east by Cottonwood Creek and Tributary 4 of Cottonwood Creek, and by existing residential development on the north (Westcreek at Wolf Ranch Phase 2). Well-established native grasses exist throughout the proposed development. The topography generally slopes from northwest to southeast. Areas along the westerly boundary line of Westcreek Phase 3 slopes westerly. The development will be platted in two filings with Filing No. 1 containing 52 lots and Filing No. 2 containing 43 lots.

SOILS

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the soils underlying the Recreation Center fall under the Stapleton/Bernal Series (Soil 85) and the Blakeland Series (Soil 8). These soils are classified as Hydrologic Group "A" and "D" soils. Since bedrock is known to exist just below the surface Hydrologic Group "D" soils were used to determine runoff coefficients.

CLIMATE

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) #08041C0529 F dated March 17, 1997, no portion of Westcreek at Wolf Ranch Phase 3 lies within a designated 100-year floodplain.

DRAINAGE CRITERIA

The current City of Colorado Springs Drainage Criteria was utilized in this report. Peak runoff quantities were determined using the Rational Method for both the 5 year and 100 year storms, as required for drainage basins less than 130 acres. Urban Drainage and Flood Control criteria, including water quality and full spectrum detention pond spreadsheets, was also used in the preparation of this report.

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

Step 1: West Creek Phase 3 will be developed to minimize directly connected impervious areas. This will be done by directing as much of the runoff generated from impervious areas as possible to landscape areas prior to reaching streets or storm sewers. To accomplish this, approximately 4.79 acres of Unconnected Impervious Area (UIA) will be routed through approximately 6.0 acres of Receiving Pervious Area (RPA) within this development.

Step 2: The runoff collected from this development will be captured and conveyed to a proposed Extended Detention Basin (EDB). The EDB will be utilized to provide water quality capture volume for this parcel and adjacent parcels.

Step 3: The EDB will discharge directly into Cottonwood Creek. Grade control structures have recently been constructed along Tributary #4 to stabilize the channel. The City of Colorado Springs is planning to construct a detention pond just east of Tutt Boulevard along Cottonwood Creek which will provide storm water detention and also help stabilize Cottonwood Creek.

Step 4: Site specific BMP's will be utilized during construction and up to stabilization of the site to minimize off-site contaminants and to protect the downstream receiving waters.

HISTORIC DRAINAGE BASIN DESCRIPTIONS

A brief description of the historic drainage for the site is provided in this section of the report. A summary of peak historic runoff for the historic basin(s) is depicted on the Historic Drainage Plan (Exhibit 1) provided in the appendix. The historic drainage area affecting this site is defined by five historic drainage basins that were outlined in the Wolf Ranch Master Development Drainage Report.

Basin H-1 consists of 1.65 acres at the northwest corner of the proposed Westcreek Phase 3 development. Runoff rates of 0.8 cubic feet per second (cfs) and 4.5 cfs are generated from this basin during the 5 and 100 year storms, respectively. These flows sheet flow to the southwest onto the adjacent property to the west of Westcreek Phase 3.

Basin H-2 consists of 4.62 acres along the northeast side of the proposed project. Runoff rates of 1.9 cfs and 10.5 cfs are generated from this 4.62 acre basin during the 5 and 100 year storms, respectively. Runoff from this basin sheet flow directly into Tributary #4.

Basin H-3 is located along the westerly boundary line of the proposed project. This 4.02 acre basin generates runoff rates of Q_5= 1.5 cfs and Q_{100} = 8.5 cfs. Runoff from this basin sheet flow southerly and then westerly onto the adjacent property to the west.

The 20.50 acre Basin H-4, situated in the middle of the proposed development, generates runoff rates of 8.0 cfs during the 5 year storm and 44.6 cfs during the 100 year storm. Runoff from this basin flows from north to south and exits the site along the devleopment's southeast boundary line. These flows are then conveyed to Tributary #4 via existing earthen swales.

Basin H-5 consists of 3.10 acres at the southern tip of the proposed project. Runoff rates of Q_5= 1.3 cfs and Q_{100} = 7.1 cfs generated from this basin exit the site and enter Cottonwood Creek.

DEVELOPED DRAINAGE BASIN

A brief description of each developed drainage basin for the site is provided in this section of the report. A summary of peak-developed runoff for the basins is depicted on the Developed Drainage Plan (Exhibit 2) provided in the appendix. All proposed drainage facilities are approximate in size and may vary with actual layout and design.

Within the single-family residential development, side lot line swales will be created on the downstream lots to convey flows from the upstream lots and into the street. Swales will be constructed by the homebuilders and maintained by the homeowner to limit concentrated flows and to disperse the flows as much as possible. Individual lot drainage is the responsibility of the lot owner/builder.

Basin 1A consists of 0.88 acres of single-family residential development in the northwest corner of the Westcreek 3 subdivision, northwest of Basin 1. The basin generates runoff rates of $Q_5 = 2.1$ cfs and $Q_{100} = 4.6$ cfs. These flows will be directed into Basin 1 via swales and berms along the west side of this basin.
Basin 1 consists of 1.75 acres of single-family residential development located toward the northwest corner of the subdivision. The basin generates runoff rates of $Q_5 = 4.3$ cfs and $Q_{100} = 8.7$ cfs. These are collected by a public 14' sump inlet (Inlet #1-3) at the south end of Noreen Falls Drive. Total runoff rates of 6.4 cfs during the 5 year storm and 13.3 cfs during the 100 year storm reach the Noreen Falls Drive cul-de-sac from Basins 1 and 1A. Additional flows will reach this same inlet from Basins 2 and 3.

Basin 2 consists of 2.11 acres of single-family residential development on the east side of Noreen Falls. Runoff rates of $Q_5 = 5.5$ cfs and $Q_{100} = 11.2$ cfs generated from this basin reach a proposed public 12' on-grade D10R inlet to be constructed at the south end of this basin., just north of Miller Run Drive. This inlet will collect runoff rates of 5.5 cfs during the 5 year storm and 9.1 cfs during the 100 year storm. Bypass flows of $Q_5 = 0.0$ cfs and $Q_{100} = 2.1$ cfs will enter Basin 3 as street flows. A proposed public 18" RCP will convey these collected flows southerly.

Basin 3 consists of 1.06 acres of single-family residential development along the southern portion of Noreen Falls Drive. The 1.06 acre basin generates runoff rates of $Q_5 = 3.4$ cfs and $Q_{100} = 6.7$ cfs. These flows, combine with bypass flows from Basin 2. Street flow rates of 3.4 cfs during the 5 year storm and 8.8 cfs during the 100 year storm reach the Noreen Falls Drive intersection from Basins 2 and 3. A 14' public sump inlet, located within the Noreen Falls cul-de-sac, will collect these flows.

Total runoff rates of 13.5 cfs during the 5 year storm and 27.5 cfs during the 100 year storm from Basins 1A, 1, 2 and 3 reach this inlet at Design Point #1. A proposed public 24" reinforced concrete pipe (RCP) will convey these collected flows easterly along the north side of Williams Run Drive.

Basin 4 consists of 1.13 acres single family residential development located just north of Miller Run Drive. The 1.13 acre basin generates runoff rates of $Q_5 = 3.0$ cfs and $Q_{10\,0} = 6.4$ cfs. Runoff from this basin will flow easterly along the north side of Millers Run Drive and then crosses Millers Run Drive in a proposed cross pan entering Basin 6 as street flows.

Basin 5 consists of 1.20 acres of single family residential development also located north of Miller Run Drive. This basin generates runoff rates of $Q_5 = 3.2$ cfs and $Q_{100} = 6.9$ cfs. These flows combine with the flows generated in Basin 4 and are conveyed in a crosspan across Miller Run Drive and into Basin 6. The accumulated flows entering Basin 6 from Basins 4 and 5 are $Q_5 = 6.2$ cfs and $Q_{100} = 13.3$ cfs.

Basin 6 consists of 0.82 acres of single-family residential development immediately south of Basin 5. This basin generates runoff rates of $Q_5 = 2.5$ cfs and $Q_{100} = 5.0$ cfs. These flows, along with the flows from Basins 4 and 5 reach Design Point #2 as street flows. The total street flows reaching Design Point #2 are 7.9 cfs during the 5 year storm and 16.6 cfs during the 100 year storm. A proposed 12' public on-grade inlet (Inlet #DP2) will be constructed at this point to collect a portion of these flows.

Inlet #DP2 collects flows of $Q_5 = 7.3$ cfs and $Q_{100} = 11.3$ cfs leaving bypass flows of 0.6 cfs during the 5 year storm and 5.3 cfs during the 100 year storm. These bypass flows enter Basin 7 as street flows on Wendy Stream Drive. A proposed public 18" RCP will convey these flows southerly.

Basin 7 consists of 0.80 acres of single-family residential development along the east side of the development just north of the Wendy Stream Drive cul-de-sac. The basin generates runoff rates of $Q_5 = 2.2$ cfs and $Q_{100} = 4.5$ cfs which are conveyed from the cul-de-sac to Wendy Stream Drive and into Basin 8.

Basin 8 consists of 0.32 acres of single-family residential development immediately south of Basin 6 along the east side of Wendy Stream Drive. This basin generates runoff rates of Q_5 = 1.1 cfs and Q_{100} = 2.1 cfs. These flows combine with the bypass flows from Basin 6 and flows from Basin 7 resulting in total street flows of Q_5 = 3.9 cfs and Q_{100} = 11.9 cfs just upstream of Inlet #8. Inlet #8 is a 10' public on-grade inlet located along the east side of Wendy Stream Drive.

Inlet #8 collects flows of Q_5 = 3.9 cfs and Q_{100} = 8.3 cfs leaving bypass flows of 0.0 cfs during the 5 year storm and 3.6 cfs during the 100 year storm. These bypass flows enter Basin 9 as street flows along Wendy Stream Drive. A proposed public 18" reinforced concrete pipe (RCP) will convey the collected flows southerly.

Flow Rates of 10.9 cfs during the 5 year storm and 22.6 cfs during the 100 year storm reach Design Point #3 from Basins 4 through 8.

Basin 9 consists of 1.93 acres of single-family residential development south of Basin 8. This basin generates runoff rates of Q_5 = 4.6 cfs and $Q_{10\,0}$ = 9.6 cfs that are conveyed southerly along the east side of Wendy Stream Drive. The bypass flows from Inlet #8 combine with these flows resulting in total street flows of 4.6 cfs during the 5 year storm and 13.2 cfs during the 100 year storm at the south end of Basin 9.

A proposed public 10' on-grade inlet will be installed at the south end of Basin 9. This inlet will collect runoff rates of 4.5 cfs during the 5 year storm and 8.7 cfs during the 100 year storm. The bypass flows of Q_5 = 0.1 cfs and $Q_{10\,0}$ = 4.5 cfs will enter Basin 10 as street flows. A proposed public 18" RCP will convey these collected flows to the proposed storm sewer manhole at Wendy Stream Drive and Yallaly Drive.

Basin 10 consists of 3.67 acres of single-family residential development immediately south of Basin 9. This basin generates runoff rates of Q_5 = 8.2 cfs and Q_{100} = 17.3 cfs. These flows combine with the bypass flows from Basin 9 resulting in total street flows of 8.3 cfs during the 5 year storm and 21.8 cfs during the 100 year storm reaching the south end of Basin 10.

A proposed 12' on-grade public inlet will be installed at the south end of this basin. Inlet #10 collects runoff rates of Q_5 =7.5 cfs and Q_{100} = 12.9 cfs with bypass flows of 0.8 cfs during the 5 year storm and 8.9 cfs during the 100 year storms. These bypass flows will enter Basin 11 as street flows.

Basin 11 consists of 0.66 acres of single-family residential development immediately south of Basin 10. This basin generates runoff rates of Q_5 = 1.8 cfs and Q_{100} = 3.8 cfs. These flows will be directed to a proposed public 12' sump inlet. Flow rates of 2.6 cfs during the 5 year storm and 12.7 cfs during the 100 year storm will be collected by this inlet.

Basin 12 consists of 1.42 acres of street and streetscape along Tutt Boulevard, encompassing a portion of the eastern half of Tutt Boulevard. The basin generates runoff rates of Q_5 = 3.5 cfs and Q_{100} = 7.8 cfs. These flows enter Basin 13 as street flows on Williams Run Drive.

Basin 13 consists of 0.66 acres of single-family residential development along the north side of Williams Run Drive. This basin generates runoff rates of Q_5 = 1.9 cfs and Q_{100} = 3.8 cfs. These flows, along with the flows from Basin 12 reach a proposed public 12' on-grade inlet at the east end of Basin 13. Total flow rates of 5.4 cfs during the 5 year storm and 11.6 cfs during the 100 year storm will reach this public 12' on-grade inlet.

This inlet will collect runoff rates of Q_5 = 5.4 cfs and Q_{100} = 9.3 cfs. The bypass flows of 0.0 cfs during the 5 year storm and 2.3 cfs during the 100 year storm enter Basin 14 as street flows. A 30" reinforced concrete pipe (RCP) will convey the flows collected by Inlets 1-3 and 13 towards the east.

Basin 14 consists of 2.62 acres of single-family residential development along the west side of Wendy Stream Drive. The basin generates runoff rates of $Q_5 = 6.2$ cfs and $Q_{100} = 13.0$ cfs. These flows combine with bypass flows from Inlet 13 and enter Basin 15 as street flows. The accumulated flows entering Basin 15 from Basins 13 and 14 are $Q_5 = 6.2$ cfs and $Q_{100} = 15.3$ cfs.

Approximately 10.5 acres are tributary to Design Point #4. Total runoff rates of $Q_5 = 23.4$ cfs and $Q_{100} = 48.4$ cfs reach Design Point #4 located just south of Basin 14.

Basin 15 consists of 0.28 acres of single-family residential development along the south side of Williams Run Drive and the west side of Wendy Stream Drive. The basin generates runoff rates of $Q_5 = 1.3$ cfs and $Q_{100} = 2.3$ cfs. Total street flows of 7.5 cfs during the 5 year storm and 17.6 cfs during the 100 year storm reach the south end of Basin 15.

These flows approach a 12' on-grade inlet (Inlet #15) at the south end of Basin 15. Inlet #15 collects flows of $Q_5 = 7.1$ cfs and $Q_{100} = 11.7$ cfs leaving bypass flows of 0.4 cfs during the 5 year storm and 5.9 cfs during the 100 year storm. These bypass flows enter Basin 16 as street flows on Wendy Stream Drive. An 18" reinforced concrete pipe (RCP) will convey the collected flows to the 30" RCP in Wendy Stream Drive.

Basin 16 consists of 1.06 acres street of single-family residential development along the west side of Wendy Stream Drive. The basin generates runoff rates of $Q_5 = 2.5$ cfs and $Q_{100} = 5.4$ cfs. These flows combine with bypass flows from Inlet 15 resulting in total street flows of 2.9 cfs and 11.3 cfs reaching the south end of Basin 16 during the 5 year and 100 year storms, respectively.

Total runoff rates of $Q_5 = 38.9$ cfs and $Q_{100} = 80.9$ cfs reach Design Point #5 located just south of Basin 16.

These flows approach a proposed 12' public on-grade inlet (Inlet #16) at the south end of the basin. Inlet #16 collects flows of $Q_5 = 2.9$ cfs and $Q_{100} = 9.2$ cfs. Bypass flows of 0.0 cfs during the 5 year storm and 2.1 cfs during the 100 year storm enter Basin 17 as street flows. An 18" reinforced concrete pipe (RCP) will convey the collected flows to the 36" RCP in Wendy Stream Drive.

Basin 17 consists of 1.32 acres of single-family residential development immediately north of Yallely River Drive. This basin generates runoff rates of $Q = 3.7$ cfs and $Q_{100} = 7.5$ cfs. Total flow rates of $Q_5 = 3.7$ cfs and $Q_{100} = 9.6$ cfs enter Basin 18 as street flows on Wendy Stream Drive.

Basin 18 consists of 1.70 acres of single-family residential development also along the west side of Wendy Stream Drive. Runoff rates of $Q_5 = 4.2$ cfs and $Q_{100} = 8.6$ cfs are generated from this basin. These flows combine with the bypass flows from Inlet #16 and Basin 17. Total street flows of 7.9 cfs during the 5 year storm and 18.2 cfs during the 100 year storm reach the south end of Basin 18. A 12' public on-grade inlet will be installed at the south end of Basin 18.

Inlet #18 collects flows of $Q_5 = 7.3$ cfs and $Q_{100} = 11.7$ cfs. Flow rates of 0.6 cfs during the 5 year storm and 6.5 cfs during the 100 year storm bypass this inlet and enter Basin 19 as street flows. A 18" reinforced concrete pipe (RCP) conveys these flows to a manhole where it combines with the 42" RCP in Wendy Stream Drive and is then conveyed by the 42" RCP that outfalls into the creek to the east. Flow rates of 51.9 cfs during the 5 year storm and 107.9 cfs during the 100 year storm reach Design Point #6.

Basin 19 consists of 0.90 acres of single-family residential development immediately south of Basin 18. Basin 19 generates runoff rates of $Q_5 = 2.2$ cfs and $Q_{100} = 4.7$ cfs. These flows along with the flows from Basin 22 will be collected within a proposed 12' sump inlet at the west end of Basin 19.

Basin 20 consists of 0.75 acres of single-family residential development along the east side of Winings Fork Way. The basin generates runoff rates of $Q_5 = 2.4$ cfs and $Q_{100} = 4.7$ cfs. These flows reach the cul-de-sac at the south end of Winings Fork Way. These flows will be collected within a proposed public 10' sump inlet.

Basin 21 consists of 1.10 acres of single-family residential development along the west side of Winings Fork Way. The basin generates runoff rates of $Q_5 = 2.6$ cfs and $Q_{100} = 5.8$ cfs. These flows combine with flows from Basin 20 and are collected by Inlet #20-21, a public 10' sump inlet, located at the south end of the basin. A proposed public 18" reinforced concrete pipe (RCP) will convey these collected flows towards the south.

Basin 22 consists of 1.30 acres of street and streetscape west, encompassing a portion of the eastern half of Tutt Boulevard. The basin generates runoff rates of $Q_5 = 3.6$ cfs and $Q_{100} = 7.3$ cfs. These flows enter Basin 19 from the west as street flows. These flows will be collected by the proposed public 12' sump inlet at the low point of Basins 19 and 22.

Basin 23 consists of 0.60 acres of street and streetscape immediately south of Basin 22 encompassing a portion of the eastern half of Tutt Boulevard. The basin generates runoff rates of $Q_5 = 2.2$ cfs and $Q_{100} = 4.4$ cfs. The flows from this basin will continue southerly to as street flows. These flows will be collected within future inlets to be constructed as part of the City of Colorado Springs Tutt Boulevard Extension Roadway project. These flows will enter the proposed water quality/detention pond to be constructed as part of the Tutt Boulevard City project. These facilities must constructed prior to or at the same time the Westcreek Project is constructed.

Design Point #7 is located just north of the proposed water quality pond. Total runoff rates of 61.8 cfs and 128.4 cfs reach Design Point #7 during the 5 and 100 year storms, respectively.

Basin 24 consists of 2.16 acres encompassing a portion of the western half of Tutt Boulevard. The west half of Tutt Boulevard will be constructed at a future date by others. Upon development of the west half of Tutt Boulevard, it is anticipated this basin will generate runoff rates of $Q_5 = 5.1$ cfs and $Q_{100} = 10.4$ cfs. The flows generated from this area will be addressed once the area to the west of Westcreek Phase 3 is developed.

Basin 25 consists of 2.34 acres of single-family residential development in the northeast corner of the Westcreek 3 subdivision. This basin generates runoff rates of $Q_5 = 5.9$ cfs and $Q_{100} = 13.1$ cfs. These flows drain to the east discharging into Tributary #4 as sheet flow across backyards and native open space.

Basin 26 consists of 0.42 acres of single-family residential development along the easterly boundary line of Westcreek Phase 3. Runoff rates of $Q_5 = 0.5$ cfs and $Q_{100} = 1.8$ cfs generated from this basin also sheet flow across landscaped area and then into Tributary #4.

Basin 27 is also located along the easterly boundary line of Westcreek Phase 3. This 0.42 acre basin generates runoff rates of $Q_5 = 0.9$ cfs and $Q_{100} = 2.1$ cfs which sheet flow across landscaped areas and into Tributary #4.

Basin 28 consists of 0.45 acres of single-family residential development at the southeast corner of the Westcreek Phase 3 development. This basin generates runoff rates of $Q_5 = 1.0$ cfs and $Q_{100} = 2.2$ cfs which sheet flow into Tributary #4.

Basin 29 is located at the south end of the Westcreek Phase 3 development. This 0.79 acre basin generates runoff rates of $Q_5 = 0.8$ cfs and $Q_{100} = 3.2$ cfs. These flows reach the proposed water quality pond to be constructed at the south end of this basin.

Hydraulic grade line calculations will be submitted with the construction documents as an addendum to this report.

WATER QUALITY

A private Extended Detention Basin (EDB) will be utilized to provide Water Quality Capture volume for the Westcreek Phase 3 development. The pond will be constructed at the southern end of the Westcreek Phase 3 development. The required water quality capture volume for this site is 0.696 acre-feet. The EDB will not provide Full Spectrum Detention, since that will be provided in a future downstream facility.

The proposed on-site area draining to the EDB consists of approximately 30.2 acres of which 21.2 acres are impervious. This results in a 70.3% on-site impervious area. A proposed 30' wide emergency spillway from the pond is being proposed. In the event the emergency spillway is reached, the flows will overtop into Cottonwood Creek to the east of the project.

A proposed downstream detention pond that will be built by the City will be constructed just east of Tutt Boulevard along Cottonwood Creek. This pond will be designed to provide full spectrum detention (FSD) for the Westcreek Phase 3 development and for additional areas to the east. Water quality calculations are provided in the Appendix of this report.

EROSION CONTROL

Erosion control measures will be installed per the approved grading/erosion control plans.

DRAINAGE, BRIDGE AND POND FEES

The Westcreek Phase 3 Development is within the Cottonwood Creek Drainage Basin. The 2017 Drainage, Bridge and Pond Fees are listed below.

Westcreek at Wolf Ranch Filing No. 13 Drainage Fee ($9,315/Acre Total)

	Area	$/Acre	Total Fee
Capital Improvements Portion	18.420	$ 9,623.00	$177,255.66
Land Portion	18.420	$ 3,069.00	$ 56,530.98
Cash Portion	18.420	$ 641.00	$ 11,807.22
BRIDGE FEES	18.420	$ 1,002.00	$ 8.456.84
			$264,050.70

Westcreek at Wolf Ranch Filing No. 14 Drainage Fee ($9,315/Acre Total)

	Area	$/Acre	Total Fee
Capital Improvements Portion	14.417	$ 9,623.00	$138,734.79
Land Portion	14.417	$ 3,069.00	$ 44,245.77
Cash Portion	14.417	$ 641.00	$ 9,241.30
BRIDGE FEES	14.417	$ 1,002.00	$ 14.445.83
			$206,667.70

DRAINAGE FACILTIES (Public Non Reimbursable)

The following drainage facilities will be required for Westcreek Filings 13 and 14. All these facilities are public non-reimbursable drainage facilities. Drainage facilities within these filings are all part of the overall Wolf Ranch Drainage system presented in the Wolf Ranch Master Development Drainage Plan.

Westcreek at Wolf Ranch Filing No. 13 (Public/Non-Reimbursable)

ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
42" RCP	670	L.F.	$ 140.00	$93,800.00
36" RCP	467	L.F.	$ 115.00	$53,705.00
30" RCP	491	L.F.	$ 95.00	$46,645.00
24" RCP	440	L.F.	$ 65.00	$28,600.00
18" RCP	302	L.F.	$ 55.00	$16,610.00
14' D-10-R Inlets	0	Ea.	$ 7,100.00	$ 0.00
12' D-10-R Inlets	8	Ea.	$ 6,800.00	$54,400.00
10' D-10-R Inlets	3	Ea.	$ 6,200.00	$18,600.00
Type I MH	2	Ea.	$ 7,000.00	$14,000.00
Type II MH	3	Ea.	$ 3,000.00	$ 9,000.00
			Sub-Total	$335,360.00
10% Eng. and Contingency				$ 33,536.00
			Grand Total	$ 368,896.00

Westcreek at Wolf Ranch Filing No. 14 (Public/Non-Reimbursable)

ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
18" RCP	576	L.F.	$ 55.00	$31,680.00
Type I MH	1	Ea.	$ 7,000.00	$ 4,000.00
12' D-10-R Inlets	1	Ea.	$ 6,800.00	$ 6,800.00
14' D-10-R Inlets	1	Ea.	$ 7,100.00	$ 7,100.00
			Sub-Total	$49,580.00
10% Eng. and Contingency				$ 4,958.00
			Grand Total	$54,538.00

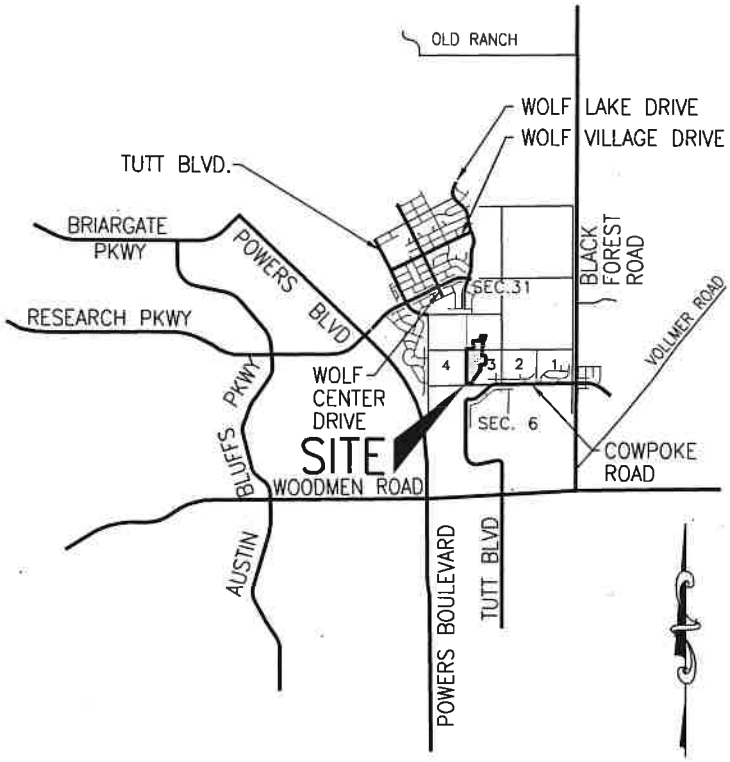
Westcreek at Wolf Ranch Filing No. 13 (Private/Non-Reimbursable)

ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
Pond/Structures	1	Ea.	$ 25,000.00	$ 25,000.00
			Sub-Total	$ 25,000.00
10% Eng. and Contingency				$ 2,500.00
			Grand Total	$27,500.00

CONCLUSION

Runoff generated from Westcreek Phase 3 will be collected within streets, inlets and drainage pipes and conveyed to a proposed water quality pond and/or directly to Tributary #4. The conveyance of these flows to the various detention/water quality basins and Tributary #4 is consistent with the overall Wolf Ranch Master Plan and Master Development Drainage Plan and with the Cottonwood Creek Drainage Basin Planning Study. The site runoff and storm drains and appurtenances will not adversely affect the downstream and surrounding developments in properly installed and maintained.

APPENDIX



Vicinity Map

NOT TO SCALE

FIGURE 1

JOB NO. 17-025

FILE: 17025fp.DWG
DATE: 5/16/17

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223


BLACK FOREST ROAD
RESEARCH PKWY
SITE
COWPOKE
Creek
TUTT BLVD
Cottonwood
WOODMEN ROAD
NORTH
1" = 2000'
SOILS MAP
EXHIBIT 2
26
25
30
35
36
31
2
1
6
11
12
7

31

RESEARCH PARKWAY

CITY OF COLORADO SPRINGS
080060

BLACK FOREST ROAD

CAPITOL ROAD

CITY OF COLORADO SPRINGS
EL PASO COUNTY

7051
7040
7056
BQ
7029
BQ
Creek
7025
BP
7021
BP
BO
ZONE X
BN
BM
ZONE X
7000
7006
7010
7021
7020
BM
6996
6993
Cottonwood
6985
6980
BL
ZONE X
BI
BH
BJ
BK
6970
6954
6975
ZONE AE
6966
6950
6959
6957
ZONE X
BL
ZONE X
6961
6960
6945
6954
BG
BI
BJ
ZONE X
6939
BG
6935
6930
6926
6922
BF
6918
6914
6910
6906
BF
6903
BE
6900
6895
BE
6893
ZONE X
ZONE X

CITY OF COLORADO SPRINGS
EL PASO COUNTY

WESTCREEK PHASE 3 SITE

FUTURE TUTT BLVD

ZONE X

ZONE X

CORPORATE LIMITS

T12S
T13S

JOINS PANEL 0528

BD
6890
BD
BC
Creek
6887
6885
BC
CROWN LANE
BB
6880
BB
COWPOKE ROAD
6875
AZ
BA
AY
6950
6860
Cottonwood
6875

FEMA FIRM PANEL
#08041C0529 F

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: H-1
AREA: 1.65
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Open Space	1.65	0.15	0.50	100.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	1.65			100%

COMPOSITE: C5= 0.15 C100= 0.50

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	265	3.8%		17.97
Street	0	0%	4.2	0.00
Tc Total:				17.97

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.2 in/hr	5.5 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
0.8 cfs	4.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: H-2
AREA: 4.62
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Open Space	4.62	0.15	0.50	100.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	4.62			100%

COMPOSITE: C5= 0.15 C100= 0.50

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	300	6.0%		16.45
Swale	560	4.0%	1.0	9.33
Tc Total:				25.78

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
2.7 in/hr	4.5 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.9 cfs	10.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: H-3
AREA: 4.02
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Open Space	4.02	0.15	0.50	100.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	4.02			100%

COMPOSITE: C5= 0.15 C100= 0.50

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	300	3.3%		20.03
Swale	560	3.9%	1.0	9.45
Tc Total:				29.49

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
2.5 in/hr	4.2 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.5 cfs	8.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: H-4
AREA: 20.50
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Open Space	20.5	0.15	0.50	100.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	20.50			100%

COMPOSITE: C5= 0.15 C100= 0.50

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	300	3.3%		20.03
Swale	1400	4.0%	3.0	7.78
Tc Total:				27.81

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
2.6 in/hr	4.4 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
8.0 cfs	44.6 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: H-5
AREA: 3.10
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Open Space	3.1	0.15	0.50	100.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	0	0.00	0.00	0.00%
	3.10			100%

COMPOSITE: C5= 0.15 C100= 0.50

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	300	9.0%		14.39
Swale	1400	2.0%	2.1	11.00
Tc Total:				25.39

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
2.7 in/hr	4.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.3 cfs	7.1 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 1A
AREA: 0.88
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.88	0.49	0.65	100.00%
Street	0.00	0.90	0.96	0.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.88			100%

COMPOSITE: C5= 0.49 C100= 0.65

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	4.8%		6.56
Street	0	3.0%	3.5	0.00
Tc Total:				6.56

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.8 in/hr	8.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.1 cfs	4.6 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 1
AREA: 1.75
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.56	0.49	0.65	32.00%
Street	0.92	0.90	0.96	52.57%
Open Space	0.27	0.15	0.50	15.43%
	0.00	0.00	0.00	0.00%
	1.75			100%

COMPOSITE: C5= 0.65 C100= 0.79

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Tc Total:				12.96

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
3.7 in/hr	6.3 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
4.3 cfs	8.7 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 2
AREA: 2.11
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	1.42	0.49	0.65	67.30%
Street	0.69	0.90	0.96	32.70%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	2.11			100%

COMPOSITE: C5= 0.62 C100= 0.75

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	40	2.0%		5.54
Street	750	2.5%	3.2	3.95
Tc Total:				9.49

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.2 in/hr	7.1 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
5.5 cfs	11.2 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 3
AREA: 1.06
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.58	0.49	0.65	54.72%
Street	0.48	0.90	0.96	45.28%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.06			100%

COMPOSITE: C5= 0.68 C100= 0.79

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	40	3.0%		4.85
Street	400	4.0%	4.0	1.67
Tc Total:				6.51

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.8 in/hr	8.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
3.4 cfs	6.7 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 4
AREA: 1.13
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	1.03	0.49	0.65	91.15%
Street	0.10	0.90	0.96	8.85%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.13			100%

COMPOSITE: C5= 0.53 C100= 0.68

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	¯c (5 year)
Overland	100	10.0%		5.15
Street	100	2.0%	2.8	0.59
Tc Total:				5.74

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
5.0 in/hr	8.3 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
3.0 cfs	6.4 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 5
AREA: 1.20
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	1.02	0.49	0.65	85.00%
Street	0.18	0.90	0.96	15.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.20			100%

COMPOSITE: C5= 0.55 C100= 0.70

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	10.0%		5.15
Street	150	2.0%	2.8	0.88
Tc Total:				6.04

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.9 in/hr	8.2 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
3.2 cfs	6.9 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 6
AREA: 0.82
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.47	0.49	0.65	57.32%
Street	0.35	0.90	0.96	42.68%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.82			100%

COMPOSITE: C5= 0.67 C100= 0.78

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	˜c (5 year)
Overland	40	2.0%		5.54
Street	400	3.5%	3.7	1.78
Tc Total:				7.32

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.6 in/hr	7.7 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.5 cfs	5.0 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 7
AREA: 0.80
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.60	0.49	0.65	75.00%
Street	0.20	0.90	0.96	25.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.80			100%

COMPOSITE: C5= 0.59 C100= 0.73

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	$\bar{t}_c$ (5 year)
Overland	100	5.0%		6.48
Street	120	2.0%	2.8	0.71
Tc Total:				7.18

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.6 in/hr	7.8 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.2 cfs	4.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 8
AREA: 0.32
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.15	0.49	0.65	46.88%
Street	0.17	0.90	0.96	53.13%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.32			100%

COMPOSITE: C5= 0.71 C100= 0.81

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	40	2.0%		5.54
Street	250	2.5%	3.2	1.32
Tc Total:				6.86

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.7 in/hr	7.9 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.1 cfs	2.1 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 9
AREA: 1.93
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	1.58	0.49	0.65	81.87%
Street	0.35	0.90	0.96	18.13%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.93			100%

COMPOSITE: C5= 0.56 C100= 0.71

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	480	4.0%	4.0	2.00
Tc Total:				9.66

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.2 in/hr	7.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
4.6 cfs	9.6 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 10
AREA: 3.67
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	3.05	0.49	0.65	83.11%
Street	0.62	0.90	0.96	16.89%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	3.67			100%

COMPOSITE: C5= 0.56 C100= 0.70

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	3.0%		7.66
Street	600	2.3%	3.0	3.30
Tc Total:				10.96

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.0 in/hr	6.7 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
8.2 cfs	17.3 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 11
AREA: 0.66
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.51	0.49	0.65	77.27%
Street	0.15	0.90	0.96	22.73%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.66			100%

COMPOSITE: C5= 0.58 C100= 0.72

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	tc (5 year)
Overland	40	3.0%		4.85
Street	300	2.0%	2.8	1.77
Tc Total:				6.62

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.7 in/hr	8.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.8 cfs	3.8 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 12
AREA: 1.42
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.00	0.49	0.65	0.00%
Street	0.80	0.90	0.96	56.34%
Open Space	0.62	0.15	0.50	43.66%
	0.00	0.00	0.00	0.00%
	1.42			100%

COMPOSITE: C5= 0.57 C100= 0.76

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	50	10.0%		5.67
Street	750	3.7%	3.8	3.25
Tc Total:				8.92

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.3 in/hr	7.2 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
3.5 cfs	7.8 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 13
AREA: 0.66
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.44	0.49	0.65	66.67%
Street	0.22	0.90	0.96	33.33%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.66			100%

COMPOSITE: C5= 0.63 C100= 0.75

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	3.0%		7.66
Street	0	3.7%	3.8	0.00
Tc Total:				7.66

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.5 in/hr	7.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.9 cfs	3.8 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 14
AREA: 2.62
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	2.11	0.49	0.65	80.53%
Street	0.51	0.90	0.96	19.47%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	2.62			100%

COMPOSITE: C5= 0.57 C100= 0.71

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	˜c (5 year)
Overland	100	3.0%		7.66
Street	550	4.5%	4.2	2.16
Tc Total:				9.82

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.2 in/hr	7.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
6.2 cfs	13.0 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 15
AREA: 0.28
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.02	0.49	0.65	7.14%
Street	0.26	0.90	0.96	92.86%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.28			100%

COMPOSITE: C5= 0.87 C100= 0.94

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	10	3.0%		2.42
Street	430	2.3%	3.0	2.36
Tc Total:				4.79

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
5.2 in/hr	8.7 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.3 cfs	2.3 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 16
AREA: 1.06
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.92	0.49	0.65	86.79%
Street	0.14	0.90	0.96	13.21%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.06			100%

COMPOSITE: C5= 0.54 C100= 0.69

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	t_c (5 year)
Overland	100	3.0%		7.66
Street	200	4.0%	4.0	0.83
Tc Total:				8.50

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.4 in/hr	7.3 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.5 cfs	5.4 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 17
AREA: 1.32
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.94	0.49	0.65	71.21%
Street	0.38	0.90	0.96	28.79%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.32			100%

COMPOSITE: C5= 0.61 C100= 0.74

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	t_c (5 year)
Overland	50	3.0%		5.42
Street	500	4.0%	4.0	2.08
Tc Total:				7.50

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.6 in/hr	7.7 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
3.7 cfs	7.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 18
AREA: 1.70
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	1.31	0.49	0.65	77.06%
Street	0.39	0.90	0.96	22.94%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	1.70			100%

COMPOSITE: C5= 0.58 C100= 0.72

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	360	2.5%	3.2	1.90
Tc Total:				9.56

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.2 in/hr	7.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
4.2 cfs	8.6 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 19
AREA: 0.90
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.75	0.49	0.65	83.33%
Street	0.15	0.90	0.96	16.67%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.90			100%

COMPOSITE: C5= 0.56 C100= 0.70

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	tc (5 year)
Overland	100	3.0%		7.66
Street	100	2.0%	2.8	0.59
Tc Total:				8.25

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.4 in/hr	7.4 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.2 cfs	4.7 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 20
AREA: 0.75
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.39	0.49	0.65	52.00%
Street	0.36	0.90	0.96	48.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.75			100%

COMPOSITE: C5= 0.69 C100= 0.80

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	40	3.0%		4.85
Street	450	3.0%	3.5	2.17
Tc Total:				7.01

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.7 in/hr	7.8 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.4 cfs	4.7 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 21
AREA: 1.10
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.00	0.49	0.65	0.00%
Street	0.63	0.90	0.96	57.27%
Open Space	0.47	0.15	0.50	42.73%
	0.00	0.00	0.00	0.00%
	1.10			100%

COMPOSITE: C5= 0.58 C100= 0.76

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	30	3.0%		6.54
Street	800	3.5%	3.7	3.56
Tc Total:				10.10

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.1 in/hr	6.9 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.6 cfs	5.8 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 22
AREA: 1.30
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.00	0.49	0.65	0.00%
Street	0.91	0.90	0.96	70.00%
Open Space	0.39	0.15	0.50	30.00%
	0.00	0.00	0.00	0.00%
	1.30			100%

COMPOSITE: C5= 0.68 C100= 0.82

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	30	3.0%		6.54
Street	900	3.5%	3.7	4.01
Tc Total:				10.55

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.0 in/hr	6.8 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
3.6 cfs	7.3 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 23
AREA: 0.60
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.00	0.49	0.65	0.00%
Street	0.45	0.90	0.96	75.00%
Open Space	0.15	0.15	0.50	25.00%
	0.00	0.00	0.00	0.00%
	0.60			100%

COMPOSITE: C5= 0.71 C100= 0.85

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	20	3.0%		3.43
Street	250	2.4%	3.1	1.34
Tc Total:				4.77

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
5.2 in/hr	8.7 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
2.2 cfs	4.4 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 24
AREA: 2.16
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.00	0.49	0.65	0.00%
Street	1.54	0.90	0.96	71.30%
Open Space	0.62	0.15	0.50	28.70%
	0.00	0.00	0.00	0.00%
	2.16			100%

COMPOSITE: C5= 0.68 C100= 0.83

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	20	3.0%		5.34
Street	2100	3.0%	3.5	10.10
Tc Total:				15.44

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
3.5 in/hr	5.8 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
5.1 cfs	10.4 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 25
AREA: 2.34
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	2.34	0.49	0.65	100.00%
Street	0.00	0.90	0.96	0.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	2.34			100%

COMPOSITE: C5= 0.49 C100= 0.65

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	10.0%		5.15
Street	0	3.0%	3.5	0.00
Tc Total:				5.15

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
5.1 in/hr	8.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
5.9 cfs	13.1 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 26
AREA: 0.42
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.15	0.49	0.65	35.71%
Street	0.00	0.90	0.96	0.00%
Open Space	0.27	0.15	0.50	64.29%
	0.00	0.00	0.00	0.00%
	0.42			100%

COMPOSITE: C5= 0.27 C100= 0.55

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	tc (5 year)
Overland	100	3.0%		7.66
Street	0	3.0%	3.5	0.00
Tc Total:				7.66

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.5 in/hr	7.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
0.5 cfs	1.8 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 27
AREA: 0.42
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.42	0.49	0.65	100.00%
Street	0.00	0.90	0.96	0.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.42			100%

COMPOSITE: C5= 0.49 C100= 0.65

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	3.0%		7.66
Street	0	3.0%	3.5	0.00
Tc Total:				7.66

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.5 in/hr	7.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
0.9 cfs	2.1 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 28
AREA: 0.45
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.45	0.49	0.65	100.00%
Street	0.00	0.90	0.96	0.00%
Open Space	0.00	0.15	0.50	0.00%
	0.00	0.00	0.00	0.00%
	0.45			100%

COMPOSITE: C5= 0.49 C100= 0.65

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˆc (5 year)
Overland	100	3.0%		7.66
Street	0	3.0%	3.5	0.00
Tc Total:				7.66

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.5 in/hr	7.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
1.0 cfs	2.2 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: 29
AREA: 0.79
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
1/8 Acre Residential	0.16	0.49	0.65	20.25%
Street	0.00	0.90	0.96	0.00%
Open Space	0.63	0.15	0.50	79.75%
	0.00	0.00	0.00	0.00%
	0.79			100%

COMPOSITE: C5= 0.22 C100= 0.53

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	ˉc (5 year)
Overland	100	3.0%		7.66
Street	0	3.0%	3.5	0.00
Tc Total:				7.66

Intensity, I (inches/hr) from Fig 6-5

I5	**I100**
4.5 in/hr	7.6 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
0.8 cfs	3.2 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#1
AREA: 5.80
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Basin 1	1.75	0.65	0.79	30.17%
Basin 2	2.11	0.62	0.75	36.38%
Basin 3	1.06	0.68	0.79	18.28%
Basin 1A	0.88	0.49	0.65	15.17%
	5.80			100%

COMPOSITE: C5= 0.62 C100= 0.75

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Pipe Flow	0	1.5%	16	0.00
Tc Total:				12.96

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.7 in/hr	6.3 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
13.5 cfs	27.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#1
AREA: 5.80
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Basin 1	1.75	0.65	0.79	30.17%
Basin 2	2.11	0.62	0.75	36.38%
Basin 3	1.06	0.68	0.79	18.28%
Basin 1A	0.88	0.49	0.65	15.17%
	5.80			100%

COMPOSITE: C5= 0.62 C100= 0.75

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Pipe Flow	0	1.5%	16	0.00
Tc Total:				12.96

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.7 in/hr	6.3 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
13.5 cfs	27.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#2
AREA: 3.15
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
Basin 4	1.13	0.53	0.68	35.87%
Basin 5	1.2	0.55	0.70	38.10%
Basin 6	0.82	0.67	0.78	26.03%
	0	0.00	0.00	0.00%
	3.15			100%

COMPOSITE: C5= 0.57 C100= 0.71

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	10.0%		5.15
Street	550	2.0%	2.8	3.24
Pipe Flow	0	1.5%	16	0.00
Tc Total:				8.39

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
4.4 in/hr	7.4 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
7.9 cfs	16.6 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#3
AREA: 4.27
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
DP#2	3.15	0.57	0.71	73.77%
Basin 7	0.8	0.59	0.73	18.74%
Basin 8	0.32	0.71	0.81	7.49%
	0	0.00	0.00	0.00%
	4.27			100%

COMPOSITE: C5= 0.58 C100= 0.72

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	10.0%		5.15
Street	550	2.0%	2.8	3.24
Pipe Flow	140	4.0%	12	0.19
Tc Total:				8.59

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
4.4 in/hr	7.3 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
10.9 cfs	22.5 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#4
AREA: 10.50
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
DP#1	5.80	0.62	0.75	55.24%
Basin 12	1.42	0.57	0.76	13.52%
Basin 13	0.66	0.63	0.75	6.29%
Basin 14	2.62	0.57	0.71	24.95%
	10.50			100%

COMPOSITE: C5= 0.60 C100= 0.74

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Pipe Flow	200	2.3%	10	0.33
Tc Total:				13.29

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.7 in/hr	6.2 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
23.4 cfs	48.4 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#5
AREA: 18.08
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
DP#3	4.27	0.58	0.72	23.62%
DP#4	10.54	0.60	0.74	58.30%
Basin 9	1.93	0.56	0.71	10.67%
Basin 15	0.28	0.87	0.94	1.55%
Basin 16	1.06	0.54	0.69	5.86%
	18.08			100%

COMPOSITE: C5= 0.59 C100= 0.73

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Pipe Flow	550	2.3%	10	0.92
Tc Total:				13.87

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.6 in/hr	6.1 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
38.9 cfs	80.9 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#6
AREA: 24.77
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
DP#5	18.08	0.59	0.73	72.99%
Basin 10	3.67	0.56	0.70	14.82%
Basin 17	1.32	0.61	0.74	5.33%
Basin 18	1.7	0.58	0.72	6.86%
	0	0.00	0.00	0.00%
	24.77			100%

COMPOSITE: C5= 0.59 C100= 0.73

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Pipe Flow	900	2.3%	10	1.50
Tc Total:				14.46

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.6 in/hr	6.0 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
51.9 cfs	107.9 cfs

HYDROLOGY

RATIONAL METHODOLOGY

PROJECT: WESTCREEK AT WOLF RANCH PHASE 3

BASIN: DP#7
AREA: 29.48
SOIL TYPE: C & D

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA	C5	C100	% AREA
DP#6	24.77	0.59	0.73	84.02%
Basin 11	0.66	0.58	0.72	2.24%
Basin 19	0.90	0.56	0.70	3.05%
Basin 20	0.75	0.69	0.80	2.54%
Basin 21	1.10	0.58	0.76	3.73%
Basin 22	1.30	0.68	0.82	4.41%
	29.48			100%

COMPOSITE: C5= 0.60 C100= 0.74

TIME OF CONCENTRATION: Tc In Minutes:

Travel Type	L	s %	v5 (fps)	Tc (5 year)
Overland	100	3.0%		7.66
Street	1100	3.0%	3.5	5.29
Pipe Flow	1200	2.3%	10	2.00
Tc Total:				14.96

Intensity, I (inches/hr) from Fig 5-1

I5	**I100**
3.5 in/hr	5.9 in/hr

PEAK FLOW: Q-CIA in cfs

Q5	**Q100**
61.8 cfs	128.4 cfs

STREET AND INLET HYDRAULICS

Version 4.05 Released March 2017
Urban Drainage and Flood Control District
Denver, Colorado

Purpose: **This workbook can be used to size a variety of inlets based on allowable spread and depth in a street or swale.**

Content: **The workbook consists of the following worksheets:**

Q-Peak The *Q-Peak* sheet calculates the peak discharge for the inlet tributary area based on the Rational Method for the minor and major storm events. Alternatively, the user can enter a known flow. Information from this sheet is then exported to the *Inlet Management* sheet.

Inlet Management The *Inlet Management* sheet imports information from the *Q-Peak* sheet and *Inlet [#]* sheets and can be used to connect inlets in series so that bypass flow from an upstream inlet is added to flow calculated for the next downstream inlet. This sheet can also be used to modify design information from the Q-peak sheet.

Inlet [#] *Inlet [#]* sheets are created each time the user exports information from the *Q-Peak* sheet to the *Inlet Management* sheet. The *Inlet [#]* sheets calculate allowable half-street capacity based on allowable depth and allowable spread for the minor and major storm events. This is also where the user selects an inlet type and calculates the capacity of that inlet.

Inlet Pictures The Inlet Pictures sheet contains a library of photographs of the various types of inlets contained in UD-Inlet and referenced in the USDCM.

Acknowledgements: ***Spreadsheet Development Team:***
Dr. James C.Y. Guo, P.E.
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Urban Drainage and Flood Control District
Derek N. Rapp, P.E.
Peak Stormwater Engineering, LLC

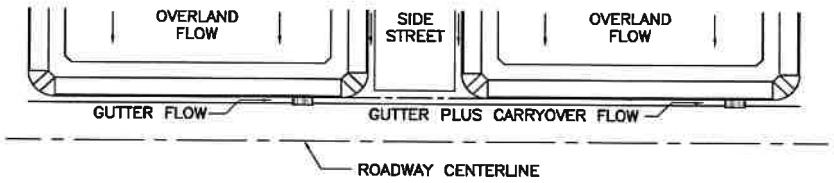
Comments? Direct all comments regarding this spreadsheet workbook to: UDFCD email
Revisions? Check for revised versions of this or any other workbook at: Downloads

Version 4.05 Released March 2017

Worksheet Protected

DESIGN PEAK FLOW FOR SWALE OR ONE-HALF OF STREET BY THE RATIONAL METHOD

Project: Westcreek Phase 3 (Filings 13 and 14)



Show Details

Design Flow: ONLY if already determined through other methods:

(local peak flow for 1/2 of street OR grass-lined channel):

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

<--- FILL IN THIS SECTION OR...

* If you enter flows in Row 14, select "Street Inlet" or "Area Inlet" button and then skip the rest of this sheet and click "Add New Inlet" at bottom of sheet.

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

FILL IN THE SECTIONS BELOW. <---

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

Site Type:
- (●) Site is Urban
- ( ) Site is Rural

Flows Developed For:
- (●) Street Inlet
- ( ) Area Inlet in a Swale

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

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

	Minor Storm	Major Storm	
Design Storm Return Period, T_1 =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =			cfs
Total Design Peak Flow, Q =			cfs

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 1-3	Inlet 2	Inlet DP#2	Inlet 8	Inlet 9	Inlet 10
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	On Grade	On Grade	On Grade	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	9.8	5.5	7.9	1.1	4.6	8.2
Major Q_{Known} (cfs)	22.1	11.2	16.6	2.1	9.6	17.3

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	User-Defined	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	2.8	0.0	0.1
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	9.8	3.6	4.5

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

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

Minor Storm Rainfall Input

Design Storm Return Period, T, (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T, (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**9.8**	**5.5**	**7.9**	**3.9**	**4.6**	**8.3**
Major Total Design Peak Flow, Q (cfs)	**22.1**	**11.2**	**16.6**	**11.9**	**13.2**	**21.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.0	0.6	0.0	0.1	0.8
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	2.1	5.3	3.6	4.5	8.9

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 11	Inlet 13	Inlet 15	Inlet 16	Inlet 18	Inlet 19-22
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	On Grade	On Grade	On Grade	In Sump
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	1.9	1.3	2.5	4.2	2.2
Major Q_{Known} (cfs)	3.8	3.8	2.3	5.4	8.6	4.7

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	User-Defined	User-Defined	User-Defined	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.8	3.5	6.2	0.4	3.7	4.2
Major Bypass Flow Received, Q_b (cfs)	8.9	7.8	15.3	5.9	9.6	13.8

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

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

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.6**	**5.4**	**7.5**	**2.9**	**7.9**	**6.4**
Major Total Design Peak Flow, Q (cfs)	**12.7**	**11.6**	**17.6**	**11.3**	**18.2**	**18.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.0	0.4	0.0	0.6	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	2.3	5.9	2.1	6.5	N/A

Minor Storm (Calculated) Analysis of Flow T

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow T

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 20-21
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	In Sump
Inlet Type	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	5.0
Major Q_{Known} (cfs)	10.5

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

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

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**5.0**
Major Total Design Peak Flow, Q (cfs)	**10.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A

Minor Storm (Calculated) Analysis of Flow T

C	N/A
C_5	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

Major Storm (Calculated) Analysis of Flow T

C	N/A
C_5	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

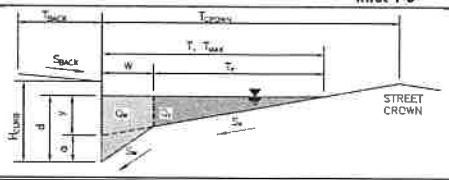
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 1-3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches

Check boxes are not applicable in SUMP conditions

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

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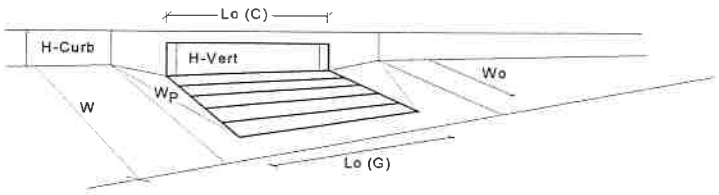
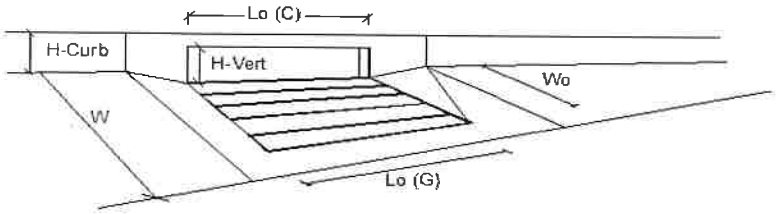


Design Information (Input)	Colorado Springs D-10-R	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	8.1	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	16.00	16.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.51	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.56	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.90	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	9.8	22.1	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	9.8	22.1	cfs

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.5**	**9.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**82**	**%**

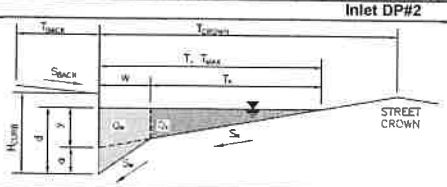
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet DP#2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longiludinal Slope - Enter 0 for sump condition	S_O =	0.045	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

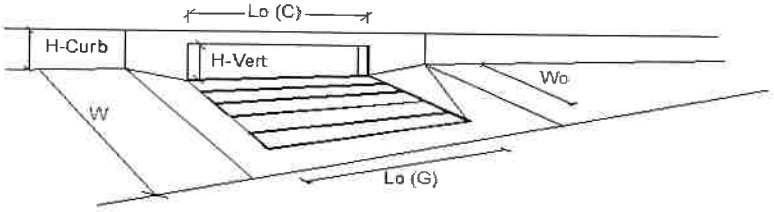
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	14.4	29.3	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.3**	**11.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**5.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**93**	**68**	**%**

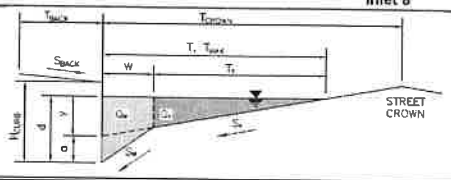
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 8



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.045	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

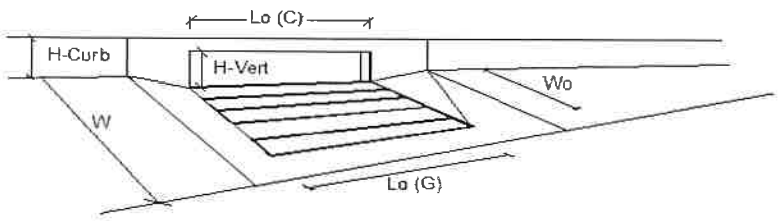
		Minor Storm	Major Storm	
	Q_{allow} =	14.4	29.3	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.9**	**8.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**70**	**%**

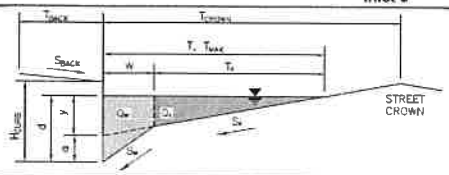
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 9



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

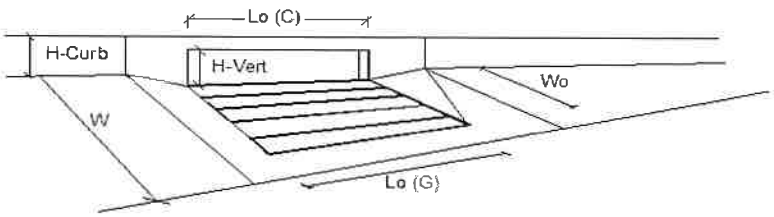
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	11.3	33.7	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.5**	**8.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**4.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**66**	**%**

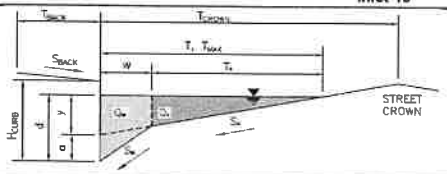
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 10



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.016	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

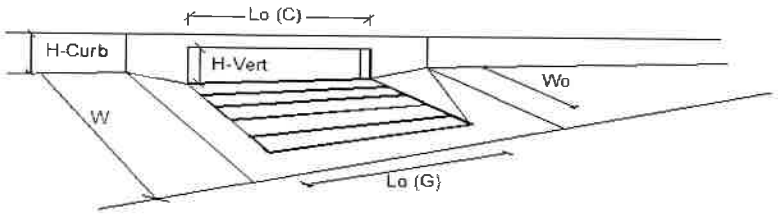
	Minor Storm	Major Storm	
Q_{allow} =	8.6	39.9	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	7.5	12.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.8	8.9	cfs
Capture Percentage = Q_a/Q_o =	C% =	91	59	%

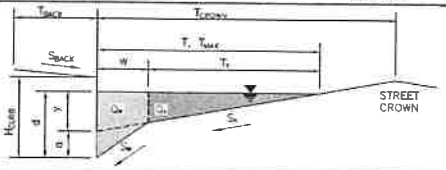
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 11



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches

Check boxes are not applicable in SUMP conditions

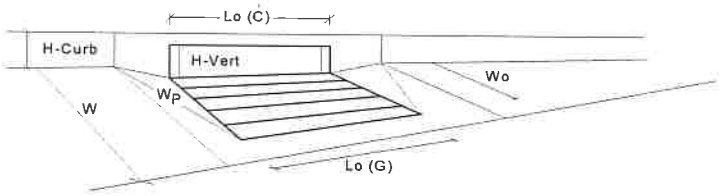
MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.9	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	12.00	12.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.41	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.38	0.65	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.72	0.92	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**2.6**	**12.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.6	12.7	cfs

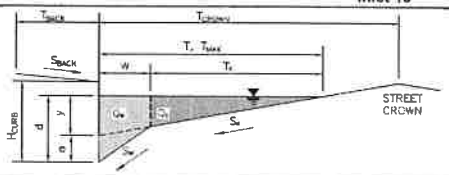
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 13



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_x =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.023	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

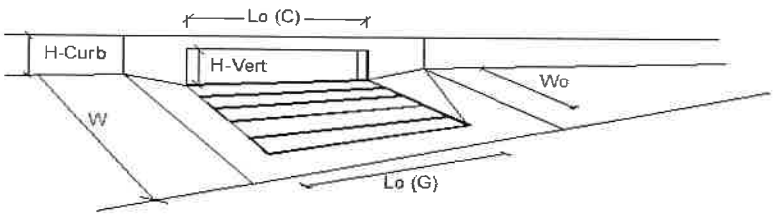
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	10.3	35.8	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.4**	**9.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**80**	**%**

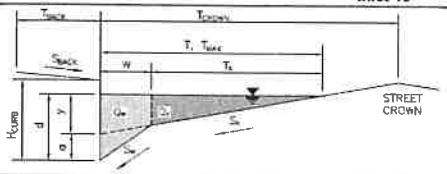
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 15



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)			☑	check = yes

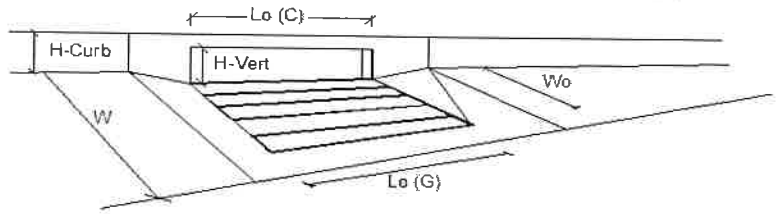
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	14.9	28.3	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	7.1	11.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.4	5.9	cfs
Capture Percentage = Q_a/Q_o =	C% =	95	66	%

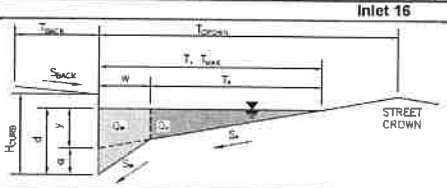
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 16



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

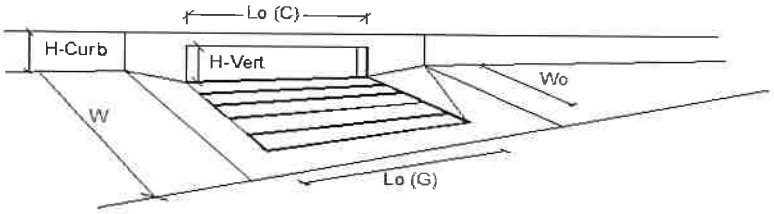
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	11.3	33.7	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.9**	**9.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

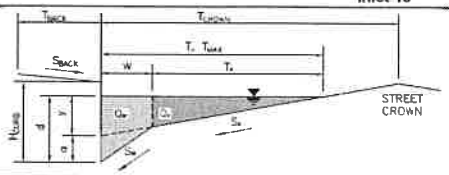
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 18



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

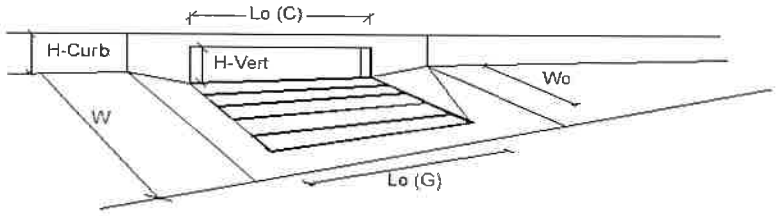
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	8.3	38.7	cfs

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.3**	**11.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**6.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**92**	**65**	**%**

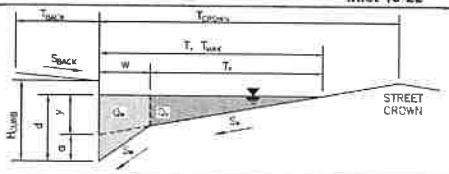
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 19-22



Gutter Geometry (Enter data in the blue cells)

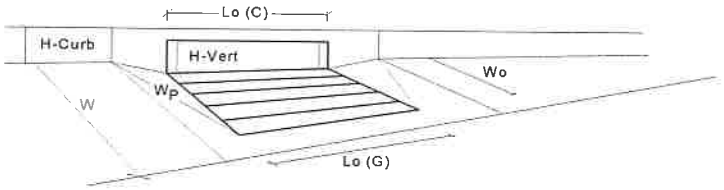
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion				

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.4	8.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	12.00	12.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.28	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.51	0.76	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.83	0.97	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.7**	**18.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.4	18.5	cfs

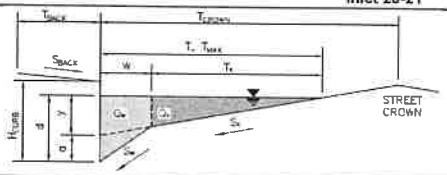
Version 4.05 Released March 2017

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

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

Project: Westcreek Phase 3 (Filings 13 and 14)

Inlet ID: Inlet 20-21



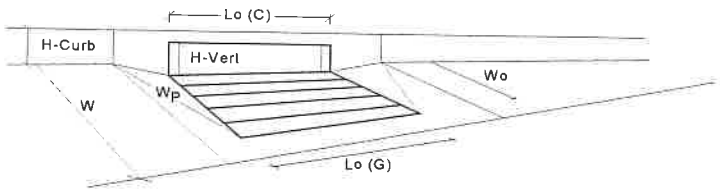
Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion				

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Colorado Springs D-10-R	Type =	Colorado Springs D-10-R	
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00 inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	6.6 inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A feet
Width of a Unit Grate		W_o =	N/A	N/A feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00 feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00 inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00 inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00 degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00 feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.25	0.38 ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.47	0.62
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.87	0.97
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	5.0	10.6 cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	5.0	10.5 cfs

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #1A	100 year		
Pipe Diameter (inches)		18	**Inches**	1.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		8.3	**Inches**	0.69 **ft**
Pipe Slope (ft/ft)		0.04	**ft/ft**	
Pipe radius		0.75	**ft**	
d/D		0.46		
Q (cfs)		**9.13**	**cfs**	
Area of Flow (ft^2)		0.80	**ft^2**	
Velocity		**11.47**	**fps**	
Pipe Total Circumference		4.71	**ft**	
Angle of Flow		2.99	**Radians**	
Hydraulic Radius (A/P)		0.36		
Wetted Perimeter		2.24		
Velocity head, hv		2.04		
T, Top Width		1.50	**feet**	
Froude Number		2.77		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #1	100 year	

Pipe Diameter (inches)	24	**Inches**	2.00 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	16.6	**Inches**	1.38 **ft**
Pipe Slope (ft/ft)	0.022	**ft/ft**	
Pipe radius	1.00	**ft**	
d/D	0.69		
Q (cfs)	**27.64**	**cfs**	
Area of Flow (ft^2)	2.32	**ft^2**	
Velocity	**11.92**	**fps**	
Pipe Total Circumference	6.28	**ft**	
Angle of Flow	3.93	**Radians**	
Hydraulic Radius (A/P)	0.59		
Wetted Perimeter	3.93		
Velocity head, hv	? 21		
T, Top Width	1.85	**feet**	
Froude Number	1.88		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #2	100 year	

Pipe Diameter (inches)	18	**Inches**	1.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	9.4	**Inches**	0.78 **ft**
Pipe Slope (ft/ft)	0.04	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.52		
Q (cfs)	**11.30**	**cfs**	
Area of Flow (ft^2)	0.93	**ft^2**	
Velocity	**12.10**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	3.23	**Radians**	
Hydraulic Radius (A/P)	0.39		
Wetted Perimeter	2.42		
Velocity head, hv	2.27		
T, Top Width	1.50	**feet**	
Froude Number	2.70		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #3	100 year		
Pipe Diameter (inches)		18	**Inches**	1.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		13.8	**Inches**	1.15 **ft**
Pipe Slope (ft/ft)		0.04	**ft/ft**	
Pipe radius		0.75	**ft**	
d/D		0.77		
Q (cfs)		**19.60**	**cfs**	
Area of Flow (ft^2)		1.45	**ft^2**	
Velocity		**13.50**	**fps**	
Pipe Total Circumference		4.71	**ft**	
Angle of Flow		4.26	**Radians**	
Hydraulic Radius (A/P)		0.45		
Wetted Perimeter		3.20		
Velocity head, hv		2.83		
T, Top Width		1.27	**feet**	
Froude Number		2.23		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #4	100 year	

Pipe Diameter (inches)	18	**Inches**	1.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	13.2	**Inches**	1.10 **ft**
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.73		
Q (cfs)	**9.32**	**cfs**	
Area of Flow (ft^2)	1.39	**ft^2**	
Velocity	**6.71**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	4.11	**Radians**	
Hydraulic Radius (A/P)	0.45		
Wetted Perimeter	3.08		
Velocity head, hv	0.70		
T, Top Width	1.33	**feet**	
Froude Number	1.16		

Manning's Pipe Flow (Normal Flow)

Project Westcreek Phase 3

Date 5/16/2017

Pipe #5 100 year

Pipe Diameter (inches)	30	**Inches**	2.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	16.9	**Inches**	1.40 **ft**
Pipe Slope (ft/ft)	0.022	**ft/ft**	
Pipe radius	1.25	**ft**	
d/D	0.56		
Q (cfs)	**36.85**	**cfs**	
Area of Flow (ft^2)	2.84	**ft^2**	
Velocity	**12.98**	**fps**	
Pipe Total Circumference	7.85	**ft**	
Angle of Flow	3.39	**Radians**	
Hydraulic Radius (A/P)	0.67		
Wetted Perimeter	4.24		
Velocity head, hv	2.62		
T, Top Width	2.48	**feet**	
Froude Number	2.14		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #6	100 year	

Pipe Diameter (inches)	30	**Inches**	2.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	18.3	**Inches**	1.52 **ft**
Pipe Slope (ft/ft)	0.04	**ft/ft**	
Pipe radius	1.25	**ft**	
d/D	0.61		
Q (cfs)	**56.40**	**cfs**	
Area of Flow (ft^2)	3.13	**ft^2**	
Velocity	**18.01**	**fps**	
Pipe Total Circumference	7.85	**ft**	
Angle of Flow	3.58	**Radians**	
Hydraulic Radius (A/P)	0.70		
Wetted Perimeter	4.48		
Velocity head, hv	5.04		
T, Top Width	2.44	**feet**	
Froude Number	2.80		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #7	100 year	

Pipe Diameter (inches)	18	**Inches**	1.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	12.1	**Inches**	1.01 **ft**
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.67		
Q (cfs)	**11.75**	**cfs**	
Area of Flow (ft^2)	1.26	**ft^2**	
Velocity	**9.32**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	3.84	**Radians**	
Hydraulic Radius (A/P)	0.44		
Wetted Perimeter	2.88		
Velocity head, hv	1.35		
T, Top Width	1.41	**feet**	
Froude Number	1.74		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #8	100 year		
Pipe Diameter (inches)		30	**Inches**	2.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		20.9	**Inches**	1.74 **ft**
Pipe Slope (ft/ft)		0.04	**ft/ft**	
Pipe radius		1.25	**ft**	
d/D		0.70		
Q (cfs)		**68.10**	**cfs**	
Area of Flow (ft^2)		3.65	**ft^2**	
Velocity		**18.68**	**fps**	
Pipe Total Circumference		7.85	**ft**	
Angle of Flow		3.95	**Radians**	
Hydraulic Radius (A/P)		0.74		
Wetted Perimeter		4.93		
Velocity head, hv		5.42		
T, Top Width		2.30	**feet**	
Froude Number		2.62		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3	
Date	5/16/2017	
	Pipe #9	100 year

Pipe Diameter (inches)	18	**Inches**	1.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	12.5	**Inches**	1.04 **ft**
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.69		
Q (cfs)	**8.70**	**cfs**	
Area of Flow (ft^2)	1.31	**ft^2**	
Velocity	**6.64**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	3.94	**Radians**	
Hydraulic Radius (A/P)	0.44		
Wetted Perimeter	2.96		
Velocity head, hv	0.69		
T, Top Width	1.38	**feet**	
Froude Number	1.20		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #10	100 year		
Pipe Diameter (inches)		18	**Inches**	1.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		13.1	**Inches**	1.09 **ft**
Pipe Slope (ft/ft)		0.01	**ft/ft**	
Pipe radius		0.75	**ft**	
d/D		0.73		
Q (cfs)		**9.20**	**cfs**	
Area of Flow (ft^2)		1.37	**ft^2**	
Velocity		**6.70**	**fps**	
Pipe Total Circumference		4.71	**ft**	
Angle of Flow		4.08	**Radians**	
Hydraulic Radius (A/P)		0.45		
Wetted Perimeter		3.06		
Velocity head, hv		0.70		
T, Top Width		1.34	**feet**	
Froude Number		1.17		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #11	100 year		
Pipe Diameter (inches)		36	**Inches**	3.00 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		31.6	**Inches**	2.64 **ft**
Pipe Slope (ft/ft)		0.015	**ft/ft**	
Pipe radius		1.50	**ft**	
d/D		0.88		
Q (cfs)		**86.01**	**cfs**	
Area of Flow (ft^2)		6.58	**ft^2**	
Velocity		**13.07**	**fps**	
Pipe Total Circumference		9.42	**ft**	
Angle of Flow		4.86	**Radians**	
Hydraulic Radius (A/P)		0.90		
Wetted Perimeter		7.29		
Velocity head, hv		2.65		
T, Top Width		1.96	**feet**	
Froude Number		1.26		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #12	100 year		
Pipe Diameter (inches)		18	**Inches**	1.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		13.5	**Inches**	1.12 **ft**
Pipe Slope (ft/ft)		0.015	**ft/ft**	
Pipe radius		0.75	**ft**	
d/D		0.75		
Q (cfs)		**11.70**	**cfs**	
Area of Flow (ft^2)		1.42	**ft^2**	
Velocity		**8.25**	**fps**	
Pipe Total Circumference		4.71	**ft**	
Angle of Flow		4.18	**Radians**	
Hydraulic Radius (A/P)		0.45		
Wetted Perimeter		3.14		
Velocity head, hv		1.06		
T, Top Width		1.30	**feet**	
Froude Number		1.39		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #13 100 year		
Pipe Diameter (inches)	18	**Inches**	1.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	14.8	**Inches**	1.23 **ft**
Pipe Slope (ft/ft)	0.015	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.82		
Q (cfs)	**12.90**	**cfs**	
Area of Flow (ft^2)	1.55	**ft^2**	
Velocity	**8.30**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	4.54	**Radians**	
Hydraulic Radius (A/P)	0.46		
Wetted Perimeter	3.41		
Velocity head, hv	1.07		
T, Top Width	1.15	**feet**	
Froude Number	1.26		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #14	100 year		
Pipe Diameter (inches)		42	**Inches**	3.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		31.1	**Inches**	2.59 **ft**
Pipe Slope (ft/ft)		0.015	**ft/ft**	
Pipe radius		1.75	**ft**	
d/D		0.74		
Q (cfs)		**110.65**	**cfs**	
Area of Flow (ft^2)		7.64	**ft^2**	
Velocity		**14.49**	**fps**	
Pipe Total Circumference		11.00	**ft**	
Angle of Flow		4.15	**Radians**	
Hydraulic Radius (A/P)		1.05		
Wetted Perimeter		7.25		
Velocity head, hv		3.26		
T, Top Width		3.07	**feet**	
Froude Number		1.62		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #15	100 year		
Pipe Diameter (inches)		18	**Inches**	1.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		12.4	**Inches**	1.03 **ft**
Pipe Slope (ft/ft)		0.015	**ft/ft**	
Pipe radius		0.75	**ft**	
d/D		0.69		
Q (cfs)		**10.51**	**cfs**	
Area of Flow (ft^2)		1.29	**ft^2**	
Velocity		**8.12**	**fps**	
Pipe Total Circumference		4.71	**ft**	
Angle of Flow		3.91	**Radians**	
Hydraulic Radius (A/P)		0.44		
Wetted Perimeter		2.93		
Velocity head, hv		1.02		
T, Top Width		1.39	**feet**	
Froude Number		1.48		

Manning's Pipe Flow (Normal Flow)

Project	Westcreek Phase 3			
Date	5/16/2017			
	Pipe #16	100 year		
Pipe Diameter (inches)		42	**Inches**	3.50 **ft**
Manning's Coeff (n)		0.013		
Depth of Flow (d)		32.2	**Inches**	2.69 **ft**
Pipe Slope (ft/ft)		0.02	**ft/ft**	
Pipe radius		1.75	**ft**	
d/D		0.77		
Q (cfs)		**133.11**	**cfs**	
Area of Flow (ft^2)		7.92	**ft^2**	
Velocity		**16.80**	**fps**	
Pipe Total Circumference		11.00	**ft**	
Angle of Flow		4.27	**Radians**	
Hydraulic Radius (A/P)		1.06		
Wetted Perimeter		7.47		
Velocity head, hv		4.38		
T, Top Width		2.96	**feet**	
Froude Number		1.81		

Manning's Pipe Flow (Normal Flow)

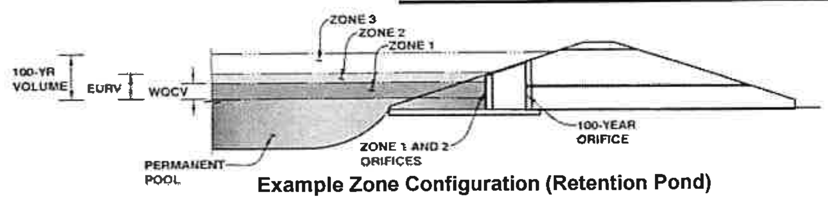
Project	Westcreek Phase 3		
Date	5/16/2017		
	Pipe #17	100 year	

Pipe Diameter (inches)	42	**Inches**	3.50 **ft**
Manning's Coeff (n)	0.013		
Depth of Flow (d)	35.5	**Inches**	2.96 **ft**
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	1.75	**ft**	
d/D	0.84		
Q (cfs)	**145.81**	**cfs**	
Area of Flow (ft^2)	8.67	**ft^2**	
Velocity	**16.83**	**fps**	
Pipe Total Circumference	11.00	**ft**	
Angle of Flow	4.66	**Radians**	
Hydraulic Radius (A/P)	1.06		
Wetted Perimeter	8.16		
Velocity head, hv	4.40		
T, Top Width	2.54	**feet**	
Froude Number	1.60		

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Westcreek Phase 3

Basin ID:



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	30.23	acres
Watershed Length =	2,300	ft
Watershed Slope =	0.033	ft/ft
Watershed Imperviousness =	70.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.696	acre-feet
Excess Urban Runoff Volume (EURV) =	2.066	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.055	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.866	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	3.538	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	4.338	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	5.029	acre-feet
100-yr Runoff Volume (P1 = 2.5 in.) =	5.798	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	1.950	acre-feet
Approximate 5-yr Detention Volume =	2.487	acre-feet
Approximate 10-yr Detention Volume =	2.672	acre-feet
Approximate 25-yr Detention Volume =	2.814	acre-feet
Approximate 50-yr Detention Volume =	3.118	acre-feet
Approximate 100-yr Detention Volume =	3.524	acre-feet

Optional User Input 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.50	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.696	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.696	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	

Total detention volume is less than 100-year volume.

Depth Increment = 0.5 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	30	0.001		
90	--	0.50	--	--	--	3,826	0.088	926	0.021
91	--	1.00	--	--	--	4,751	0.109	3,061	0.070
92	--	2.00	--	--	--	5,756	0.132	8,304	0.191
93	--	3.00	--	--	--	6,824	0.157	14,652	0.336
94	--	4.00	--	--	--	7,957	0.183	22,042	0.506
95	--	5.00	--	--	--	9,245	0.212	30,643	0.703
96	--	6.00	--	--	--	10,710	0.246	40,621	0.933
97	--	7.00	--	--	--	12,200	0.280	52,076	1.195
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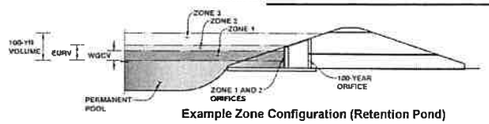
Detention Basin Outlet Structure Design

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.97	0.696	Orifice Plate
Zone 2			Not Utilized
Zone 3			Not Utilized
		0.696	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 bottom of basin at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.97	ft (relative to bottom of basin at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	24.00	inches
Orifice Plate: Orifice Area per Row =	3.07	sq. inches (diameter = 1-15/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.132E-02	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	2.00	4.00					
Orifice Area (sq. inches)	3.07	3.07	3.07					

	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 bottom of basin at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to bottom of basin 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)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.97	N/A	ft (relative to bottom of basin at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area / total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Not Selected	Not Selected	
Height of Grate Upper Edge, H_t =	4.97	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.33	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	22.40	N/A	ft^2
Overflow Grate Open Area with Debris =	11.20	N/A	ft^2

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

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	0.00	ft (distance below bottom of basin at Stage = 0 ft)
Circular Orifice Diameter =	42.00	42.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Not Selected	Not Selected	
Outlet Orifice Area =	9.62	9.62	ft^2
Outlet Orifice Centroid =	1.75	1.75	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to bottom of basin at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	0.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.10	feet
Stage at Top of Freeboard =	8.10	feet
Basin Area at Top of Freeboard =	0.28	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	1.19	1.50	1.75	2.00	2.25	2.50	0.00
Calculated Runoff Volume (acre-ft) =	0.696	2.066	2.055	2.866	3.538	4.338	5.029	5.798	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.695	2.066	2.055	2.866	3.538	4.337	5.024	5.793	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.27	0.45	0.86	1.09	1.37	1.91
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	8.1	13.7	26.1	33.0	41.5	57.8
Peak Inflow Q (cfs) =	13.7	40.3	40.1	56.2	69.6	85.4	99.0	114.3	#N/A
Peak Outflow Q (cfs) =	0.4	25.6	25.4	44.2	58.4	73.4	82.7	91.5	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	5.5	4.3	2.8	2.5	2.2	#N/A
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	1.13	1.10	1.9	2.6	3.2	3.7	4.1	#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) =	40	45	45	45	45	44	44	44	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	45	45	45	45	45	45	45	#N/A
Maximum Ponding Depth (ft) =	4.05	5.59	5.58	5.86	6.09	6.38	6.60	6.97	#N/A
Area at Maximum Ponding Depth (acres) =	0.18	0.23	0.23	0.24	0.25	0.26	0.27	0.28	#N/A
Maximum Volume Stored (acre-ft) =	0.513	0.832	0.832	0.898	0.955	1.028	1.086	1.187	#N/A

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	10-Year Event	1.75	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: Kent Rockwell
Company: Rockwell Consulting, Inc.
Date: May 12, 2017
Project: Westcreek Phase 3
Location: Cowpoke Road and Tutt Boulevard

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	1A	1	2	3	4	5	6	7	8	9	10	11	12	13
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.880	1.750	2.110	1.060	1.130	1.200	0.820	0.800	0.320	1.930	3.670	0.660	1.420	0.660
Directly Connected Impervious Area (DCIA, acres)	0.000	1.100	1.460	0.740	0.690	0.730	0.600	0.520	0.250	1.230	2.380	0.370	0.800	0.470
Unconnected Impervious Area (UIA, acres)	0.570	0.180	0.150	0.120	0.080	0.110	0.060	0.070	0.020	0.150	0.220	0.110	0.000	0.040
Receiving Pervious Area (RPA, acres)	0.140	0.100	0.250	0.130	0.270	0.240	0.050	0.140	0.015	0.250	0.670	0.090	0.000	0.070
Separate Pervious Area (SPA, acres)	0.170	0.370	0.250	0.070	0.090	0.120	0.110	0.070	0.035	0.300	0.400	0.090	0.620	0.080
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.880	1.750	2.110	1.060	1.130	1.200	0.820	0.800	0.320	1.930	3.670	0.660	1.420	0.660
Directly Connected Impervious Area (DCIA, %)	0.0%	62.9%	69.2%	69.8%	61.1%	60.8%	73.2%	65.0%	78.1%	63.7%	64.9%	56.1%	56.3%	71.2%
Unconnected Impervious Area (UIA, %)	64.8%	10.3%	7.1%	11.3%	7.1%	9.2%	7.3%	8.8%	6.3%	7.8%	6.0%	16.7%	0.0%	6.1%
Receiving Pervious Area (RPA, %)	15.9%	5.7%	11.8%	12.3%	23.9%	20.0%	6.1%	17.5%	4.7%	13.0%	18.3%	13.6%	0.0%	6.1%
Separate Pervious Area (SPA, %)	19.3%	21.1%	11.8%	6.6%	8.0%	10.0%	13.4%	8.8%	10.9%	15.5%	10.9%	13.6%	43.7%	12.1%
A_R (RPA / UIA)	0.246	0.556	1.667	1.083	3.375	2.182	0.833	2.000	0.750	1.667	3.045	0.818	0.000	1.750
I_a Check	0.800	0.640	0.380	0.480	0.230	0.310	0.550	0.330	0.570	0.380	0.250	0.550	1.000	0.360
f / I for WQCV Event:	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
f / I for 10-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
f / I for 100-Year Event:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.78	0.69	0.54	0.59	0.45	0.50	0.63	0.51	0.65	0.54	0.46	0.63	1.00	0.53
IRF for 10-Year Event:	0.94	0.92	0.87	0.89	0.85	0.86	0.90	0.86	0.90	0.87	0.85	0.90	1.00	0.87
IRF for 100-Year Event:	0.96	0.93	0.89	0.91	0.87	0.88	0.92	0.89	0.92	0.89	0.87	0.92	1.00	0.89
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	64.8%	73.1%	76.3%	81.1%	68.1%	70.0%	80.5%	73.8%	84.4%	71.5%	70.8%	72.7%	56.3%	77.3%
Effective Imperviousness for WQCV Event:	50.3%	69.9%	73.0%	76.5%	64.3%	65.4%	77.8%	69.5%	82.2%	67.9%	67.6%	66.6%	56.3%	74.4%
Effective Imperviousness for 10-Year Event:	61.1%	72.3%	75.4%	79.9%	67.1%	68.7%	79.8%	72.6%	83.8%	70.5%	69.9%	71.1%	56.3%	76.5%
Effective Imperviousness for 100-Year Event:	62.1%	72.5%	75.5%	80.1%	67.2%	68.9%	79.9%	72.8%	83.9%	70.7%	70.1%	71.4%	56.3%	76.6%
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	18.2%	5.3%	5.6%	8.2%	5.8%	7.0%	4.9%	7.0%	4.3%	5.7%	5.1%	9.5%	0.0%	5.0%
10-Year Event CREDIT**: Reduce Detention By:	5.8%	1.2%	1.2%	1.6%	1.7%	1.9%	1.0%	1.7%	0.9%	1.5%	1.3%	2.4%	0.0%	1.1%
100-Year Event CREDIT**: Reduce Detention By:	3.9%	0.9%	0.9%	1.2%	1.3%	1.5%	0.7%	1.3%	0.6%	1.1%	1.0%	1.8%	0.0%	0.9%
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**71.8%**
Total Site Effective Imperviousness for WQCV Event:	**67.9%**
Total Site Effective Imperviousness for 10-Year Event:	**70.8%**
Total Site Effective Imperviousness for 100-Year Event:	**71.0%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	10-Year Event	1.75	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: Kent Rockwell
Company: Rockwell Consulting, Inc.
Date: May 12, 2017
Project: Westcreek Phase 3
Location: Cowpoke Road and Tutt Boulevard

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	2.620	0.280	1.060	1.320	1.700	0.900	0.750	1.100	1.300	0.600	2.160	2.340	0.420	0.420
Directly Connected Impervious Area (DCIA, acres)	1.620	0.260	0.650	0.880	1.090	0.590	0.610	0.630	0.910	0.450	1.540	0.000	0.000	0.000
Unconnected Impervious Area (UIA, acres)	0.260	0.010	0.090	0.110	0.150	0.050	0.000	0.000	0.000	0.000	0.000	1.520	0.100	0.270
Receiving Pervious Area (RPA, acres)	0.490	0.000	0.200	0.220	0.310	0.180	0.000	0.000	0.000	0.000	0.000	0.820	0.320	0.150
Separate Pervious Area (SPA, acres)	0.250	0.010	0.120	0.110	0.150	0.080	0.140	0.470	0.390	0.150	0.620	0.000	0.000	0.000
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	2.620	0.280	1.060	1.320	1.700	0.900	0.750	1.100	1.300	0.600	2.160	2.340	0.420	0.420
Directly Connected Impervious Area (DCIA, %)	61.8%	92.9%	61.3%	66.7%	64.1%	65.6%	81.3%	57.3%	70.0%	75.0%	71.3%	0.0%	0.0%	0.0%
Unconnected Impervious Area (UIA, %)	9.9%	3.6%	8.5%	8.3%	8.8%	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	65.0%	23.8%	64.3%
Receiving Pervious Area (RPA, %)	18.7%	0.0%	18.9%	16.7%	18.2%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%	35.0%	76.2%	35.7%
Separate Pervious Area (SPA, %)	9.5%	3.6%	11.3%	8.3%	8.8%	8.9%	18.7%	42.7%	30.0%	25.0%	28.7%	0.0%	0.0%	0.0%
A_R (RPA / UIA)	1.885	0.000	2.222	2.000	2.067	3.600	0.000	0.000	0.000	0.000	0.000	0.539	3.200	0.555
I_a Check	0.350	1.000	0.310	0.330	0.330	0.220	1.000	1.000	1.000	1.000	1.000	0.650	0.240	0.640
f / I for WQCV Event:	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
f / I for 10-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
f / I for 100-Year Event:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.52	1.00	0.50	0.51	0.51	0.45	1.00	1.00	1.00	1.00	1.00	0.69	0.46	0.69
IRF for 10-Year Event:	0.87	1.00	0.86	0.86	0.86	0.85	1.00	1.00	1.00	1.00	1.00	0.92	0.85	0.92
IRF for 100-Year Event:	0.89	1.00	0.88	0.89	0.89	0.87	1.00	1.00	1.00	1.00	1.00	0.94	0.87	0.93
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	71.8%	96.4%	69.8%	75.0%	72.9%	71.1%	81.3%	57.3%	70.0%	75.0%	71.3%	65.0%	23.8%	64.3%
Effective Imperviousness for WQCV Event:	67.0%	96.4%	65.5%	70.9%	68.6%	68.0%	81.3%	57.3%	70.0%	75.0%	71.3%	44.9%	10.9%	44.1%
Effective Imperviousness for 10-Year Event:	70.4%	96.4%	68.6%	73.9%	71.7%	70.3%	81.3%	57.3%	70.0%	75.0%	71.3%	59.6%	20.2%	58.9%
Effective Imperviousness for 100-Year Event:	70.7%	96.4%	68.8%	74.0%	71.9%	70.4%	81.3%	57.3%	70.0%	75.0%	71.3%	60.8%	20.8%	60.0%
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	7.5%	0.0%	6.5%	6.8%	6.9%	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%	24.1%	44.8%	24.2%
10-Year Event CREDIT**: Reduce Detention By:	1.9%	0.1%	1.8%	1.6%	1.7%	1.3%	0.1%	0.1%	0.0%	0.1%	0.0%	8.5%	16.9%	8.8%
100-Year Event CREDIT**: Reduce Detention By:	1.4%	0.1%	1.4%	1.2%	1.3%	1.0%	0.0%	0.0%	0.0%	0.1%	0.0%	6.2%	13.9%	6.4%
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**69.5%**
Total Site Effective Imperviousness for WQCV Event:	**64.0%**
Total Site Effective Imperviousness for 10-Year Event:	**68.0%**
Total Site Effective Imperviousness for 100-Year Event:	**68.3%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	10-Year Event	1.75	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: Kent Rockwell
Company: Rockwell Consulting, Inc.
Date: May 12, 2017
Project: Westcreek Phase 3
Location: Cowpoke Road and Tutt Boulevard

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	28	29
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.450	0.790
Directly Connected Impervious Area (DCIA, acres)	0.000	0.000
Unconnected Impervious Area (UIA, acres)	0.290	0.060
Receiving Pervious Area (RPA, acres)	0.160	0.730
Separate Pervious Area (SPA, acres)	0.000	0.000
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	V

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.450	0.790
Directly Connected Impervious Area (DCIA, %)	0.0%	0.0%
Unconnected Impervious Area (UIA, %)	64.4%	7.6%
Receiving Pervious Area (RPA, %)	35.6%	92.4%
Separate Pervious Area (SPA, %)	0.0%	0.0%
A_R (RPA / UIA)	0.552	12.167
I_a Check	0.640	0.080
f / I for WQCV Event:	3.2	3.2
f / I for 10-Year Event:	0.5	0.5
f / I for 100-Year Event:	0.4	0.4
f / I for Optional User Defined Storm CUHP:		
IRF for WQCV Event:	0.69	0.00
IRF for 10-Year Event:	0.92	0.30
IRF for 100-Year Event:	0.93	0.32
IRF for Optional User Defined Storm CUHP:		
Total Site Imperviousness: I_{total}	64.4%	7.6%
Effective Imperviousness for WQCV Event:	44.2%	0.0%
Effective Imperviousness for 10-Year Event:	59.1%	2.3%
Effective Imperviousness for 100-Year Event:	60.2%	2.4%
Effective Imperviousness for Optional User Defined Storm CUHP:		

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	24.3%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-Year Event CREDIT**: Reduce Detention By:	8.6%	95.4%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	6.3%	93.5%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:															

Total Site Imperviousness:	**28.2%**
Total Site Effective Imperviousness for WQCV Event:	**16.0%**
Total Site Effective Imperviousness for 10-Year Event:	**22.9%**
Total Site Effective Imperviousness for 100-Year Event:	**23.4%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
***Minor Storm: 1-Hour Rain Depth	10-Year Event	1.75	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: Kent Rockwell
Company: Rockwell Consulting, Inc.
Date: May 12, 2017
Project: Westcreek Phase 3
Location: Cowpoke Road and Tutt Boulevard

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	Total
Receiving Pervious Area Soil Type	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	36.620
Directly Connected Impervious Area (DCIA, acres)	20.570
Unconnected Impervious Area (UIA, acres)	4.790
Receiving Pervious Area (RPA, acres)	5.995
Separate Pervious Area (SPA, acres)	5.265
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	36.620
Directly Connected Impervious Area (DCIA, %)	56.2%
Unconnected Impervious Area (UIA, %)	13.1%
Receiving Pervious Area (RPA, %)	16.4%
Separate Pervious Area (SPA, %)	14.4%
A_R (RPA / UIA)	1.252
I_a Check	0.440
f / I for WQCV Event:	3.2
f / I for 10-Year Event:	0.5
f / I for 100-Year Event:	0.4
f / I for Optional User Defined Storm CUHP:	
IRF for WQCV Event:	0.57
IRF for 10-Year Event:	0.88
IRF for 100-Year Event:	0.90
IRF for Optional User Defined Storm CUHP:	
Total Site Imperviousness: I_{total}	69.3%
Effective Imperviousness for WQCV Event:	63.6%
Effective Imperviousness for 10-Year Event:	67.7%
Effective Imperviousness for 100-Year Event:	68.0%
Effective Imperviousness for Optional User Defined Storm CUHP:	

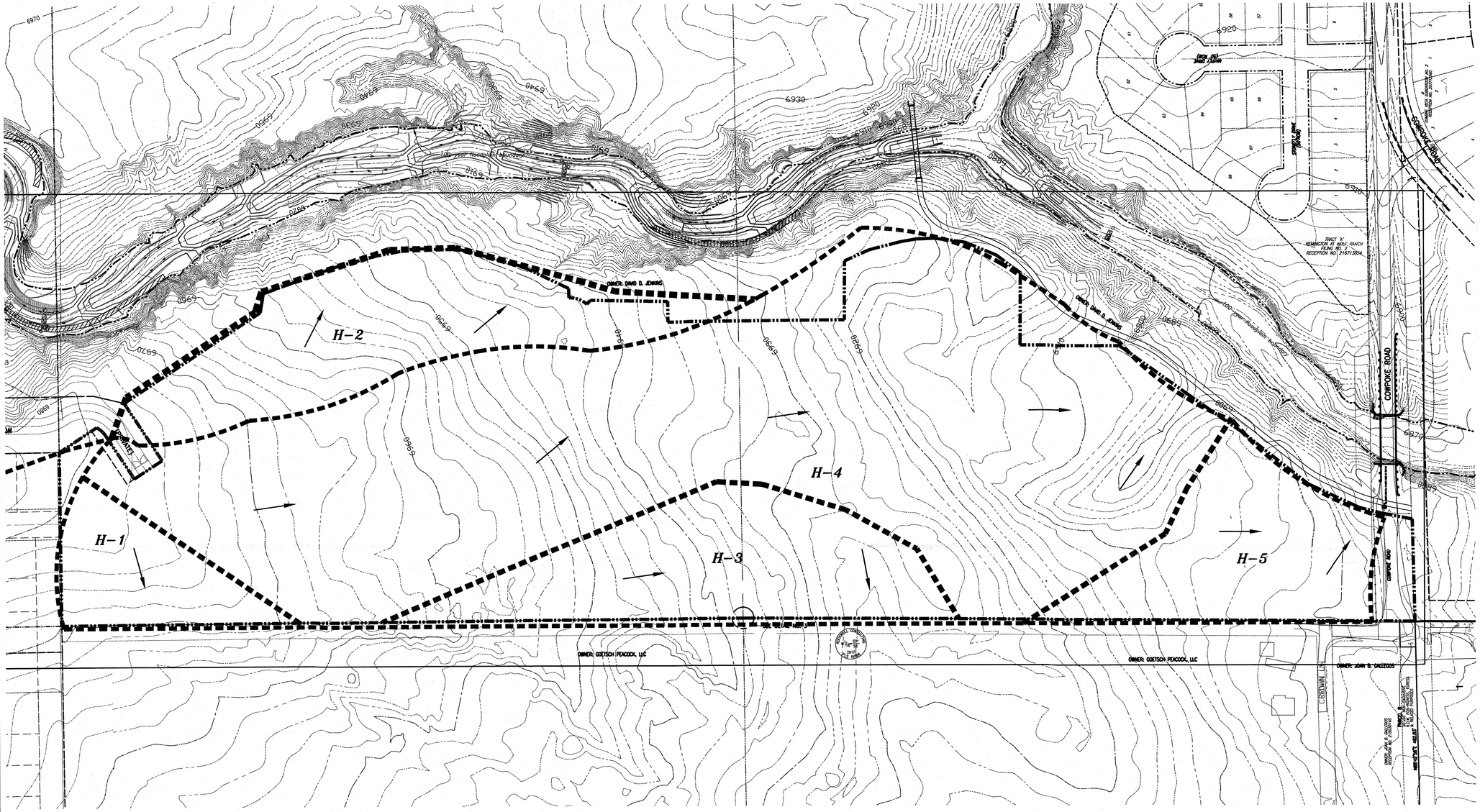
LID / EFFECTIVE IMPERVIOUSNESS CREDITS

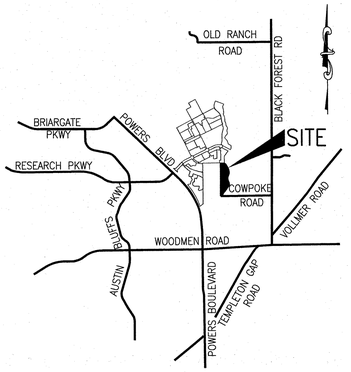
WQCV Event CREDIT: Reduce Detention By:	8.3%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-Year Event CREDIT**: Reduce Detention By:	2.3%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	1.7%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**69.3%**
Total Site Effective Imperviousness for WQCV Event:	**63.6%**
Total Site Effective Imperviousness for 10-Year Event:	**67.7%**
Total Site Effective Imperviousness for 100-Year Event:	**68.0%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed





Vicinity Map

NOT TO SCALE

LEGEND

- EXISTING CONTOURS (7000)
- HISTORIC BASINS
- DIRECTION OF FLOW
- *H-1* DRAINAGE BASIN
- DEVELOPMENT BOUNDARY

1" = 100'

0 25 50 100 200

Scale in Feet

HISTORIC DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
H-1	1.65	0.8	4.5
H-2	4.62	1.9	10.5
H-3	4.02	1.5	8.5
H-4	20.50	8.0	44.6
H-5	3.10	1.3	7.1

SHEET 1 OF 1

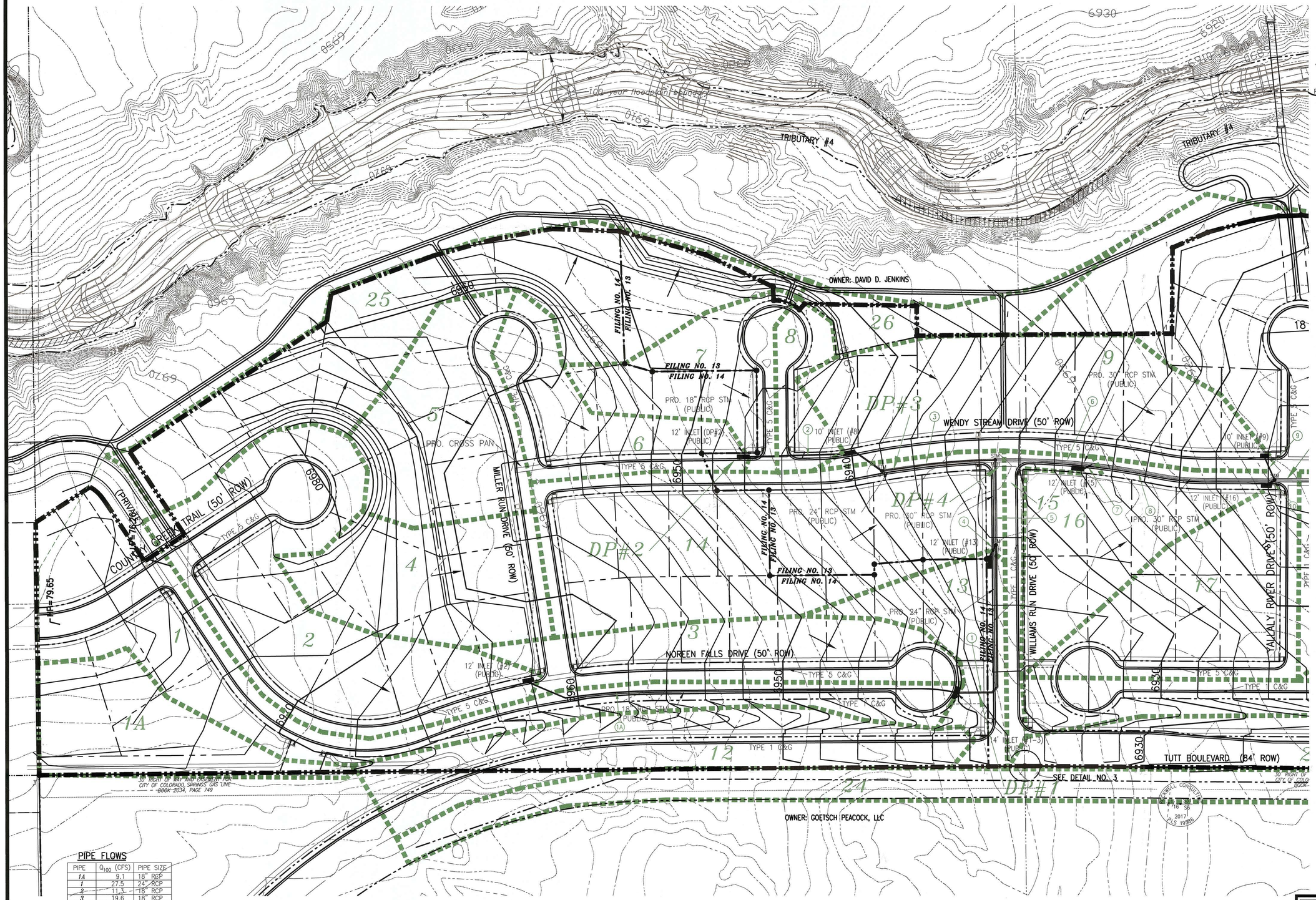
EXHIBIT 1

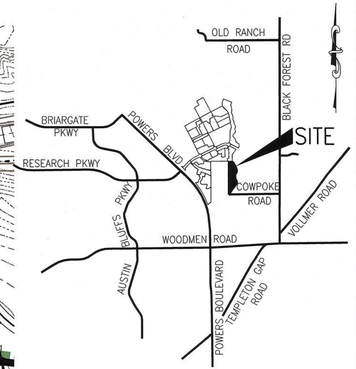
FILE: 17025DEV.DWG 12/11/17

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

TITLE : WESTCREEK III AT WOLF RANCH (FILING 13 AND 14) HISTORIC DRAINAGE PLAN

SCALE : 1"=100'	DRAWN BY : NM	17-025
DATE : 12/11/17	CHECKED BY : KDR	JOB NO.





Vicinity Map

NOT TO SCALE

DEVELOPED DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
1	1.75	4.3	8.7
1A	0.88	2.1	4.6
2	2.11	5.5	11.2
3	1.06	3.4	6.7
4	1.13	3.0	6.4
5	1.20	3.2	6.9
6	0.82	2.5	5.0
7	0.80	2.2	4.5
8	0.32	1.1	2.1
9	1.93	4.6	9.6
10	3.67	8.2	17.3
11	0.66	1.8	3.8
12	1.42	3.5	7.8
13	0.66	1.9	3.8
14	2.62	6.2	13.0
15	0.28	1.3	2.3
16	1.06	2.5	5.4
17	1.32	3.7	7.5
18	1.70	4.2	8.6
19	0.90	2.2	4.7
20	0.75	2.4	4.7
21	1.10	2.6	5.8
22	1.30	3.6	7.3
23	0.60	2.2	4.4
24	2.16	5.1	10.4
25	2.34	5.9	13.1
26	0.42	0.5	1.8
27	0.42	0.9	2.1
28	0.45	1.0	2.2
29	0.79	0.8	3.2

DEVELOPED DESIGN POINTS

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
DP#1	5.80	13.5	27.5
DP#2	3.15	7.9	16.6
DP#3	4.27	10.9	22.5
DP#4	10.50	23.4	48.4
DP#5	18.08	38.9	80.9
DP#6	24.77	51.9	107.9
DP#7	29.48	61.8	128.4

LEGEND

- EXISTING 2' CONTOUR
- 7000 EXISTING 10' CONTOUR
- PROPOSED 2' CONTOUR
- 7000 PROPOSED 10' CONTOUR
- DIRECTION OF FLOW
- DEVELOPED BASINS
- DIRECTION OF FLOW
- PROPOSED INLET & PIPE
- X DRAINAGE BASIN
- DP#1 DESIGN POINT
- (1) PIPE NUMBER

PIPE FLOWS

PIPE	Q_{100} (CFS)	PIPE SIZE
1A	9.1	18" RCP
1	27.5	24" RCP
2	11.3	18" RCP
3	19.6	18" RCP
4	9.3	18" RCP
5	36.8	30" RCP
6	56.4	30" RCP
7	11.7	18" RCP
8	68.1	30" RCP
9	8.7	18" RCP
10	9.2	18" RCP
11	86.0	36" RCP
12	11.7	18" RCP
13	12.9	18" RCP
14	110.6	42" RCP
15	10.5	18" RCP
16	133.1	42" RCP
17	145.8	42" RCP

NOTES

1. THIS IS A CONCEPT GRADING PLAN ONLY – NOT TO BE USED FOR CONSTRUCTION.
2. TOPSOIL TO BE STOCK PILED ON SITE AND REDISTRIBUTED AFTER OVER LOT GRADING IS COMPLETE.

APPROXIMATE FINISHED GRADING, SUBJECT TO FINAL DESIGN

1" = 60'

0 15 30 60 120

Scale in Feet

SHEET 1 OF 2

EXHIBIT 2

FILE: 17025DEV.DWG 12/11/17

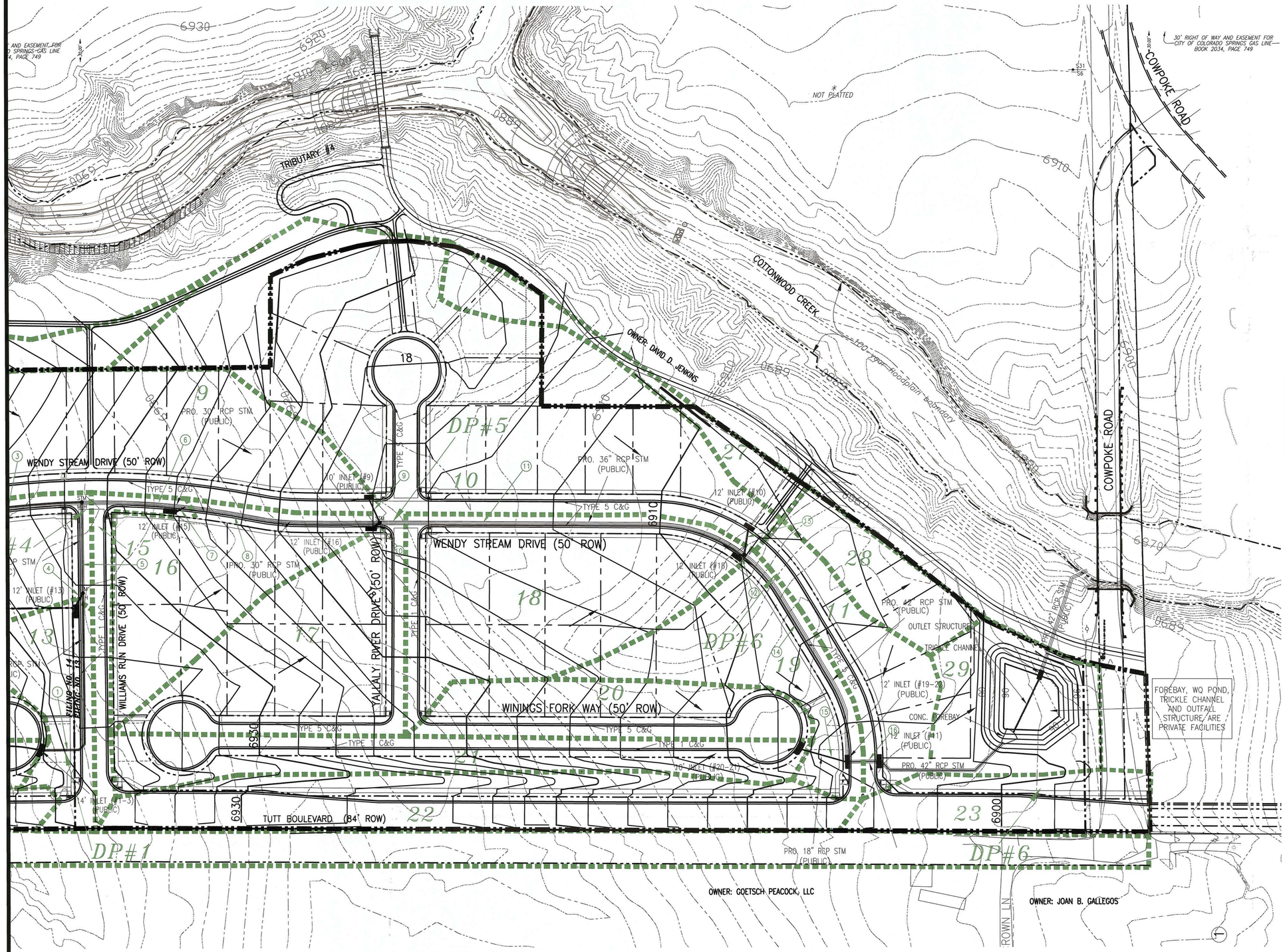
ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

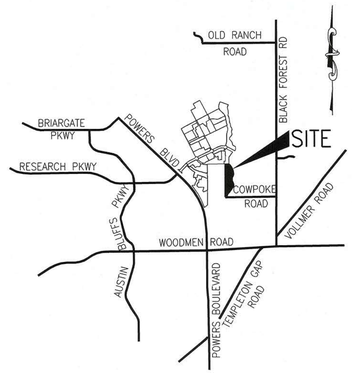
TITLE : WESTCREEK III AT WOLF RANCH (FILING NO. 13&14) DEVELOPED DRAINAGE PLAN

SCALE : 1"=60' | DRAWN BY : NM

DATE : 12/11/17 | CHECKED BY : KDR

17-025 JOB NO.





Vicinity Map

NOT TO SCALE

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PIPE FLOWS

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DEVELOPED DESIGN POINTS

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
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DP#7	29.48	61.8	128.4

LEGEND

- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- PROPOSED 2' CONTOUR
- PROPOSED 10' CONTOUR
- DIRECTION OF FLOW
- DEVELOPED BASINS
- DIRECTION OF FLOW
- PROPOSED INLET & PIPE
- X — DRAINAGE BASIN
- DP#1 — DESIGN POINT
- (1) — PIPE NUMBER

NOTES

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APPROXIMATE FINISHED GRADING, SUBJECT TO FINAL DESIGN

1" = 60'

0 15 30 60 120

Scale in Feet

SHEET 2 OF 2

EXHIBIT 2

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17-025 JOB NO.