MASTER DEVELOPMENT DRAINAGE PLAN
FOR
BRADLEY RANCH FILING NO.1

August 2017

Prepared for:

The Landhuis Company
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Prepared by:

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Project #43-093

MASTER DEVELOPMENT DRAINAGE PLAN
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DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

This report and plan for the drainage design of Bradley Ranch Filing No. 1 was prepared by me (or under my direct 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.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc.

VIRGIL A. SANCHEZ II
37160
8-29-17

DEVELOPER'S STATEMENT

The Landuis Company, hereby certifies that the drainage facilities for Bradley Ranch Filing No.1 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 Bradley Ranch Filing No. 1, guarantee that final drainage design review will absolve The Landuis Company, and/or their successors and/or assigns future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

BY: ______________________ DATE: 8/29/17

PRINTED NAME: Jeff Mark

TITLE:
ADDRESS: The Landuis Company
212 N. Wahsatch Ave, Suite 301
Colorado Springs, CO 80903

CITY OF COLORADO SPRINGS

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

BY: Anna Bergmark DATE: 9-6-17
For the City Engineer

CONDITIONS:

MASTER DEVELOPMENT DRAINAGE PLAN
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PURPOSE

The purpose of this drainage report is to identify and analyze the existing and proposed drainage patterns, determine the associated runoff quantities, evaluate existing drainage conveyance facilities, and when necessary recommend proposed drainage structures to aid and safely route developed storm water runoff to adequate outfall facilities. This report is also intended to support a property zoning change to allow for single-family residential development, zoned PUD, Planned Unit Development.

GENERAL LOCATION AND DESCRIPTION

The site is located in the NW and NE 1/4 of the NW 1/4 and of Section 36 and a portion of the NE 1/4 of the NE 1/4 of Section 25, Township 12 South, Range 66 West of the 6th Principal Meridian in Colorado Springs, Colorado. The site, known as Bradley Ranch Filing No.1, consists of approximately 120.193 acres in size and will be developed into single family lots, open space, neighborhood park site and utility and drainage tracts and public rights-of-way. The development is anticipated to overlot graded as a single filing, but finished construction is likely to follow a phased development based upon market conditions. Individual preliminary/final drainage reports will be required prior to the development of the interior lots.

The site is bounded to the north by several rural low density single family lots that line the south edge of the Black Forest. The site is bound to the east by the un-platted portions of the planned Wolf Ranch residential development and a Colorado Springs Utilities Water Tank Site. The site is bounded to the south by un-platted portions of the planned Wolf Ranch and Cordera subdivisions which are also planned for residential development. The site is bound to the by west by un-platted portions of the Cordera development, of which a portion will become the west half of Future Union Boulevard. A vicinity map showing the location of the site, and an aerial map showing the parcel and the surrounding features is provided within the appendix of this report.

The Bradley Ranch Filing No. 1 site is contained within both Pine Creek (North and South) and Cottonwood Creek major drainage basins. The existing site currently drains from the north to the west, southwest, and south. It should be noted that no onsite existing infrastructure, irrigation facilities or detention facility of significance were noted during field inspections. A few small stockponds are present near the middle of the site. Most likely, these ponds were utilized in watering livestock and are to be filled with the development of the site.

SOILS

The "Soil Survey of El Paso County Area" prepared by the Soil Conservation Service Soil Map indicates the presence of five Soil Map Units within the project area. They are as follows, Kettle gravelly loamy sand with 3 to 8 percent slopes (40), Kettle gravelly loamy sand with 8 to 40 percent slopes (41), Peyton-Pring complex with 3 to 8 percent slopes (68), Peyton-Pring complex with 8 to 15 percent slopes (69), Pring coarse sandy loam with 3 to 8 percent slopes (71). The Hydrologic Soil Group Rating associated with these soils is "B". Typically, HSG "B" rated soils possess moderate infiltration rates when thoroughly wetted, are moderately well to well drained and have a moderate rate of water transmission. A copy of the soils map for this site is included within the appendix of this report.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs Storm Drainage Design Criteria Manual. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. Topography for the site was complied at a two foot contour interval using LIDAR data, which was utilized to determine onsite-sub basin boundaries. Offsite sub-basin boundaries were determined utilizing mapping provided within previous drainage reports. Field inspections were conducted to verify offsite and onsite mapping.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria Manual. Inlet sizing, interception, and street capacities were calculated using Street Capacity and Inlet Sizing UD-Inlet v4.03 software from Urban Drainage and Flood Control District. Pertinent data sheets are included in the appendix of this report.

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) Panel No. 0804C0530, effective date March 17, 1997, no portion of the site lies within a designated floodplain.

DRAINAGE CRITERIA

The drainage analysis has been prepared in accordance with the current City of Colorado Springs Drainage Criteria Manual. Calculations were performed to determine runoff quantities during the 5- year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having areas less than 100 acres.

EXISTING DRAINAGE CONDITIONS

With the exception of the a few residential structures and outbuildings associated with the Bradley Ranch residence, the 120.193 acre site is primarily undeveloped. The site is covered by native grasses with a few elevated areas in the northern half of the property that contain rock outcroppings, trees and scrub oak and brush. The site lies within both the Pine Creek and Cottonwood Creek Drainage Basins, with its northern boundary line located approximately a quarter of a mile to the south of the upper most point, or top, of the two watersheds.

Historically about 1/12 or 10.1 acres of the subject site located along eastern boundary falls within the Cottonwood Creek Drainage Basin (CCDB). Generally this portion of the site drains from north to south, with slopes typically ranging from 2-10% with some steep existing grades reaching as high as four to one (4:1). Runoff from the up-gradient offsite portion of the watershed enters this portion of the subject site along the north and eastern boundaries before combining with internal runoff and discharging along the south boundary into portions of the undeveloped planned Wolf Ranch Development. Based upon the available data this portion of future Wolf Ranch is planned for low density residential development. This CCDB portion of the site has been previously analyzed within both the Cottonwood Creek Drainage Basin Planning Study, by URS Consultants in 1994 and more recently within the Wolf Ranch Master Development Drainage Plan Update, by Kiowa Engineering in 2013.

The majority of the site or the remaining 110.0 acres of Bradley Ranch Filing No. 1 falls with the Pine Creek Drainage Basin (PCDB). The majority up-gradient runoff entering this portion of the subject site is generated within unplatted rural 5 to 40 acre parcels located to the north of the site. Historically runoff from the Pine Creek Drainage Basin portion of the site drains to the south, southwest and west toward the un-platted portions the Future Cordera Development. Onsite slopes for this portion of the property range from 2 to 10% with some steep existing grades reaching as high as three to one (3:1) where forested rock outcroppings are present. Portions of the site, falling within the PCDB have been previously analyzed within the Pine Creek Drainage Basin Planning Study as most recently amended by JR Engineering in February 2003 (Amendment No. 3) and by several Master Development Drainage Plans for Cordera Filings No. 2 and 3 and the Briargate Crossings Neighborhoods Studies produced between 2002 and 2014. An aerial map in the appendix of the report illustrates the relationship of the proposed site in its existing condition to the surrounding developments.

An existing condition hydrologic analysis was prepared to determine peak runoff entering and exiting the subject site. The existing condition topography, basins boundaries, contributing design points, and peak flow summaries are depicted on the Bradley Ranch Filing No. 1 Existing Drainage Map in the appendix of this report. For purposes of discussion the existing condition basins have been grouped by offsite, onsite, and contributing watershed. It should be noted that the small existing stockponds located onsite, were not considered to store runoff and thus do not reduce the calculated runoff rates. No known functioning irrigation facilities are located on site.

Pine Creek Offsite Basins EX16-EX21 (North of Bradley Ranch)

Basins EX16 thru **EX21** and **Design Points 1, 2, 4, 13, 14** and **20** designate the watersheds areas and runoff data points that reach the northern boundary of Bradley Ranch. This area is a combination of platted and unplatted rural residential and undeveloped lots ranching from 0.5 acres to 40 acres in size.

Basin EX16 (Q5 = 10.4 cfs, Q100 = 60.5 cfs) is the largest delineated offsite basin located north of the subject site. The watershed consists of approximate 48.1 acres and is located north of the site, immediately south of the ridgeline that separates the Pine Creek and Kettle Creek drainage basins. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover, a few exposed rock outcroppings are present. A hand full of rural housing structures and outbuildings are present. Runoff produced within the basin is conveyed east to west as concentrated ditch flow from the top of the Pine Creek watershed to **Design Point 1** (Q5 = 10.4 cfs, Q100 = 60.5 cfs), located near the northwest corner of the site at the intersection of Old Ranch Road and existing Milam Road. Some erosion is noted south of the existing intersection where the existing roadway embankment directs flows to the southwest.

Basin EX17 (Q5 = 5.1 cfs, Q100 = 29.8 cfs) is the third largest offsite basin consisting of 16.2 acres and is located between **Basin EX-16** and the northern boundary of the site. The basin possesses a few structures with mixture of pine forest canopy, brush, and native grasses, providing relatively good ground cover. Some exposed rock outcroppings are present. Runoff from the basin generally travels as sheet flow and concentrated ditch flow from east to west until it reaches **Design Point 2** (Q5 = 5.1 cfs, Q100 = 29.8 cfs) near the northwest corner of the site.

Basin EX18 (Q5 = 0.3 cfs, Q100 = 1.8 cfs) is the smallest offsite basin consisting of 0.6 acres and is located adjacent to the northern boundary of the site. This offsite area contains a mixture of pine forest canopy, brush, and native grasses. Runoff from the basin generally travels as southwesterly as sheet flow to the boundary and **Design Point 4** (Q5 = 0.3 cfs, Q100 = 1.8 cfs) prior to entering onsite **Basin EX6**.

Basin EX20 (Q5 = 3.2 cfs, Q100 = 18.6 cfs) is an offsite basin consisting of 6.8 acres and is located adjacent to the northern boundary of the site. This offsite area contains a mixture of pine forest canopy, brush, and native grasses provide relatively good ground cover. Runoff from the basin generally travels as sheet flow and concentrated ditch flow from north to south to **Design Point 13** (Q5 = 3.2 cfs, Q100 = 18.6 cfs) and entering the subject site at **Basin EX9**.

Basin EX19 (Q5 = 3.3 cfs, Q100 = 19.3 cfs) is an offsite basin consisting of 8.0 acres and is located adjacent to the northern boundary of the site. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover. Runoff from the basin generally travels north to south as sheet flow and concentrated ditch flow to **Design Point 14** (Q5 = 3.3 cfs, Q100 = 19.3 cfs) and enters onsite **Basin EX9**.

Basin EX21 (Q5 = 4.7 cfs, Q100 = 27.6 cfs) is an offsite basin consisting of 11.8 acres and is located adjacent to the northern boundary of the site. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover with a few residential structures. Runoff from the basin generally travels as sheet flow and concentrated ditch flow from north to south to **Design Point 20** (Q5 = 4.7 cfs, Q100 = 27.6 cfs) and enters onsite **Basin EX13** traveling onward south through the site.

Pine Creek Onsite Basins EX1-EX13

Basins EX1 thru **EX13** and **Design Points 3, 5** thru **12, 15** thru **19** and **21** designate the watersheds areas and runoff data points which discharge to the southern and western boundaries of Bradley Ranch within the Pine Creek watershed. With the exception of the a few sporadic gravel access roadways, the Bradley Ranch residential structures and outbuilding the site remains primarily undeveloped.

Basin EX6 and Basin EX5A (EX6 Q5 = 2.9 cfs, Q100 = 16.6 cfs, EX5A Q5 = 0.9 cfs, Q100 = 5.3 cfs,) are located in the northwest corner of the site and are currently undeveloped, with the exception of a small gravel access driveway that bisects the two basins. **Basins EX6** and **EX5A** consist of approximately 8.5 acres and 2.5 acres respectively. The basins are covered by native grass vegetation with a few trees and shrubs. Sheet flow from entering the site from **DP-4** combines with runoff produced within **Basin EX6** and travels eastward to **Design Point 5** (Q5 = 3.1cfs, Q100 = 17.8 cfs). Runoff reaching **DP-5** continues eastward, ultimately combining runoff from **Basin EX5A** and **DP-2** just inside the northwest corner of the site at **Design Point 6** (Q5 = 7.9 cfs, Q100 = 45.9 cfs). Runoff from **DP-6** combines with runoff from **DP-1** offsite, **DP-7** and **DP-8**, south of Milan Road, at **Design Point 3**. The total peak runoff at this location is calculated at 22.3 cfs and 129.3 cfs in the 5 and 100-year storm events respectively.

Basin EX2 and Basin EX5B (EX2 Q5 = 2.1 cfs, Q100 = 12.4 cfs, EX5B Q5 = 1.7 cfs, Q100 = 9.9 cfs) are onsite basins consisting of 4.8 acres and 3.7 acres respectively. The two basins are located along the western boundary of the site, south of Milam Road. These basins are currently undeveloped, covered by natural, grassy vegetation with a few trees, shrubs and a portion of steep hillside with rock outcroppings. Runoff from each basins generally travels as sheet flow and concentrated ditch flow from east to west to the western boundary at **Design Points 7 (**Q5 = 1.7 cfs, Q100 = 9.9 cfs) and **Design Point 8** (Q5 = 2.1 cfs, Q100 = 12.4 cfs). Runoff from **DP-7** and **DP-8** combines with runoff from **DP-1** offsite and **DP-6**, south of Milan Road, at **Design Point 3**. The total peak runoff at this location is calculated at 22.3 cfs and 129.3 cfs in the 5 and 100-year storm events respectively.

Basin EX3 and Basin EX1 (EX3 Q5 = 2.9 cfs, Q100 = 17.0 cfs, EX1 Q5 = 5.0 cfs, Q100 = 28.8 cfs) are onsite basins consisting of 9.2 acres and 16.2 acres respectively. These two basins are located within the western half of the site, below existing **Basins EX6 and EX2**. Both basins are currently undeveloped consisting mostly of natural, grassy vegetation with sparse brush and trees. Runoff generally travels as sheet flow and concentrated ditch flow through **Basin EX3** from north to southwest to **Design Point 9** (Q5 = 2.9 cfs, Q100 = 17.0 cfs). Drainage reaching **DP-9** continues southwesterly through **Basin EX1**. Combined runoff from **Basin EX1** and **DP-9** exits the southwest corner of the site at **Design Point 10** (Q5 = 6.5 cfs, Q100 = 37.6 cfs).

Basin EX4 and Basin EX7 (EX4 Q5 = 2.1 cfs, Q100 = 12.0 cfs, EX7 Q5 = 0.9 cfs, Q100 = 5.4 cfs) are onsite basins consisting of 5.5 acres and 2.4 acres respectively. These two basins are located along the southern boundary of the site and do not receive runoff from other contributing up-gradient basins. The basins remain undeveloped, and are covered primarily with native grass vegetation. Runoff from theses basins typically travels as sheet flow and concentrated ditch flow from north to south/southwest ultimately reaching the southern boundary of the Bradley Ranch at **Design Points 11** (Q5 = 2.1 cfs, Q100 = 12.0 cfs) and **Design Point 12** (Q5 = 0.9 cfs, Q100 = 5.4 cfs).

Basin EX9 and Basin EX8 (EX9 Q5 = 2.9 cfs, Q100 = 17.0 cfs, EX8 Q5 = 4.6 cfs, Q100 = 26.7 cfs) are onsite basins consisting of 8.7 acres and 13.0 acres respectively. These two basins are located within the central portion of the site. These portions are primarily undeveloped with the exception of a few gravel roadways which lead to the various ranch buildings. The basins are typically covered with natural, grassy vegetation with a few trees and shrubs that increase in density further to the north. Sheet flow from entering the subject site from **DP-13** and **DP-14** combines with runoff produced within **Basin EX9** and travels southwesterly to a localized low point or stock pond located at **Design Point 15** (Q5 = 7.3cfs, Q100 = 42.6 cfs). Flows discharged at **DP-15** continue southwesterly, combining with runoff produced within **Basin EX8**. Combined runoff from **Basin EX8** and **DP-15** exits the south central portion of the site at **Design Point 16** (Q5 = 9.3 cfs, Q100 = 53.7 cfs).

Basin EX12, Basin EX10 and Basin EX11 (EX12 Q5 = 2.0 cfs, Q100 = 11.5 cfs, EX10 Q5 = 3.5 cfs, Q100 = 20.1 cfs, EX11 Q5 = 1.8 cfs, Q100 = 10.3 cfs) are onsite basins consisting of 4.9 acres, 9.7 acres and 4.8 acres respectively. These three basins are located in the eastern half of the site and are primarily undeveloped with the exception of a few residential structures, outbuildings and gravel drives that make up a large portion of the sparse ranch housing. These basins are typically covered with native grasses and a few trees and shrubs, which become more prevalent in the northern portions of **Basins EX12** and **EX10**. Runoff produced within **Basin EX12** generally travels as sheet flow and concentrated ditch flow from north to southwest entering **Basin EX10**

at **Design Point 17** (Q5 = 2.0 cfs, Q100 = 11.5 cfs). Combined runoff from **Basin EX10** and **DP-17** collect at an existing stock pond located a few hundred feet north of the south boundary at **Design Point 18** (Q5 = 5.2 cfs, Q100 = 30.0 cfs). Flows discharged at **DP-18** continue southwesterly combining with runoff produced within **Basin EX11**. Runoff from **Basin EX11** and **DP-18** discharges to the undeveloped ground to south of the subject site at **Design Point 19** at peak flow rates of Q5 = 6.1 cfs, Q100 = 35.6 cfs.

Basin EX13 (Q5 = 4.8 cfs, Q100 = 27.8 cfs) is an onsite basin consisting of 15.5 acres and is located within the eastern half of the site. This basin is primarily undeveloped with of a few residential structures, outbuildings and gravel drives that make up a large portion of the sparse ranch housing. The basin is typically covered with native grasses and a few trees and shrubs, which become more prevalent in the northern portions of the basin. Concentrated ditch flow from **DP-20** combines with flows from **Basin EX13** and continues southward through **Basin EX13** exiting the site at the southern boundary at **Design Point 21** at a peak flow rates of Q5 = 6.5 cfs, Q100 = 37.9 cfs.

Cottonwood Creek Offsite Basins EX22 and EX23/Onsite Basins EX14 and EX15 (North and East of Bradley Ranch)

Offsite Basins EX22 and EX23 and Onsite Basins EX15 and EX14 designate the watershed areas and runoff data calculated flows reaching the southern boundary of Bradley Ranch at **Design Point 23** within the Cottonwood Creek watershed.

Basin EX22 (Q5 = 3.2 cfs, Q100 = 18.8 cfs) is an offsite basin consisting of 8.8 acres and is located adjacent to the northeastern corner of the site. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover with a few residential structures. Runoff from the basin generally travels as sheet flow and concentrated ditch flow from north to south to **Design Point 20A** (Q5 = 3.2 cfs, Q100 = 18.8 cfs) and enters the onsite **Basin EX13** and continues traveling south through the site.

Basin EX23 (Q5 = 2.5 cfs, Q100 = 14.5 cfs) is an offsite basin consisting of 7.5 acres and is located adjacent to the eastern boundary of the site. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover and is located within an undeveloped portion of the adjacent Wolf Ranch Subdivision. This basin is primarily undeveloped with of an exception of the offsite tank site at the north end of the site. Runoff from the basin generally travels as sheet flow and concentrated ditch flow from north to south to **Design Point 23A** (Q5 = 2.5 cfs, Q100 = 14.5 cfs) and enters the onsite **Basin EX13** and continues traveling south through the site.

Basin EX15 (Q5 = 2.5 cfs, Q100 = 14.6 cfs) is approximately 7.4 acres in size and is located along the eastern boundary of the site within the Cottonwood Creek watershed. The basin is typically covered with native grasses and a few trees and shrubs, which become more prevalent in the northern portions of the basin. This basin is primarily undeveloped with of an exception of a small offsite construction storage yard located near the south corner of the site. Runoff from the **Basin EX15** combines with runoff from **DP-20A** and **DP-23A** and travels as sheet flow and concentrated ditch flow from north to south until it reaches **Design Point 23** at the southeast corner of the site (Q5 = 6.4 cfs, Q100 = 37.1 cfs).

Basin EX14 (Q5 = 1.2 cfs, Q100 = 6.8 cfs) is an onsite basin consisting of 2.9 acres. This basin is located along the southern boundary of the site and does not receive runoff from other contributing up-gradient basins. The basins remain undeveloped, and are covered primarily with native grass vegetation. Runoff from this basin typically travels as sheet flow and concentrated ditch flow from north to south ultimately reaching the southern boundary of the Bradley Ranch at **Design Points 22** (Q5 = 1.2 cfs, Q100 = 6.8 cfs).

WETLANDS

M&S Civil is currently coordinating with Core Engineering to determine if jurisdictional wetlands are present onsite. Should they be found, an additional jurisdictional determination will be made the Corps of Engineers. Additional information will be provided in subsequent submittal of this report. If wetlands are present, a plan to mitigate for replacement will be forthcoming. It should be noted that review DPBS and MDDP documents indicate that wetlands are present within the natural drainageways west of the site. The reports indicate that a minor amount of storm water should be discharged to the drainage ways to retain growth.

PREVIOUS REPORTS

Several studies and reports were reviewed during the preparation of the current study. A brief synopsis of the recommendations and/or key assumptions for the site and the relevant study are provided below. The provided synopsis also provides a timeline as to changes in assumptions. Please refer to each study for specific references to design points, pond and basin identifiers, etc. Copies of portions of the referenced documents are included within the appendix of this report.

Amendment 3 to Pine Creek Basin Planning Study and Master Development Drainage Plan for the Pine Creek Neighborhoods (Portions Contributing to Pine Creek), by JR Engineering, dated February, 2003.

- Assume flows from PNE1 (86.1ac) and PNE2 (109.3ac) (of which Bradley Ranch Filing No.1 and up-gradient offsite area is a portion) shall have a limited discharge of not more than 1.17 cfs/acre in the 100 year developed condition. This is to be accomplished by onsite detention within Bradley Ranch (Filing No. 1).

- Assumes development of PNE1 to include 63.5 acres of 2DU/AC, 19.3 acres of Commercial and 1.8 acres of 7DU/AC and 0.9 of park lands. CN=75.3

- Assumes development of PNE2 (109.3) to include 51.1 acres of 4DU/AC, 25.6 acres of 2DU/AC and 13.8 acres of 7DU/AC/Commercial and 12.7 acres of Park lands. CN=76.1

- **The land use associated with the offsite areas north of the boundary of Bradley Ranch are listed as unknown.**

- Indicates two ponds DFNE1 and DFNE2 are assumed for construction along the east Boundary of Bradley Ranch. Total allowable discharge from pond is 230 cfs or 239cfs at DP-E1 (includes 8.1 acre PNE3). Indicates discharges from Bradley Ranch ultimately flow to a single offsite location at DP-E3. Indicates that a single pond may be utilized in place of two ponds assuming total discharge is the same, if this is done it should be considered the ninth regional in Pine Creek.

- Recommends a diversion box be created downstream of the ponds that allows for trickle flow be discharged to the natural channel downstream of the pond in all events (Reach PC-9). Diverts flows less than the 5-year to a storm sewer system located that parallels Pine Creek North Fork in Basin PNE5, and that flows in excess of the 5-year event be allowed to overflow into the downstream channel.

- Recommends that the incised upper portion of the reach (PC-9) be regarded to a wide shallow swale and vegetated with native grasses and shrubs. **Report indicates that the existing stability of the reach can be maintained using the above recommendation for discharge from Bradley Ranch**.

Final Drainage report for Cordera Filing No. 1 & Master Development Drainage Plan for Cordera and Briargate Crossing East Pine Creek and Cottonwood Creek Basins, by Matrix Design Group, Inc., November 2004.

- **Indicates that a single pond DF-5 shall be constructed at the south west corner of Bradley Ranch (Filing No.1). Discharge from the pond should be limited to 130 cfs in the 5-year and 230 cfs in the 100-year event**.

- Drainage from Pine Creek Watershed Basins PF-11/PF-12 (this is the majority of land known as Bradley Ranch Filing No.1) and the up-gradient land north of subject site) shall discharge to the proposed pond DF-5, and no flow from these basins shall be allowed to enter Basin PE6 (Cordera South of Bradley Ranch). **The attached map shows a small (~50ft) strip of land along the south boundary of Bradley Ranch that is anticipated to be discharged adjacent Basin PE6 (clearly north of boundary.**

- Indicates flows from Basin A-1 in Cottonwood Creek (eastern portion of Bradley Ranch Filing No.1) shall be discharged to a Regional Detention Pond northeast of Powers Blvd and Research (Pond DF-1). The report discusses that the final volumes for the pond, including WQ will need to be adjusted after a site plan for Wolf Ranch firms up.

- Report indicates that Regional ponds have been expanded to provide WQ for developed watershed and now include 20% increase in the volume to account for sediment.

Master Development Drainage Plan - Wolf Ranch Development, Kiowa Engineering, February 2005 Update (Sept 2013).

- **Assumes flow from discharged from Basin A-1 (of which Bradley Ranch Filing No.l and up-gradient offsite area is a portion) will be Q5=3 cfs and Q100=32 cfs.**

- Indicates that Grades control structures will needed within Basin A-3 Wolf Ranch, downstream of the Bradley Ranch. The MDDP does not indicate what development triggers the construction of improvements.

Final Drainage report for Cordera Filing No. 3A & Master Development Drainage Plan for Cordera Filing No.3 Pine Creek & Kettle Creek Drainage Basins, by Matrix Design Group, Inc., November 2007.

It should be noted that the design points referenced within the text and those shown on the provided maps do not always coincide, thereby making the report difficult to interpret.

- **Assumes if development occurs within the Bradley Ranch area prior to the construction of the downstream facilities, Bradley Ranch shall discharge to sub-basin PP-1 at historic conditions.**

- Establishes DF-7, a detention pond, with no water quality, which is to be constructed downstream of Bradley Ranch, upstream of CSU gas line (DPJ21). This pond is to collect developed runoff from sub-basins, OP-1, PP-1, and design Point J1 (which includes Bradley Ranch OP-2, OP-3 and Union Boulevard OP-6, OP-7, OP-8 and OP-9); an area totaling 273.6 acres. Anticipates 100 year runoff of 363.9 cfs). This still assumes 230cfs+/- from Bradley Ranch (Filing No.1) and up-gradient watershed.

- Established a temporary detention pond and 36" RCP to collect interim flows the southwestern portion of Bradley Ranch and the offsite area between Bradley Ranch and the Cordera Development located south of the CSU gas main. Flows to this location are limited to historic discharge.

Final Drainage Report for Cordera Filing No. 2A & Master Development Drainage Plan for Cordera Filings 2A- 2D Pine Creek Drainage Basin, by Matrix Design Group, Inc., April 2006.

- Provides concept lot layout and grading for Cordera Subdivision areas adjacent to the south boundary of Bradley Ranch Filing No.1.

Amendment #1 to the Final Drainage Report for Cordera Filing No. 3A & Amendment #1 to the Master Development Drainage Plan for Cordera Filing No.3 & Final Drainage Report for Cordera Filing No. 3F Pine Creek & Kettle Creek Drainage Basins, by Matrix Design Group, Inc., October 2013.

- Eliminates Pond DF-7, by increases size of Pond DF-5 located within Cordera Filing No. 3.

- Pond DF-5 provides no water quality for offsite areas upstream of Cordera Filing No. 3.

- Fully Developed Condition Model appears to assume that two ponds area developed within Bradley Ranch by formally separating the outfall of Basins OP2 and OP3. Model indicates northern portion of Bradley Ranch Basins OP2 (offsite & onsite ~ 87.52 acres) and Milan Road Basins OP6 & 7 outfall to DP-SCS21, while the southern portion of Bradley Ranch Basin OP3 and Milan Road Basin OP8 and 9 outfall to DP-SCS7.

- A 54" Pipe at SCS21 will intercept 310 cfs (Referred to as System 3), a 42" Pipe at SCS7 will intercept 200 cfs (Referred to as System 4)

- Fully Developed Condition anticipates 100-Year developed Flow Rates for **Basin OP-2 = 116.6cfs,** OP6 = 10.2cfs and OP7 = 10.2cfs and 100-Year developed **Flow Rates for Basin OP3 = 144.1cfs, OP8 = 6.8cfs and OP9 = 6.8cfs,**

PROPOSED DRAINAGE PLAN

A proposed drainage plan for the fully develop condition is presented graphically on two maps contained in the appendix of this study. General developed drainage patterns from the proposed Bradley Ranch Filing No.1 will follow the recommendations of the Drainage Planning Basin Planning Studies and for both Cottonwood Creek and Pine Creek watersheds as well as the Master Development Drainage Plans for the adjacent developments. Both a general and detailed summary of the proposed development drainage plan is as follows. The discussion has been divided into two sections one per major watershed. A short discussion regarding the four step process precedes the drainage discussion.

FOUR STEP PROCESS

Step 1 Employ Runoff Reduction Practices. – Several large 0.5 acres lots will be constructed with custom homes with limited grading to preserving the natural vegetation. Approx. 8.7 Acres of ground within the project is being set aside for Open Space/Neighborhood Park. 5.5 acres of the Park are designated as a preservation area. Roof drains will be directed to side yard swales and in a case roadway flows will be directed to a grass lined swale to aid minimize direct connection of impervious surfaces.

Step 2 Implement BMPs that provide a water quality capture volume with slow release. – Multiple Full Spectrum Detention Facilities are planned for the site which will incorporate water quality capture volumes that are intended to slowly drain in 40 hours and excess urban runoff volumes that are intended to drain within 72 hours. .

Step 3 Stabilize streams. – The site is not directly adjacent to main branch of the Pine Creek or Cottonwood Creeks; however it does discharges into smaller up-gradient un-named tributaries. The developed discharge from the site is anticipated to be less that existing and therefore is not anticipated to have negative effects on downstream drainageways. A minor amount of frequent discharge to the downstream tributaries should be of benefit by providing water to existing wetlands vegetation which to provides habitat and functions to stabilize the existing channel banks and channel bed. Several onsite constructed grasslined channels have been constructed to convey runoff and provide water quality benefits.

Step 4 Implement site specific and other source control BMPs. – A final grading and erosion control plans will be submitted for review and approval and will address site specific needs. The proposed project will use silt fence, a vehicle tracking control pad, concrete washout area, inlet protection, check dams, sediment control logs, mulching and reseeding to mitigate the potential for erosion across the site.

Pine Creek Drainage Basin

General Description

Runoff produced within the rural offsite areas located to the north of the subject site are to be intercepted by proposed storm sewer extensions or conveyed onsite via side lot swales and natural drainageways into the streets of the Bradley Ranch Filing No.1 development. Developed runoff produced onsite shall combine with the aforementioned offsite runoff in underground storm sewer systems that are to convey flows to a single full spectrum detention pond located in the southwest corner of the site. As recommended as an alternative within the early iterations of the Pine Creek DBPS and early Cordera MDDP’s, a single regional detention facility has been selected over multiple ponds to treat runoff given that proposing to construction a second pond near the western boundary, functions poorly with the site topography, significantly impacts the development footprint, and maybe unnecessary given the assumption that the parcels to the north will see little to no expansion given that they lie within the heavily treed portion of the Black Forest and sufficient volume can be obtained at a single site.

As delineated within the Previous Reports section of the report, the assumptions regarding the allowable discharge from Bradley Ranch and the method for discharge to downstream basins within the Pine Creek Watershed has altered as various downstream developments have been brought on line. One of the more recent MDDPs in the area (Amendment #1 to the Final Drainage Report for Cordera Filing No. 3A & Amendment #1 to the Master Development Drainage Plan for Cordera Filing No.3 & Final Drainage Report for Cordera Filing

No. 3F Pine Creek & Kettle Creek Drainage Basins, by Matrix Design Group, Inc., October 2013), has HEC-HMS modeling and maps detailing discharge from two contributing watersheds denoted as Basins “OP-2” and “OP-3”. These basins are bound to the west by proposed/future Union Boulevard and are separated by the existing knoll which falls along the middle of the western boundary of Bradley Ranch. According the interim condition model runoff discharged at the north side of the knoll from “Basin OS-2” is anticipate to reach flow rates of 16.7cfs in the 5 year and 129.6 cfs in the 100 year while discharge from the south side and “Basin OS-3” is anticipated to reach flow rates of 9.9 and 74.4 cfs in the respective events. According the fully developed model runoff anticipated from “Basin OS-2” is similar with anticipated flow rates of 20.5cfs in the 5-year and 116.6 cfs in the 100-year while discharge from “Basin OS-3” was significantly increased to 28.3 and 144.1 cfs in the respective events. The interim condition discharge rates are in line with the historic flows calculated in the existing condition section of this report of 22.3cfs and 129.3 cfs at design Point 3 although not as restrictive as the 7.2 and 41.6cfs calculated at design point 24.

Thus in an attempt to conform to the MDDP assumptions regarding the discharge of runoff to Pine Creek from Bradley Ranch discharge from FSD 1 will be limited to the more restrictive historic flow rates calculated by this study. To accommodate the multi-basin discharge assumption from the site with only a single pond a splitter box is proposed below the pond outlet. This will allow for runoff to be distributed to both downstream watersheds ensuring runoff to the vegetation with both basins.. Runoff discharged from the proposed FSD Pond 1 will be over-detained to discharge around MDDP’s assumed 100-year 144.1 cfs thus allowing for a single discharge into Basin OS-3 if desired, thus limiting downstream infrastructure improvements that might impact offsite development.

It should be noted that at the time of the preparation of this study, is was determined that a development plan for the Cordera Parcel immediately adjacent to the west side of proposed Union Boulevard was being submitted to the City of Colorado Springs for review, but was not yet approved and thus was not available to the public. It is unclear at this time how that report may affect the planned discharge for this development; M&S plans to meet with civil engineers for the Cordera properties prior to issuing subsequent drainage report to further discuss the best alternative that works for all parties.

Detailed Description

The following is a detailed description of the onsite basins, offsite flows and the overall proposed drainage patterns and recommended infrastructure required for the development facility within the Pine Creek portion of of Bradley Ranch Filing No.1. The following Design Points and Basins were determined using the Rational Method since each individual basin is less than 100 acres and the combined acreage at any Design Point are also less than 100 acres. The proposed drainage design for this subdivision is typical for single family residential, consisting of; homes, landscaping, rear and side lot drainage swales, curb & gutter, streets, curb inlets, and pipes to convey developed flows downstream. Rear and side lot swales will be constructed to get developed flows to street curb and gutter.

Storm Sewer System A

Basin A is located along western boundary of the site and contains approximately 1.53 acres of the western half of proposed Union Boulevard. This offsite basin produces design flow rates of 5.7 cfs for the minor storm event (5-Year) and 10.3 cfs for the major storm event (100-Year). Runoff produced within Basin A will be conveyed via proposed curb and gutter to a low point and a proposed 6’ Sump D-10R inlet located at **Design Point A1** (Q_5= 5.7 cfs, Q_{100}=10.3 cfs). Storm water runoff collected by the proposed inlet will be conveyed under planned Union Boulevard in a proposed 24" RCP (**Pipe 1**).

Basin B is adjacent to **Basin A** and contains approximately 4.32 acres of the eastern half of proposed Union Boulevard as well as a portion of planned residential lots planned within the future Cordera Subdivision to the south of the subject site. **Basin B** has proposed design flow rates of 9.7 cfs for the minor storm event (5-Year) and 19.8 cfs for the major storm event (100-Year).

Basin C is located to the east of basin **Basin B** and will consist of approximately 2.32 acres of single family residential back yard lots and proposed tracts adjacent to proposed Union Boulevard. **Basin C** produces runoff of 2.5 cfs for the minor storm event (5-Year) and 7.1 cfs for the major storm event (100-Year). Runoff from **Basin C** will combine with runoff from **Basin B** and flow-by from inlets located within Tochal Drive. The combined flows will be conveyed via proposed curb and gutter to a proposed 16' sump inlet located at **Design Point A2** (Q5=10.1 cfs, Q100=25.7 cfs). Runoff captured by the proposed sump inlet (Q5= 10.1 cfs, Q100=25.7 cfs) and runoff carried in **Pipe 1** are to be discharged to the proposed **Full Spectrum Detention Facility Pond 1**, via a proposed 30" RCP (**Pipe 2**) at peak flow rates of 14.3 cfs and 33.3 cfs in the 5 and 100 year events respectively.

Storm Sewer System B

Basin OS3 (Q5 = 5.1 cfs, Q100 = 29.8 cfs) is a 16.17 acre offsite watershed located north subject site and east of existing Milan Drive. For the purposes of the study, the basin (**OS3**) is anticipated to remain in its undeveloped/highly pervious state. Runoff produced within the basin travels in a southwesterly direction as both sheet flow and as concentrated flow within several small natural shallow drainages, ultimately reaching the northern boundary of the property.

Basin J (Q5 = 2.7 cfs, Q100 = 8.6 cfs) consists of approximately 3.06 acres of the rear half of residential lots located along the northwest corner of the site. Runoff produced within **Basin J** is to be conveyed to a proposed trapezoidal shaped earthen swale in the landscaping set back which parallels the northern boundary.

Basin K (Q5 = 0.6 cfs, Q100 = 3.8 cfs) is a narrow 1.64 acre basin located along the northern boundary at the northwest corner of the site. The onsite basin possess a small of portion of undeveloped land and portion which will be utilized as a drainage corridor, and house a proposed trapezoidal shaped earthen swale that will function to collect runoff from within the basin as well as protect residential lots by diverting intercepted offsite flows to **Design Point B1**.

Basin OS2 (Q5 = 10.2 cfs, Q100 = 59.2 cfs) is a large 47.03 acre offsite basin located north of the subject site that extends from Milan Road to the ridgeline that separates the Pine Creek and Kettle Creek drainage basins. The watershed possesses a mixture of pine forest canopies native brush and grasses providing relatively good ground cover. A few exposed rock outcroppings are also present. A hand full of rural housing structures and outbuildings are present. For the purposes of the study, the watershed (**OS2**) is anticipated to remain in its relatively undeveloped/highly pervious state. Runoff produced within the basin is conveyed east to west within several natural drainages from the top of the Pine Creek watershed to northwest corner of the subject site and **Design Point B1** (Q5 = 15.6 cfs, Q100 = 86.4 cfs). At **DP-B1** drainage from **Basins K**, **OS2** and **OS3** will combine at a localized depression and a proposed 48" RCP culvert (**Pipe 3**) at peak flow rates of Q5 = 15.6 cfs, Q100 = 86.4 cfs.

It is recommended that the addition site inspection be conducted to further interpret offsite drainage patterns so that the sizing of the trapezoidal ditch can be adjusted to adequately intercept and convey runoff. It should be noted that the side slopes of the proposed swale may require slope protection, such as a permanent soil loaded geotextile blanket which will function to arrest erosion. Riprap lining may be required in locations where significant concentrated enters the swale from larger offsite parcels. These efforts are anticipated to be furthered analyzed and discussed within subsequent drainage reports.

Basin L2 (Q5 = 3.6 cfs, Q100 = 7.8 cfs) consists of approximately 1.61 acres of the rear of residential lots and the north half of Tochal Drive located to the west of **Design Point X1**. Runoff from Basin L2 will combine with flow-by from **DPX1** in the northern curb and gutter of Tochal Road and conveyed westward to a 14' At-Grade D-10R inlet located at **Design Point B2** (Q5 = 3.5 cfs, Q100 = 12.2 cfs). A proposed 24" RCP (**Pipe 4**) will convey the collected flows of Q5 = 3.5 cfs, Q100 = 10.0 cfs south under Tochal Drive.

Basin L4 (Q5 = 1.6 cfs, Q100 = 3.1 cfs) consists of approximately 0.51 acres of a portion of the southern half rights of way of Tochal Drive west of **Design Point X2**. Runoff produced within **Basin L4** will combine with by-pass flows from **Design Point D9** and continue westward via curb and gutter to a 14' At-Grade D-10R inlet located at **Design Point B3** (Q5 = 1.5 cfs, Q100 = 12.9 cfs). A proposed 30" RCP (**Pipe 5**) will convey the combined runoff in **Pipe 4** and flow intercepted at **DPB3** of Q5 = 3.9 cfs, Q100 = 15.5 cfs underground where it will combine with flow in Pipe3. Pipe 6 a 48" RCP will convey runoff of Q5 = 18.1 cfs, Q100 = 96.1 cfs to proposed **Full Spectrum Detention Pond 1**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to Full Spectrum Detention Pond 1 summary). Flows by-passing the proposed inlets at **DPB2** and **DPB3** will continue westward within Tochal Drive to Union Boulevard (refer to **Storm System A**).

Storm Sewer System X

Basin OS4 (Q5 = 0.3 cfs, Q100 = 1.8 cfs) is an offsite basin consisting of 0.63 acres located adjacent to the northern boundary of the site. This offsite area contains a mixture of pine forest canopy, brush, and native grasses. Runoff from the basin generally travels as southwesterly as sheet flow to the north boundary prior to entering onsite **Basin M**.

Basin M (Q5 = 3.1 cfs, Q100 = 9.7 cfs) consists of approximately 3.01 acres of the 0.5 acre residential lots and streets located along the north half of Lonzo Drive. Runoff produced within **Basin M** combines within runoff from **Basin OS4** prior to reaching the curb and gutter of Lonzo drive. Similar to the basin located along the north side of Yari Drive is anticipated that this area will require additional planning during final design with the implemented drainage solution being highly dependent upon final roadway elevations and the placement of houses on half acre lots. Once again, potential solutions could range from the grading of a small ditch along a portion of the lots behind the sidewalk and directing runoff to the back of the proposed inlet, to the installation of a small culvert or culvert(s), or individual lot side lot swale grading to prevent concentrated from reaching the design point. Additional drainage analysis and drainage recommendation will be provided within subsequent drainage reports or letters. For the purposes of this report, runoff will be collected and conveyed via the curb and gutter conveyed to the intersection of Wrangell Circle and Lonzo Drives where it they enter **Basin U**.

Basin U (Q5 = 4.1 cfs, Q100 = 10.3 cfs) consists of approximately 2.80 acres of residential lots and streets, which includes a portion of the south half of proposed Lonzo Drive and a portion of the eastt half of Wrangell Circle. Runoff produced within residential lots of **Basin U** will be conveyed via side lot swales to the adjacent streets, where it will combine with the runoff produced **Basins OS-4** and **M** at the northeast corner of Tochal and Wrangell Circle.

<u>Basin U1</u> (Q5 = 2.3 cfs, Q100 = 5.4 cfs) consists of approximately 1.16 acres of the front half of residential lots and street along a portion of proposed Yari Drive and a portion of the north half of Tochal Drive. Runoff produced within residential lots of **Basin U1** will be conveyed via side lot swales to the adjacent streets, where it will combine with the flow-by from inlets located at **Design points DPD4** thru **DPD8,** and **Basins M OS4** and **U** in the north curb line of proposed Tochal Drive.

<u>Basin L1</u> (Q5 = 2.6 cfs, Q100 = 5.6 cfs) consists of approximately 1.15 acres of the rear of residential lots located along the north half of Tochal Drive east of Wrangell Circle. Runoff from **Design points DPD4** thru **DPD8,** and **Basins M OS4** and **U** will combine with runoff produced within **Basin L1** and continue westward via curb and gutter to a 14' At-Grade D-10R inlet located at **Design Point X1** (Q5 = 10.1 cfs, Q100 = 19.4 cfs). A proposed 24" RCP (**Pipe 54**) will convey the collected flows of Q5 = 9.6 cfs, Q100 = 14.4 cfs south under Tochal Drive.

<u>Basin L3</u> (Q5 = 3.4 cfs, Q100 = 7.2 cfs) consists of approximately 1.50 acres of a portion of the southern half rights of way of Tochal Drive between Yari Drive and **Design Point X2.** Runoff produced within **Basin L1** will combine with by-pass flows from **Design Point D9** and continue westward via curb and gutter to a 14' At-Grade D-10R inlet located at **Design Point X2** (Q5 = 3.4 cfs, Q100 = 26.5 cfs). A proposed 30" RCP (**Pipe 55**) will convey the collected flows from **DPX2 and Pipe 54 of** Q5 = 12.3 cfs, Q100 = 27.3 cfs underground to proposed **Full Spectrum Detention Pond 1**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to **Full Spectrum Detention Pond** 1 summary). Runoff by-passing the proposed inlets at **DPX1** and **DPX2** will continue westward within Tochal Drive to Union Boulevard (refer to **Storm System B**).

<u>Storm Sewer System C</u>

<u>Basin D</u> (Q5 = 4.6 cfs, Q100 = 9.9 cfs) consists of approximately 2.26 acres of the front half of residential lots and streets located along the north and west halves of a portion of proposed Wrangell Drive in the northwest corner of the site. Runoff produced within the residential lots is conveyed via side lot swales to the streets where they combine with runoff produced within **Basin D** and conveyed via curb and gutter to a proposed 10' At-grade D-10R inlet located at **Design Point C1** (Q5 = 4.6 cfs, Q100 = 9.9 cfs). A proposed 30" RCP (**Pipe 7**) will convey the runoff from intercepted by the inlet (Q5 = 4.5 cfs, Q100 = 7.3 cfs) under Wrangell Drive to **Pipe 9**.

<u>Basin H</u> (Q5 = 6.2 cfs, Q100 = 14.1 cfs) consists of approximately 3.56 acres of lots, backyards and streets located along north half of Olympus Drive. Runoff produced within the residential lots is conveyed via side lot swales to the street section. Runoff within Basin H conveyed westward via curb and gutter to a proposed 12' At-grade D-10R inlet located at **Design Point C2** (Q5 = 6.2 cfs, Q100 = 10.7 cfs). A proposed 18" RCP (**Pipe 8.1**) will convey the runoff from intercepted by the inlet (Q5 = 6.1 cfs, Q100 = 8.9 cfs) under Olympus Drive. Flows by-passing the proposed inlet at **DPC2** continue south within the east half of Wrangell Circle.

<u>Basin G</u> (Q5 = 3.3 cfs, Q100 = 7.2 cfs) basin consists of approximately 1.72 acres of the residential lots and streets located along the south half of proposed Olympus Drive. Runoff produced within the residential lots is conveyed via side lot swales to the street section. Runoff within **Basin G** is conveyed westward via curb and gutter to a proposed 12' At-grade D-10R inlet located at **Design Point C3** (Q5 = 3.3 cfs, Q100 = 10.6 cfs). Runoff intercepted by the inlet (Q5 = 3.3 cfs, Q100 = 8.8 cfs) will combine with those conveyed by **Pipe 8.1**. **Pipe 8.2**, a proposed 24" RCP, will convey flood flows of Q5 =9.4 cfs, Q100 = 17.7 cfs southwesterly underground. Flows by-passing the proposed inlet at **DPC3** continue south within the east half of Wrangell Drive.

Basin I (Q5 = 4.0 cfs, Q100 = 8.5 cfs) basin consists of approximately 1.87 acres of the residential lots and streets located along a portion of the south and eastern halves of proposed Wrangell Circle. Runoff produced within **Basin I** combines with flow-by from **DPC2 and DPC3** and is conveyed to the west and then south via curb and gutter to a proposed 12' At-grade D-10R inlet located at **Design Point C4** (Q5 = 4.0 cfs, Q100 = 8.5 cfs). A proposed 30" RCP (**Pipe 8.3)** (Q5 = 13.2 cfs, Q100 = 25.0 cfs). will convey the runoff from intercepted by the inlet at **DPC4** (Q5 = 4.0 cfs, Q100 = 7.6 cfs) and the runoff conveyed within **Pipe 8.2** under Wrangell Circle combine with the flows conveyed by **Pipe 7**. **Pipe 9**, a proposed 30" RCP, will convey flood flows of Q5 =17.1 cfs, Q100 = 31.2 cfs down-gradient. Flows by-passing the proposed inlet at **DP4** continue south within the east half of Wrangell Circle.

Basin F (Q5 = 6.4 cfs, Q100 = 13.9 cfs) basin consists of 3.01 acres of the residential lots and streets located along a portion of proposed Wrangell Circle. Runoff produced within **Basin F** will be conveyed to the south and west where it will combine with flow-by from **DPC4** at **Design Point C5** (Q5 = 6.4 cfs, Q100 = 14.3 cfs). A proposed 12' Sump D-10R inlet and a proposed 24" RCP (**Pipe 10**) will convey the runoff from intercepted by the inlet (Q5 = 6.4 cfs, Q100 = 14.3 cfs) under Wrangell Drive. Runoff contained within **Pipe 10** will combine with those conveyed by **Pipe 9** in a proposed 36" RCP (**Pipe 11**), which will convey flood flows of Q5 =22.3 cfs, Q100 = 43.0 cfs under Wrangell Circle.

Basin D1 (Q5 = 1.2 cfs, Q100 = 2.6 cfs) consists of 0.57 acres of the residential lots and streets located along a portion of the western half proposed Wrangell Drive. Runoff produced within **Basin D1** combines within flow-by from the inlet at **DPC1.** The combined runoff is directed to a low point and a sump inlet at the southwest corner of the site at **Design Point C6**.

Basin E (Q5 = 3.8 cfs, Q100 = 8.1 cfs) basin consists of 0.72 acres of the residential lots and streets located along the south half of proposed Wrangell Circle. Runoff produced within **Basin E** will be conveyed to the west where it will combines with runoff from **Basin D1** and flow-by from **DPC1** at **Design Point C6** (Q5 = 3.4 cfs, Q100 = 7.2 cfs). Runoff intercepted by the 12' sump inlet (Q5 = 5.1 cfs, Q100 = 14.0 cfs) will combine with those conveyed by **Pipe 11** in a proposed 36" RCP (**Pipe 12**), which will convey flood flows of Q5 =26.6 cfs, Q100 = 54.8 cfs to proposed **Full Spectrum Detention Pond 1**. It should be noted that the proposed tract located below **DPC6** will be need to be graded in a manner to accommodate a safe path for overflow in the case the storm sewer system becomes clogged.

Storm Sewer System D

Basin OS6 (Q5 = 3.3 cfs, Q100 = 19.3 cfs) is an offsite basin consisting of 7.99 acres and is located adjacent to the northern boundary of the site. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover. Runoff from the basin generally travels north to south as both sheet flow and as concentrated ditch flow to the northern boundary ultimately entering onsite **Basin O**.

Basin O (Q5 = 0.8 cfs, Q100 = 4.7 cfs) consists of 1.76 acres of undeveloped open space within the proposed neighborhood park. Runoff from **Basin O** combines with runoff produced within **Basin OS6** at **Design Point**

D1 (Q5 = 3.9 cfs, Q100 = 22.5 cfs). A proposed 24" RCP culvert (**Pipe 13**) will intercept the runoff reaching **DP1**. A Berm/Swale is proposed downstream of the culvert, to protect the adjacent lot and provide an overflow path to the Yari Drive in the case that the culvert were to become clogged. **Pipe 13** continues underground to the west below Proposed Yari Drive.

Basin O1 (Q5 = 0.2 cfs, Q100 = 1.1 cfs) consists of 0.39 acres of undeveloped open space within the proposed neighborhood park. Runoff from **Basin O1** will be conveyed within trapezoidal earthen swale. (also proposed as an overflow path downstream of the culvert). **Basin O1** will be discharge to Yari Drive likely via a proposed sidewalk chase. A small permanent sediment basin is recommended to be placed upstream of the sidewalk chase to prevent sediment from entering the roadway on a frequent basis. The facility will be inside the park and thus shall be privately maintained by the Bradley Ranch Home Owners Association.

Basin OS5 (Q5 = 3.2 cfs, Q100 = 18.6 cfs) is an offsite basin consisting of 6.81 acres and is located adjacent to the northern boundary of the site. This offsite area contains a mixture of pine forest canopy, brush, and native grasses provide relatively good ground cover. Runoff from the basin generally travels as both sheet flow and as concentrated ditch flow to the northern boundary ultimately entering onsite **Basin O2**.

Basin O2 (Q5 =0.3 cfs, Q100 = 1.5 cfs) is a narrow 0.63 acre basin located along the northern boundary near the middle of the site. The onsite basin possesses a small segment of land which will be utilized as a drainage corridor and landscaping buffer. A trapezoidal earthen swale/berm will collect runoff from within the basin as well as protect residential lots by diverting intercepted offsite flows from **Basin OS5** to **Design Point D2 (**Q5 = 3.5 cfs, Q100 = 20.3 cfs). A 24" RCP Culvert (**Pipe 15**) will collect runoff from **DPD2** and convey it underground to downstream facilities. A public drainage easement is provided for access to the storm system and to allow for an overflow path should the culvert become clogged.

Basin N1 (Q5 = 3.7 cfs, Q100 = 12.0 cfs) basin consists of approximately 4.01 acres of the 0.5 acre residential lots and streets located along the north half of proposed Yari Drive. Runoff produced within **Basin N1** will combine with flows from in **Basin O1** and continue to the west via curb and gutter to **Design Point D3** (Q5 = 3.9 cfs, Q100 = 12.9 cfs). A proposed 10' At-grade D-10R inlet is provided as a placeholder at **DPD3** as this portion of the site will require additional planning during final design, with the implemented drainage solution being highly dependent upon final roadway elevations and the placement of houses on half acre lots. Potential solution could range from the grading of a small ditch along a portion of the lots behind the sidewalk and directing runoff to the back of the proposed inlet, to the installation of a small culvert(s), or individual lot side lot swale grading to prevent concentrated from reaching the design point. Additional drainage analysis and drainage recommendation will be provided within subsequent drainage reports or letters. For the purposes of this report, runoff from intercepted by the inlet (Q5 = 3.9 cfs, Q100 = 8.4 cfs) and conveyed under in a proposed 18" RCP (**Pipe 14**). Runoff contained within **Pipe 14** will combine with the runoff conveyed by **Pipe 15** in a proposed 36" RCP (**Pipe 16**), which will convey flood flows of Q5 = 7.4 cfs, Q100 = 27.6 cfs southwesterly under Yari Drive. Flows by-passing the proposed inlet at **DPD3** continue south within the north half of Yari Drive. Runoff conveyed within **Pipe 13** combines with flows in **Pipe 16**, before continuing west under the roadway within an 36" RCP (**Pipe 17**) at flow rates of Q5 = 10.9 cfs, Q100 = 48.8 cfs.

Basin N (Q5 = 2.6 cfs, Q100 = 7.8 cfs) consists of approximately 2.22 acres of the 0.5 acre residential lots and streets located along the north half of proposed Yari and Lonzo Drives. Runoff produced within **Basin N** will be combine with flow-by from **DPD3** and conveyed to the west to **Design Point D4** (Q5 = 2.3 cfs, Q100 = 9.4 cfs). Similar to **Basin N1**, a proposed 12' At-grade D-10R inlet is provided as a placeholder at **DPD3** as this portion of the site will require additional planning during final design, with the implemented drainage solution being highly dependent upon final roadway elevations and the placement of houses on half acre lots. As before, potential solutions could range from the grading of a small ditch along a portion of the lots behind the sidewalk and directing runoff to the back of the proposed inlet, to the installation of a small culvert or culvert(s), or individual lot side lot swale grading to prevent concentrated from reaching the design point. Additional drainage analysis and drainage recommendation will be provided within subsequent drainage reports or letters. For the purposes of this report, runoff from intercepted by the inlet (Q5 = 2.3 cfs, Q100 = 8.2 cfs) and conveyed under in a proposed 18" RCP (**Pipe 18**). Flows by-passing the proposed inlet at **DPD4** continue south within the western half of Yari Drive.

<u>Basin P</u> (Q5 = 3.7 cfs, Q100 = 8.0 cfs) consists of approximately 1.69 acres of the front halves of residential lots and street located along south half of Yari Drive. Runoff produced within the residential lots is conveyed via side lot swales to the street section. Runoff within **Basin P** is conveyed westward via curb and gutter to a proposed 12' At-grade D-10R inlet located at **Design Point D5** (Q5 = 3.7 cfs, Q100 = 10.6 cfs). Runoff intercepted by the inlet (Q5 = 3.7 cfs, Q100 = 8.8 cfs) will combine with flows conveyed by **Pipe19** in **Pipe 20**, a proposed 42" RCP, which will convey flood flows of Q5 = 16.0 cfs, Q100 = 63.3 cfs south underground. Flows by-passing the proposed inlet at **DPD5** continue south within the east half of Yari Drive.

<u>Basin Q</u> (Q5 = 8.6 cfs, Q100 = 19.5 cfs) falls within the north central section of the proposed site. The 4.96 acres basin consists of the rear half of residential lots on the south side of Yari Drive and several residential lots located along the north side of Sirbal Drive as well as a small portion of the neighborhood park site. Runoff produced within the basin will be directed within side lots swales to the north half of Sirbal Drive and conveyed westward via curb and gutter to a 14' At-Grade D-10R inlet located at **Design Point D6** (Q5 = 8.6 cfs, Q100 = 12.6 cfs). A proposed 18" RCP (**Pipe 21**) will convey the collected flows (Q5 = 8.2 cfs, Q100 = 10.6 cfs) south under Sirbal Drive. Flows by-passing the proposed inlet at **DPD6** continue south within the east half of Yari Drive.

<u>Basin R</u> (Q5 = 2.9 cfs, Q100 = 6.2 cfs) consists of approximately 1.31 acres of the front halves of residential lots and streets located along south half of Sibral Drive. Runoff produced in **Basin R** will be conveyed westward via curb and gutter to a proposed 14' At-grade D-10R inlet located at **Design Point D7** (Q5 = 2.9 cfs, Q100 = 13.7 cfs). A proposed 24" RCP (**Pipe 22**) will convey the collected flows from the inlets at **DPD6** and **DPD7** of Q5 = 10.9 cfs, Q100 = 20.8 cfs west underground where they will combine with flows in **Pipe 20** in a proposed 42" RCP (**Pipe 23**). **Pipe 23** will convey flood flows of Q5 = 25.6 cfs, Q100 = 81.2 cfs under Yari Drive. Flows by-passing the proposed inlet at **DPD7** continue south within the east half of Yari Drive.

<u>Basin S</u> (Q5 = 4.4 cfs, Q100 = 9.5 cfs) consists of approximately 2.01 acres of the rear halves of residential lots located along north half of Tochal Drive, between Tallac Drive and Yari Drive as well as portion of the adjacent streets. Runoff produced in **Basin S** will be conveyed westward via curb and gutter to a proposed 12' At-grade D-10R inlet located at **Design Point D8** (Q5 = 4.4 cfs, Q100 = 9.5 cfs). A proposed 18" RCP (**Pipe 24**) will convey the collected flows (Q5 = 4.4 cfs, Q100 = 7.8 cfs) south under Tochal Drive. Flows by-passing the proposed inlet at **DPD8** combine with flow-by from **DP4** thru **DP7** continue west within the north half of Yari Drive.

<u>Basin S1</u> (Q5 = 1.7 cfs, Q100 = 3.2 cfs) consists of approximately 0.5 acres of a portion of the southern half rights of way of proposed Tochal Drive between Tallac Drive and **Design Point D9**. Runoff produced in **Basin S1** will be conveyed westward via curb and gutter to a proposed 6' At-grade D-10R inlet located at **DPD9** (Q5 = 1.7 cfs, Q100 = 3.2 cfs). A proposed 18" RCP (**Pipe 25**) will convey the collected flows (Q5 = 1.7 cfs, Q100 = 2.6 cfs) north under Tochal Drive. Runoff contained within **Pipe 25** will combine with those conveyed by **Pipe 24** in a proposed 18" RCP (**Pipe 26**), which will convey flood flows of Q5 = 6.0 cfs, Q100 = 10.3 cfs westerly under Tochal Drive. Runoff contained within **Pipe 26** will combine with those conveyed by **Pipe 23** in a proposed 48" RCP (**Pipe 27.1**), which will convey flood flows of Q5 = 30.4 cfs, Q100 = 89.4 cfs south under Yari Drive. Flows by-passing the proposed inlet at **DPD8** combine with flow-by from DP4 thru DP7 continue west within the north half of Yari Drive.

Basin V1 (Q5 = 1.4 cfs, Q100 = 2.9 cfs) consists of approximately 0.53 acres of residential lots and streets located along south half of proposed Sirbal Drive east of Tallac Drive as well as a portion of Tallac. Runoff produced in **Basin V1** conveyed in the proposed curb and gutter of Tallac Drive to the south.

Basin T (Q5 = 6.0 cfs, Q100 = 13.2 cfs) consists of approximately 2.84 acres of the residential lots and streets located along the north half of proposed Makalu Drive between proposed Tallac and Yari Drives. Runoff produced within the residential lots is conveyed via side lot swales to the street section. Runoff within **Basin T** combines with runoff from **Basin V1** and flow-by from the inlet at **DPE7** at a proposed 16' At-grade inlet located at **Design Point D10** (Q5 = 10.8 cfs, Q100 = 24.8 cfs). A proposed 24" RCP (**Pipe 27.2**) will convey the collected runoff from the inlet to the west where it will combine with flows conveyed in a 48" RCP (**Pipe 27.3)** at Q5 = 39.1 cfs, Q100 = 103.2 cfs.

Basin T1 (Q5 = 2.8 cfs, Q100 = 5.9 cfs) consists of approximately 1.42 acres of residential lots and streets located along the north half of proposed Makalu Drive between the far west cul-de-sac and proposed Yari Drive. Runoff from **Basin T1** and up-gradient inlet flow-by at **DPD10** continues within the curb and guttered Makalu Drive to **DPD11** at the aforementioned cul-de-sac.

Basin X1 (Q5 = 2.1 cfs, Q100 = 4.4 cfs) consists of approximately 0.88 acres of residential lots and streets located along south half of proposed Makalu Drive between **DPE8** and proposed Piran Drive.. Runoff within **Basin X1** combines with flow-by from **DPE8** and flow-by from the inlet at **DPD7** prior to entering **Basin X**.

Basin X (Q5 = 3.6 cfs, Q100 = 7.6 cfs) consists of approximately 1.71 acres of residential lots and streets located along south half of proposed Makalu Drive west of between the far west cul-de-sac and Piran Drive. Runoff produced in **Basin X** combines with flow-by from **DPE7**, **DPE8** and runoff from **Basins** , **V1, X**, **T** and **T1** at a proposed 16' Sump inlet located at **Design Point D11** (Q5 = 6.7 cfs, Q100 = 20.0 cfs). A proposed 24" RCP (**Pipe 28**) will convey the collected runoff from the inlet to the northwest where it will combine with flows conveyed in **Pipe 27.** A proposed 48" RCP (**Pipe 29**) will convey the combined flow Q5 = 43.4 cfs, Q100 = 117.2 to the proposed **Full Spectrum Detention Pond 1**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to **Full Spectrum Detention Pond 1** summary). Should the inlet at **DPD11** become clogged runoff will overtop the curb and flow to the **FSD Pond 1**.

Storm Sewer System E

Basin OS7 (Q5 = 4.8 cfs, Q100 = 27.6 cfs) is an offsite basin consisting of 11.84 acres and is located adjacent to the northern boundary of the site. The area possesses a mixture of pine forest canopy, brush, and native grasses providing relatively good ground cover with a few residential structures. Runoff from the basin generally travels as both sheet flow and concentrated ditch flow to the northern boundary ultimately entering onsite **Basin KK**.

Basin KK (Q5 =0.2 cfs, Q100 = 0.9 cfs) is a narrow 0.35 acre basin located along the northern boundary near the northeast corner of the site. The onsite basin possesses a small segment of land which will be utilized as a drainage corridor and landscaping buffer. A proposed trapezoidal earthen swale/berm will collect runoff from within the basin as well as protect residential lots by diverting runoff to **Design Point E1 (**Q5 = 4.9 cfs, Q100 = 28.4 cfs). A 30" RCP Culvert (**Pipe 30**) will collect runoff from **DPE1** and convey it underground to downstream facilities in Odin Drive. A public drainage easement is provided for access to the storm system and to allow for an overflow path should the culvert become clogged.

Basin JJ3 (Q5 = 3.0 cfs, Q100 = 6.8 cfs) consists of approximately 1.57 acres of the front halves of residential lots and streets located along south and east half of proposed Odin Drive. Runoff within **Basin JJ3** is conveyed west then south via curb and gutter to a proposed 14' At-grade D-10R inlet located at **Design Point E2** (Q5 = 3.0 cfs, Q100 = 13.7 cfs). A proposed 24" RCP (**Pipe 31**) will convey the runoff from intercepted by the inlet (Q5 = 3.0 cfs, Q100 = 11.5 cfs) under Odin Drive. Flows by-passing the proposed inlet at **DPE2** continue south within the east half of the roadway.

Basin JJ (Q5 = 2.2 cfs, Q100 = 7.2 cfs) is a 1.83 acre watershed located at the northeast corner of the site. This basin consists of both onsite and offsite naturally vegetated lands as well as a portion of proposed Odin Drive. It is anticipated that the offsite area will remain in its existing undeveloped state, while the onsite portion of the basin will be developed into half acre design custom home lots and a portion of street. As is the case with several of the larger custom lots located along the north side of the property, additional drainage analysis and infrastructure recommendations will be provided within subsequent detailed drainage reports or letters. For the purposes of this report, runoff will be directed collected and conveyed via the curb and gutter conveyed to the intersection of Odin Drive.

Basin JJ1 (Q5 = 2.0 cfs, Q100 = 6.8 cfs) consists of approximately 2.23 acres of the 0.5 acre residential lots and streets located along the north half of proposed Yari and Lonzo Drives. Runoff from **Basin JJ1** will be conveyed south along the west property via an earthen swale/berm (which also serves to protect the lots from flows reaching **DPE1** should the culvert become clogged. Runoff from **Basin O1** is planned to be discharge to Yari Drive via a proposed sidewalk chase. A small permanent sediment basin is recommended to be placed upstream of the sidewalk chase to prevent sediment from entering the roadway on a frequent basis. The small basin would be privately maintained by the Bradley Ranch Home Owners Association. The option to extend the storm sewer within Odin Drive to collect runoff from **Basin JJ** and **JJ1** can be assessed with future detailed drainage reports.

Basin JJ2 (Q5 = 2.5 cfs, Q100 = 7.8 cfs) basin consists of approximately 2.23 acres of the standard 5du/ac residential lots and street section located along a portion of proposed Odin Drive as well as a small portion a steep hillside located inside the nearby proposed neighborhood park site. Runoff produced within **Basin JJ2** will be conveyed via side lot swales to the street section where it will combine with flows from **Basin JJ** and **JJ1**. The combined runoff travels southwesterly within the west half of Odin Drive to proposed 14' At-grade D-10R inlet located at **DPE3** (Q5 = 6.1 cfs, Q100 = 13.2 cfs). Runoff intercepted by the inlet (Q5 = 6.1 cfs, Q100 = 11.2 cfs) will combine with those conveyed by **Pipes 31**. **Pipe 33** a proposed 36" RCP, will convey flood flows of Q5 =13.5 cfs, Q100 = 49.9 cfs from **Pipes 30** and **32** to a proposed trapezoidal earthen channel located along the southern boundary of the park site. Runoff discharged to the channel continues westward towards Proposed Tallac Drive. Flows by-passing the proposed inlet at **DPE3** continue south within the west half of Odin Drive. .

Basin LL1 (Q5 = 0.9 cfs, Q100 = 5.5 cfs) consists of approximately 2.11 acres of proposed Bradley Ranch Neighborhood Park site. It should be noted that with the development of the subdivision disturbances within the park site are to be limited in an attempt to retain is natural state. Runoff produced within **Basin LL1** is to be conveyed as surface runoff via natural drainages to a small proposed triangular shaped swale located at the south end of the park. A private 18” culvert (**Pipe 34**) located at **Design Point E4** (Q5 = 0.9 cfs, Q100 = 5.5 cfs) conveys the runoff from the top of the hillside to the invert of the proposed drainage channel located at the bottom of the slope.

Basin LL2 (Q5 = 0.6 cfs, Q100 = 3.6 cfs) consists of approximately 1.33 acres of proposed Bradley Ranch Neighborhood Park site. With the development of the subdivision the majority of the park site is to remain undisturbed or preserved. Runoff produced within **Basin LL2** is to be conveyed as surface runoff via natural drainages to a small proposed triangular shaped swale located along the south end of the parksite. A private 18” culvert (**Pipe 35**) located at **Design Point E5** (Q5 = 0.6 cfs, Q100 = 3.6 cfs) conveys the collected runoff from the top of the hillside to the invert of the aforementioned drainage channel.

It should be noted that riprap inlet protection, outlet aprons and/or stilling basins are likely required at the culvert entrances and outlets when implemented. These erosion protection measures will need to be revisited and further detailed within subsequent drainage reports. Future grading and drainage analysis should attempt to limit grading within the park site whenever feasible.

Basin MM (Q5 =0.8 cfs, Q100 = 4.1 cfs) is a 1.54 acre basin located along the southern boundary of the proposed neighborhood park site. The area will be the site of a drainage conveyance corridor that functions collect and convey runoff from the basin as well as from storm sewer pipes (**33, 34 and 35**) to **Design Point E6 (**Q5 = 13.6 cfs, Q100 = 54.1 cfs). A 36” RCP Culvert (**Pipe 36**) will collect runoff from **DPE6** and convey it underground to downstream facilities located within Tallic Drive. Care should be taken in final design to provide an emergency overflow path to Tallac Drive in the case that the culvert were to become clogged.

Basin V (Q5 = 5.4 cfs, Q100 = 11.9 cfs) consists of approximately 2.75 acres of residential lots and streets located along the north half of proposed Makalu Drive between proposed Odin and proposed Tallac Drives. Runoff generated by **Basin V** combines with flow-by from **DPE2, DPE3** and **DPF1** before being directed to a 16” At-grade inlet located at **Design Point E7** (Q5 = 5.3 cfs, Q100 = 12.1 cfs). A proposed 24” RCP (**Pipe 37**) will convey the runoff intercepted by the inlet (Q5 = 5.3 cfs, Q100 = 11.2 cfs) under Makalu Drive. Flows by-passing the proposed inlet at **DPE7** will continue west within the roadway.

Basin X3 (Q5 = 1.3 cfs, Q100 = 2.7 cfs) consists of approximately 0.51 acres of the front halves of residential lots and streets located along south half of Makalu Drive between Odin and Elgon Drives. Runoff produced in **Basin X3** and flow-by from **DPF2** will be conveyed westward within the south half of the roadway.

Basin X2 (Q5 = 1.7 cfs, Q100 = 3.7 cfs) consists of approximately 0.74 acres of residential lots and streets located along the south half of proposed Makalu Drive immediately east of Elgon Drive. Runoff generated by **Basin V** combines with flow-by from **DPF2** and **Basin X3** before being directed to a 16” At-grade inlet located at **Design Point E8** (Q5 = 2.7 cfs, Q100 = 11.9 cfs). A proposed 24” RCP (**Pipe 38**) will convey the runoff intercepted by the inlet (Q5 = 2.7 cfs, Q100 = 11.1 cfs) under Makalu Drive. Runoff contained within **Pipe 38** will combine with those conveyed by **Pipe 37** in a proposed 36” RCP (**Pipe 39**), which will convey flood flows of Q5 =7.9 cfs, Q100 = 22.2 cfs westerly under Makalu Drive. Runoff contained within **Pipe 39** will combine with runoff carried within **Pipe 36** and continue west via a proposed 42” RCP (**Pipe 40**). The total peak flows calculated to be conveyed by **Pipe 40** are Q5 =19.7 cfs, Q100 = 70.8 cfs. Flows by-passing the proposed inlet at **DPE8** will continue west within south half of Makalu Drive.

Basin BB (Q5 = 5.5 cfs, Q100 = 13.4 cfs) consists of approximately 3.88 acres of residential lots and streets located east of Elgon Drive and north of Janga Drive. Runoff produced in **Basin BB** is conveyed via the adjacent curb and guttered street sections to a proposed 14' At-Grade D-10R inlet located at **Design Point E9** (Q5 = 5.5 cfs, Q100 = 13.4 cfs). A proposed 18" RCP (**Pipe 41**) will convey the collected flows of Q5 = 5.5 cfs, Q100 = 11.0 cfs west under the Janga Drive. Flows by-passing the proposed inlet at **DPE9** continue westward within the north half of Janga Drive.

Basin AA (Q5 = 3.7 cfs, Q100 = 8.3 cfs) consists of approximately 2.16 acres of residential lots, backyards and streets located along north half of Janga Drive to the west of Elgon Drive. Runoff produced in **Basin AA** and flow-by from **DPE9** continues west in the north half of Janga Drive.

Basin Z (Q5 = 3.6 cfs, Q100 = 8.1 cfs) consists of approximately 2.13 acres of residential lots, backyards and streets located along north half of Janga Drive to the west of Piran Drive. Runoff produced in **Basin Z** combines with runoff from **Basin AA** and flow-by from **DPE9** and continues within the local streets to a proposed 16' At-Grade D-10R inlet located at **Design Point E10** (Q5 = 6.6 cfs, Q100 = 14.1 cfs). A proposed 24" RCP (**Pipe 42**) will convey the runoff from intercepted by the inlet of Q5 = 6.6 cfs, Q100 = 12.3 cfs under Janga Drive. Flows by-passing the proposed inlet at **DPE10** continue westward within the north half of Janga Drive.

Basin CC (Q5 = 5.8 cfs, Q100 = 12.4 cfs) consists of approximately 2.91 acres of the front halves of residential lots and streets located along the south half of proposed Janga Drive to the west of Piran Drive. Runoff produced in **Basin CC** is conveyed to the west via curb and gutter to a proposed 16' At-Grade D-10R inlet located at **Design Point E11** (Q5 = 5.8 cfs, Q100 = 15.8 cfs). A proposed 24" RCP (**Pipe 43**) will convey the runoff from intercepted by the inlet (Q5 = 5.8 cfs, Q100 = 13.2 cfs) under Janga Drive to **Pipe 44**, where flows will combine with runoff conveyed in **Pipe 42**. **Pipe 44** has been calculated to convey flood flows of Q5 =17.0 cfs, Q100 = 34.6 cfs. Runoff contained within **Pipe 44** will combine with runoff carried within **Pipe 40** and continue west via a proposed 48" RCP (**Pipe 45**). The total peak flows calculated to be conveyed by **Pipe 45** are Q5 =34.6 cfs, Q100 = 100.2 cfs. Flows by-passing the proposed inlet at **DPE11** continue westward within the south half of Janga Drive.

Basin Y (Q5 = 6.8 cfs, Q100 = 15.1 cfs) consists of approximately 3.99 acres of residential lots, backyards and streets located along north half of Janga Drive between Piran Drive and the proposed cul-de-sac. Runoff produced within **Basin Y** combines with flow-by from **DPE10** prior to reaching the low point in the proposed Janga Drive cul-de-sac.

Basin Y1 (Q5 = 2.7 cfs, Q100 = 5.7 cfs) consists of approximately 1.26 acres of the front halves of residential lots and streets located along the south half of proposed Janga Drive and between Piran Drive and the proposed cul-de-sac. Runoff produced in **Basin Y1** combines with flows from **Basin Y** and flow-by from **DPE10 and DPE11**, at a proposed 16'Sump D-10R inlet located at **Design Point E 12** (Q5 = 8.4 cfs, Q100 = 22.5 cfs). A proposed 24" RCP (**Pipe 46**) will convey the runoff from intercepted by the inlet (Q5 = 8.4 cfs, Q100 = 22.5 cfs) behind the cul-de-sac to **Pipe 47**, where flows will combine with those conveyed within **Pipe 45**. **Pipe 47,** a proposed 48" RCP is anticipated to convey flood flows of Q5 = 41.3 cfs, Q100 = 118.1 cfs to proposed **Full Spectrum Detention Pond 1**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to **Full Spectrum Detention Pond 1** summary). A shared maintenance and access road located behind the inlet can serve to function as an emergency overflow path in case of clogging of the inlet.

Full Spectrum Detention Pond 1

Six (6) storm sewer pipes with a combined peak runoff rate of Q5=130.5 cfs and Q100=412.6 cfs discharge to the proposed Full Spectrum Detention Pond 1 (**Design Point P1)**. Based upon the existing basin drainage basin characteristics and the developed conditions impervious ratio the proposed detention and water quality facility requires a minimum of 2.51 ac-ft of water quality storage, 6.17 ac-feet of excess urban runoff volume and 14.6 ac-ft of 100-year storage (see UD-Detention Worksheet in appendix). Although not shown on the enclosed drainage map the pond will be constructed with a concrete forebays, concrete T-stem wall energy dissipaters, concrete low flow 'trickle' channels, a concrete outlet structure with micropool, trash rack, trash screen and restrictor/orifice plate(s) in accordance with the City of Colorado Spring and Urban Drainage and Flood Control District manual. The proposed facility will route the WQCV and EURV will be routed through an orifice plate. While larger storm events will be detained by the outlet box grate opening and a restrictor plate placed on the outlet pipe. In the event of clogging or outlet pipe failure, runoff at FSD1 will over top the emergency spillway at a low point in Union Boulevard and outfall to west to natural drainage ways. A concrete stem wall and 4:1SS buried trapezoidal riprap spillway will need to be provided on the west side of Union Boulevard and should be further evaluated with final design of Union Boulevard. The roadway/pond embankment height and slope and roadway median elevation will be need to be designed in a manner that will allow for runoff to overtop the roadway section the in the case that the emergency spillway for the pond was operational. A proposed 48" pipe will discharge runoff from the pond to a proposed splitter box planned to be located within the right of way. Runoff exiting the box will be conveyed to the two downstream discharge points (and into Basins OP-2/PP-1 and OP-3/PP-2) via a pair of proposed 42" RCP pipes. Until downstream development occurs it is proposed that the splitter box be designed in a manner that limits discharge to the historic flow rates determined by the existing conditions analysis. In this scenario, the southern pipe (Pipe 57) would be limited to a historic 100-year release rate of 41.5 cfs, (refer to existing drainage map and DP26) and the remaining developed discharge of 107.5 cfs would be conveyed to the north via Pipe 58, also at a rate which is less than the existing calculated runoff of 129.3 cfs (existing drainage map DP3).

By initially over sizing Pipe 57 to convey not just the existing flow but the entire developed discharge from the FSD pond 1 of 149 cfs, the existing parcels located to the north of the subject site (within Black Forest) could one day be redeveloped to a greater development density (also assuming the downstream development has in Cordera has occurred), thereby meeting the design assumptions discussed and illustrated within the Amendment #1 FDR for Cordera 3 Report and Drainage Map, which assumed that approximately 144.1 cfs (OP3) + 6.8 cfs (OP8) + 6.8 cfs (OP9) or ~ 150* cfs would be discharged from the subject site in Basin PP-13, and 116.6 cfs (OP2) +10.2 (OP6) +10.2 (OP7) or ~ 120 cfs* could be discharged into Basin PP-1 (refer to Cordera Filing No. 3, Fully Developed Drainage Map). Additional engineering, outside the scope of this project, would be required to evaluate how to further divide the drainage at the northwest corner of the subject site to accomplish this aforementioned distribution of runoff. (*not calculated. Conservative rounding)

A rip rap pad will be required at the two outlet pipes to dissipate energy and prevent local scour. Additional coordination will be required with the adjacent property owners to agree on the development of conveyance systems improvements to direct runoff from the subject site to the downstream developments/improvements and to acquire easements as needed. The City of Colorado Springs has requested that written agreements from adjacent property owners will be required to obtain approval of the Final Drainage Reports and permission to grade from offsite owners will be required with the Grading and Erosion Control Plan where offsite grading is required. Coordination with the Dam Safety Engineer will be conducted prior to the completion of construction drawings. Detailed calculations and construction plans for the pond will be submitted separately to the City for review and acceptance.

Cottonwood Creek Drainage Basin

In general, runoff produced within the rural offsite and more density developed onsite watersheds are to be directed via side lot swales and natural drainageways to the proposed streets to storm sewer systems located within the eastern portion of Bradley Ranch Filing No.1. Runoff captured by the conveyance systems are then to be directed to a proposed full spectrum detention pond located in the southeast corner of the site. To coincide with development assumptions, the proposed pond will discharge at or less than historic or to the discharge rate of Q100=3cfs Q100=32 cfs anticipated by the Wolf Ranch Master Plan, whichever is more restrictive. Based upon existing conditions analysis historic runoff conveyed to the south property line within the Cottonwood Creek basin at Design Point 24 is 7.2 cfs and 41.6 cfs, thus discharge rates will be meet those set by the Wolf Ranch MDDP. Additional coordination is anticipated with adjacent property owners to agree on the development of conveyance systems and/or channel improvements, and aquire easements as needed to direct runoff from the subject site to the downstream facilities.

Detailed Description

The following is a detailed description of the onsite basins, offsite flows and the overall proposed drainage patterns and recommended infrastructure required for the development facility within the Pine Creek portion of of Bradley Ranch. The following Design Points and Basins were determined using the Rational Method since each individual basin is less than 100 acres and the combined acreage at any Design Point is also less than 100 acres. The proposed drainage design for this subdivision is typical for single family residential, consisting of; homes, landscaping, rear and side lot drainage swales, curb & gutter, streets, curb inlets, and pipes to convey developed flows downstream. Rear and side lot swales will be constructed to get developed flows to street curb and gutter.

Storm Sewer System F

Basin W1 (Q5 = 0.7 cfs, Q100 = 1.9 cfs) consists of approximately 0.47 acres of residential lots and associated street located at the eastern end of proposed Makalu Drive. Runoff produced within the basin is conveyed via side lot swales to roadway. Runoff produced within **Basin W1** is continues west in the north curb line to Basin W2. A drainage tract located within the basin houses a proposed storm sewer and an overflow swale.

Basin W2 (Q5 = 5.5 cfs, Q100 = 13.6 cfs) consists of approximately 3.42 acres of residential lots, backyards and streets located north half of proposed Makalu Drive near the east subdivision boundary. Runoff produced within the residential lots is conveyed via side lot swales to the proposed roadway where it combines with runoff from **Basin W1**. Runoff continues westward within the in the north curb and gutter to a proposed 14' At-grade D-10R inlet located at **Design Point F1** (Q5 = 6.0 cfs, Q100 = 10.1 cfs). A proposed 18" RCP (**Pipe 48**) will convey the runoff from intercepted by the inlet (Q5 = 6.0 cfs, Q100 = 9.3 cfs) under Makalu Drive. Flows by-passing the proposed inlet at **DPF1** continue westward within the north half of the roadway (see Storm Sewer System E)

Basin W (Q5 = 3.1 cfs, Q100 = 6.5 cfs) consists of approximately 1.18 acres of the front halves of residential lots and streets located along south half of Makalu Drive. Runoff produced in **Basin W** will be conveyed westward via curb and gutter to a proposed 14' At-grade D-10R inlet located at **Design Point F2** (Q5 = 3.1 cfs, Q100 = 12.4 cfs). A proposed 24" RCP (**Pipe 49**) will convey the collected flows from the inlet at **DPF2** and Pipe 48 of Q5 = 9.0 cfs, Q100 = 18.9 cfs west underground south and east to the inlet at **Design Point F3**.

Flows by-passing the proposed inlet at **DPF2** continue westward within the south half of the Makalu Drive (see Storm Sewer System E)

<u>Basin DD</u> (Q5 = 4.6 cfs, Q100 = 11.2 cfs) consists of approximately 2.73 acres of residential lots and associated street located at the eastern end of proposed Makalu Drive. Runoff produced in **Basin DD** will be conveyed westward via curb and gutter to a proposed 8' Sump D-10R inlet located at **Design Point F3** (Q5 = 4.6 cfs, Q100 = 10.2 cfs). A proposed 30" RCP (**Pipe 50**) will convey the collected flows from the inlet at **DPF2** and **Pipe 49** of Q5 = 12.9 cfs, Q100 = 27.6 cfs south to the inlet at **Design Point F4**

<u>Basin DD1</u> (Q5 = 1.4 cfs, Q100 = 3.4 cfs) consists of approximately 0.86 acres of the front halves of residential lots and streets located along south half of Odin Drive between Makalu and Janga Drives. Runoff produced in **Basin DD1** will be conveyed south and westward via curb and gutter to a proposed 8' sump D-10R inlet located at **Design Point F4.**

<u>Basin OS10</u> (Q5 = 0.1 cfs, Q100 = 0.6 cfs) is a small 0.22 acre offsite watershed located along the eastern boundary of the site within the Cottonwood Creek watershed. The basin undeveloped covered with native grasses. Runoff from **Basin OS10** sheet flows onsite into **Basin EE**.

<u>Basin EE</u> (Q5 = 1.9 cfs, Q100 = 4.9 cfs) consists of approximately 1.28 acres of the front halves of residential lots and streets located along south side of Odin Drive just east of Janga Drive. Runoff produced in **Basin EE** will be conveyed east via curb and gutter, combining with runoff from **Basin OS10 and Basin DD1** at a proposed 8' sump D-10R inlet located at **Design Point F4** (Q5 = 3.5 cfs, Q100 = 9.9 cfs). Intercepted runoff of Q5 = 3.5 cfs, Q100 = 9.9 cfs combines with flows from **Pipe 50**. A proposed 30" RCP (**Pipe 51**) will convey the combined flow Q5 = 16.3 cfs, Q100 = 37.3 to the proposed **Full Spectrum Detention Pond 2**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to **Full Spectrum Detention Pond 2** summary). In the case that the storm sewer system at DPF3 and DPF4 become obstructed flow will overtop a high point in Janga Drive and continue south within the roadway section.

<u>Basin OS8</u> (Q5 = 3.8 cfs, Q100 = 22.3 cfs) is a 10.69 acre watershed located to the north and east of the subject site. This watershed is anticipated to remain in its undeveloped/low density state, with the exception of the existing water tank site. Runoff produced within the basin conveyed to the south by the natural drainage ways along the eastern boundary, where it will combine with **Basins MM1** and **MM2** at **DPG1**.

<u>Basin MM1</u> (Q5 = 0.6 cfs, Q100 = 2.3 cfs) consists of approximately 0.72 acres of a portion of a 0.5-acre lot at the northeast corner of the subject site. Runoff from B**asin MM1** will combine with runoff from **Basin OS**8 along the eastern boundary of the site. Care should be taken regarding the elevation and placement of the house foundation on this lot ensures that offsite drainage safely routed around the structure.

<u>Basin MM2</u> (Q5 = 0.1 cfs, Q100 = 0.4 cfs) is approximately 0.13 acres located along the eastern boundary of the subject site. **Basin MM2** will contain a small localized depression and proposed 24" culvert (**Pipe 52**) which will function to collect runoff of Q5 = 4.3 cfs, Q100 = 23.9 cfs reaching **Design Point G1** from **Basins OS-8, MM1** and **MM2**. As previously discuss a small overflow swale will be provided to convey drainage reaching **DPG1** in the case that the culvert becomes clogged. The proposed 30" RCP (**Pipe 51**) culvert at **DP G1** will continue thru a series of drainage tracts ultimately out falling into the proposed **Full Spectrum Detention Pond 2**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of

Detention Pond 2. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to **Full Spectrum Detention Pond 2** summary).

Basin OS9 (Q5 = 1.3 cfs, Q100 = 7.5 cfs) is a 3.32 acre watershed located to the east of the subject site. Based upon the concept layout and site grading, the planned Wolf Ranch subdivision, will redirect much of the runoff from Basin OS-9 to the east thereby decreasing the runoff anticipated to reach the eastern boundary of the site, when compared to the existing condition. As such the existing condition basin was used to determine the largest peak flow at **Design Point G2**. The lots and grading have been lightly shown on the proposed drainage map for reference.

Basin NN (Q5 = 0.1 cfs, Q100 = 0.4 cfs) is approximately 0.15 acres located along the eastern boundary of the subject site. **Basin NN** will contain a small localized depression and proposed 24" culvert (**Pipe 53**) which will function to collect runoff of Q5 = 1.2 cfs, Q100 = 7.1 cfs reaching **Design Point G1** from **Basins OS-9** and **NN,** ultimately discharges into the proposed **Full Spectrum Detention Pond 2**. A concrete forebay with a t-shaped energy dissipation wall will be provided at the end of the RCP FES in the pond. Concrete trickle channels will convey low flows to a single outlet structure within the bottom of the pond (refer to **Full Spectrum Detention Pond 2** summary).

Basin OS11 (Q5 = 4.1 cfs, Q100 = 24.0 cfs) is a 2.07 acre watershed located to the east of the subject site. This watershed has been analyzed based undeveloped/low density state as flow rates are lesser in the future based upon the concept layout and grading of the adjacent Wolf Ranch subdivision. Ruonff conveyed by OS011 will be directed to the proposed full spectrum in the interim. The lots and grading have been lightly shown on the proposed drainage map for reference.

Basin FF (Q5 = 3.6 cfs, Q100 = 15.5 cfs) basin consists of approximately 3.2. acres open space dedicated for stormwater detention and water quality. Runoff produced within **Basin FF** will combine with runoff from **Basin OS11** and **Pipes 51 thru 53** in **Full Spectrum Detention Pond 2**.

Full Spectrum Detention Pond 2

Developed runoff reaching the **Full Spectrum Detention Pond 2** totals Q5=22.9 cfs and Q100=79.5 cfs at **Design Point P2**. Based upon the existing basin drainage basin characteristics and the developed conditions impervious ratio the proposed detention and water quality facility requires a minimum of 0.33 ac-ft of water quality storage, 0.73 ac-feet of excess urban runoff volume and 1.985 ac-ft of 100-year storage (see UD-Detention Worksheet in appendix). Although not shown on the enclosed drainage map the pond will be constructed with a concrete forebays, concrete T-stem wall energy dissipaters, concrete low flow 'trickle' channels, a concrete outlet structure with micropool, trash rack, trash screen and restrictor/orifice plate(s) in accordance with the City of Colorado Spring and Urban Drainage and Flood Control District manual. The proposed facility will route the WQCV and EURV will be routed through an orifice plate. While larger event storms will be detained by the outlet box grate opening and a restrictor plate place on the outlet pipe. The estimated peak release rate from **Pond 2** of Q5=3.4 cfs and Q100=31.9 cfs will outfall, via a 36" RCP into the Cottonwood Creek drainage basin. This discharge is approximately equivalent to the allowable discharge of Q5=3 cfs and Q100=32 cfs anticipated by the 2013 Wolf Ranch Master Plan. In the event of clogging or outlet pipe failure, runoff at FSD2 will over top a proposed emergency spillway which shall be constructed along the east embankment to safely convey overflow down the slope to the natural channel, until such time the channel is formalized with the planned Wolf Ranch development. A rip rap pad will be constructed to property owners to agree on the development of conveyance systems improvements to direct runoff from the subject site to the downstream developments/improvements. Coordination with the Dam Safety Engineer will be conducted prior to the completion of construction drawings. . The City of Colorado Springs has requested that written agreements from adjacent property owners will be required to obtain approval of the Final Drainage Reports and permission to grade from offsite owners will be required with the Grading and Erosion Control Plan where offsite grading is required. Coordination with the Dam Safety Engineer will be conducted prior to the completion of construction drawings. Detailed calculations and construction plans for the pond will be submitted separately to the City for review and acceptance.

Inter-basin Transfer Pine Creek to Cottonwood Creek

It should be noted that the proposed development plan for the 120.193 acre Bradley Ranch Filing No.1 redistributes portions of the small percentage of the historic watershed between Pine Creek and Cottonwood Creek Drainage Basins.

Prior to development approximately 110.796 acres Bradley Ranch Filing No.1 fell within the Pine Creek watershed with the remaining 10.134 acres in the Cottonwood Creek Watershed.

After development approximately 4.066 acres will be redirected from the Pine Creek Drainage Basin into Cottonwood Creek Drainage Basin into resulting in 106.730 acres of Bradley Ranch Filing No.1, within Pine Creek and 14.200 acres in Cottonwood Creek.

This modification is minor resulting in a 3.8% change and is driven by grading constraints associated with the lot layout and existing topography coupled with a sensible utility layout

It should be noted that the proposed Full Spectrum Pond No.2 provides detention and releases at or below the historic discharge rates thereby reducing any flood management impacts from the inter-basin transfer.

CONSTRUCTION COST OPINION

All proposed drainage facilities within Bradley Ranch Filing No.1, will be constructed by the developer and publically owned and maintained with the exception of the small sediment basins at a few of the culvert entrances which are to maintained by the Bradley Ranch Filing No.1 Homeowner’s Association. The cost of the sediment basins is considered negligible.

Public Drainage Facilities (Non Reimbursable)

Item	Description	Quantity	Unit Cost		Cost
1	18" RCP	1371	$50	/LF	$68,550.00
2	24" RCP	1844	$85	/LF	$156,740.00
3	30" RCP	2532	$115	/LF	$291,180.00
4	36" RCP	1152	$140	/LF	$161,280.00
5	42" RCP	1131	$157	/LF	$177,567.00
6	48" RCP	3661	$175	/LF	$640,675.00
7	54" RCP	154	$220	/LF	$34,650.00
8	Full Spectrum Det. Pond 1	1	$40,000	/EA	$40,000.00

9	Full Spectrum Det. Pond 2	1	$20,000	/EA	$20,000.00
10	FSD Pond 1 Outlet Structure	1	$12,000	/EA	$12,000.00
15	FSD Pond 2 Outlet Structure	1	$10,000	/EA	$10,000.00
16	FSD Pond 1 Spillway	1	$30,000	/EA	$30,200.00
17	FSD Pond 2 Spillway	1	$15,000	/EA	$15,000.00
18	6' CS D-10-R Inlet	2	$3,800	/EA	$7,600.00
19	8' CS D-10-R Inlet	2	$4,000	/EA	$8,100.00
20	10' CS D-10-R Inlet	2	$4,200	/EA	$8,400.00
21	12’ CS D-10-R Inlet	8	$4,400	EA	$35,200.00
22	14’CS D-10-R Inlet	11	$4,550	/EA	$50,050.00
23	16’ CS D-10-Rond 1	8	$4,700	/EA	$37,600.00
				Total	$1,806,492.00

DRAINAGE FEES

This subdivision lies within both the Cottonwood Creek and Pine Creek Drainage Basin.
Pine Creek is a closed, no fee basin.

The 2017 Drainage Bridge and Pond fees per the City of Colorado Springs for Bradley Ranch Filing No.1 are as follows;

Bradley Ranch Filing No. 1(Cottonwood Creek)

DRAINAGE FEES:	14.200* acres	x	$12,692.00	$180,226.40
BRIDGE FEES:	14.200* acres	x	$ 1,002.00	$ 14,228.40
			Total:	$ 182,662.83

***4.066 acres transferred from Pine Creek Drainage Basin.**

Bradley Ranch Filing No. 1 (Pine Creek) is a closed fee basin

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2017. Upon completion of the aforementioned improvements, M & S shall submit the actual construction costs to the City of Colorado Springs/City Drainage Board for reimbursement.

SUMMARY

The proposed Bradley Ranch Filing No.1 site is located within the Cottonwood and Pine Creek Drainage Basins. Developed runoff both offsite and onsite basins are collected and conveyed to full spectrum detention facilities located in the southwest and southeast corners of the site. All stormwater collected by the ponds will be detained, treated, and released in accordance with the requirements of the City of Colorado Springs Drainage Criteria. All drainage patterns and outfall conditions remain closely mimic historic and/or align with previous approved reports, therefore developed runoff discharged from Bradley Ranch is not anticipated to adversely affect the surround developments.

REFERENCES

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual", Volumes 1 & 2, City of Colorado May 2014.

2.) Web Soils Survey", United States Department of Agriculture, National Resources Conservation Service, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

3.) FEMA Flood Map Service Center", Federal Emergency Management Agency https://msc.fema.gov/portal

4.) "Urban Storm Drainage Criteria Manual, Volume 1, January 2016, Urban Drainage and Flood Control District.

5.) "Urban Storm Drainage Criteria Manual, Volume 2, Revised November 2016, Urban Drainage and Flood Control District.

6.) "Amendment No. 3 to Pine Creek Drainage Basin Planning Study and Master Development Plan for Pine Creek and Cordera Neighborhoods (Portions Contributing to Pine Creek), by JR Engineering, February 2003.

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

8.) "Cottonwood Creek Drainage Basin Planning Study", by Ayres Associates Inc. June 2000.

9.) "Final Drainage Report for Cordera Filing No. 1A, & Master Development Drainage Plan for Cordera and Briargate Crossing East, Pine Creek and Cottonwood Creek Basins, by Matrix Design Group, November 2004.

10.) "Final Drainage Report for Cordera Filing No. 2A, & Master Development Drainage Plan for Cordera Filing 2A-2D, Pine Creek Drainage Basins, by Matrix Design Group, October 2006.

11.) "Final Drainage Report for Cordera Filing No. 2B, Pine Creek Drainage Basins, by Matrix Design Group, October 2007.

12.) "Final Drainage Report for Cordera Filing No. 3A & Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins, by Matrix Design Group, October 2007.

13.) "Final Drainage Report for Cordera Filing No. 3A & Amendment #1 to the Master Development Drainage Plan Cordera Filing No. 3, & Final Drainage Report for Cordera Filing No. 3F Pine Creek Basin, by Matrix Design Group, October 2013.

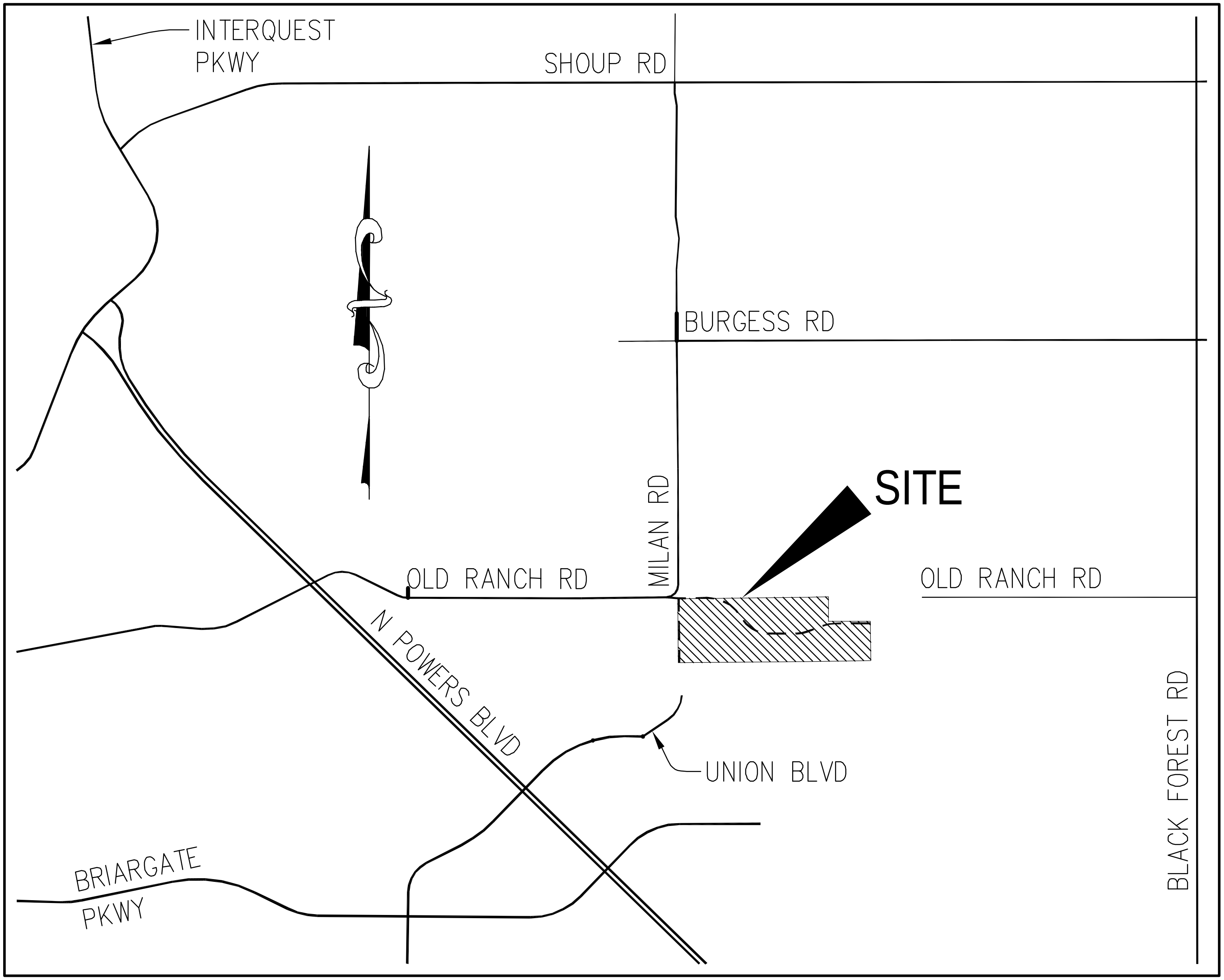
14.) "Final Drainage Report for Cordera Filing No. 3B & Final Drainage Report for Cordera Filing No. 3D Pine Creek Drainage Basin, by Matrix Design Group, October 2014.

15.) "Master Development Drainage Plan Wolf Ranch Development, by Kiowa Engineering Corporation, Revised February 2005.

16.) "Wolf Ranch Master Development Drainage Plan Update", by Kiowa Engineering Corporation, Revised September 2013.

APPENDIX

VICINITY MAP

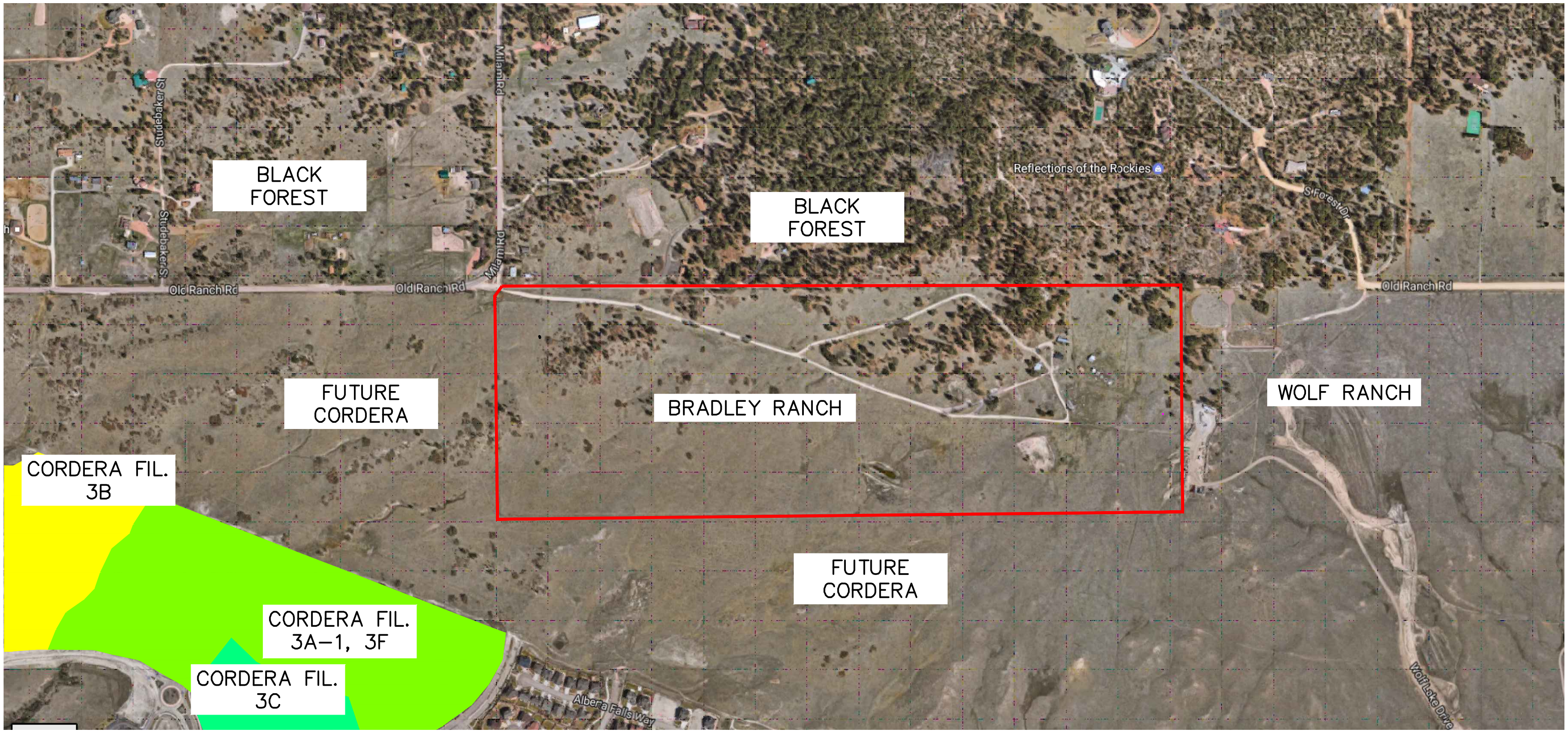


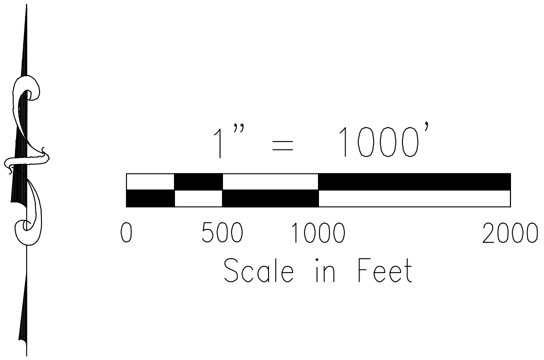
VICINITY MAP

N.T.S.

AERIAL MAP

AERIAL MAP OF SITE AND VICINITY





LEGEND

🟥	SITE BOUNDARY

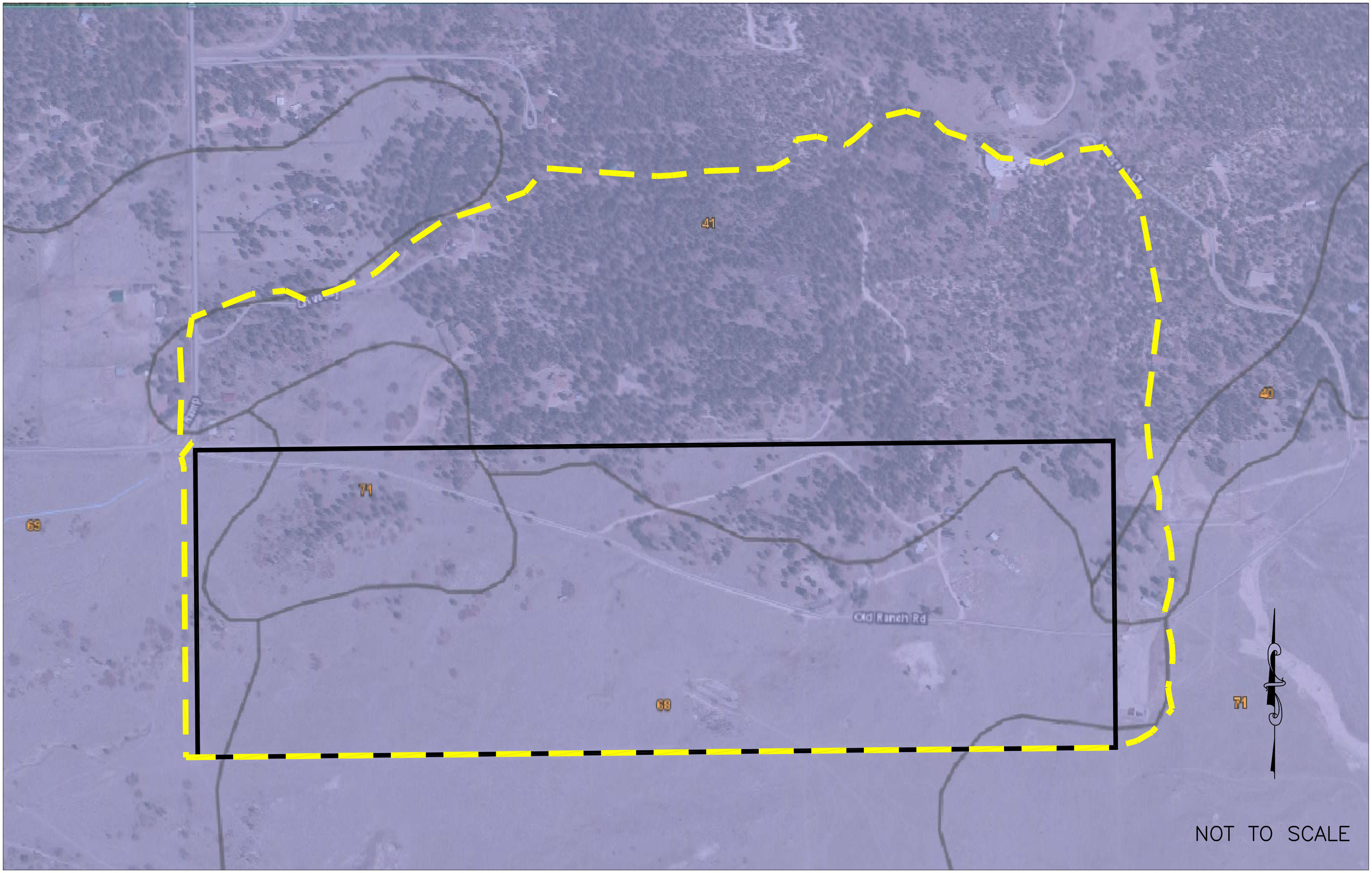
M&S CIVIL CONSULTANTS, INC.

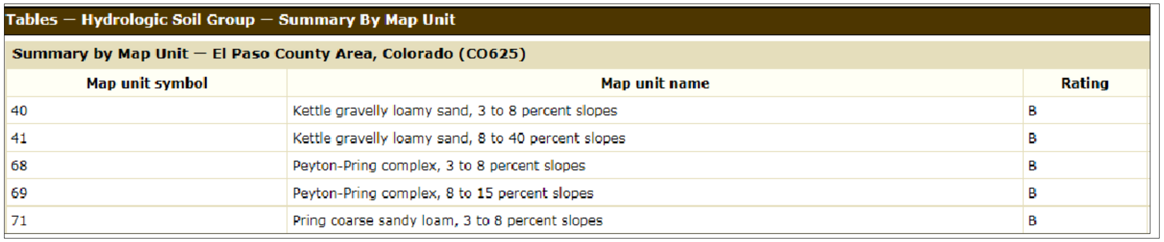
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

SHEET 1 OF 1

File: O:\43093A\Bradley Ranch\dwg\Eng Exhibits\FDP\Aerial Map Bradley Ranch.dwg Plotstamp: 12/21/2016 4:23 PM

SOILS MAP





Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Map unit symbol	Map unit name	Rating
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	B
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B
68	Peyton-Pring complex, 3 to 8 percent slopes	B
69	Peyton-Pring complex, 8 to 15 percent slopes	B
71	Pring coarse sandy loam, 3 to 8 percent slopes	B

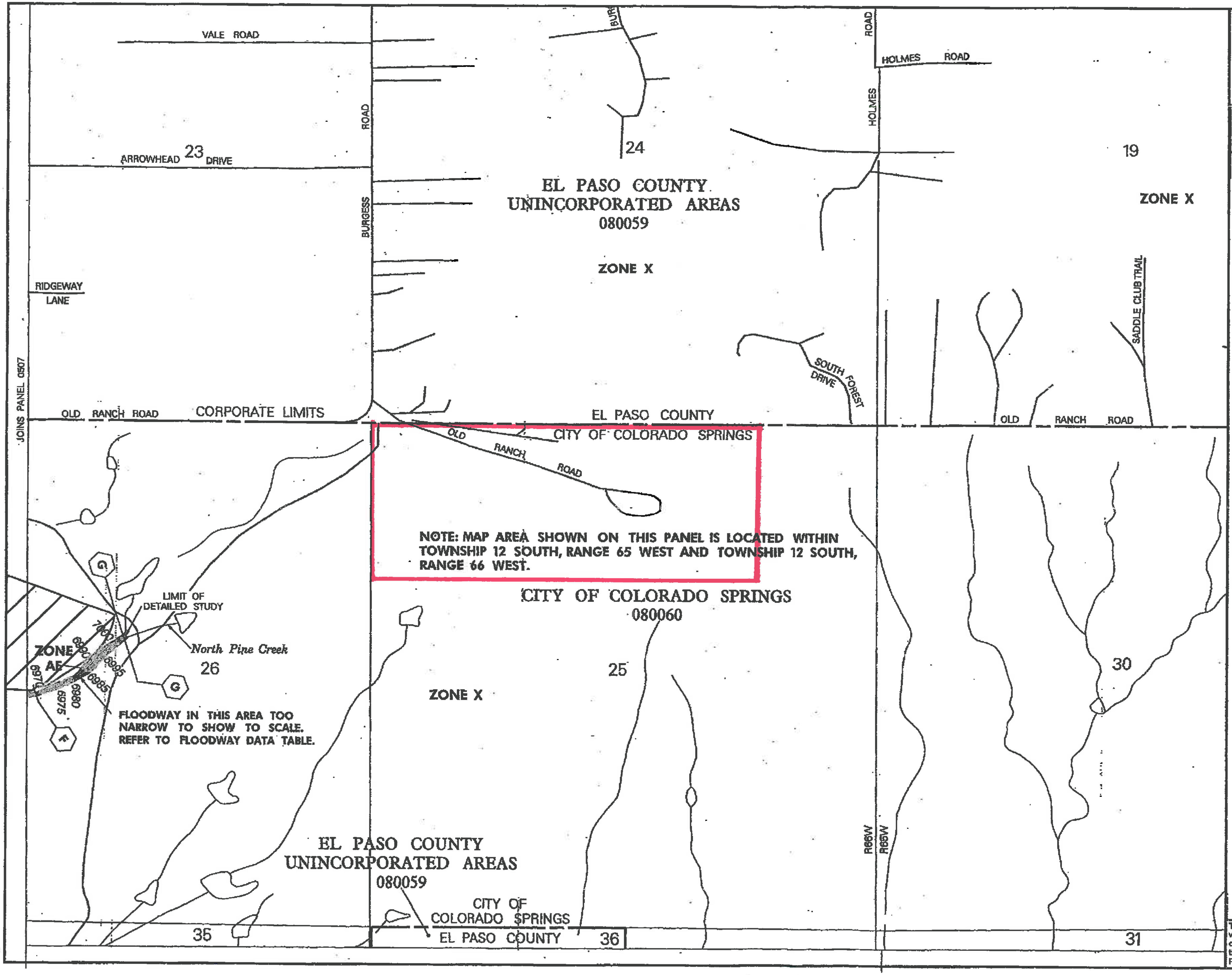
HYDROLOGIC TYPE B SOILS	▨
SITE BOUNDARY	━
ANALYZED WATERSHED BOUNDARY	╍

BRADLEY RANCH

SOILS MAP

M&S CIVIL CONSULTANTS, INC.

FLOODPLAIN MAP



APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 530 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0530	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0530	F

MAP NUMBER
08041C0530 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

		STREETS / DEVELOPED			***OVERLAND / DEVELOPED***			***OVERLAND / UNDEVELOPED***			***WEIGHTED***	
BASIN	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
EX1	16.17	0.0	0.90	0.96	16.17	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX2	4.76	0.0	0.90	0.96	4.76	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX3	9.23	0.0	0.90	0.96	9.23	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX4	5.52	0.0	0.90	0.96	5.52	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX5A	2.45	0.0	0.90	0.96	2.45	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX5B	3.73	0.0	0.90	0.96	3.73	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX6	8.54	0.0	0.90	0.96	8.54	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX7	2.43	0.0	0.90	0.96	2.43	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX8	13.02	0.0	0.90	0.96	13.02	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX9	8.66	0.0	0.90	0.96	8.66	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX10	9.73	0.0	0.90	0.96	9.73	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX11	4.80	0.0	0.90	0.96	4.80	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX12	4.86	0.0	0.90	0.96	4.86	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX13	15.46	0.0	0.90	0.96	15.46	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX14	2.89	0.0	0.90	0.96	2.89	0.11	0.38	0.00	0.11	0.38	***0.11***	***0.38***
EX15	7.40	0.0	0.90	0.96	7.40	0.11	0.38	0.00	0.11	0.38	***0.11***	***0.38***
EX16	48.06	0.0	0.90	0.96	48.06	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX17	16.17	0.0	0.90	0.96	16.17	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX18	0.63	0.0	0.90	0.96	0.63	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX19	7.99	0.0	0.90	0.96	7.99	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX20	6.81	0.0	0.90	0.96	6.81	0.11	0.38	0.0	0.00	0.00	***0.11***	***0.38***
EX21	11.84	0.0	0.90	0.96	11.84	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX22	8.78	0.0	0.90	0.96	8.78	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX23	7.50	0.0	0.90	0.96	7.50	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***
EX24	2.59	0.0	0.90	0.96	2.59	0.11	0.38	0.0	0.11	0.38	***0.11***	***0.38***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				***OVERLAND***				***STREET / CHANNEL FLOW***				***Time of Travel (T_t)***	***INTENSITY ****		***TOTAL FLOWS***	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
EX1	16.17	0.11	0.38	0.11	130	8	11.2	1195	4.6%	1.5	13.3	24.5	2.8	4.7	***5.0***	***28.8***
EX2	4.76	0.11	0.38	0.11	100	16.0	7.2	394	8.6%	2.1	3.2	10.4	4.1	6.8	***2.1***	***12.4***
EX3	9.23	0.11	0.38	0.11	115	12.0	8.8	1335	5.1%	1.6	14.1	22.9	2.9	4.8	***2.9***	***17.0***
EX4	5.52	0.11	0.38	0.11	100	6	9.9	564	4.6%	1.5	6.3	16.2	3.4	5.7	***2.1***	***12.0***
EX5A	2.45	0.11	0.38	0.11	85	4	9.9	563	4.6%	1.5	6.3	16.1	3.4	5.7	***0.9***	***5.3***
EX5B	3.73	0.11	0.38	0.11	65	14	5.2	511	7.4%	1.9	4.5	9.7	4.2	7.0	***1.7***	***9.9***
EX6	8.54	0.11	0.38	0.11	90	10	7.7	1153	4.6%	1.5	12.8	20.5	3.1	5.1	***2.9***	***16.6***
EX7	2.43	0.11	0.38	0.11	90	4	10.4	485	4.9%	1.5	5.2	15.6	3.5	5.8	***0.9***	***5.4***
EX8	13.02	0.11	0.38	0.11	80	10	6.9	1123	5.5%	1.6	11.4	18.3	3.2	5.4	***4.6***	***26.7***
EX9	8.66	0.11	0.38	0.11	100	6	9.9	1054	6.0%	1.7	10.2	20.1	3.1	5.2	***2.9***	***17.0***
EX10	9.73	0.11	0.38	0.11	100	10	8.4	1050	6.7%	1.8	9.7	18.0	3.2	5.4	***3.5***	***20.1***
EX11	4.80	0.11	0.38	0.11	90	6	9.1	668	4.5%	1.5	7.5	16.6	3.4	5.7	***1.8***	***10.3***
EX12	4.86	0.11	0.38	0.11	70	12	5.9	867	7.8%	2.0	7.4	13.2	3.7	6.2	***2.0***	***11.5***
EX13	15.46	0.11	0.38	0.11	85	10	7.3	1586	5.1%	1.6	16.7	24.0	2.8	4.7	***4.8***	***27.8***
EX14	2.89	0.11	0.38	0.11	75	6	7.8	513	4.6%	1.5	5.7	13.5	3.7	6.2	***1.2***	***6.8***
EX15	7.40	0.11	0.38	0.11	90	12	7.2	1310	5.9%	1.7	12.8	20.1	3.1	5.2	***2.5***	***14.6***
EX16	48.06	0.11	0.38	0.11	98	12	7.7	3318	5.3%	1.6	34.3	42.1	2.0	3.3	***10.4***	***60.5***
EX17	16.17	0.11	0.38	0.11	100	14	7.5	1651	6.5%	1.8	15.4	22.9	2.9	4.8	***5.1***	***29.8***
EX18	0.63	0.11	0.38	0.11	85	14	6.5	147	12.2%	2.4	1.0	7.5	4.6	7.6	***0.3***	***1.8***
EX19	7.99	0.11	0.38	0.11	90	16	6.6	686	7.2%	1.9	6.1	12.6	3.8	6.3	***3.3***	***19.3***
EX20	6.81	0.11	0.38	0.11	70	10	6.2	417	12.1%	2.4	2.9	9.1	4.3	7.2	***3.2***	***18.6***
EX21	11.84	0.11	0.38	0.11	80	16	5.9	940	8.3%	2.0	7.8	13.7	3.7	6.1	***4.8***	***27.6***
EX22	8.78	0.11	0.38	0.11	115	10	9.4	940	9.4%	2.1	7.3	16.7	3.4	5.6	***3.2***	***18.8***
EX23	7.50	0.11	0.38	0.11	120	6	11.5	1140	8.8%	2.1	9.1	20.7	3.0	5.1	***2.5***	***14.5***
EX24	2.59	0.11	0.38	0.11	90	4	10.4	540	4.8%	1.5	5.9	16.2	3.4	5.7	***1.0***	***5.6***

Calculated by: CMN
Date: 6/15/2017
Checked by: ______________

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				***Time of Travel (T_t)***	***PIPE / CHANNEL FLOW***				***Total Time of Travel (T_t)***	***INTENSITY ****		***TOTAL FLOWS***		
DESIGN POINT	**CONTRIBUTING BASINS *AND DESIGN POINTS***	**CA_5**	**CA_{100}**	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*		**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
1	**EX16**	5.29	18.26	42.1					42.1	2.0	3.3	***Design Point***	***10.4***	***60.5***
2	**EX17**	1.78	6.14	22.9					22.9	2.9	4.8	***Design Point***	***5.1***	***29.8***
3	**DP-1, DP-6, DP-7, DP-8**	9.28	32.05 16.00	27.9	322	4.3%	1.5	3.7	31.6	2.4	4.0	***Design Point***	***22.3***	***129.3***
4	**EX18**	0.07	0.24	7.5					7.5	4.6	7.6	***Design Point***	***0.3***	***1.8***
5	**DP4, EX6**	1.01	3.48	7.5	1244	5.1%	1.6	13.1	20.7	3.0	5.1	***Design Point***	***3.1***	***17.8***
6	**DP2, DP5, EX5A**	3.06	10.56	20.7	650	4.6%	1.5	7.2	27.9	2.6	4.3	***Design Point***	***7.9***	***45.9***
7	**EX5B**	0.41	1.42	9.7					9.7	4.2	7.0	***Design Point***	***1.7***	***9.9***
8	**EX2**	0.52	1.81	10.4					10.4	4.1	6.8	***Design Point***	***2.1***	***12.4***
9	**EX3**	1.02	3.51	22.9					22.9	2.9	4.8	***Design Point***	***2.9***	***17.0***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*Time of Travel (T_t)*	*PIPE / CHANNEL FLOW*				*Total Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS** ***AND DESIGN POINTS***	**CA_5**	**CA_{100}**	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*		**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
10	**DP9, EX1**	2.79	9.65	22.9	917	4.4%	1.5	10.4	33.3	2.3	3.9	***Design Point***	***6.5***	***37.6***
11	**EX4**	0.61	2.10	16.2					16.2	3.4	5.7	***Design Point***	***2.1***	***12.0***
12	**EX7**	0.27	0.92	15.6					15.6	3.5	5.8	***Design Point***	***0.9***	***5.4***
13	**EX20**	0.75	2.59	9.1					9.1	4.3	7.2	***Design Point***	***3.2***	***18.6***
14	**EX19**	0.88	3.04	12.6					12.6	3.8	6.3	***Design Point***	***3.3***	***19.3***
15	**DP13, DP14, EX9**	2.58	8.91	12.6	1152	6.4%	1.8	10.8	23.5	2.8	4.8	***Design Point***	***7.3***	***42.6***
16	**DP15, EX8**	4.01	13.86	23.5	836	3.8%	1.4	10.2	33.7	2.3	3.9	***Design Point***	***9.3***	***53.7***
17	**EX12**	0.53	1.85	13.2					13.2	3.7	6.2	***Design Point***	***2.0***	***11.5***
18	**DP17, EX10**	1.61	5.55	13.2	500	5.6%	1.7	5.0	18.3	3.2	5.4	***Design Point***	***5.2***	***30.0***
19	**DP18, EX11**	2.13	7.37	18.3	361	3.3%	1.3	4.7	23.0	2.9	4.8	***Design Point***	***6.1***	***35.6***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				***Time of Travel (T_t)***	***PIPE / CHANNEL FLOW***				***Total Time of Travel (T_t)***	***INTENSITY ****		***TOTAL FLOWS***		
DESIGN POINT	**CONTRIBUTING BASINS** ***AND DESIGN POINTS***	**CA_5**	**CA_{100}**	**T_C** ***(min)***	**Length** ***(ft)***	**Slope** ***(%)***	**Velocity** ***(fps)***	**T_t** ***(min)***	**TOTAL** ***(min)***	**I_5** ***(in/hr)***	**I_{100}** ***(in/hr)***		**Q_5** ***(c.f.s.)***	**Q_{100}** ***(c.f.s.)***
20	**EX21**	1.30	4.50	20.7					20.7	3.0	5.1	***Design Point***	***4.0***	***23.0***
20A	**EX22**	0.97	3.34	16.7					16.7	3.4	5.6	***Design Point***	***3.2***	***18.8***
21	**DP20, EX13**	3.00	10.38	20.7	1586	5.5%	1.6	16.1	36.8	2.2	3.7	***Design Point***	***6.5***	***37.9***
22	**EX14**	0.32	1.10	13.5					13.5	3.7	6.2	***Design Point***	***1.2***	***6.8***
23A	**EX23**	0.83	2.85	20.7					20.7	3.0	5.1	***Design Point***	***2.5***	***14.5***
23	**DP20A, DP23A,EX15**	2.60	9.00	16.7	1415	5.9%	1.7	13.8	30.5	2.5	4.1	***Design Point***	***6.4***	***37.1***
24	**DP22, DP23**	2.92	10.10	30.5					30.5	2.5	4.1	***Design Point***	***7.2***	***41.6***
25	**EX24**	0.28	0.98	16.2					16.2	3.4	5.7	***Design Point***	***1.0***	***5.6***
26	**DP10, DP25**	3.08	10.64	16.2 33.3					33.3	2.3	3.9	***Design Point***	***7.2***	***41.5***

Calculated by: CMN
Date: 6/15/2017
Checked by:

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
(Area Runoff Coefficient Summary)

			STREETS / DEVELOPED						*OVERLAND / DEVELOPED*						*WEIGHTED*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{10}	C_{25}	C_{50}	C_{100}	**AREA** *(Acres)*	C_5	C_{10}	C_{25}	C_{50}	C_{100}	C_5	C_{100}
A	*66530.9212*	**1.53**	1.53	0.90	0.92	0.94	0.95	0.96	0.00	0.00	0.00	0.00	0.00	0.00	***0.90***	***0.96***
B	*188065.867*	**4.32**	2.12	0.90	0.92	0.94	0.95	0.96	2.20	0.30	0.36	0.42	0.46	0.50	***0.59***	***0.73***
C	*100937*	**2.32**	0.00	0.90	0.92	0.94	0.95	0.96	2.32	0.30	0.36	0.42	0.46	0.50	***0.30***	***0.50***
D	*98490*	**2.26**	0.46	0.90	0.92	0.94	0.95	0.96	1.80	0.40	0.45	0.50	0.53	0.56	***0.50***	***0.64***
D1	*24659*	**0.57**	0.11	0.90	0.92	0.94	0.95	0.96	0.46	0.40	0.45	0.50	0.53	0.56	***0.50***	***0.64***
E	*74914*	**1.72**	0.38	0.90	0.92	0.94	0.95	0.96	1.34	0.40	0.45	0.50	0.53	0.56	***0.51***	***0.65***
F	*130957*	**3.01**	0.49	0.90	0.92	0.94	0.95	0.96	2.52	0.40	0.45	0.50	0.53	0.56	***0.48***	***0.63***
G	*74892*	**1.72**	0.30	0.90	0.92	0.94	0.95	0.96	1.42	0.40	0.45	0.50	0.53	0.56	***0.49***	***0.63***
H	*154965*	**3.56**	0.28	0.90	0.92	0.94	0.95	0.96	3.28	0.40	0.45	0.50	0.53	0.56	***0.44***	***0.59***
I	*81494*	**1.87**	0.46	0.90	0.92	0.94	0.95	0.96	1.41	0.40	0.45	0.50	0.53	0.56	***0.52***	***0.66***
J	*133255*	**3.06**	0.00	0.90	0.92	0.94	0.95	0.96	3.06	0.25	0.32	0.39	0.43	0.47	***0.25***	***0.47***
K	*71349*	**1.64**	0.00	0.90	0.92	0.94	0.95	0.96	1.64	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
L1	*49934*	**1.15**	0.26	0.90	0.92	0.94	0.95	0.96	0.89	0.40	0.45	0.50	0.53	0.56	***0.51***	***0.65***
L2	*70288*	**1.61**	0.26	0.90	0.92	0.94	0.95	0.96	1.35	0.40	0.45	0.50	0.53	0.56	***0.48***	***0.62***
L3	*65155*	**1.50**	0.31	0.90	0.92	0.94	0.95	0.96	1.19	0.40	0.45	0.50	0.53	0.56	***0.50***	***0.64***
L4	*22027*	**0.51**	0.26	0.90	0.92	0.94	0.95	0.96	0.25	0.40	0.45	0.50	0.53	0.56	***0.66***	***0.77***
M	*130935*	**3.01**	0.21	0.90	0.92	0.94	0.95	0.96	2.80	0.22	0.30	0.37	0.41	0.46	***0.27***	***0.49***
N	*96674*	**2.22**	0.18	0.90	0.92	0.94	0.95	0.96	2.04	0.22	0.30	0.37	0.41	0.46	***0.28***	***0.50***
N1	*174624*	**4.01**	0.20	0.90	0.92	0.94	0.95	0.96	3.81	0.22	0.30	0.37	0.41	0.46	***0.25***	***0.48***
O	*76752*	**1.76**	0.00	0.90	0.92	0.94	0.95	0.96	1.76	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
O1	*16776*	**0.39**	0.00	0.90	0.92	0.94	0.95	0.96	0.39	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
O2	*27567*	**0.63**	0.00	0.90	0.92	0.94	0.95	0.96	0.63	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
P	*73541*	**1.69**	0.39	0.90	0.92	0.94	0.95	0.96	1.30	0.40	0.45	0.50	0.53	0.56	***0.52***	***0.65***
Q	*216135*	**4.96**	0.40	0.90	0.92	0.94	0.95	0.96	4.56	0.40	0.45	0.50	0.53	0.56	***0.44***	***0.59***
R	*57044*	**1.31**	0.31	0.90	0.92	0.94	0.95	0.96	1.00	0.40	0.45	0.50	0.53	0.56	***0.52***	***0.65***
S	*87348*	**2.01**	0.38	0.90	0.92	0.94	0.95	0.96	1.63	0.40	0.45	0.50	0.53	0.56	***0.49***	***0.64***
T	*123868*	**2.84**	0.42	0.90	0.92	0.94	0.95	0.96	2.42	0.40	0.45	0.50	0.53	0.56	***0.47***	***0.62***
T1	*61784*	**1.42**	0.29	0.90	0.92	0.94	0.95	0.96	1.13	0.40	0.45	0.50	0.53	0.56	***0.50***	***0.64***
S1	*21713*	**0.50**	0.30	0.90	0.92	0.94	0.95	0.96	0.20	0.40	0.45	0.50	0.53	0.56	***0.70***	***0.80***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Area Runoff Coefficient Summary)

			STREETS / DEVELOPED						***OVERLAND / DEVELOPED***						***WEIGHTED***	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**C_5**	**C_{100}**
U	*121932*	**2.80**	0.28	0.90	0.92	0.94	0.95	0.96	2.52	0.30	0.36	0.42	0.46	0.50	***0.36***	***0.55***
U1	*50666*	**1.16**	0.30	0.90	0.92	0.94	0.95	0.96	0.86	0.30	0.36	0.42	0.46	0.50	***0.45***	***0.62***
V	*119852*	**2.75**	0.35	0.90	0.92	0.94	0.95	0.96	2.40	0.40	0.45	0.50	0.53	0.56	***0.46***	***0.61***
V1	*23058*	**0.53**	0.17	0.90	0.92	0.94	0.95	0.96	0.36	0.40	0.45	0.50	0.53	0.56	***0.56***	***0.69***
W	*51318*	**1.18**	0.32	0.90	0.92	0.94	0.95	0.96	0.86	0.40	0.45	0.50	0.53	0.56	***0.54***	***0.67***
W1	*20280*	**0.47**	0.05	0.90	0.92	0.94	0.95	0.96	0.42	0.30	0.36	0.42	0.46	0.50	***0.36***	***0.55***
W2	*148978*	**3.42**	0.32	0.90	0.92	0.94	0.95	0.96	3.10	0.34	0.40	0.46	0.50	0.54	***0.39***	***0.58***
X	*74636*	**1.71**	0.40	0.90	0.92	0.94	0.95	0.96	1.31	0.40	0.45	0.50	0.53	0.56	***0.52***	***0.65***
X1	*38500*	**0.88**	0.21	0.90	0.92	0.94	0.95	0.96	0.67	0.40	0.45	0.50	0.53	0.56	***0.52***	***0.66***
X2	*32320*	**0.74**	0.17	0.90	0.92	0.94	0.95	0.96	0.57	0.40	0.45	0.50	0.53	0.56	***0.51***	***0.65***
X3	*22277*	**0.51**	0.15	0.90	0.92	0.94	0.95	0.96	0.36	0.40	0.45	0.50	0.53	0.56	***0.55***	***0.68***
Y	*173877*	**3.99**	0.47	0.90	0.92	0.94	0.95	0.96	3.52	0.40	0.45	0.50	0.53	0.56	***0.46***	***0.61***
Y1	*54970*	**1.26**	0.30	0.90	0.92	0.94	0.95	0.96	0.96	0.40	0.45	0.50	0.53	0.56	***0.52***	***0.66***
Z	*92917*	**2.13**	0.20	0.90	0.92	0.94	0.95	0.96	1.93	0.40	0.45	0.50	0.53	0.56	***0.45***	***0.60***
AA	*93919*	**2.16**	0.17	0.90	0.92	0.94	0.95	0.96	1.99	0.40	0.45	0.50	0.53	0.56	***0.44***	***0.59***
BB	*168811*	**3.88**	0.56	0.90	0.92	0.94	0.95	0.96	3.32	0.30	0.36	0.42	0.46	0.50	***0.39***	***0.57***
CC	*126967*	**2.91**	0.67	0.90	0.92	0.94	0.95	0.96	2.24	0.40	0.45	0.50	0.53	0.56	***0.51***	***0.65***
DD	*118921*	**2.73**	0.30	0.90	0.92	0.94	0.95	0.96	2.43	0.34	0.40	0.46	0.50	0.54	***0.40***	***0.59***
DD1	*37455*	**0.86**	0.15	0.90	0.92	0.94	0.95	0.96	0.71	0.30	0.36	0.42	0.46	0.50	***0.40***	***0.58***
EE	*55671*	**1.28**	0.14	0.90	0.92	0.94	0.95	0.96	1.14	0.31	0.37	0.43	0.47	0.51	***0.37***	***0.56***
FF	*138224*	**3.17**	0.00	0.90	0.92	0.94	0.95	0.96	3.17	0.15	0.23	0.34	0.37	0.42	***0.15***	***0.42***
GG	*136759*	**3.14**	0.00	0.90	0.92	0.94	0.95	0.96	3.14	0.40	0.45	0.50	0.53	0.56	***0.40***	***0.56***
HH	*322869*	**7.41**	0.00	0.90	0.92	0.94	0.95	0.96	7.41	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
JJ	*79716*	**1.83**	0.11	0.90	0.92	0.94	0.95	0.96	1.72	0.21	0.28	0.36	0.40	0.45	***0.25***	***0.48***
JJ1	*97202*	**2.23**	0.07	0.90	0.92	0.94	0.95	0.96	2.16	0.21	0.28	0.36	0.40	0.45	***0.23***	***0.47***
JJ2	*96985*	**2.23**	0.14	0.90	0.92	0.94	0.95	0.96	2.09	0.21	0.28	0.36	0.40	0.45	***0.25***	***0.48***
JJ3	*68304*	**1.57**	0.36	0.90	0.92	0.94	0.95	0.96	1.21	0.34	0.40	0.46	0.50	0.54	***0.47***	***0.64***
KK	*15403*	**0.35**	0.00	0.90	0.92	0.94	0.95	0.96	0.35	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
LL1	*91737*	**2.11**	0.00	0.90	0.92	0.94	0.95	0.96	2.11	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
LL2	*57893*	**1.33**	0.00	0.90	0.92	0.94	0.95	0.96	1.33	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Area Runoff Coefficient Summary)

			STREETS / DEVELOPED						*OVERLAND / DEVELOPED*						*WEIGHTED*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{10}	C_{25}	C_{50}	C_{100}	**AREA** *(Acres)*	C_5	C_{10}	C_{25}	C_{50}	C_{100}	C_5	C_{100}
MM	*66924*	**1.54**	0.00	0.90	0.92	0.94	0.95	0.96	1.54	0.13	0.21	0.31	0.35	0.4	***0.13***	***0.40***
MM1	*31520*	**0.72**	0.00	0.90	0.92	0.94	0.95	0.96	0.72	0.21	0.28	0.36	0.40	0.45	***0.21***	***0.45***
MM2	*5454*	**0.13**	0.00	0.90	0.92	0.94	0.95	0.96	0.13	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
NN	*6555*	**0.15**	0.00	0.90	0.92	0.94	0.95	0.96	0.15	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS1	*42775*	**0.98**	0.00	0.90	0.92	0.94	0.95	0.96	0.98	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS2	*2048813*	**47.03**	0.00	0.90	0.92	0.94	0.95	0.96	47.03	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS3	*704442*	**16.17**	0.00	0.90	0.92	0.94	0.95	0.96	16.17	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS4	*27268*	**0.63**	0.00	0.90	0.92	0.94	0.95	0.96	0.63	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS5	*296741*	**6.81**	0.00	0.90	0.92	0.94	0.95	0.96	6.81	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS6	*348137*	**7.99**	0.00	0.90	0.92	0.94	0.95	0.96	7.99	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS7	*515821*	**11.84**	0.00	0.90	0.92	0.94	0.95	0.96	11.84	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS8	*465654*	**10.69**	0.00	0.90	0.92	0.94	0.95	0.96	10.69	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS9	*144573*	**3.32**	0.00	0.90	0.92	0.94	0.95	0.96	3.32	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS10	*9778*	**0.22**	0.00	0.90	0.92	0.94	0.95	0.96	0.22	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***
OS11	*90040*	**2.07**	0.00	0.90	0.92	0.94	0.95	0.96	2.07	0.11	0.19	0.29	0.33	0.38	***0.11***	***0.38***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Area Drainage Summary)

From Area Runoff Coefficient Summary				***OVERLAND***				***STREET / CHANNEL FLOW***				***Time of Travel (T_t)***		***INTENSITY ****		***TOTAL FLOWS***	
BASIN	**AREA TOTAL** *(Acres)*	**C_5**	**C_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
A	1.53	0.90	0.96	0.90	65	2.0	2.0	1170	1.6%	2.5	7.7	9.7	16.9	4.2	7.0	***5.7***	***10.3***
B	4.32	0.59	0.73	0.59	65	2.0	5.1	1170	1.6%	2.5	7.7	12.7	16.9	3.8	6.3	***9.7***	***19.8***
C	2.32	0.30	0.50	0.30	130	14.0	7.5	1010	1.9%	2.7	6.1	13.7	16.3	3.7	6.1	***2.5***	***7.1***
D	2.26	0.50	0.64	0.50	70	1.5	7.0	780	3.6%	3.8	3.4	10.5	14.7	4.1	6.8	***4.6***	***9.9***
D1	0.57	0.50	0.64	0.50	70	1.5	7.1	240	1.0%	2.0	2.0	9.0	11.7	4.3	7.2	***1.2***	***2.6***
E	1.72	0.51	0.65	0.51	60	2.0	5.5	770	3.6%	3.8	3.4	8.9	14.6	4.3	7.2	***3.8***	***8.1***
F	3.01	0.48	0.63	0.48	90	4.0	6.5	415	3.4%	3.7	1.9	8.4	12.8	4.4	7.4	***6.4***	***13.9***
G	1.72	0.49	0.63	0.49	100	2.0	8.8	505	3.4%	3.7	2.3	11.1	13.4	4.0	6.7	***3.3***	***7.2***
H	3.56	0.44	0.59	0.44	160	12.0	7.8	660	3.0%	3.5	3.2	10.9	14.6	4.0	6.7	***6.2***	***14.1***
I	1.87	0.52	0.66	0.52	61	1.5	6.0	950	3.7%	3.8	4.1	10.2	15.6	4.1	6.9	***4.0***	***8.5***
J	3.06	0.25	0.47	0.25	220	8.0	14.9	640	5.0%	1.6	6.8	21.7	14.8	3.5	5.9	***2.7***	***8.6***
K	1.64	0.11	0.38	0.11	60	6.0	6.5	720	4.6%	1.5	8.0	14.5	14.3	3.6	6.0	***0.6***	***3.8***
L1	1.15	0.51	0.65	0.51	85	4.0	5.9	435	3.2%	3.6	2.0	7.9	12.9	4.5	7.5	***2.6***	***5.6***
L2	1.61	0.48	0.62	0.48	70	4.0	5.3	535	5.2%	4.6	1.9	7.2	13.4	4.6	7.8	***3.6***	***7.8***
L3	1.50	0.50	0.64	0.50	65	2.0	6.0	435	3.2%	3.6	2.0	8.0	12.8	4.5	7.5	***3.4***	***7.2***
L4	0.51	0.66	0.77	0.66	50	1.0	4.5	535	5.2%	4.6	1.9	6.4	13.3	4.8	8.0	***1.6***	***3.1***
M	3.01	0.27	0.49	0.27	155	10.0	10.1	440	4.3%	4.2	1.8	11.9	13.3	3.9	6.5	***3.1***	***9.7***
N	2.22	0.28	0.50	0.28	155	16.0	8.6	260	4.2%	4.1	1.1	9.6	12.3	4.2	7.0	***2.6***	***7.8***
N1	4.01	0.25	0.48	0.25	150	4.0	13.5	500	4.4%	4.2	2.0	15.5	13.6	3.7	6.2	***3.7***	***12.0***
O	1.76	0.11	0.38	0.11	100	16.0	7.2	260	7.7%	1.9	2.2	9.4	12.0	4.2	7.1	***0.8***	***4.7***
O1	0.39	0.11	0.38	0.11	100	10.0	8.4	70	8.6%	2.0	0.6	8.9	10.9	4.3	7.2	***0.2***	***1.1***
O2	0.63	0.11	0.38	0.11	100	8.0	9.0	390	3.1%	1.2	5.3	14.3	12.7	3.8	6.3	***0.3***	***1.5***
P	1.69	0.52	0.65	0.52	60	1.5	6.0	660	3.6%	3.8	2.9	8.9	14.0	4.3	7.2	***3.7***	***8.0***
Q	4.96	0.44	0.59	0.44	160	11.0	8.0	770	3.9%	3.9	3.3	11.2	15.2	4.0	6.6	***8.6***	***19.5***
R	1.31	0.52	0.65	0.52	50	1.0	5.9	580	2.6%	3.2	3.0	8.9	13.5	4.3	7.2	***2.9***	***6.2***
S	2.01	0.49	0.64	0.49	90	6.0	5.5	540	2.8%	3.3	2.7	8.2	13.5	4.4	7.4	***4.4***	***9.5***
T	2.84	0.47	0.62	0.47	60	4.0	4.7	615	2.3%	3.0	3.4	8.1	13.8	4.4	7.5	***6.0***	***13.2***
T1	1.42	0.50	0.64	0.50	100	2.0	8.6	560	2.1%	2.9	3.2	11.8	13.7	3.9	6.5	***2.8***	***5.9***
S1	0.50	0.70	0.80	0.70	55	1.5	3.8	500	2.8%	3.3	2.5	6.3	13.1	4.8	8.1	***1.7***	***3.2***
U	2.80	0.36	0.55	0.36	120	6.0	8.6	460	3.5%	3.7	2.1	10.7	13.2	4.0	6.8	***4.1***	***10.3***
U1	1.16	0.45	0.62	0.45	60	2.0	6.1	550	4.7%	4.3	2.1	8.2	13.4	4.4	7.4	***2.3***	***5.4***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Area Drainage Summary)

From Area Runoff Coefficient Summary				***OVERLAND***				***STREET / CHANNEL FLOW***				***Time of Travel (T_t)***		***INTENSITY ****		***TOTAL FLOWS***	
BASIN	**AREA TOTAL** ***(Acres)***	**C_5**	**C_{100}**	**C_5**	**Length** ***(ft)***	**Height** ***(ft)***	**T_C** ***(min)***	**Length** ***(ft)***	**Slope** ***(%)***	**Velocity** ***(fps)***	**T_t** ***(min)***	**TOTAL** ***(min)***	**CHECK** ***(min)***	**I_5** ***(in/hr)***	**I_{100}** ***(in/hr)***	**Q_5** ***(c.f.s.)***	**Q_{100}** ***(c.f.s.)***
V	2.75	0.46	0.61	0.46	105	6.0	6.6	670	3.9%	3.9	2.8	9.5	14.3	4.2	7.1	***5.4***	***11.9***
V1	0.53	0.56	0.69	0.56	75	2.0	6.1	240	8.3%	5.8	0.7	6.8	11.8	4.7	7.9	***1.4***	***2.9***
W	1.18	0.54	0.67	0.54	50	1.0	5.7	130	13.1%	7.2	0.3	6.0	11.0	4.9	8.2	***3.1***	***6.5***
W1	0.47	0.36	0.55	0.36	100	4.0	8.4	30	1.0%	2.0	0.3	8.7	10.7	4.3	7.3	***0.7***	***1.9***
W2	3.42	0.39	0.58	0.39	145	9.0	8.4	450	4.4%	4.2	1.8	10.2	13.3	4.1	6.9	***5.5***	***13.6***
X	1.71	0.52	0.65	0.52	50	1.0	5.9	770	1.9%	2.8	4.6	10.5	14.6	4.1	6.8	***3.6***	***7.6***
X1	0.88	0.52	0.66	0.52	50	1.0	5.9	390	2.6%	3.2	2.0	7.9	12.4	4.5	7.5	***2.1***	***4.4***
X2	0.74	0.51	0.65	0.51	50	1.0	5.9	350	3.4%	3.7	1.6	7.5	12.2	4.6	7.7	***1.7***	***3.7***
X3	0.51	0.55	0.68	0.55	70	1.5	6.5	225	4.4%	4.2	0.9	7.4	11.6	4.6	7.7	***1.3***	***2.7***
Y	3.99	0.46	0.61	0.46	160	6.0	9.5	650	2.2%	2.9	3.7	13.2	14.5	3.7	6.2	***6.8***	***15.1***
Y1	1.26	0.52	0.66	0.52	60	1.0	6.9	590	2.2%	3.0	3.3	10.2	13.6	4.1	6.9	***2.7***	***5.7***
Z	2.13	0.45	0.60	0.45	160	6.0	9.6	380	1.1%	2.1	3.1	12.7	13.0	3.8	6.3	***3.6***	***8.1***
AA	2.16	0.44	0.59	0.44	165	5.0	10.6	310	3.5%	3.8	1.4	12.0	12.6	3.9	6.5	***3.7***	***8.3***
BB	3.88	0.39	0.57	0.39	115	1.5	12.7	565	2.5%	3.1	3.0	15.6	13.8	3.6	6.1	***5.5***	***13.4***
CC	2.91	0.51	0.65	0.51	50	1.0	5.9	1140	2.6%	3.2	5.9	11.8	16.6	3.9	6.5	***5.8***	***12.4***
DD	2.73	0.40	0.59	0.40	140	10.0	7.8	325	2.0%	2.8	1.9	9.7	12.6	4.2	7.0	***4.6***	***11.2***
DD1	0.86	0.40	0.58	0.40	75	1.5	8.6	315	2.1%	2.9	1.8	10.5	12.2	4.1	6.8	***1.4***	***3.4***
EE	1.28	0.37	0.56	0.37	60	1.0	8.6	325	2.0%	2.8	1.9	10.5	12.1	4.1	6.8	***1.9***	***4.9***
FF	3.17	0.15	0.42	0.15	140	14.0	9.5	290	0.7%	0.6	8.3	17.8	12.4	3.8	6.4	***1.8***	***8.5***
GG	3.14	0.40	0.56	0.40	50	2.0	5.7	0	0.0%	0.0	0.0	5.7	10.3	5.0	8.4	***6.3***	***14.7***
HH	7.41	0.11	0.38	0.11	380	42.0	15.8	200	0.5%	0.5	6.7	22.5	13.2	3.7	6.2	***3.0***	***17.5***
JJ	1.83	0.25	0.48	0.25	90	18.0	5.4	184	9.8%	4.1	0.8	6.2	11.5	4.9	8.2	***2.2***	***7.2***
JJ1	2.23	0.23	0.47	0.23	160	10.0	10.8	160	2.5%	3.2	0.8	11.7	11.8	3.9	6.5	***2.0***	***6.8***
JJ2	2.23	0.25	0.48	0.25	95	14.0	6.1	360	3.3%	2.4	2.5	8.7	12.5	4.3	7.3	***2.5***	***7.8***
JJ3	1.57	0.47	0.64	0.47	55	1.0	6.9	600	5.2%	3.0	3.4	10.3	13.6	4.1	6.9	***3.0***	***6.8***
KK	0.35	0.11	0.38	0.11	70	2.0	10.6	180	4.4%	1.5	2.0	12.6	11.4	3.9	6.6	***0.2***	***0.9***
LL1	2.11	0.11	0.38	0.11	105	16.0	7.5	350	8.0%	2.0	2.9	10.4	12.5	4.1	6.8	***0.9***	***5.5***
LL2	1.33	0.11	0.38	0.11	100	14.0	7.5	220	10.0%	2.2	1.7	9.1	11.8	4.3	7.2	***0.6***	***3.6***
MM	1.54	0.13	0.40	0.13	40	8.0	4.1	570	3.7%	1.3	7.1	11.2	13.4	4.0	6.6	***0.8***	***4.1***
MM1	0.72	0.21	0.45	0.21	90	6.0	8.2	165	6.1%	1.7	1.6	9.7	11.4	4.2	7.0	***0.6***	***2.3***
MM2	0.13	0.11	0.38	0.11	70	8.0	6.7	30	13.3%	2.6	0.2	6.9	10.6	4.7	7.9	***0.1***	***0.4***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Area Drainage Summary)

From Area Runoff Coefficient Summary				***OVERLAND***				***STREET / CHANNEL FLOW***				***Time of Travel (T_t)***		***INTENSITY ****		***TOTAL FLOWS***	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)				***(ft)***	***(ft)***	***(min)***	***(ft)***	***(%)***	***(fps)***	***(min)***	***(min)***	***(min)***	***(in/hr)***	***(in/hr)***	***(c.f.s.)***	***(c.f.s.)***
NN	0.15	0.11	0.38	0.11	70	6.0	7.4	30	13.3%	2.6	0.2	7.6	10.6	4.5	7.6	***0.1***	***0.4***
OS1	0.98	0.11	0.38	0.11	125	12.0	9.5	270	7.4%	1.9	2.4	11.8	12.2	3.9	6.5	***0.4***	***2.4***
OS2	47.03	0.11	0.38	0.11	98	12.0	7.7	3318	5.3%	1.6	34.3	42.1	N/A	2.0	3.3	***10.2***	***59.2***
OS3	16.17	0.11	0.38	0.11	100	14.0	7.5	1651	6.5%	1.8	15.4	22.9	N/A	2.9	4.8	***5.1***	***29.8***
OS4	0.63	0.11	0.38	0.11	85	14	6.5	147	12.2%	2.4	1.0	7.5	N/A	4.6	7.6	***0.3***	***1.8***
OS5	6.81	0.11	0.38	0.11	70	10	6.2	417	12.1%	2.4	2.9	9.1	N/A	4.3	7.2	***3.2***	***18.6***
OS6	7.99	0.11	0.38	0.11	90	16	6.6	686	7.2%	1.9	6.1	12.6	N/A	3.8	6.3	***3.3***	***19.3***
OS7	11.84	0.11	0.38	0.11	80	16	5.9	940	8.3%	2.0	7.8	13.7	N/A	3.7	6.1	***4.8***	***27.6***
OS8	10.69	0.11	0.38	0.11	120	20.0	7.7	1125	7.2%	1.9	10.0	17.7	N/A	3.3	5.5	***3.8***	***22.3***
OS9	3.32	0.11	0.38	0.11	145	16.0	9.7	570	7.0%	1.9	5.1	14.9	N/A	3.5	5.9	***1.3***	***7.5***
OS10	0.22	0.11	0.38	0.11	140	14.0	9.9	60	10.0%	2.2	0.5	10.3	N/A	4.1	6.8	***0.1***	***0.6***
OS11	2.07	0.11	0.38	0.11	135	14.0	9.6	231	7.8%	2.0	2.0	11.6	N/A	3.9	6.6	***0.9***	***5.2***

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CMN
Date: 6/15/2017
Checked by: VAS

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT *(DP)*	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
Storm Sewer System A																	
A1	**A**	1.37	1.47									9.7	4.2	7.0	***5.7***	***10.3***	6' D-10-R Sump Inlet
A2	**B, C** **Flowby DPB2, DPB3** **Total**	3.26 0.00 3.26	4.29 0.67 4.96									20.0	3.1	5.2	***10.1***	***25.7***	16' D-10-R Sump Inlet
Storm Sewer System B																	
B1	**J, K, OS2, OS3**	7.90	26.08					Tc from Basin OS2				42.1	2.0	3.3	***15.6***	***86.4***	Culvert
B2	**L2** **Flowby X1** **Total**	0.78 0.15 0.93	1.01 0.91 1.92					Average of L2 and Flowby X1				12.5	3.8	6.4	***3.5***	***12.2***	14' D-10-R At Grade Inlet
B3	**L4** **Flowby X2** **Total**	0.33 0.00 0.33	0.39 1.28 1.67					Average of L4 and Flowby X2				7.2	4.6	7.8	***1.5***	***12.9***	14' D-10-R At Grade Inlet
Storm Sewer System C																	
C1	**D**	1.13	1.45									10.5	4.1	6.8	***4.6***	***9.9***	10' D-10-R At Grade Inlet
C2	**H**	1.56	1.59									10.9	4.0	6.7	***6.2***	***10.7***	12' D-10-R At Grade Inlet Total CA100=3.18 Split Between DPC2 & DPC3 For Crown Overflow
C3	**G**	0.84	1.59									11.1	4.0	6.7	***3.3***	***10.6***	12' D-10-R At Grade Inlet
C4	**I** **Flowby DPC2, DPC3** **Total**	0.98 0.03 1.00	1.23 0.54 1.77									10.2	4.1	6.9	***4.0***	***8.5***	12' D-10-R At Grade Inlet
C5	**F** **Flowby DPC4** **Total**	1.45 0.00 1.45	1.93					Tc from Basin F				8.4	4.4	7.4	***6.4***	***14.3***	12' D-10-R Sump Inlet Total CA100=3.86 Split Between DPC5 & DPC6 For Crown Overflow
C6	**D1, E** **Flowby DPC1** **Total**	1.16 0.02 1.18	1.93					Tc from Basin E				8.9	4.3	7.2	***5.1***	***14.0***	12' D-10-R Sump Inlet
Storm Sewer System D																	
D1	**O, OS6**	1.07	3.71	0.11	90	16	6.6	830	6.9%	1.8	7.5	14.1	3.6	6.1	***3.9***	***22.5***	Culvert
D2	**O2, OS5**	0.82	2.83					Tc from Basin OS6				9.1	4.3	7.2	***3.5***	***20.3***	Culvert
D3	**N1, O1**	1.06	2.09					Tc from Basin N1				13.6	3.7	6.2	***3.9***	***12.9***	10' D-10-R At Grade Inlet
D4	**N** **Flowby DPD3** **Total**	0.61 0.00 0.61	1.47					Tc of Basin N and Flowby considered				12.5	3.8	6.4	***2.3***	***9.4***	12' D-10-R At Grade Inlet Total CA100=2.94 Split Between DPD4 & DPD5 For Crown Overflow
D5	**P**	0.87	1.47									8.9	4.3	7.2	***3.7***	***10.6***	12' D-10-R At Grade Inlet
D6	**Q**	2.18	1.90									11.2	4.0	6.6	***8.6***	***12.6***	14' D-10-R At Grade Inlet Total CA100=3.80 Split Between DPD6 & DPD7 For Crown Overflow

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT *(DP)*	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
D7	**R**	0.68	1.90									8.9	4.3	7.2	***2.9***	***13.7***	14' D-10-R At Grade Inlet
D8	**S**	0.99	1.27									8.2	4.4	7.4	***4.4***	***9.5***	12' D-10-R At Grade Inlet
D9	**S1**	0.35	0.40									6.3	4.8	8.1	***1.7***	***3.2***	6' D-10-R At Grade Inlet
D10	**T, V1**	2.62	3.44									10.0	4.1	6.9	***10.8***	***24.8***	16' D-10-R At Grade Inlet
	Flowby E7	0.00	0.13														
		2.62	3.57														
D11	**T1, X, X1**	2.06	2.61	0.53	120	6	6.6	1450	2.0%	2.8	8.5	20.0	3.1	5.2	***6.7***	***20.0***	16' D-10-R Sump Inlet
	DPE8, DPD10	0.10	1.24														
	Total	2.15	3.85														
Storm Sewer System E																	
E1	**KK, OS7**	1.34	4.63					Tc from Basin OS7				13.7	3.7	6.1	***4.9***	***28.4***	Culvert
E2	**JJ3**	0.73	2.00									10.3	4.1	6.9	***3.0***	***13.7***	14' D-10-R At Grade Inlet Total CA100=4.00 Split Between DPE2 & DPE3 For Crown Overflow
E3	**JJ, JJ1, JJ2**	1.54	2.00	0.24	140	12	9.0	600	4.4%	4.2	2.4	11.4	3.9	6.6	***6.1***	***13.2***	14' D-10-R At Grade Inlet
E4	**LL1**	0.23	0.80									10.4	4.1	6.8	***0.9***	***5.5***	Culvert
E5	**LL2**	0.15	0.51									9.1	4.3	7.2	***0.6***	***3.6***	Culvert
E6	**MM**	0.20	0.61	Tc of (PR) Pipe Run 33			13.0	440	4.3%	1.5	5.1	18.1	3.2	5.4	***13.6***	***54.1***	Culvert
	Flow PR33, PR34, PR35	4.01	9.32														
	Total	4.21	9.93														
E7	**V**	1.28		0.46	100	6	6.4	800	3.5%	3.7	3.6	10.0	4.1	6.9	***5.3***	***12.1***	16' D-10-R At Grade Inlet
	Flowby DPF1, DPE2, DPE3	0.00															Total CA100=3.50 Split Between
	Total	1.28	1.74														DPE7 & DPE8 For Crown Overflow
E8	**X2, X3**	0.66		0.53	60	1	6.7	800	3.5%	3.7	3.6	10.3	4.1	6.9	***2.7***	***11.9***	16' D-10-R At Grade Inlet
	Flowby DPF2	0.00															
	Total	0.66	1.74														
E9	**BB**	1.50	2.20									13.8	3.6	6.1	***5.5***	***13.4***	14' D-10-R At Grade Inlet
E10	**Z, AA**	1.90		0.45	170	4	11.5	800	2.8%	3.3	4.0	15.5	3.5	5.8	***6.6***	***14.1***	16' D-10-R At Grade Inlet
	Flowby DPE9	0.00															Total CA100=4.84 Split Between
	Total	1.90	2.42														DPE10 & DPE11 For Crown Overflow
E11	**CC**	1.50	2.42									11.8	3.9	6.5	***5.8***	***15.8***	16' D-10-R At Grade Inlet
E12	**Y, Y1**	2.49	3.25	0.49	180	6	9.9	1010	1.7%	2.6	6.5	16.4	3.4	5.7	***8.4***	***22.5***	16' D-10-R Sump Inlet
	Flowby DPE10, DPE11	0.00	0.71														
		2.49	3.96														

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT *(DP)*	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
Storm Sewer System F																	
F1	**W1, W2**	1.51	1.51	0.38	130	6	8.9	500	4.2%	4.1	2.0	11.0	4.0	6.7	***6.0***	***10.1***	14' D-10-R At Grade Inlet Total CA100=3.02 Split Between DPF1 & DPF2 For Crown Overflow
F2	**W**	0.63	1.51									6.0	4.9	8.2	***3.1***	***12.4***	14' D-10-R At Grade Inlet
F3	**DD**	1.10	1.45									9.7	4.2	7.0	***4.6***	***10.2***	8' D-10-R Sump Inlet Total CA100=2.90 Split Between DPF3 & DPF4 For Crown Overflow
F4	**DD1, EE, OS10**	0.85	1.45	0.30	100	8	7.3	500	1.9%	2.8	3.0	10.3	4.1	6.9	***3.5***	***9.9***	8' D-10-R Sump Inlet
Storm Sewer System G																	
G1	**MM1, MM2, OS8**	1.34	4.44	0.11	120	20	7.7	1200	7.2%	1.9	10.6	18.4	3.2	5.4	***4.3***	***23.9***	Culvert
G2	**NN, OS9**	0.38	1.32	0.11	145	16	9.7	500	1.9%	1.0	8.6	18.4	3.2	5.4	***1.2***	***7.1***	Culvert
Storm Sewer System X																	
X1	**L1, U, U1, M, OS4** **Flowby DPD4 To DPD8**	3.00 0.10 3.10	3.54	0.37	160	8	9.8	1900	4.0%	4.0	7.9	17.7	3.3	5.5	***10.1***	***19.4***	14' D-10-R At Grade Inlet Total CA100=7.08 Split Between DPX1 & DPX2 For Crown Overflow
X2	**L3** **Flowby DPD9**	0.75 0.00 0.75	3.54					Tc from Basin L3				8.0	4.5	7.5	***3.4***	***26.5***	14' D-10-R At Grade Inlet
Pond Design Points																	
P1	**HH** **PR2, PR6, PR12, PR29, PR47** **FSD Pond 1 Total**	0.82 47.58 48.40	2.82 88.37 91.19									26.0	2.7	4.5	***130.5***	***412.6***	Outlet Structure
P2	**FF, OS11** **PR51, PR52, PR53** **FSD Pond 2 Total**	0.70 5.81 6.51	2.12 11.33 13.45									15.0	3.5	5.9	***22.9***	***79.5*** `	Outlet Structure

DP - Design Point
PR - Pipe Run

FB- Flow By from Design Point

Calculated by: CMN
Date: 6/15/2017
Checked by: VAS

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow	
					I_5	I_{100}	Q_5	Q_{100}
1	**DPA1**	1.37	1.47	9.7	4.2	7.0	***5.7***	***10.3***
2	**DPA2, PR1**	4.64	6.43	20.0	3.1	5.2	***14.3***	***33.3***
3	**DPB1**	7.90	26.08	42.1	2.0	3.3	***15.6***	***86.4***
4	**DPB2**	0.92	1.57	12.5	3.8	6.4	***3.5***	***10.0***
5	**DPB3, PR4**	1.25	2.91	19.0	3.2	5.3	***3.9***	***15.5***
6	**PR3, PR5**	9.14	28.99	42.0	2.0	3.3	***18.1***	***96.1***
7	**DPC1**	1.11	1.07	10.5	4.1	6.8	***4.5***	***7.3***
8.1	**DPC2**	1.53	1.33	10.9	4.0	6.7	***6.1***	***8.9***
8.2	**DPC3, PR8.1**	2.36	2.65	11.0	4.0	6.7	***9.4***	***17.7***
8.3	**DPC4, PR8.2**	3.33	3.75	11.1	4.0	6.7	***13.2***	***25.0***
9	**PR7, PR8.3**	4.44	4.82	12.0	3.9	6.5	***17.1***	***31.2***
10	**DPC5**	1.45	1.93	8.4	4.4	7.4	***6.4***	***14.3***
11	**PR9, PR10**	5.89	6.75	12.5	3.8	6.4	***22.3***	***43.0***
12	**DPC6, PR11**	7.07	8.69	12.8	3.8	6.3	***26.6***	***54.8***
13	**DPD1**	1.07	3.71	14.1	3.6	6.1	***3.9***	***22.5***
14	**DPD3**	1.06	1.36	13.6	3.7	6.2	***3.9***	***8.4***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
(Storm Sewer Routing Summary)

PIPE RUN	***Contributing Pipes/Design Points***	***Equivalent CA_5***	***Equivalent CA_{100}***	***Maximum T_C***	***Intensity****		***Flow***	
					I_5	***I_{100}***	***Q_5***	***Q_{100}***
15	**DPD2**	0.82	2.83	9.1	4.3	7.2	***3.5***	***20.3***
16	**PR14, PR15**	1.88	4.19	11.5	3.9	6.6	***7.4***	***27.6***
17	**PR13, PR16**	2.96	7.90	13.5	3.7	6.2	***10.9***	***48.8***
18	**DPD4**	0.61	1.29	12.5	3.8	6.4	***2.3***	***8.2***
19	**DPD5**	0.86	1.22	8.9	4.3	7.2	***3.7***	***8.8***
20	**PR17, PR18, PR19**	4.42	10.41	14.0	3.6	6.1	***16.0***	***63.3***
21	**DPD6**	2.07	1.60	11.2	4.0	6.6	***8.2***	***10.6***
22	**DPD7, PR21**	2.75	3.13	11.2	4.0	6.6	***10.9***	***20.8***
23	**PR20, PR22**	7.17	13.54	14.5	3.6	6.0	***25.6***	***81.2***
24	**DPD8**	1.00	1.05	8.2	4.4	7.4	***4.4***	***7.8***
25	**DPD9**	0.35	0.32	6.3	4.8	8.1	***1.7***	***2.6***
26	**PR24, PR25**	1.35	1.37	8.0	4.5	7.5	***6.0***	***10.3***
27.1	**PR23, PR26**	8.52	14.91	14.5	3.6	6.0	***30.4***	***89.4***
27.2	**DPD10**	2.52	2.45	10.0	4.1	6.9	***10.4***	***17.0***
27.3	**PR27.1, PR27.2**	11.04	17.36	14.8	3.5	5.9	***39.1***	***103.2***
28	**DPD11**	2.15	3.85	20.0	3.1	5.2	***6.7***	***20.0***
29	**PR27.3, PR28**	13.19	21.22	17.5	3.3	5.5	***43.4***	***117.2***
30	**DPE1**	1.34	4.63	13.7	3.7	6.1	***4.9***	***28.4***

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN
(Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow	
					I_5	I_{100}	Q_5	Q_{100}
31	DPE2	0.74	1.68	10.3	4.1	6.9	3.0	11.5
32	DPE3, PR31	2.29	3.38	11.3	3.9	6.6	9.0	22.4
33	PR30, PR32	3.63	8.01	13.2	3.7	6.2	13.5	49.9
34	DPE4	0.23	0.80	10.4	4.1	6.8	0.9	5.5
35	DPE5	0.15	0.51	9.1	4.3	7.2	0.6	3.6
36	DPE6, PR33, PR34, PR35	4.21	9.93	18.1	3.2	5.4	13.6	54.1
37	DPE7	1.28	1.61	10.0	4.1	6.9	5.3	11.2
38	DPE8	0.66	1.62	10.3	4.1	6.9	2.7	11.1
39	PR37, PR38	1.94	3.23	10.3	4.1	6.9	7.9	22.2
40	PR36, PR39	6.15	13.16	18.5	3.2	5.4	19.7	70.8
41	DPE9	1.51	1.80	13.8	3.6	6.1	5.5	11.0
42	DPE10	1.90	2.11	15.5	3.5	5.8	6.6	12.3
43	DPE11	1.49	2.03	11.8	3.9	6.5	5.8	13.2
44	PR41, PR42, PR43	4.90	5.93	15.5	3.5	5.8	17.0	34.6
45	PR40, PR44	11.05	19.10	19.5	3.1	5.2	34.6	100.2
46	DPE12	2.49	3.96	16.4	3.4	5.7	8.4	22.5
47	PR45, PR46	13.54	23.05	20.5	3.1	5.1	41.3	118.1
48	DPF1	1.50	1.39	11.0	4.0	6.7	6.0	9.3

BRADLEY RANCH MASTER DEVELOPMENT DRAINAGE PLAN

(Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow	
					I_5	I_{100}	Q_5	Q_{100}
49	DPF2, PR48	2.14	2.68	9.5	4.2	7.1	9.0	18.9
50	DPF3, PR49	3.23	4.13	11.0	4.0	6.7	12.9	27.6
51	DPF4, PR50	4.09	5.58	11.0	4.0	6.7	16.3	37.3
52	DPG1	1.34	4.44	18.4	3.2	5.4	4.3	23.9
53	DPG2	0.38	1.32	18.4	3.2	5.4	1.2	7.1
54	DPX1	2.93	2.62	17.7	3.3	5.5	9.6	14.4
55	DPX2, PR54	3.70	4.88	17.0	3.3	5.6	12.3	27.3
56	FSD POND 1 OUTLET PIPE	From UDFCD Pond Workbook					28.4	148.9
57	SOUTH BASIN DISCHARGE	Portion of flow from Pipe 56					7.2	41.5
58	NORTH BASIN DISCHARGE	Portion of flow from Pipe 56					21.2	107.4
59	FSD POND 2 OUTLET PIPE	From UDFCD Pond Workbook					3.4	31.9

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: CMN
Date: 6/15/2017
Checked by: VAS

Weighted Percent Imperviousness of WQ Pond 1

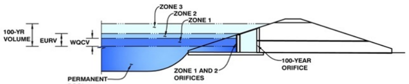
Contributing Basins	*Area (Acres)*	*C_5*	*Impervious % (I)*	*(Acres)*(I)*
A	1.53	0.90	100	152.73
B	4.32	0.59	80	345.39
C	2.32	0.30	40	92.69
D	2.26	0.50	70	158.27
D1	0.57	0.50	70	39.63
E	1.72	0.51	72	123.82
F	3.01	0.48	69	207.44
G	1.72	0.49	70	120.35
H	3.56	0.44	64	227.68
I	1.87	0.52	73	136.57
J	3.06	0.25	30	91.77
K	1.64	0.11	6	9.83
L1	1.15	0.51	72	82.54
L2	1.61	0.48	69	111.34
L3	1.50	0.50	71	106.20
L4	0.51	0.66	85	42.98
M	3.01	0.27	34	102.20
N	2.22	0.28	35	77.68
N1	4.01	0.25	30	120.26
O	1.76	0.11	6	10.57
O1	0.39	0.11	6	2.31
O2	0.63	0.11	6	3.80
P	1.69	0.52	73	123.24
Q	4.96	0.44	61	302.67
R	1.31	0.52	73	95.60
S	2.01	0.49	70	140.37
T	2.84	0.47	68	193.37
T1	1.42	0.50	70	99.29
S1	0.50	0.70	88	43.86
U	2.80	0.36	50	139.96
U1	1.16	0.45	65	75.60
V	2.75	0.46	66	181.59
V1	0.53	0.56	76	40.23
X	1.71	0.52	73	125.08
X1	0.88	0.52	73	64.52
X2	0.74	0.51	72	53.42
X3	0.51	0.55	76	38.87
Y	3.99	0.46	66	263.45
Y1	1.26	0.52	73	92.12
Z	2.13	0.45	65	138.65
AA	2.16	0.44	64	137.99

BB	3.88	0.39	55	213.15
CC	2.91	0.51	72	209.86
JJ	1.83	0.25	30	54.90
JJ1	2.23	0.23	26	58.02
JJ2	2.23	0.25	30	66.79
JJ3	1.57	0.47	68	106.63
KK	0.35	0.11	6	2.12
LL1	2.11	0.11	6	12.64
LL2	1.33	0.11	6	7.97
MM	1.54	0.13	8	12.29
OS2	47.03	0.11	6	282.21
OS3	16.17	0.11	6	97.03
OS4	0.63	0.11	6	3.76
OS5	6.81	0.11	6	40.87
OS6	7.99	0.11	6	47.95
OS7	11.84	0.11	6	71.05
Totals	***197.56***			***6003.17***
Imperviousness of WQ Pond 1	***30.4***	**%**		

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: **Bradley Ranch**

Basin ID: **Pond 1**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Top of Micro=7127.00

Selected BMP Type =	**EDB**	
Watershed Area =	197.56	acres
Watershed Length =	11,550	ft
Watershed Slope =	0.052	ft/ft
Watershed Imperviousness =	30.40%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	UDFCD Default	
Water Quality Capture Volume (WQCV) =	2.514	acre-feet
Excess Urban Runoff Volume (EURV) =	6.170	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.886	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	9.011	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	12.784	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	18.855	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	23.513	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	28.911	acre-feet
500-yr Runoff Volume (P1 = 3.29 in.) =	41.562	acre-feet
Approximate 2-yr Detention Volume =	4.598	acre-feet
Approximate 5-yr Detention Volume =	7.858	acre-feet
Approximate 10-yr Detention Volume =	8.726	acre-feet
Approximate 25-yr Detention Volume =	9.391	acre-feet
Approximate 50-yr Detention Volume =	11.169	acre-feet
Approximate 100-yr Detention Volume =	14.563	acre-feet

Note: L / W Ratio > 8

L / W Ratio = 15.5

Optional User Override
1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	2.514	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.656	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	8.393	acre-feet
Total Detention Basin Volume =	14.563	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

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

Depth Increment = 0.1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	10	0.000		
7128.00	--	1.00	--	--	--	1,036	0.024	513	0.012
	--	3.00	--	--	--	29,129	0.669	30,688	0.705
	--	5.00	--	--	--	105,861	2.430	165,679	3.803
	--	7.00	--	--	--	118,743	2.726	390,283	8.960
	--	9.00	--	--	--	129,298	2.968	638,324	14.654
	--	11.00	--	--	--	139,984	3.214	907,605	20.836
	--	13.00	--	--	--	150,901	3.464	1,198,490	27.514
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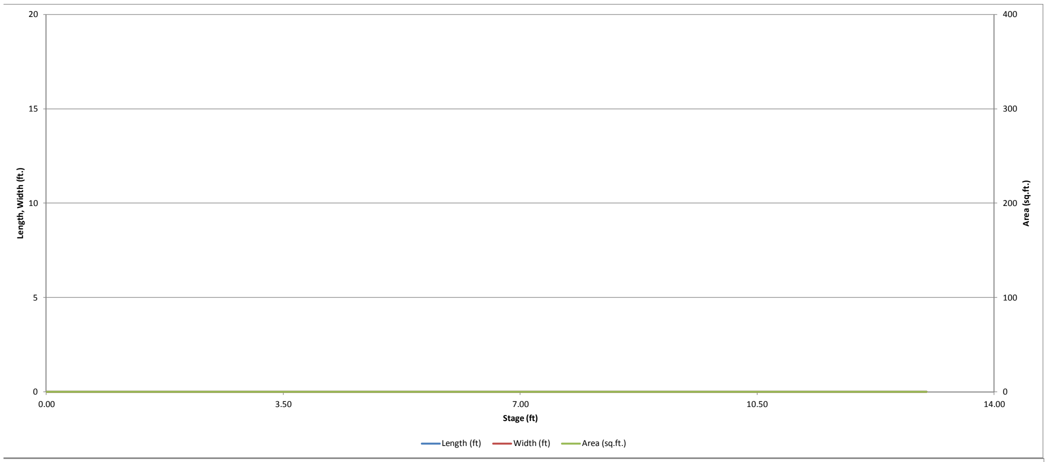
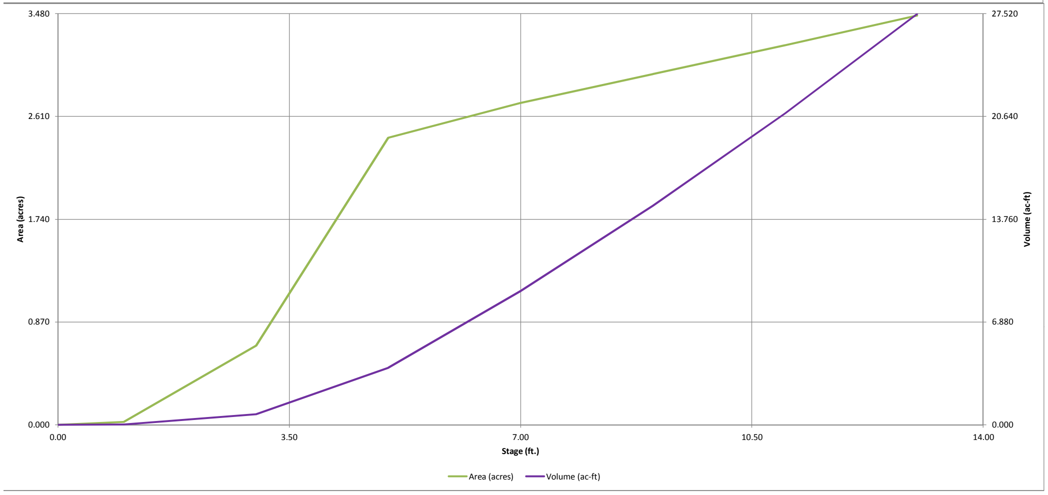
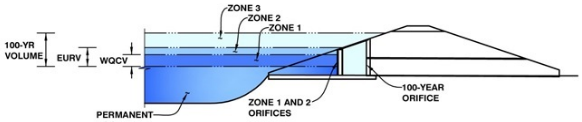
DETENTION BASIN STAGE-STORAGE TABLE BUILDER





Detention Basin Outlet Structure Design

Project: Bradley Ranch
Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.41	2.514	Orifice Plate
Zone 2 (EURV)	5.95	3.656	Orifice Plate
Zone 3 (100-year)	8.97	8.393	Weir&Pipe (Restrict)
		14.563	**Total**

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.95	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	27.20	inches
Orifice Plate: Orifice Area per Row =	8.08	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.611E-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	1.98	3.97					
Orifice Area (sq. inches)	8.08	8.08	8.08					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.95	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	19.50	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	10.00	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

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.95	N/A	feet
Over Flow Weir Slope Length =	10.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.34	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	136.50	N/A	ft^2
Overflow Grate Open Area w/ Debris =	68.25	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	39.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	11.06	N/A	ft^2
Outlet Orifice Centroid =	1.79	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.27	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.15	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	68.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.70	feet

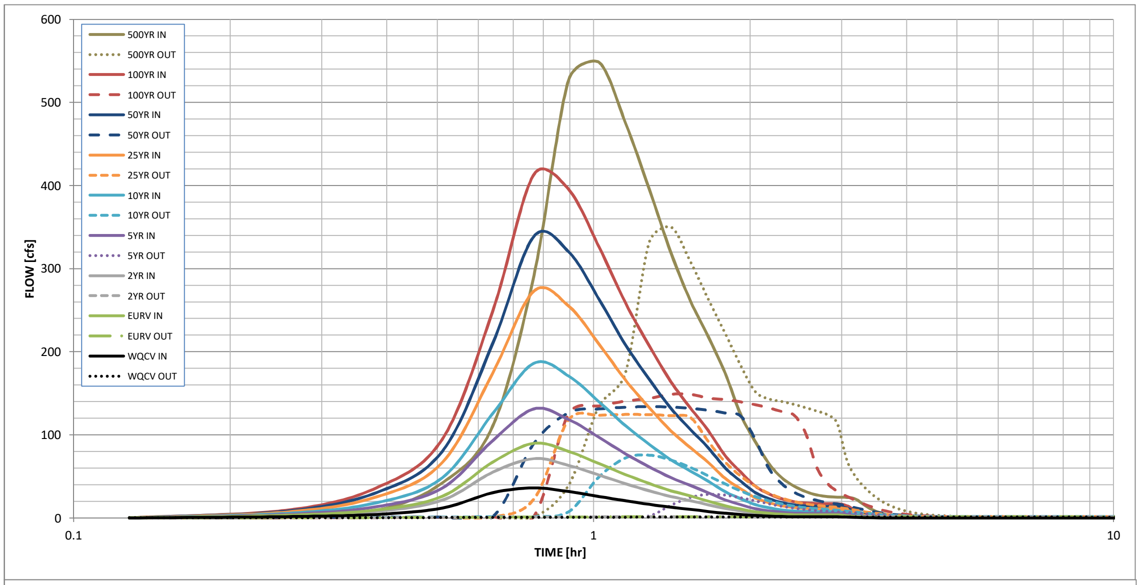
Calculated Parameters for Spillway

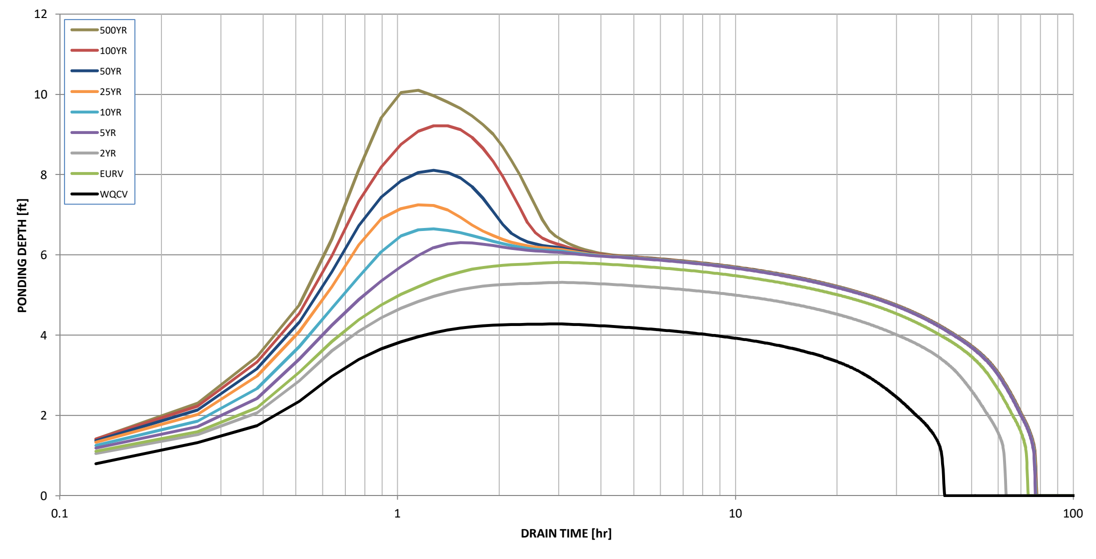
Spillway Design Flow Depth=	1.65	feet
Stage at Top of Freeboard =	12.50	feet
Basin Area at Top of Freeboard =	3.40	acres

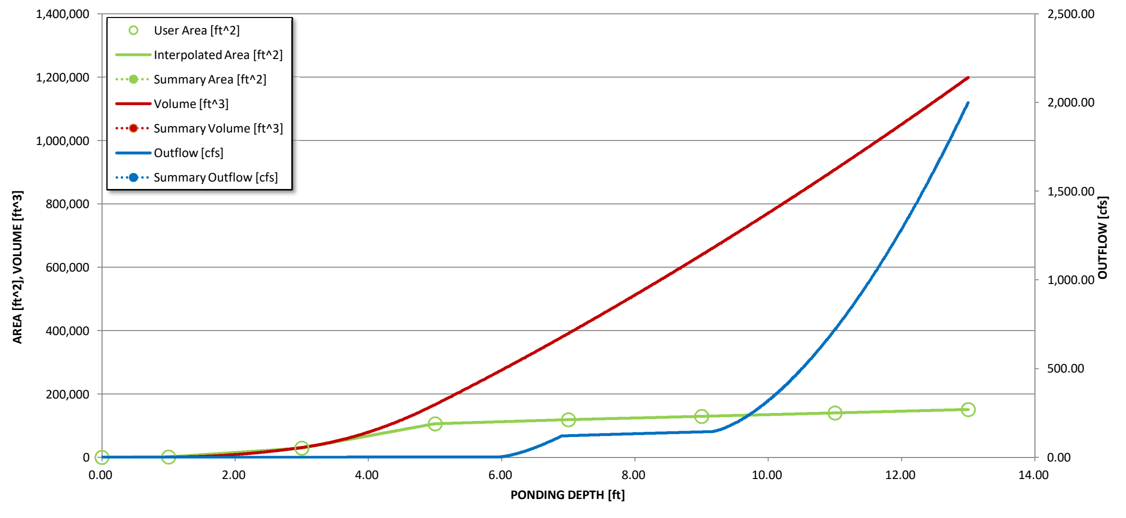
Routed Hydrograph Results

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	2.52	3.29
Calculated Runoff Volume (acre-ft) =	2.514	6.170	4.886	9.011	12.784	18.855	23.513	28.911	41.562
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.515	6.169	4.887	9.003	12.786	18.855	23.513	28.913	41.564
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.34	0.79	1.02	1.31	1.85
Predevelopment Peak Q (cfs) =	0.0	0.0	2.2	33.9	67.9	156.0	201.6	258.0	365.2
Peak Inflow Q (cfs) =	36.4	89.9	71.2	131.3	186.0	272.8	338.7	412.9	548.5
Peak Outflow Q (cfs) =	1.1	1.5	1.4	28.4	75.5	124.5	134.0	148.9	350.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	0.8	0.7	0.6	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.5	0.9	1.0	1.0	1.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	58	68	66	63	61	58	53
Time to Drain 99% of Inflow Volume (hours) =	**40**	71	61	74	73	71	69	68	66
Maximum Ponding Depth (ft) =	4.28	5.81	5.31	6.30	6.65	7.25	8.11	9.22	10.10
Area at Maximum Ponding Depth (acres) =	1.79	2.55	2.48	2.62	2.67	2.76	2.86	2.99	3.10
Maximum Volume Stored (acre-ft) =	2.264	5.820	4.564	7.088	7.988	9.617	12.032	15.280	17.962

Detention Basin Outlet Structure Design







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
7.67 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:07:40	0.05	0.11	0.09	0.14	0.17	0.22	0.25	0.28	0.28
Hydrograph Constant	0:15:20	1.67	3.32	2.80	4.34	5.51	7.10	8.16	9.22	9.27
	0:23:01	4.40	9.85	8.01	13.68	18.49	25.74	31.02	36.72	42.21
0.652	0:30:41	11.98	26.21	21.46	36.09	48.41	66.87	80.29	94.81	110.58
	0:38:21	30.42	67.30	54.93	93.15	125.52	174.32	209.92	248.56	291.68
	0:46:01	36.37	89.94	71.17	131.25	185.96	272.81	338.69	412.90	527.55
	0:53:41	31.83	80.09	63.03	118.46	170.46	254.82	320.05	395.31	548.53
	1:01:22	25.97	65.59	51.55	97.09	139.81	209.37	263.39	326.60	475.52
	1:09:02	20.76	52.31	41.14	77.28	111.01	165.84	208.35	258.99	395.70
	1:16:42	16.42	41.57	32.65	61.55	88.58	132.61	166.81	207.44	319.91
	1:24:22	12.99	32.84	25.79	48.63	70.03	104.93	132.09	164.43	261.24
	1:32:02	10.53	26.50	20.81	39.24	56.48	84.59	106.45	132.56	217.51
	1:39:43	7.79	20.20	15.75	30.26	44.00	66.53	84.10	105.00	174.00
	1:47:23	5.78	14.67	11.50	21.83	31.59	47.61	60.13	75.07	124.08
	1:55:03	4.09	10.61	8.27	15.90	23.11	34.97	44.24	55.36	91.55
	2:02:43	2.92	7.45	5.83	11.09	16.06	24.21	30.58	38.29	65.26
	2:10:23	2.26	5.74	4.50	8.52	12.28	18.44	23.25	28.98	48.21
	2:18:04	1.83	4.61	3.63	6.83	9.81	14.68	18.47	22.99	38.26
	2:25:44	1.61	4.00	3.15	5.90	8.46	12.60	15.81	19.60	31.64
	2:33:24	1.53	3.78	2.99	5.54	7.89	11.67	14.59	17.99	27.68
	2:41:04	1.50	3.68	2.91	5.38	7.65	11.30	14.11	17.38	25.70
	2:48:44	1.50	3.67	2.91	5.36	7.61	11.22	13.99	17.20	24.97
	2:56:25	1.50	3.67	2.91	5.36	7.61	11.22	13.99	17.20	24.72
	3:04:05	1.04	2.77	2.15	4.19	6.14	9.35	11.85	14.80	22.36
	3:11:45	0.61	1.60	1.24	2.42	3.56	5.46	6.96	8.79	14.80
	3:19:25	0.35	0.93	0.72	1.41	2.07	3.17	4.04	5.12	9.26
	3:27:05	0.19	0.50	0.39	0.76	1.12	1.71	2.19	2.79	5.65
	3:34:46	0.09	0.26	0.20	0.40	0.60	0.93	1.20	1.54	3.26
	3:42:26	0.03	0.09	0.07	0.15	0.24	0.38	0.51	0.67	1.84
	3:50:06	0.00	0.01	0.00	0.02	0.04	0.07	0.11	0.15	0.82
	3:57:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
	4:05:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:13:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:28:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:36:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:43:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:51:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:06:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:14:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:22:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:29:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:37:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:08:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:15:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:23:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:31:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:38:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:46:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:54:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:01:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:09:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:17:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:24:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:32:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:40:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:47:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:55:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:03:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:10:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:18:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:26:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:33:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:41:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:49:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:56:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9:04:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9:12:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BRADLEY RANCH

EMERGENCY SPILLWAY CALCULATIONS FSD POND 1

Horizontal Broad-Crested Weir (Eqn 12-20 UDFCD)

Variable				*Solve For*		
C	**3.00**			L (ft)	H (ft)	Q (cfs)
L	**68.00**	ft		**0.0**	**0.0**	**393.7**
H	**1.55**	ft				
Q		cfs				

Sloping Broad-Crested Weir (Eqn 12-21 UDFCD)

Variable				*Solve For*		
C	**3.00**			Z (ft)	H (ft)	Q (cfs)
Z	**4.00**	ft		**0.0**	**0.0**	**14.4**
H	**1.55**	ft				
Q		cfs				

Total Q	**422.38**

Equation 12-20

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

Equation 12-21

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

Where:

Q = discharge (cfs)

C_{BCW} = broad-crested weir coefficient (This ranges from 2.6 to 3.0. A value of 3.0 is often used in practice.) See Hydraulic Engineering Circular No. 22 for additional information.

L = broad-crested weir length (ft)

H = head above weir crest (ft)

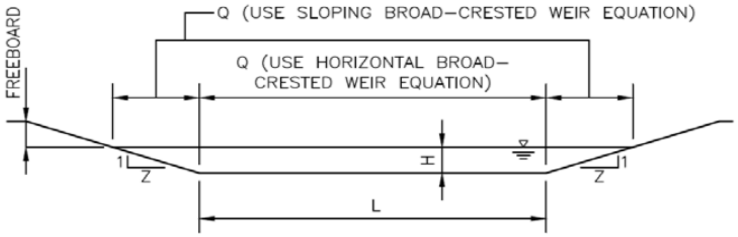


Figure 12-20. Sloping broad-crest weir

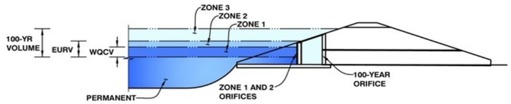
Weighted Percent Imperviousness of WQ Pond 2

Contributing Basins	***Area (Acres)***	***C_5***	***Impervious % (I)***	***(Acres)*(I)***
W	1.18	0.54	75	88.36
W1	0.47	0.36	50	23.28
W2	3.42	0.39	55	188.10
DD	2.73	0.40	56	152.88
DD1	0.86	0.40	56	48.15
EE	1.28	0.37	52	66.46
FF	3.17	0.15	12	38.08
MM1	0.72	0.21	22	15.92
MM2	0.13	0.11	6	0.75
NN	0.15	0.11	6	0.90
OS8	10.69	0.11	6	64.14
OS9	3.32	0.11	6	19.91
OS10	0.22	0.11	6	1.35
OS11	2.07	0.11	6	12.40
Totals	***30.40***			***720.68***
Imperviousness of WQ Pond 2	***23.7***	**%**		

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: **Bradlely Ranch**

Basin ID: **Pond 2**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type = **EDB**
Watershed Area = 30.40 acres
Watershed Length = 2,600 ft
Watershed Slope = 0.040 ft/ft
Watershed Imperviousness = 23.70% percent
Percentage Hydrologic Soil Group A = 0.0% percent
Percentage Hydrologic Soil Group B = 100.0% percent
Percentage Hydrologic Soil Groups C/D = 0.0% percent
Desired WQCV Drain Time = 40.0 hours
Location for 1-hr Rainfall Depths = UDFCD Default
Water Quality Capture Volume (WQCV) = 0.330 acre-feet
Excess Urban Runoff Volume (EURV) = 0.726 acre-feet

		Optional User Override 1-hr Precipitation	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.561 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.151 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.721 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.677 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.394 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.228 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.29 in.) =	6.154 acre-feet		inches

Approximate 2-yr Detention Volume = 0.527 acre-feet
Approximate 5-yr Detention Volume = 0.981 acre-feet
Approximate 10-yr Detention Volume = 1.105 acre-feet
Approximate 25-yr Detention Volume = 1.203 acre-feet
Approximate 50-yr Detention Volume = 1.471 acre-feet
Approximate 100-yr Detention Volume = 1.985 acre-feet

Stage-Storage Calculation

Zone 1 Volume (WQCV) = 0.330 acre-feet
Zone 2 Volume (EURV - Zone 1) = 0.396 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) = 1.259 acre-feet
Total Detention Basin Volume = 1.985 acre-feet
Initial Surcharge Volume (ISV) = user ft^3
Initial Surcharge Depth (ISD) = user ft
Total Available Detention Depth (H_{total}) = user ft
Depth of Trickle Channel (H_{TC}) = user ft
Slope of Trickle Channel (S_{TC}) = user ft/ft
Slopes of Main Basin Sides (S_{main}) = user H:V
Basin Length-to-Width Ratio ($R_{L/W}$) = user

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

Depth Increment = 0.1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	10	0.000		
	--	1.00	--	--	--	2,572	0.059	1,265	0.029
	--	2.00	--	--	--	18,245	0.419	11,518	0.264
	--	3.00	--	--	--	32,545	0.747	37,094	0.852
	--	4.00	--	--	--	40,673	0.934	73,703	1.692
	--	5.00	--	--	--	44,343	1.018	116,211	2.668
	--	6.00	--	--	--	48,354	1.110	162,560	3.732
	--	7.00	--	--	--	52,367	1.202	212,920	4.888
	--	8.00	--	--	--	56,516	1.297	267,362	6.138
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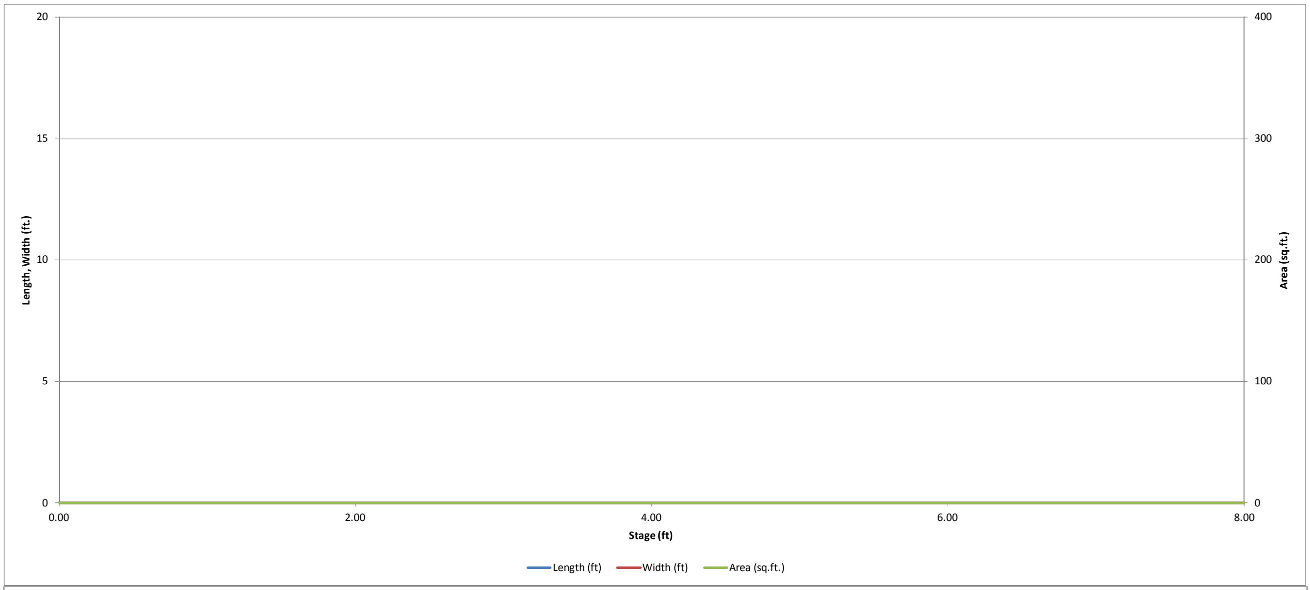
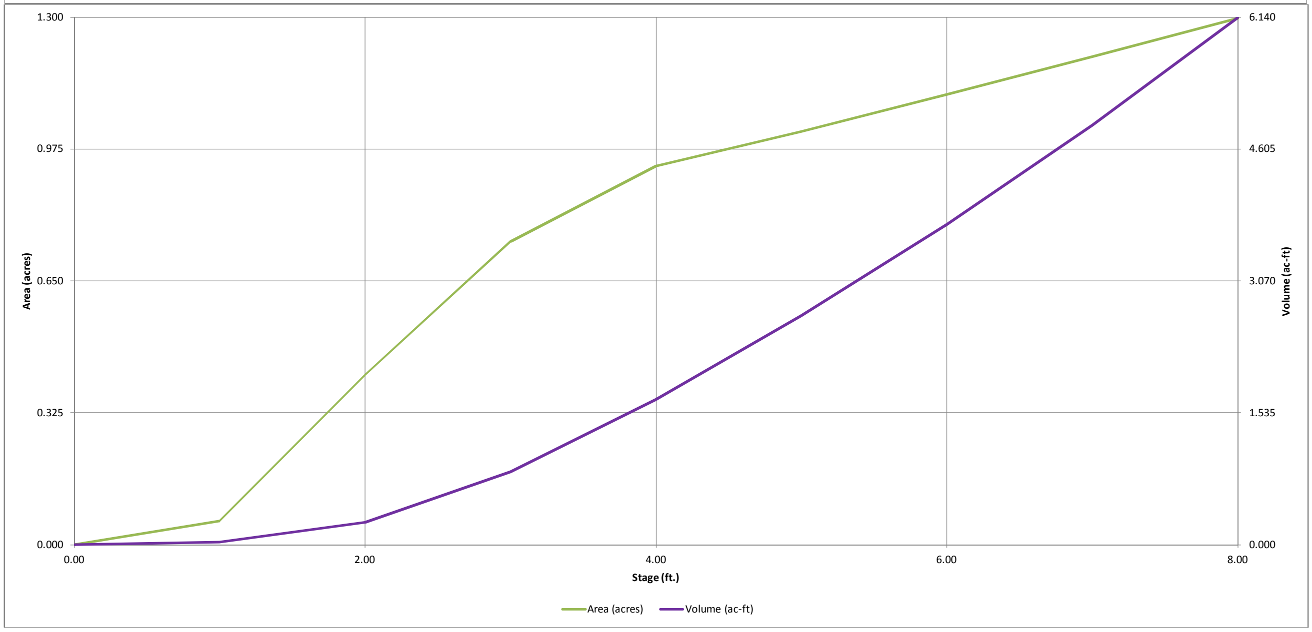
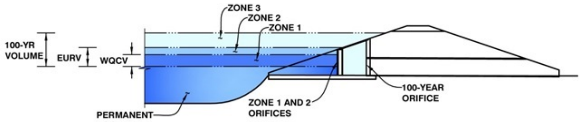
DETENTION BASIN STAGE-STORAGE TABLE BUILDER





Detention Basin Outlet Structure Design

Project: Bradley Ranch
Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.14	0.330	Orifice Plate
Zone 2 (EURV)	2.83	0.396	Orifice Plate
Zone 3 (100-year)	4.31	1.259	Weir&Pipe (Restrict)
		1.985	**Total**

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.83	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	5.60	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.94	1.89					
Orifice Area (sq. inches)	1.55	1.25	1.25					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.83	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	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

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.56	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.73	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	25.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.60	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.90		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.26	N/A	ft^2
Outlet Orifice Centroid =	0.81	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.51	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	24.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

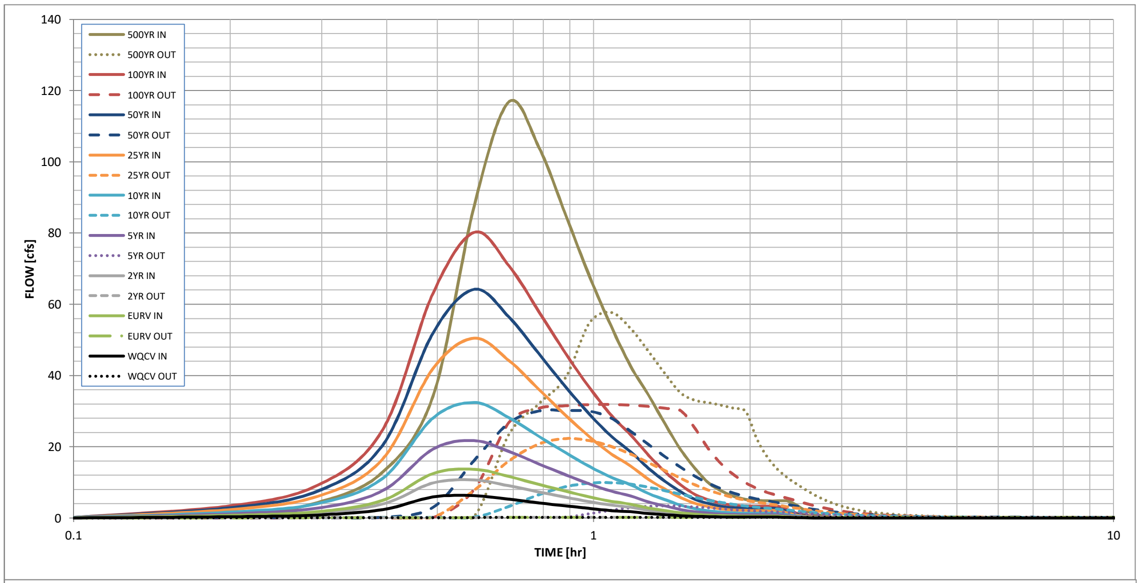
Calculated Parameters for Spillway

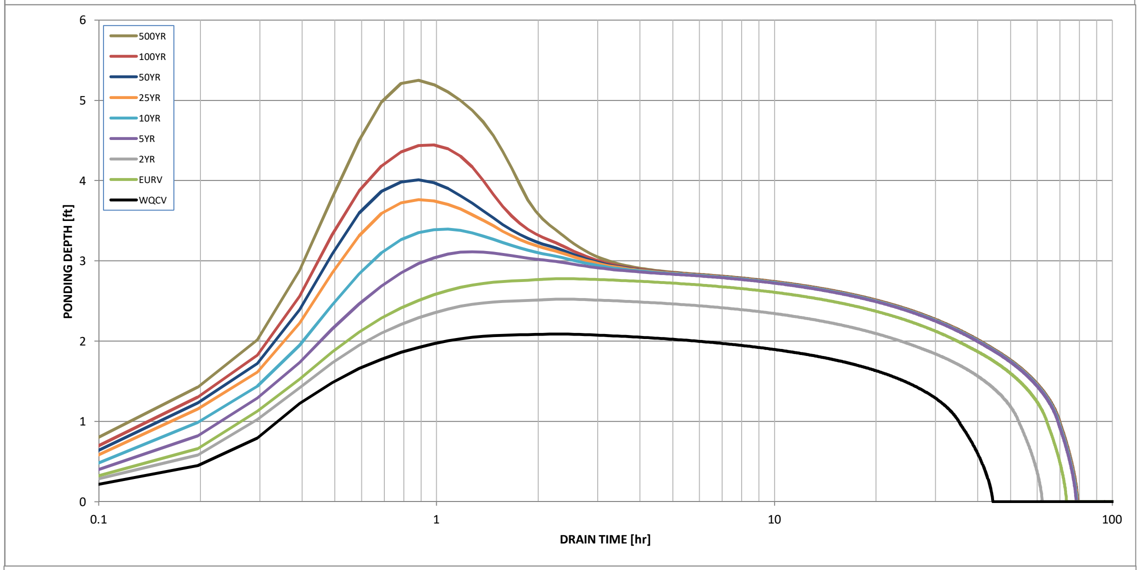
Spillway Design Flow Depth=	1.07	feet
Stage at Top of Freeboard =	6.87	feet
Basin Area at Top of Freeboard =	1.19	acres

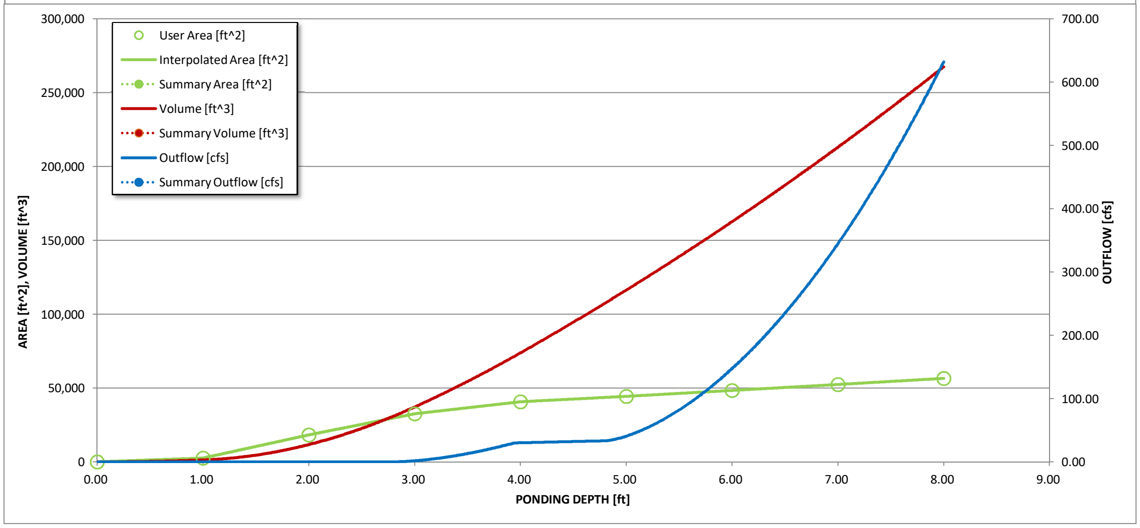
Routed Hydrograph Results

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	2.52	3.29
Calculated Runoff Volume (acre-ft) =	0.330	0.726	0.561	1.151	1.721	2.677	3.394	4.228	6.154
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.330	0.725	0.561	1.151	1.721	2.679	3.395	4.229	6.151
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.34	0.79	1.02	1.31	1.85
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	5.2	10.4	24.0	31.0	39.7	56.2
Peak Inflow Q (cfs) =	6.2	13.7	10.6	21.7	32.4	50.5	64.2	80.1	116.8
Peak Outflow Q (cfs) =	0.1	0.2	0.2	3.4	9.9	22.3	30.2	31.9	57.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.9	0.9	1.0	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	0.9	1.2	1.3	1.4
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	66	56	68	66	62	59	56	50
Time to Drain 99% of Inflow Volume (hours) =	**43**	70	59	74	72	70	69	68	65
Maximum Ponding Depth (ft) =	2.09	2.78	2.52	3.11	3.39	3.76	4.01	4.44	5.25
Area at Maximum Ponding Depth (acres) =	0.45	0.67	0.59	0.77	0.82	0.89	0.93	0.97	1.04
Maximum Volume Stored (acre-ft) =	0.303	0.688	0.531	0.935	1.157	1.473	1.692	2.111	2.915

Detention Basin Outlet Structure Design







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.89 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:53	0.01	0.02	0.02	0.04	0.05	0.07	0.09	0.11	0.14
Hydrograph Constant	0:11:47	0.35	0.73	0.58	1.11	1.58	2.29	2.76	3.27	4.32
	0:17:40	0.85	1.80	1.41	2.78	4.04	6.07	7.53	9.17	12.79
0.849	0:23:34	2.34	4.96	3.89	7.64	11.07	16.51	20.36	24.67	34.05
	0:29:27	5.89	12.49	9.79	19.28	28.01	41.94	51.88	63.01	87.42
	0:35:20	6.24	13.70	10.62	21.69	32.37	50.49	64.20	80.14	116.79
	0:41:14	5.26	11.68	9.00	18.66	28.11	44.22	56.44	70.75	103.98
	0:47:07	4.22	9.42	7.25	15.12	22.88	36.09	46.09	57.83	85.15
	0:53:01	3.39	7.56	5.82	12.12	18.32	28.85	36.82	46.16	67.91
	0:58:54	2.65	5.94	4.57	9.55	14.46	22.82	29.16	36.60	53.97
	1:04:47	2.10	4.71	3.62	7.57	11.45	18.05	23.04	28.91	42.64
	1:10:41	1.75	3.88	2.99	6.20	9.33	14.62	18.60	23.33	34.41
	1:16:34	1.24	2.79	2.14	4.49	6.82	10.84	13.91	17.57	26.22
	1:22:28	0.93	2.09	1.61	3.36	5.09	8.03	10.25	12.88	19.04
	1:28:21	0.64	1.45	1.11	2.35	3.58	5.69	7.31	9.23	13.78
	1:34:14	0.47	1.06	0.81	1.70	2.57	4.06	5.19	6.53	9.67
	1:40:08	0.37	0.82	0.63	1.32	1.99	3.14	4.01	5.04	7.45
	1:46:01	0.30	0.67	0.52	1.08	1.62	2.55	3.24	4.07	5.99
	1:51:55	0.27	0.60	0.46	0.95	1.43	2.23	2.83	3.54	5.20
	1:57:48	0.26	0.57	0.44	0.91	1.36	2.13	2.70	3.36	4.91
	2:03:41	0.26	0.56	0.43	0.89	1.33	2.07	2.63	3.28	4.78
	2:09:35	0.26	0.56	0.43	0.89	1.33	2.07	2.63	3.28	4.76
	2:15:28	0.26	0.56	0.43	0.89	1.33	2.07	2.63	3.28	4.76
	2:21:22	0.16	0.36	0.28	0.59	0.90	1.45	1.88	2.39	3.60
	2:27:15	0.09	0.21	0.16	0.34	0.53	0.85	1.09	1.38	2.07
	2:33:08	0.05	0.12	0.09	0.20	0.30	0.49	0.63	0.80	1.21
	2:39:02	0.03	0.07	0.05	0.11	0.16	0.26	0.34	0.43	0.65
	2:44:55	0.01	0.03	0.02	0.05	0.08	0.13	0.17	0.22	0.34
	2:50:49	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.07	0.12
	2:56:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:02:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:08:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:14:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:26:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:49:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:01:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:07:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:13:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:19:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:36:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:42:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:48:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:54:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:06:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:12:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:23:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:29:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:41:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:47:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:53:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:59:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:05:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:11:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:16:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:22:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:28:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:34:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:40:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:46:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:52:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:58:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:04:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BRADLEY RANCH

EMERGENCY SPILLWAY CALCULATIONS FSD POND 2

Horizontal Broad-Crested Weir (Eqn 12-20 UDFCD)

Variable				*Solve For*		
C	**3.00**			L (ft)	H (ft)	Q (cfs)
L	**30.00**	ft		**0.0**	**0.0**	**76.8**
H	**0.90**	ft				
Q		cfs				

Sloping Broad-Crested Weir (Eqn 12-21 UDFCD)

Variable				*Solve For*		
C	**3.00**			Z (ft)	H (ft)	Q (cfs)
Z	**4.00**	ft		**0.0**	**0.0**	**3.7**
H	**0.90**	ft				
Q		cfs				

Total Q	**84.22**

Equation 12-20

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

Equation 12-21

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

Where:

Q = discharge (cfs)

C_{BCW} = broad-crested weir coefficient (This ranges from 2.6 to 3.0. A value of 3.0 is often used in practice.) See Hydraulic Engineering Circular No. 22 for additional information.

L = broad-crested weir length (ft)

H = head above weir crest (ft)

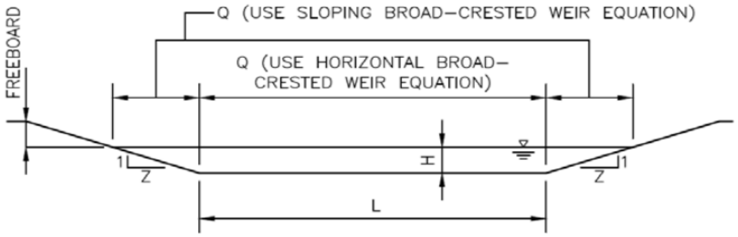


Figure 12-20. Sloping broad-crest weir

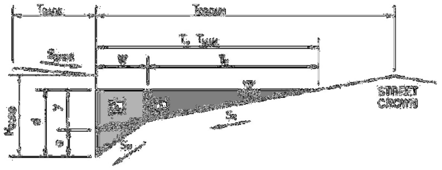
HYDRAULIC CALCULATIONS

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: Bradley Ranch
Inlet ID: Inlet DPA1

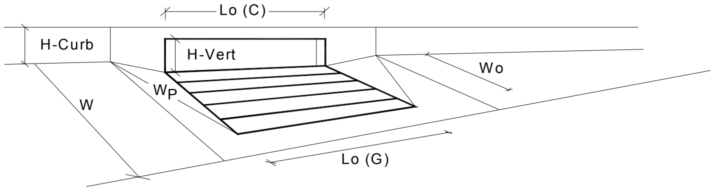


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0		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} =	8.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.5		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063		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} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.8	9.7	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

Version 4.05 Released March 2017



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 =	5.8	9.7	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) =	6.00	6.00	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} =	0.36	0.68	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.68	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
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 =	**6.8**	**16.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.7	10.3	cfs

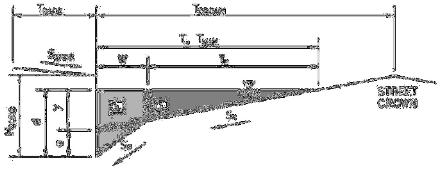
Version 4.05 Released March 2017

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

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

Project: Bradley Ranch

Inlet ID: Inlet DP A2



Gutter Geometry (Enter data in the blue cells)

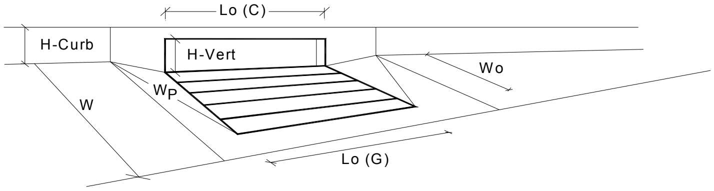
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.5	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.8	9.7	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

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input)	Colorado Springs D-10-R ▾			
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 =	5.8	9.7	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	

		MINOR	MAJOR	
Low Head Performance Reduction (Calculated)				
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.36	0.68	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.92	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.77	0.96	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

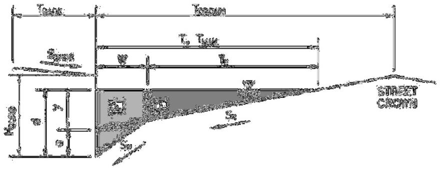
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**11.2**	**36.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	10.1	25.7	cfs

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: **Bradley Ranch**
Inlet ID: **Inlet DP B2**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	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 =	0.063	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.9	10.9	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

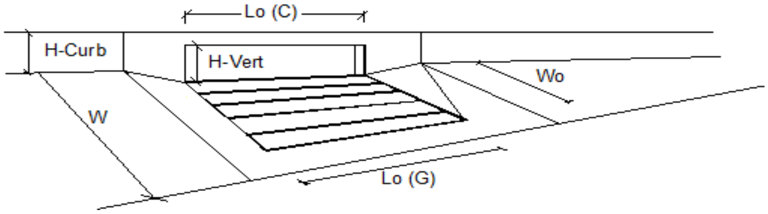
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**16.1**	**91.2**	**cfs**

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 =	14.00	14.00	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 =**	**3.5**	**10.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**82**	**%**

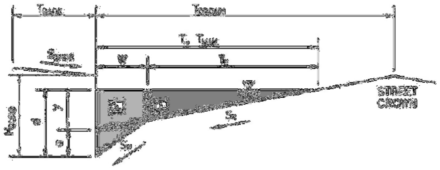
Colorado Springs D-10-R

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: **Bradley Ranch**
Inlet ID: **Inlet DP B3**

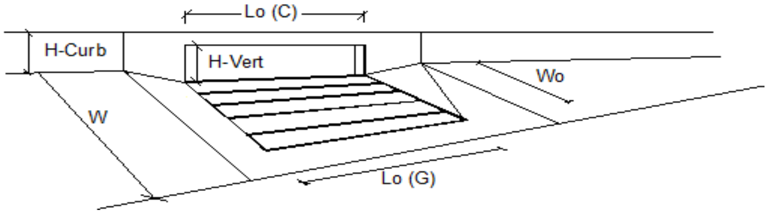


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0		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 =	0.063		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} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.9	10.9	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} =**	**16.1**	**91.2**	**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



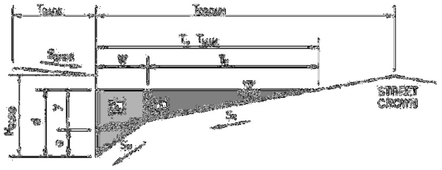
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	14.00	14.00	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 =**	**1.5**	**10.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.5**	**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: **Bradley Ranch**
Inlet ID: **Inlet DP C1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

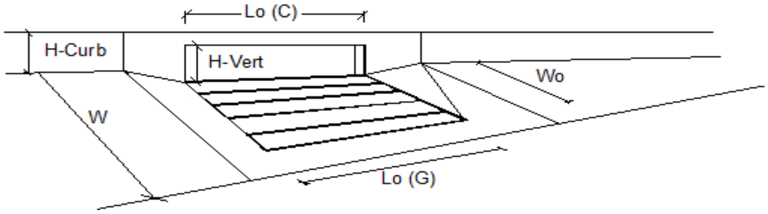
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.9**	**37.6**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



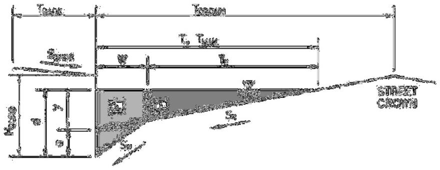
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	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**	**7.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.1**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**98**	**74**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP C2**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.044	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

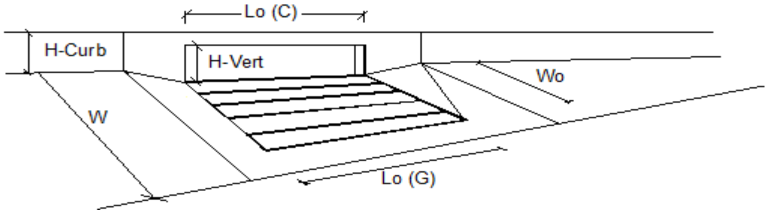
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.3**	**32.0**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		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 =**	**6.1**	**8.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**83**	**%**

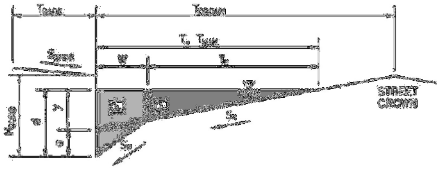
Version 4.05 Released March 2017

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

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

Project: Bradley Ranch

Inlet ID: Inlet DP C3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.044	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

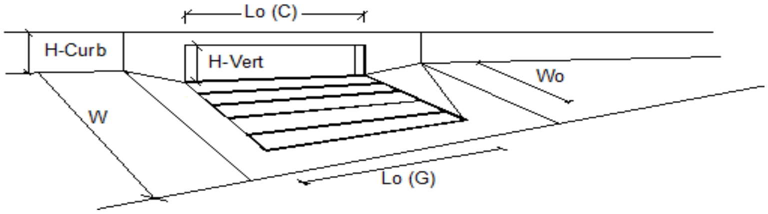
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.3**	**32.0**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		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 =**	**3.3**	**8.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**83**	**%**

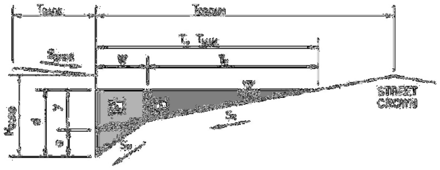
Version 4.05 Released March 2017

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

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

Project: **Bradley Ranch**

Inlet ID: **Inlet DP C4**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

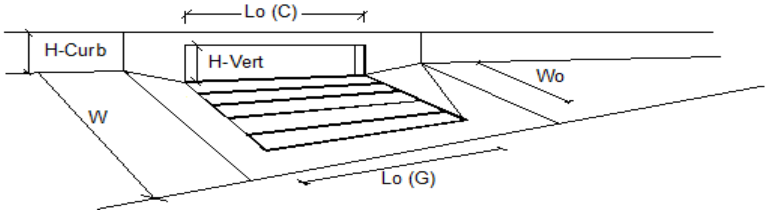
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.6**	**36.0**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		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 =**	**4.0**	**7.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.9**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**89**	**%**

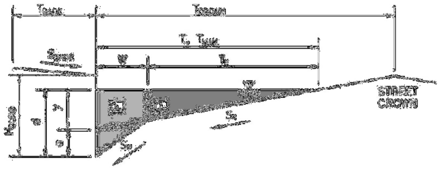
Version 4.05 Released March 2017

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

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

Project: **Bradley Ranch**

Inlet ID: **Inlet DP C5**



Gutter Geometry (Enter data in the blue cells)

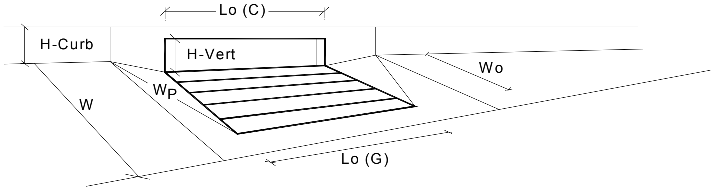
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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

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 =	5.1	7.9	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 =	0.83	0.83	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} =	0.30	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.48	0.75	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.81	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 =**	**6.1**	**17.4**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor Storm	$Q_{PEAK\ REQUIRED}$ =	6.4	14.3	cfs

Warning 5: The width of unit is greater than the gutter width.

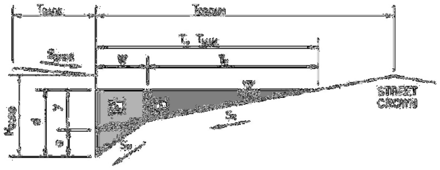
Version 4.05 Released March 2017

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

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

Project: **Bradley Ranch**

Inlet ID: **Inlet DP C6**



Gutter Geometry (Enter data in the blue cells)

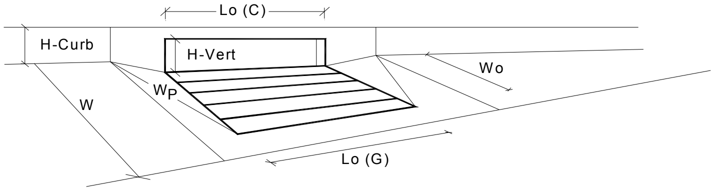
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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

Version 4.05 Released March 2017



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 =	5.1	7.8	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 =	0.83	0.83	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} =	0.30	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.48	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.81	0.96	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

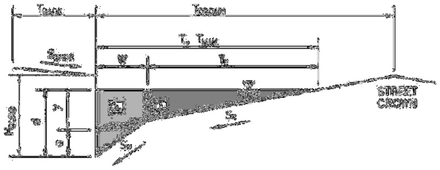
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.1**	**16.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.1	14.0	cfs

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: **Bradley Ranch**
Inlet ID: **Inlet DP D3**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

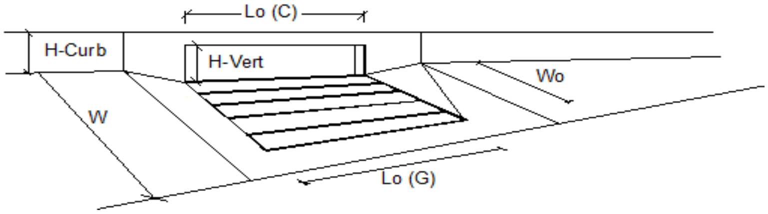
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.9**	**37.6**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



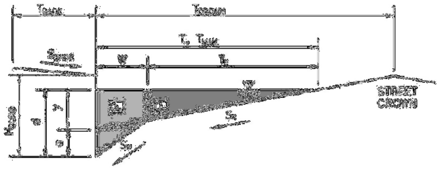
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit 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**	**8.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**4.5**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**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: **Bradley Ranch**
Inlet ID: **Inlet DP D4**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

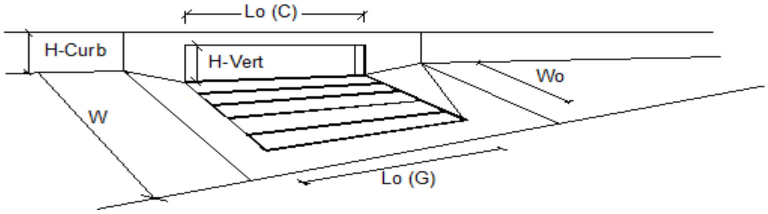
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**12.7**	**32.9**	**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



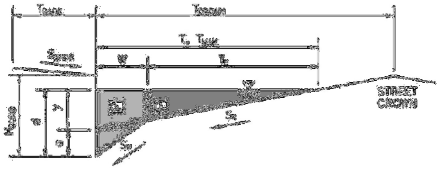
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit 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 =**	**2.3**	**8.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**87**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP D5**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

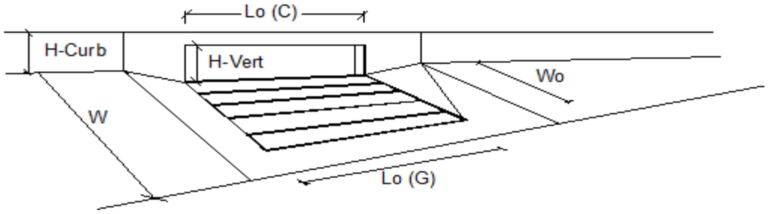
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.7**	**32.9**	**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



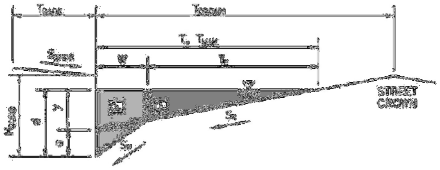
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit 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 =**	**3.7**	**8.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**83**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP D5**

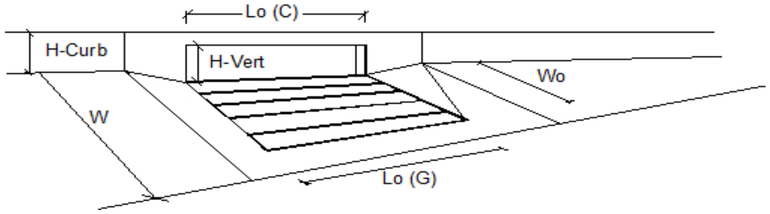


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8		ft
Gutter Width	W =	0.83		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 =	0.150		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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} =**	**12.7**	**32.9**	**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	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	

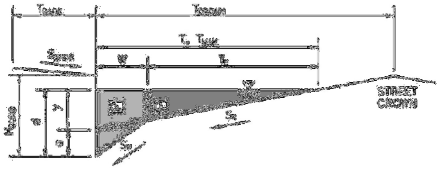
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.7**	**8.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**83**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP D6**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

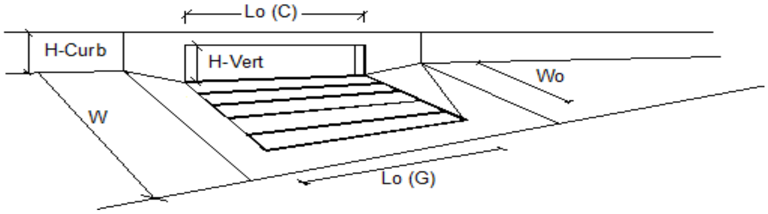
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**7.8**	**42.1**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less 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)	Colorado Springs D-10-R		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 =	14.00	14.00	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	

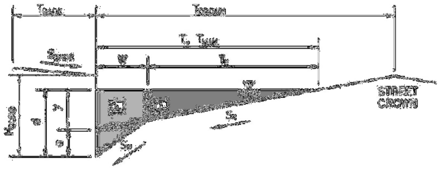
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.2**	**10.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.4**	**2.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**96**	**84**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP D7**

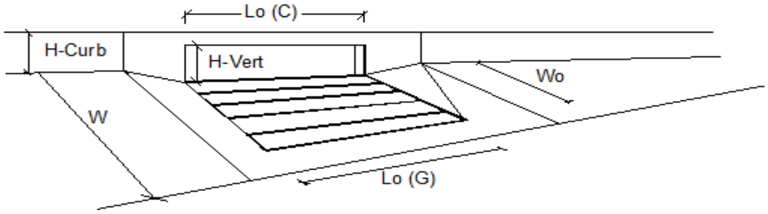


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8		ft
Gutter Width	W =	0.83		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 =	0.150		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} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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}** =	**7.8**	**42.1**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



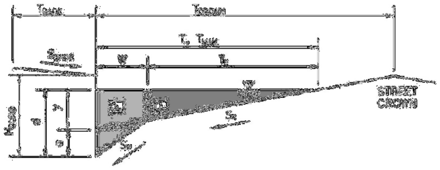
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	14.00	14.00	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**	**11.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.6**	**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: Bradley Ranch
Inlet ID: Inlet DP D8



Gutter Geometry (Enter data in the blue cells)

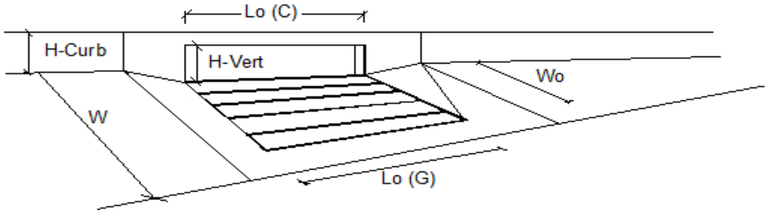
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0		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 =	0.063		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.029		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.9	10.9	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} =**	**16.3**	**89.8**	**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



Colorado Springs D-10-R

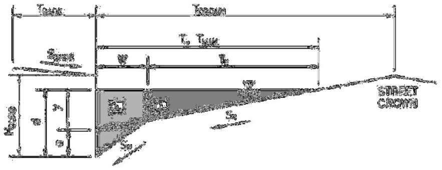
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	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 =**	**4.4**	**7.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.7**	**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: **Bradley Ranch**
Inlet ID: **Inlet DP D9**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	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 =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.029	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

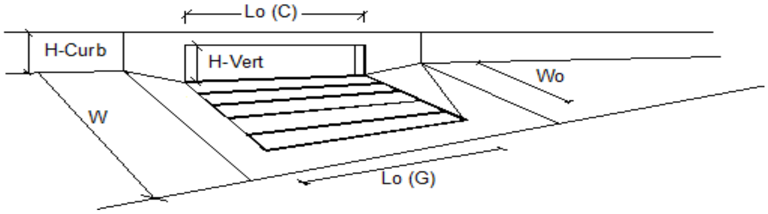
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.9	10.9	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.4**	**90.2**	**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



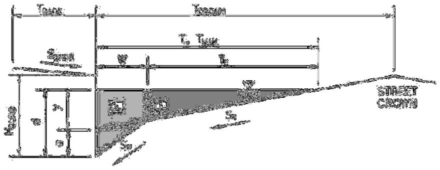
		MINOR	MAJOR	
Design Information (Input) Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	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 =**	**1.7**	**2.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**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: **Bradley Ranch**
Inlet ID: **Inlet DP D10**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

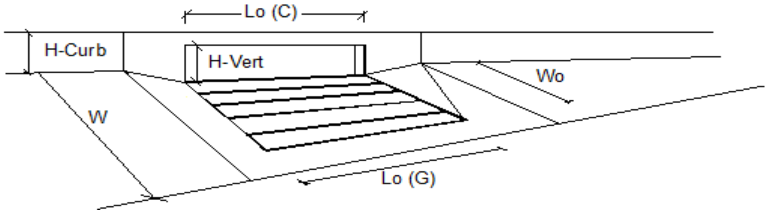
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.0**	**35.9**	**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



Colorado Springs D-10-R

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 =	16.00	16.00	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 =**	**10.4**	**17.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.4**	**7.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**96**	**69**	**%**

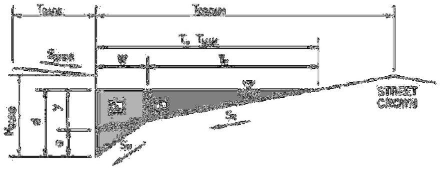
Version 4.05 Released March 2017

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

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

Project: Bradley Ranch

Inlet ID: Inlet DP D11



<u>Gutter Geometry (Enter data in the blue cells)</u>

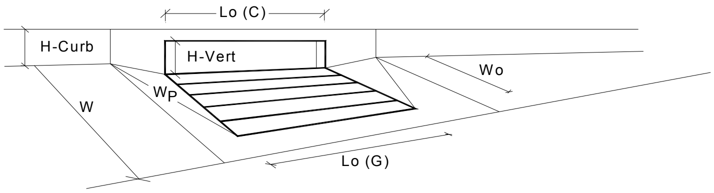
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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

Version 4.05 Released March 2017



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 =	5.1	7.8	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 =	0.83	0.83	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} =	0.30	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.48	0.74	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.73	0.88	
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 =	**7.2**	**20.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	6.7	20.0	cfs

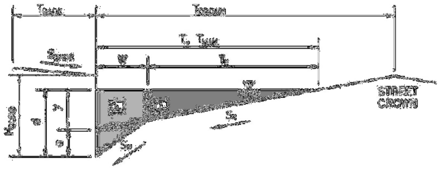
Version 4.05 Released March 2017

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

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

Project: **Bradley Ranch**

Inlet ID: **Inlet E3**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.088	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

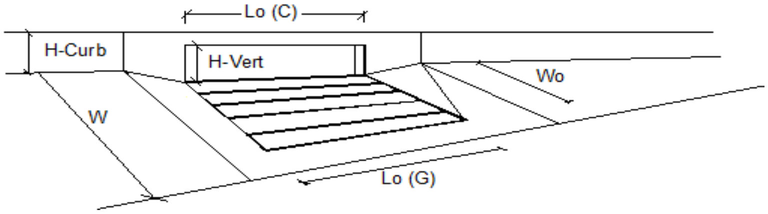
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**14.6**	**26.0**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Colorado Springs D-10-R

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 =	14.00	14.00	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	

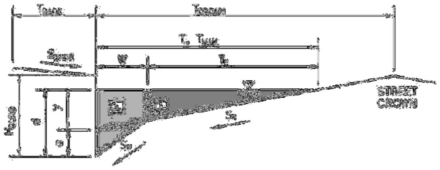
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.1**	**11.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**85**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP E7**

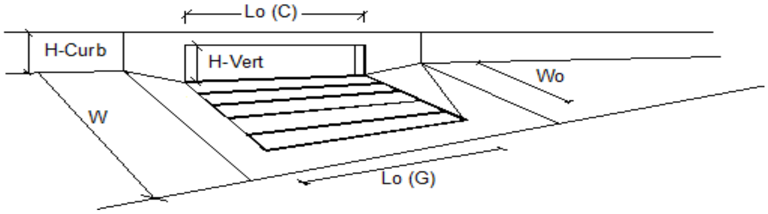


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8		ft
Gutter Width	W =	0.83		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 =	0.150		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} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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} =**	**10.6**	**36.6**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



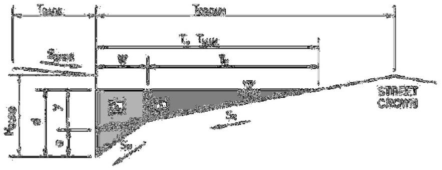
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	16.00	16.00	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 =**	**5.3**	**11.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.9**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**93**	**%**

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: Bradley Ranch
Inlet ID: Inlet DP E8



Gutter Geometry (Enter data in the blue cells)

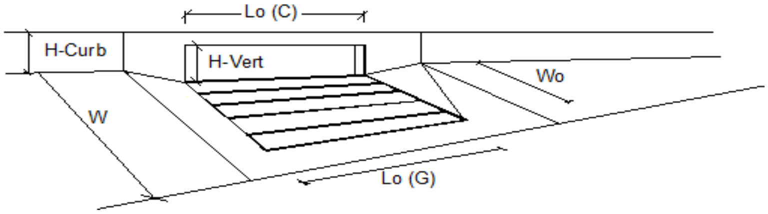
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8		ft
Gutter Width	W =	0.83		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 =	0.150		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} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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} =	**10.6**	**36.6**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



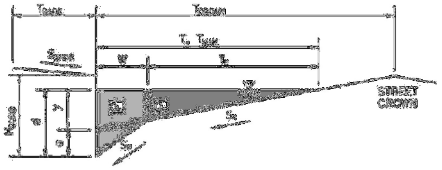
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	16.00	16.00	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 =**	**2.7**	**11.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.8**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**93**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP E9**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

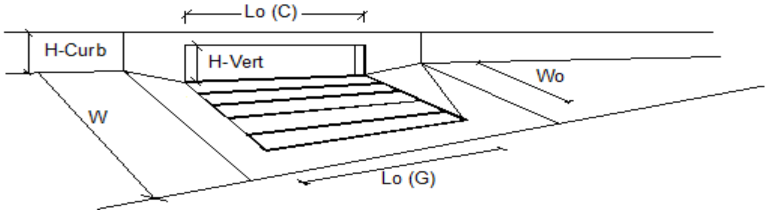
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**7.8**	**42.1**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



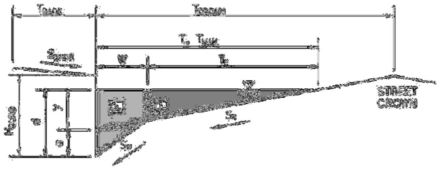
			MINOR	MAJOR	
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	14.00	14.00	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**	**11.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.4**	**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: **Bradley Ranch**
Inlet ID: **Inlet DP E10**



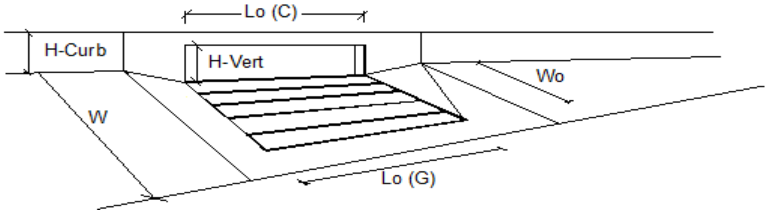
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		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} =	15.8		ft
Gutter Width	W =	0.83		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 =	0.150		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.019		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**8.7**	**41.2**	**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 =	16.00	16.00	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	

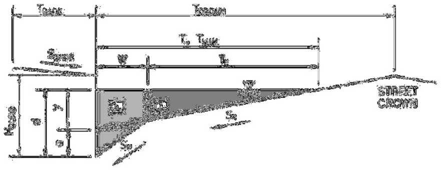
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.6**	**12.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP E11**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.019	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

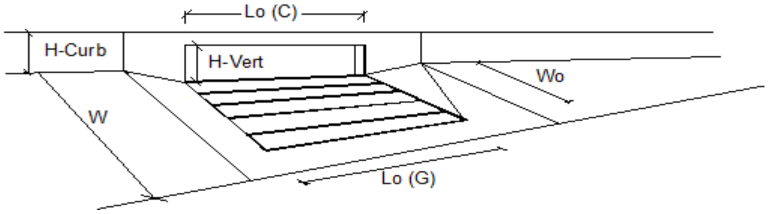
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**8.7**	**41.2**	**cfs**

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



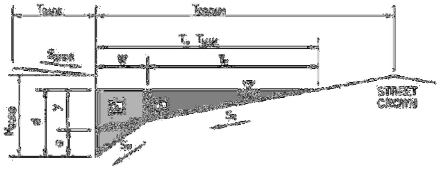
Design Information (Input)	Colorado Springs D-10-R ▾	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	16.00	16.00	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 =**	**5.8**	**13.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**84**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP E12**



Gutter Geometry (Enter data in the blue cells)

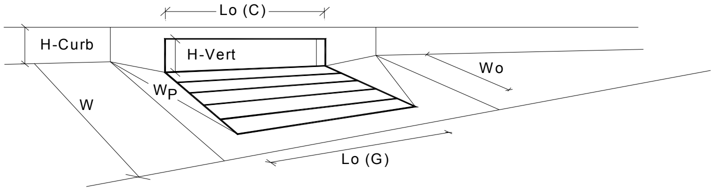
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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

Version 4.05 Released March 2017



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 =	5.5	8.2	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 =	0.83	0.83	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	0.56	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.75	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 =	**8.8**	**22.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK REQUIRED}$ =	8.4	22.5	cfs

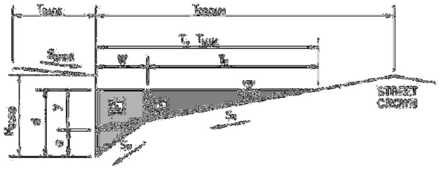
Version 4.05 Released March 2017

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

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

Project: Bradley Ranch

Inlet ID: Inlet DP F1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

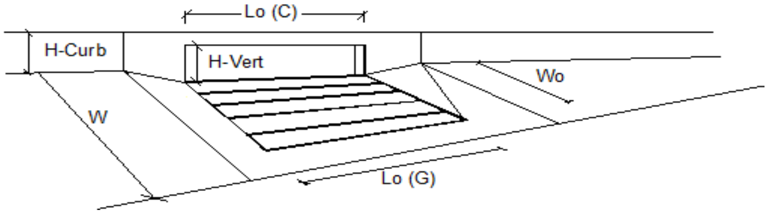
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**10.0**	**37.9**	**cfs**

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



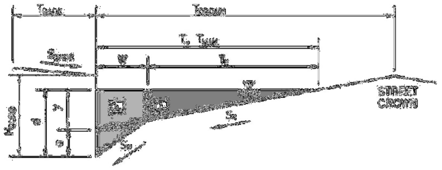
Design Information (Input) Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	14.00	14.00	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 =**	**6.0**	**9.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**92**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP F2**



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

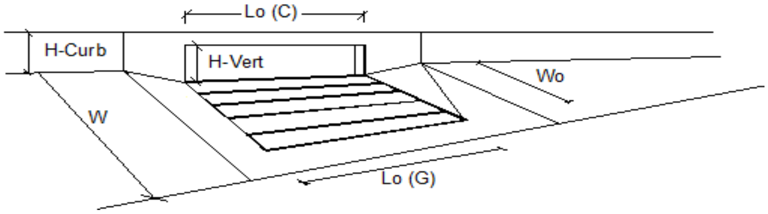
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.0**	**37.9**	**cfs**

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



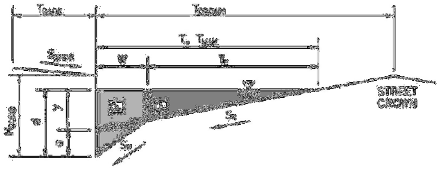
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	14.00	14.00	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 =**	**3.1**	**10.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**85**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP F3**

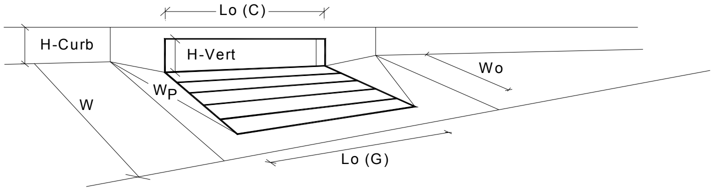


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		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} =	15.8		ft
Gutter Width	W =	0.83		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 =	0.150		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} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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

Version 4.05 Released March 2017



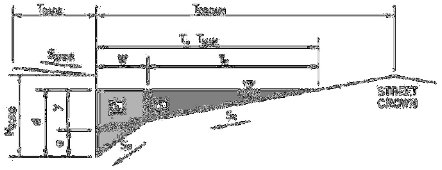
Design Information (Input) Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.1	7.8	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) =	8.00	8.00	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 =	0.83	0.83	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} =	0.30	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.79	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.96	1.00	
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**	**12.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.6	10.2	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: **Bradley Ranch**
Inlet ID: **Inlet DP F4**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	15.8	ft
Gutter Width	W =	0.83	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 =	0.150	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} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	15.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	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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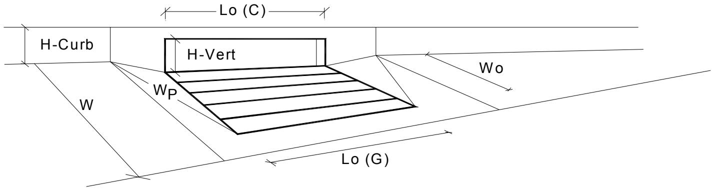


Design Information (Input)	Colorado Springs D-10-R	MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.1	7.8	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) =	8.00	8.00	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 =	0.83	0.83	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} =	0.30	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.79	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.96	1.00	
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**	**12.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.5	9.9	cfs

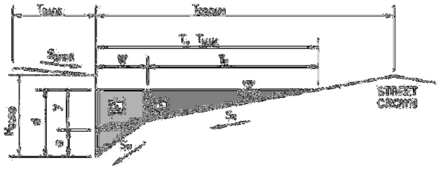
Version 4.05 Released March 2017

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

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

Project: **Bradley Ranch**

Inlet ID: **Inlet DP X1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	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 =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.9	10.9	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} =**	**19.3**	**81.9**	**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

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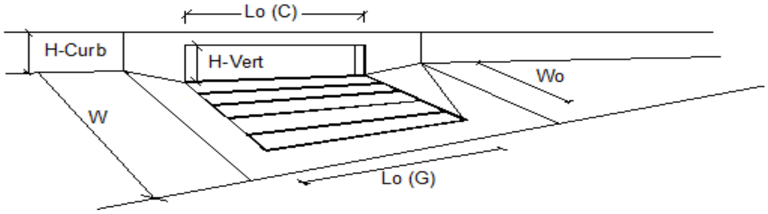


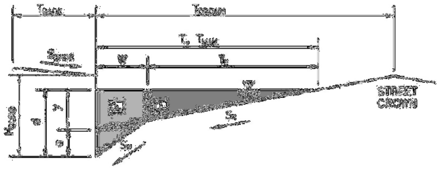
Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	16.00	16.00	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 =**	**9.6**	**14.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.5**	**5.0**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**95**	**74**	**%**

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: **Bradley Ranch**
Inlet ID: **Inlet DP X2**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	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 =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.9	10.9	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

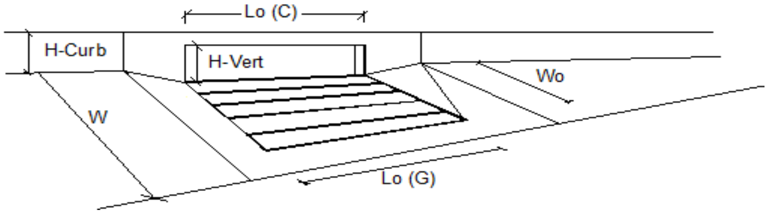
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**19.3**	**81.9**	**cfs**

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)	Colorado Springs D-10-R		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 =	16.00	16.00	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 =**	**3.4**	**16.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**9.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**64**	**%**

REFERENCE MATERIAL

J·R ENGINEERING
A Subsidiary of Westrian

AMENDMENT NO. 3 TO PINE CREEK DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN FOR THE PINE CREEK AND CORDERA NEIGHBORHOODS (PORTIONS CONTRIBUTING TO PINE CREEK)

October 2002
Minor Text Revisions
February 2003

Prepared For:

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Job No. 8716.11

B. Fully Developed Condition Plan

1. Pine Creek North Fork (Sub-basins PNE1 through PNE14)

The watershed begins east of future Powers Boulevard. It is proposed that the peak 100-year discharge from Sub-basins PNE1 and PNE2 located at the upper end of the major basin be limited to not more than 1.17 cfs per acre (the approximate average peak 100-year discharge per acre in the existing condition). For the purpose of modeling the runoff from this area, future land uses were assumed to be consistent with the Bradley Ranch Master Plan within the area covered by that plan. A CN value of 77 was assumed for the unknown developed condition for areas outside of the Bradley ranch plan. Conceptual detention facilities were sized to limit the peak release rate from these Sub–basins to the above mentioned flow rate.

The actual size of the detention facilities for Sub-basins PNE1 and PNE2 shall be adjusted based on the actual density and basin characteristics of proposed future development. However, the 100-year peak outflow rates shall be as established in this study. Sub-basin PNE1 shall be limited to a peak 100-year discharge of 103 cfs and Sub-basin PNE2 shall be limited to a peak 100-year discharge of 127 cfs. If possible at the time of development it is recommended that the detention requirement for both of these sub-basins be met in a single regional facility with a 100 year peak outflow less than or equal to 230cfs. If a single facility is not practical, smaller privately owned and maintained ponds will be required to meet the discharge requirement.

It is proposed that the detained flows from Sub-basins PNE1 and PNE2 as well as the runoff from Sub-basin PNE3 be collected and conveyed in proposed storm sewers to a proposed diversion box at Analysis Point E1. For the purpose of the current analysis it was assumed that the proposed diversion box will be designed such that peak flows less than the approximate 5-year peak rate will be directed to a proposed storm sewer parallel to Pine Creek North Fork in Sub-basin PNE5. A trickle flow shall be discharged to the downstream natural channel in all runoff events to promote the growth of vegetation. Flow rates in excess of the approximate 5-year peak rate shall be allowed to overflow into existing Pine Creek North Fork located in Sub-basin PNE5. The HEC-1 models developed for the report estimates a 100-year peak flow of 239 cfs at Analysis Point E1. Of this 156 cfs will be directed to the proposed downstream storm sewer and 131cfs will overflow to the North Fork Channel. The purpose of this division of flow is to utilize the conveyance capacity of the natural channel in large runoff events and mitigate the potential for erosion in the channel due to increased peak rates, volume, and frequency of runoff events that will occur with development. Some improvements to the natural channel as discussed in Section V. Paragraph D., Sub-paragraph 3. of this report will be required in order to assure capacity and mitigate the potential for erosion. At the time that detailed planning is done for this area this concept should be further analyzed to assure that it fits with the proposed land use and the conveyance system is optimized. A more detailed analysis of the natural channel with perhaps some select erosion control measures added may reveal that the natural channel can carry more frequent flows and the proposed downstream storm sewer can be downsized.

The flow diverted to the proposed storm sewer will be routed from Analysis Point E1 to Analysis Point E2, (Q_5 = 164 cfs, Q_{100} = 310 cfs) along with runoff collected from Sub-basin PNE4. The flow that is allowed to overflow into the natural channel will be routed from Analysis Point E1 to Analysis Point E3 along with runoff from Sub-basin PNE5. At Analysis Point E3 the flow in the natural channel (Q_5 = 5 cfs, Q_{100} = 95 cfs) should be intercepted by a proposed storm sewer and routed to Analysis Point E4 along with the flow from Analysis Point E2.

The peak 100-year runoff from Sub-basin PNE6 should be limited to 15 cfs if further development occurs in the sub-basin (similar to Sub-basins PNE1, and PNE2 discussed above). The runoff from Sub-basin PNE7 will be collected in future streets and storm sewers and conveyed to Analysis Point E4 along with the flow from Sub-basin PNE6. A diversion box is proposed to accept the runoff conveyed to Analysis Point E4 (Q_5 = 238 cfs, Q_{100} = 543 cfs) and divide it between a proposed downstream storm sewer and the downstream natural channel. The diversion box should be designed such that the modeled peak 100-year inflow is divided such that approximately 173 cfs is routed to the proposed downstream storm sewer and approximately 370 cfs is routed to the downstream portion North Fork Channel. During more frequent runoff events all of the inflow up to approximately 130 cfs should be diverted to the proposed downstream storm sewer excepting the trickle flow discussed below. The 130 cfs rate corresponds to the expected 2-year peak rate at Analysis Point E4. A trickle flow shall be directed to the channel in all runoff events to promote the growth of vegetation in the channel. The purpose of this division of flow is to utilize the conveyance capacity of the downstream natural channel in large runoff events and mitigate the potential for erosion due to increased peak rates, volume, and frequency of runoff events that will occur with development of the upstream watershed.

A concept detail drawing of the proposed diversion boxes for Analysis Points E1 and E4 is included in the appendix of this report. It may be possible to combine the proposed diversion boxes with future curb inlets to reduce costs.

The storm sewer portion of the flow from Analysis Point E4 will be routed to Analysis Point E5 where runoff from Sub-basin PNE8 will be added to the proposed storm sewer for combined peak rates of Q_5 = 185 cfs, Q_{100} = 269 cfs. This flow will be routed to Analysis Point E6 along with flow collected from Sub-basin PNE9. The flow at Analysis Point E6 (Q_5 = 194 cfs, Q_{100} = 299 cfs) will be routed to Analysis Point 3 at the proposed rundown channel to proposed Regional Detention Facility "F". The flow allowed to overflow to the natural channel will be conveyed in the natural channel along with runoff from Sub-basin PNE10 to Analysis Point 3. The HEC-1 model indicates peak rates in the natural channel of Q_5 = 180 cfs, Q_{100} = 437 cfs (AP3a) at Analysis Point 3.

Runoff from Sub-basins PNE11 is to be collected on-site and conveyed to Analysis Point 1 in a proposed storm sewer. Runoff from Sub-basin PNE12 is to be collected onsite and added to the storm sewer at Analysis Point 1 (Q_5 = 198 cfs, Q_{100} = 345 cfs). The flow will then be routed to Analysis Point 2 in a proposed storm sewer. Runoff from Sub-basins PNE13 and PNE14 will be collected in the Union and Powers Boulevard right of ways and conveyed to Analysis Point 2 in a storm sewer system to be constructed by CDOT with Powers Boulevard. It is expected that the above-described systems will be joined at Analysis Point 2 for combined peak rate of Q_5 = 255 cfs, Q_{100} = 493 cfs. The flow will be routed in a proposed storm sewer to Analysis Point 3. The peak flow rates

- **Reaches PC7 through PC8**

These reaches are generally well defined and contain some natural vegetation to aid in their stability. However, given the relatively steep natural slopes of these reaches and the lack of heavy vegetation it is anticipated that these reaches would not remain stable if exposed to the increased frequency, volumes and low sediment content of developed condition flows. Given this and the Federal requirement to minimize impacts to the natural channel due to the presence of Prebles Meadow Jumping Mouse Habitat, these reaches will only convey significant developed condition storm water flows in storms larger than the 2 year frequency storm per the current proposed plan. Runoff from more frequent storms and significant portions of the runoff from larger storms will be conveyed in a storm sewer to be constructed parallel to the Creek and outside of the Prebles habit to the extent possible. A trickle flow will be directed through the reach in all runoff events to encourage the growth of vegetation in the reach. This diversion of flows will be facilitated by a diversion structure to be constructed at the upstream end of reach PC8.

It is believed that the channel can convey the infrequent flows as proposed by the current plan in its current natural state without significant risk of uncontrolled erosion. These reaches are included in the detailed hydraulic analysis discussed in previous text for the downstream reaches. The stability of the reaches will be examined in the analysis.

- **Reach PC9**

This majority of this reach can be better described as a wide shallow swale than a well-defined incised channel. Only the upper portion of the channel is incised and exhibits signs of head cutting in the existing condition. The current land plan for the area proposes to preserve the reach as a natural drainage conveyance. Given the relatively steep gradients and the lack of a defined channel in the reach, it is not likely that the reach can serve as the primary conveyance for developed condition flows without significant reshaping and the addition of significant grade control measures.

As both of the above mentioned treatments are contrary to maintaining the area in a relatively natural state and costly, the current plan proposes to shelter the reach from frequent flows and only utilize it to convey a portion of the flows in larger event. This is the same concept presented for downstream Reaches 7 and 8. The current plan recommends that flows below the expected 5-year peak rate be conveyed in a storm sewer constructed parallel to the reach. A portion of the flow from larger runoff events will be conveyed as shallow flow through the reach. It is recommended that the incised upper portion of the reach be regraded to a wide shallow swale and vegetated with native grasses and shrubs. The current plan will shelter the reach from the normal increase in frequency and volume of runoff that accompanies development of the upstream watershed. It is believed that the existing stability of the reach can be maintained under this plan. Planning and design associated with this reach should be done with consideration that this reach will also serve as the emergency relief channel for the upstream watershed.

E. Proposed Drainage Discharge Constraints

The following discharge constraints are proposed for the study area:

a. The requirement for onsite detention to achieve a 35 percent reduction in the peak flow rate resulting from development (the difference between the historic and developed peak rates) on all office, research and development, commercial, and school properties as implemented with the original DB.P.S. will remain in effect for all existing developed properties and for future developing properties within Basins CS2, CS3, F1, F4, F5, F6, F7, PM6B and PM10 as shown on the Fully Developed Condition Drainage Map included in this study unless the following conditions are met.

- A separate detailed drainage analysis or the analysis done for this study demonstrates that the downstream existing or proposed drainage conveyance facilities are adequate to allow a greater discharge rate from the property.
- A detailed drainage analysis or the analysis performed for this study demonstrates that the greater discharge rate will not negatively impact downstream detention facilities or the overall discharge peak discharge goals of this study.

b. Runoff from Basin CS4 as shown on the Fully Developed Condition Drainage Map included in this study shall be routed through the pond labeled as "DFVC" a private detention pond as proposed in the approved "Master Development Drainage Plan for Village Center at Pine Creek and Preliminary /Final Drainage Report for Village Center

AMENDMENT 3
TO
PINE CREEK DRAINAGE BASIN PLANNING STUDY SUBDIVISION AND LAND USE IDENTIFICATION MAP

LEGEND

▬ ▬ ▬	PINE CREEK MAJOR DRAINAGE BASIN BOUNDARY
- - - -	CURRENT SUB-BASIN BOUNDARY
◇	STREET INDEX IDENTIFIER
26.	SUBDIVISION INDEX IDENTIFIER
BASIN	BASIN IDENTIFICATION
ACRES	BASIN ACRES

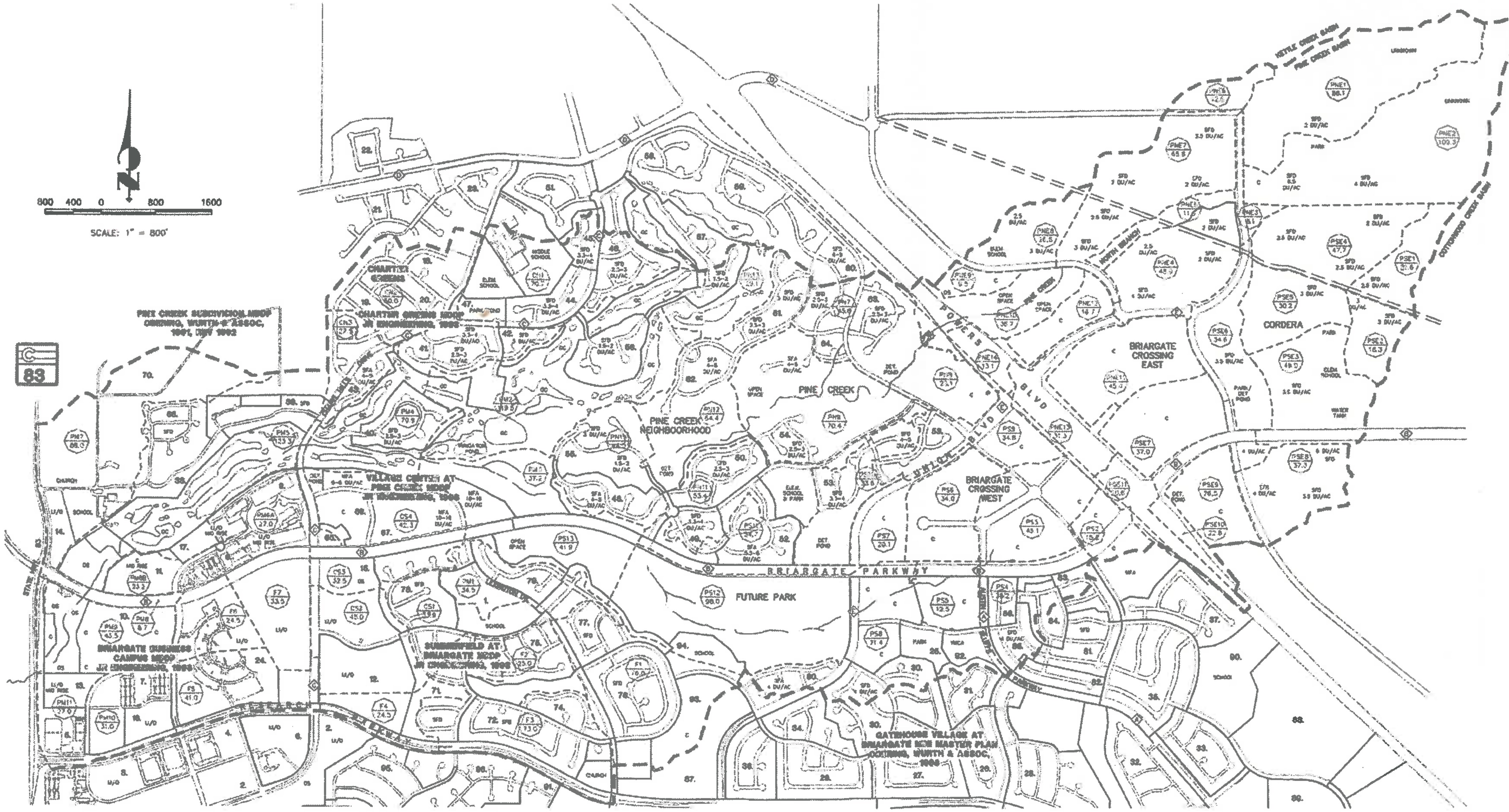
LAND USES

C	COMMERCIAL
LI/O	LIGHT INDUSTRIAL/OFFICE
MFA	MULTIFAMILY ATTACHED
MF	MULTIFAMILY
SFD	SINGLE FAMILY ATTACHED
SFA	SINGLE FAMILY DETACHED
X DU/AC	NUMBER OF DUELLINGS PER ACRE
OS	OPEN SPACE
GC	GOLF COURSE
O	OFFICE
UNKNOWN	UNKNOWN (ASSUMED 45% IMPERVIOUS, CN = 77)

◇	MAJOR STREET INDEX
A	AUSTIN BLUFFS PARKWAY
B	BRIARGATE PARKWAY
C	CHAPEL HILLS DRIVE
D	OLD RANCH ROAD
E	UNION BOULEVARD

NO.	SUBDIVISION INDEX
1.	ACADEMY MIDDLE SCHOOL NUMBER 4
2.	BRIARGATE BUSINESS CAMPUS FILING 1
3.	BRIARGATE BUSINESS CAMPUS FILING 2
4.	BRIARGATE BUSINESS CAMPUS FILING 7
5.	BRIARGATE BUSINESS CAMPUS FILING 9
6.	BRIARGATE BUSINESS CAMPUS FILING 12
7.	BRIARGATE BUSINESS CAMPUS FILING 13
8.	BRIARGATE BUSINESS CAMPUS FILING 14
9.	T. ROWE PRICE
10.	BRIARGATE BUSINESS CAMPUS FILING 16
11.	BRIARGATE BUSINESS CAMPUS FILING 17
12.	BRIARGATE BUSINESS CAMPUS FILING 18
13.	BRIARGATE BUSINESS CAMPUS FILING 19
14.	BRIARGATE BUSINESS CAMPUS FILING 20
15.	BRIARGATE BUSINESS CAMPUS FILING 21
16.	BRIARGATE BUSINESS CAMPUS FILING 22
17.	BRIARGATE BUSINESS CAMPUS FILING 23
18.	CHARTER GREENS FILING 1
19.	CHARTER GREENS FILING 2
20.	CHARTER GREENS FILING 3

NO.	SUBDIVISION INDEX
21.	CREEKSIDE FILING 1
22.	CREEKSIDE FILING 3
23.	CREEKSIDE FILING 4
24.	FOCUS ON THE FAMILY
25.	GATEHOUSE PARK
26.	GATEHOUSE VILLAGE FILING 1
27.	GATEHOUSE VILLAGE FILING 2
28.	GATEHOUSE VILLAGE FILING 3
29.	GATEHOUSE VILLAGE FILING 4
30.	GATEHOUSE VILLAGE FILING 5
31.	GATEHOUSE VILLAGE FILING 6
32.	GATEHOUSE VILLAGE FILING 7
33.	GATEHOUSE VILLAGE FILING 8
34.	GATEHOUSE VILLAGE FILING 9
35.	GATEHOUSE VILLAGE FILING 10
36.	GATEHOUSE VILLAGE FILING 11
37.	GATEHOUSE VILLAGE FILING 12
38.	PINE CREEK FILING 1
39.	PINE CREEK FILING 2
40.	PINE CREEK FILING 3
41.	PINE CREEK FILING 4
42.	PINE CREEK FILING 5
43.	PINE CREEK FILING 6
44.	PINE CREEK FILING 7
45.	PINE CREEK FILING 8
46.	PINE CREEK FILING 9
47.	PINE CREEK FILING 10
48.	PINE CREEK FILING 11
49.	PINE CREEK FILING 12
50.	PINE CREEK FILING 13
51.	PINE CREEK FILING 14
52.	PINE CREEK FILING 15
53.	PINE CREEK FILING 16
54.	PINE CREEK FILING 17
55.	PINE CREEK FILING 24
56.	PINE CREEK FILING 25
57.	PINE CREEK FILING 26
58.	PINE CREEK FILING 28
59.	PINE CREEK FILING 29
60.	PINE CREEK FILING 30
61.	PINE CREEK FILING 32
62.	PINE CREEK FILING 33
63.	PINE CREEK FILING 35
64.	PINE CREEK FILING 36
65.	PINE CREEK VILLAGE CENTER FILING 1
66.	PINE CREEK VILLATE CENTER FILING 2
67.	PINE CREEK VILLATE CENTER FILING 3
68.	PINE WOODS
70.	SPRING CREST FILING 2
71.	SUMMER FIELD FILING 1
72.	SUMMER FIELD FILING 2
73.	SUMMER FIELD FILING 3
74.	SUMMER FIELD FILING 4
75.	SUMMER FIELD FILING 5
76.	SUMMER FIELD FILING 6
77.	SUMMER FIELD FILING 6
78.	SUMMER FIELD FILING 7
79.	SUMMER FIELD FILING 8
80.	SUMMER FIELD FILING 9
81.	SAGEWOOD FILING 1
82.	SAGEWOOD FILING 2
83.	SAGEWOOD FILING 3
84.	SAGEWOOD FILING 4
85.	SAGEWOOD FILING 5
86.	SAGEWOOD FILING 6
87.	BRIARGATE FILING 37
88.	BRIARGATE FILING 40
89.	BRIARGATE FILING 46A
90.	BRIARGATE FILING 48
91.	BRIARGATE FILING 50
92.	BRIARGATE FILING 52 – YMCA
93.	BRIARGATE SUBDIVISION FILING 27
94.	BRIARGATE SUBDIVISION FILING 59
95.	WEDGEWOOD @ BRIARGATE FILING 3
96.	WEDGEWOOD @ BRIARGATE FILING 4



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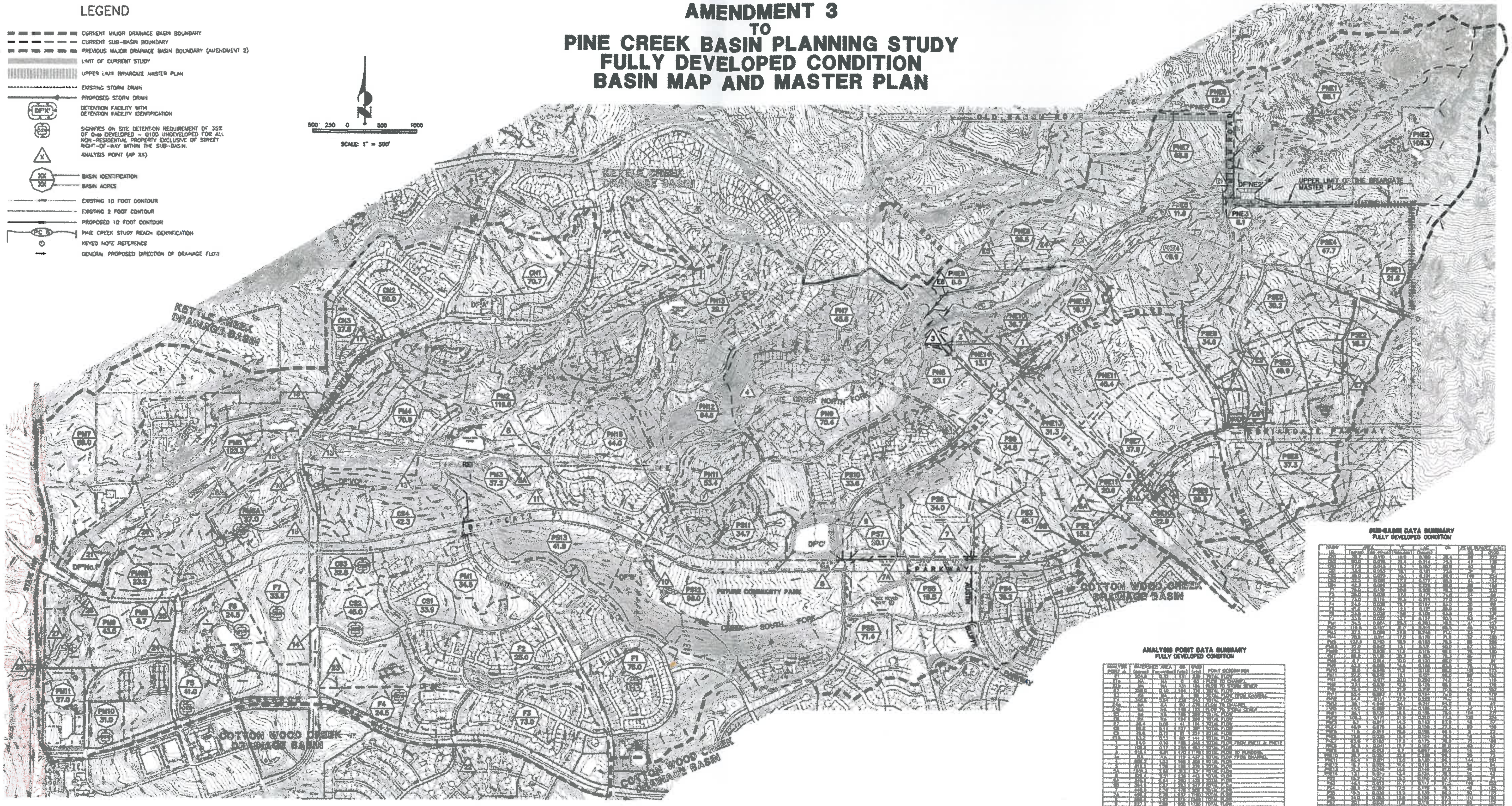
PINE CREEK DBPS
AMENDMENT 3
SUBDIVISION INDEX
JOB NO. 28716.11
DATE: 10/01/02
SHEET 4 OF 5

AMENDMENT 3
TO
PINE CREEK BASIN PLANNING STUDY FULLY DEVELOPED CONDITION BASIN MAP AND MASTER PLAN



LEGEND

- CURRENT MAJOR DRAINAGE BASIN BOUNDARY
- CURRENT SUB-BASIN BOUNDARY
- PREVIOUS MAJOR DRAINAGE BASIN BOUNDARY (AMENDMENT 2)
- LIMIT OF CURRENT STUDY
- UPPER LIMIT BRIARGATE MASTER PLAN
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- DP'X' DETENTION FACILITY WITH DETENTION FACILITY IDENTIFICATION
- 35% SIGNIFIES ON SITE DETENTION REQUIREMENT OF 35% OF Q_{100} DEVELOPED – Q100 UNDEVELOPED FOR ALL NON-RESIDENTIAL PROPERTY EXCLUSIVE OF STREET RIGHT-OF-WAY WITHIN THE SUB-BASIN.
- X ANALYSIS POINT (AP XX)
- XX BASIN IDENTIFICATION
- XX BASIN ACRES
- EXISTING 10 FOOT CONTOUR
- EXISTING 2 FOOT CONTOUR
- PROPOSED 10 FOOT CONTOUR
- PC 6 PINE CREEK STUDY REACH IDENTIFICATION
- ① KEYED NOTE REFERENCE
- → GENERAL PROPOSED DIRECTION OF DRAINAGE FLOW

GENERAL NOTES:

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

KEYED NOTES:

① SECTION OF PINE CREEK TO BE ELIMINATED.

② FLOW IS TO BE DIVERTED TO A STORM SEWER IN FREQUENT EVENTS AND IS TO BE DIVIDED BETWEEN THE STORM SEWER AND NATURAL CHANNEL IN LARGER EVENTS.

③ AN EMERGENCY OVERFLOW/RELIEF ROUTE SHOULD BE PLANNED ACROSS THIS SITE FROM THE LOW POINT OF TELSTAR DRIVE TO PINE CREEK.

PROPOSED TREATMENT FOR PINE CREEK CHANNEL:

REACH ID	PROPOSED TREATMENT **
PC 1	LEAVE NATURAL WITH ONE DROP/CONTROL STRUCTURE. (COMPLETE)
PC 2	LEAVE NATURAL WITH MINOR BED STABILIZATION AND MODIFICATIONS TO DF No. 1 RANDOM CHANNEL.
PC 3	LEAVE NATURAL WITH GRADE CONTROL STRUCTURES.
PC 4	REGRADE TO PROVIDE WIDE DEPRESSED AREA TO SERVE AS EMERGENCY RELIEF CHANNEL. CONSTRUCT 54" STORM DRAIN TO CONVEY 100 YEAR DESIGN FLOW. (COMPLETE)
PC 5	LEAVE NATURAL WITH GRADE CONTROL STRUCTURES.
PC 6	LEAVE NATURAL WITH GRADE CONTROL STRUCTURES.
PC 7	LEAVE NATURAL WITH FREQUENT FLOWS CONVEYED IN BY-PASS STORM SEWER
PC 8	LEAVE NATURAL. FREQUENT FLOWS CONVEYED IN BY-PASS STORM SEWER
PC 9	LEAVE NATURAL WITH SOME RESHAPING. FREQUENT FLOWS CONVEYED IN BY-PASS STORM SEWER.

** ACTUAL TREATMENT REQUIREMENT TO BE DETERMINED WITH FUTURE DETAILED HYDRAULIC ANALYSIS.
\- NATURAL CHANNEL WILL REQUIRE MONITORING TO VERIFY PERFORMANCE AFTER DEVELOPMENT OCCURS.
* EXCEPT FOR THE REACHES NOTED ABOVE, PINE CREEK CHANNEL WILL BE BY-PASSED WITH STORM DRAIN CONVEYANCES AND ELIMINATED WITHIN THE STUDY AREA.

REGIONAL DETENTION FACILITY DATA SUMMARY FULLY DEVELOPED CONDITION

DETENTION FACILITY I.D.	WATERSHED AREA (acres)	WATERSHED AREA (sq. miles)	PEAK INFLOW (cfs)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)	PEAK OUTFLOW (cfs)	ESTIMATED PEAK STORAGE (ac-ft)	ESTIMATED PEAK STORAGE (ac-ft)	ADDITIONAL DATA PROPOSED OWNERSHIP	ADDITIONAL DATA STATUS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ANALYSIS POINT DATA SUMMARY FULLY DEVELOPED CONDITION

[illegible]
[illegible]

SUB-BASIN DATA SUMMARY FULLY DEVELOPED CONDITION

[illegible]
[illegible]

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PINE CREEK DBPS
AMENDMENT 3
BASIN MAP & MASTER PLAN
JOB NO. 28716.11
DATE: 10/01/02
SHEET 1 OF 5
REVISED 3-4-03

AMENDMENT 3
TO
PINE CREEK BASIN PLANNING STUDY
INTERIM (PARTIALLY DEVELOPED) CONDITION
BASIN MAP AND MASTER PLAN

LEGEND

▬ ▬ ▬	CURRENT MAJOR DRAINAGE BASIN BOUNDARY
— — —	CURRENT SUB-BASIN BOUNDARY
▬ ▬ ▬	PREVIOUS MAJOR DRAINAGE BASIN BOUNDARY (1998 DBPS)
▨	LIMIT OF CURRENT STUDY
▨	UPSTREAM LIMIT OF DEVELOPMENT
◄	EXISTING STORM DRAIN
◄	PROPOSED STORM DRAIN
DP'X'	DETENTION FACILITY WITH DETENTION FACILITY IDENTIFICATION
35%	SIGNIFIES ON SITE DETENTION REQUIREMENT OF 35% OF Q100 DEVELOPED – Q100 UNDEVELOPED FOR ALL NON-RESIDENTIAL PROPERTY EXCLUSIVE OF STREET RIGHT-OF-WAY WITHIN THE SUB-BASIN
△ X	ANALYSIS POINT (AP XX)
XX	BASIN IDENTIFICATION
XX	BASIN ACRES
	EXISTING 10 FOOT CONTOUR
	EXISTING 2 FOOT CONTOUR
	PROPOSED 10 FOOT CONTOUR
PC 6	PINE CREEK STUDY REACH IDENTIFICATION
①	KEYED NOTE REFERENCE
→	GENERAL PROPOSED DIRECTION OF DRAINAGE FLOW

GENERAL NOTES:

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

KEYED NOTES:

① SECTION OF PINE CREEK TO BE ELIMINATED.

② THIS STORM SEWER IS ASSUMED TO BE CONSTRUCTED WITH POWERS BLVD. BUT IS NOT ASSUMED TO COLLECT/CONVEY STORM WATER IN THE INTERIM CONDITION.

③ AN EMERGENCY OVERFLOW/RELIEF ROUTE SHOULD BE PLANNED ACROSS THIS SITE FROM THE LOW POINT IN TELSTAR DRIVE TO PINE CREEK.

PROPOSED TREATMENT FOR PINE CREEK CHANNEL:

REACH ID	≈ PROPOSED TREATMENT **
PC 1	LEAVE NATURAL WITH ONE DROP/CONTROL STRUCTURE (COMPLETE)
PC 2	LEAVE NATURAL WITH MINOR BED STABILIZATION AND MODIFICATION TO OF ADJ RUNDOWN CHANNEL
PC 3	LEAVE NATURAL WITH GRADE CONTROL STRUCTURES
PC 4	REGRADE TO PROVIDE WIDE DEPRESSED AREA TO SERVE AS EMERGENCY RELIEF CHANNEL. CONSTRUCT 54" STORM DRAIN TO CONVEY 100 YEAR DESIGN FLOW (COMPLETE)
PC 5	LEAVE NATURAL WITH GRADE CONTROL STRUCTURES
PC 6	LEAVE NATURAL WITH GRADE CONTROL STRUCTURES
PC 7	LEAVE NATURAL

** ACTUAL TREATMENT REQUIREMENT TO BE DETERMINED WITH FUTURE DETAILED HYDRAULIC ANALYSIS.
\- NATURAL CHANNEL WILL REQUIRE MONITORING TO VERIFY PERFORMANCE AFTER DEVELOPMENT OCCURS.
≈ EXCEPT FOR THE REACHES NOTED ABOVE, PINE CREEK CHANNEL WILL BE BY-PASSED WITH STORM DRAIN CONVEYANCES AND ELIMINATED WITHIN THE STUDY AREA.

REGIONAL DETENTION FACILITY DATA SUMMARY
INTERIM CONDITION

DETENTION FACILITY I.D.	WATERSHED AREA (acres)	WATERSHED AREA (sq. miles)	PEAK INFLOW (cfs) Q5	PEAK INFLOW (cfs) Q100	PEAK OUTFLOW (cfs) Q5	PEAK OUTFLOW (cfs) Q100	ESTIMATED PEAK STORAGE (ac-ft) V5	ESTIMATED PEAK STORAGE (ac-ft) V100	ADDITIONAL DATA PROPOSED OWNERSHIP	ADDITIONAL DATA STATUS
A	[illegible]	0.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	EXISTING
B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	EXISTING
C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PARTIAL EXISTING
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	EXISTING
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PROPOSED
No.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	EXISTING
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PRIVATE	EXISTING
VC	[illegible]	0.07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PRIVATE	EXISTING

ANALYSIS POINT DATA SUMMARY
INTERIM CONDITION

ANALYSIS POINT #	WATERSHED AREA (acres)	WATERSHED AREA (sq-miles)	Q5 (cfs)	Q100 (cfs)	POINT DESCRIPTION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SUB-BASIN DATA SUMMARY
INTERIM CONDITION

BASIN I.D.	AREA (acres)	AREA (sq-miles)	Tc (min.)	LAG (hours)	CN	PEAK RUNOFF (cfs) Q5	PEAK RUNOFF (cfs) Q100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL	2817.0	[illegible]					

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PINE CREEK DBPS
AMENDMENT 3
BASIN MAP & MASTER PLAN
INTERIM CONDITION
JOB NO. 28716.11
DATE: OCTOBER 2002
SHEET: 2 OF 5
REVISED 3-4-03

FINAL DRAINAGE REPORT
for
"Cordera Filing No. 1"

&

MASTER DEVELOPMENT DRAINAGE PLAN
for
Cordera and Briargate Crossing East Pine Creek and Cottonwood Creek Basins

Prepared for:
City of Colorado Springs, Colorado
Engineering Division

On Behalf of:
LP47, LLC dba La Plata Investments
2315 Briargate Parkway, Suite 100
Colorado Springs, CO 80920

Prepared by:

Matrix Design Group, Inc.
Integrated Design Solutions
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Community Development
Program Management

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Revised November 2004

03.104.015

D. *Fully Developed Conditions*

The fully developed analysis completed has focused upon the impacts to the development area to the southeast of the existing North Fork of Pine Creek. Recommendations within Addendum #3 of the DBPS will be used when a more in-depth study is completed for the development of the surrounding area. This analysis is being used primarily to help determine the infrastructure requirements impacting Cordera Filing No. 1 and the future residential area located to the north of Filing No. 1.

Pine Creek Drainage Basin

The development criteria set forth in Addendum #3 of the DBPS has been used to evaluate the future development of the site. Within the Pine Creek Drainage Basin, at least two additional detention ponds will be constructed in addition to the facility located east of Briargate Parkway and Powers Boulevard and completed with Filing No. 1. One basin, detention pond DF-4 will be constructed to the southeast of Powers Boulevard and the North Fork of Pine Creek. The second detention pond DF-5, will detain storm water upstream of the development from the off-site tributary area.

North Fork Pine Creek

The upstream off-site drainage basins, sub-basins PF11 and PF12 are currently comprised of undeveloped land and one acre single-family lots. It is unknown at this time what kind of development will occur on the vacant land and if the larger single family lots may be re-developed. Detention will be required for development with runoff from the combined basins limited to approximately 130 cfs for the 5-year storm and 230 cfs for the 100-year storm. These runoff rates have been designated within Addendum #3 of the DBPS. The exact size and water quality requirements for the future ponds will be determined when the area is developed. For the purposes of this analysis, flows were reduced to the peak allowable and routed through a detention pond. Drainage from these sub-basins will not be allowed to be directed the adjacent sub-basin PF6. If sub-basin PF12 is developed prior to the future Cordera development sub-basin PF6, runoff shall be redirected to proposed detention pond DF-5. If drainage basin PF6 is developed prior to the upstream development, care shall be taken to isolate the flows. This item will be addressed in the final drainage report for the development of the area.

Sub-basins PF16, PF17, and PF18 will be developed as commercial and residential sites. Flow from each of these sub-basins will be reduced to historic levels in future detention pond DF-4 and released into the North Fork of Pine Creek Channel. The total tributary area to the detention pond is 110.7 acres of land. Peak storm water runoff rates entering the pond have been calculated at Q(5)=197.0 cfs and Q(100)=431.0 cfs. Maximum release rates for each storm event are Q(5)=22.1 cfs and Q(100)=151.1 cfs requiring detention storage volumes of 6.0 and 12.3 acre-feet.

Sub-basins PF13, PF14, and PF15 have all been modeled with direct discharge to the North Fork of Pine Creek. Per Addendum #3, this may not be permissible due to the environmental impacts associated with the existing wild life living within the creek limits. When this area is developed, a more in-depth evaluation of the maximum permissible flows will have to be completed. A parallel storm sewer system may be required along the channel to prevent excessive runoff from entering the existing channel and reducing the potentially harmful impacts to the existing wild life in the area. The parallel system will also reduce the erosion potential in the creek. The combined tributary area at a point in the North Fork of Pine Creek and Powers Boulevard is 472 acres. The peak routed runoff rates with the two detention ponds as described above are Q(5)=148.0 cfs and Q(100)=556.5 cfs at design point P6.

A small area of commercial development will discharge to the existing storm sewer system constructed as part of the Powers Boulevard extension at Union Boulevard. Per the design plans produced by CDOT, a peak runoff rate of 78 cfs for the 100-year storm event can enter the system. Drainage sub-basin 17 has been sized to take full advantage of this outfall. Peak runoff rates from the 16.9 acre commercial development are Q(5)=39.3 cfs and Q(100)=75.9 cfs. BMP's for this area to address water quality issues shall be evaluated when the parcel is developed in a site-specific final drainage report.

South Fork Pine Creek

The proposed detention pond east of the intersection of Briargate Parkway and Powers Boulevard will have an ultimate outfall point of a proposed 72" RCP in Briargate Parkway that ultimately flows to an existing detention pond, designated as DF-C within Addendum #3 of the DBPS. Detention pond DF-C is located approximately one mile west of Cordera Filing 1 on the northwest corner of the intersection of Briargate Parkway and Union Boulevard. Flows from sub-basins PF1 through PF9 will be routed into the proposed detention pond on the Cordera Development, DF-2. Approximately 263 acres will drain to detention pond DF-2. This area may vary depending on the final layout of the adjacent Wolf Creek Ranch. The detention pond will have a total inflow, designated as design point P7, of 212.6 cfs for the 5-year storm and 634.0 cfs for the 100-year storm event. For the minor storm, 4.6 acre-feet of storage volume will allow a peak outflow rate of 22.1 cfs. The major storm outflow rate will be reduced to 267.3 cfs and will require 14.6 acre-feet of storage.

Runoff from sub-basin PF10 will enter the Briargate Parkway storm sewer system undetained to the proposed 72" RCP. The flow from the sub-basin will combine with the outflow from the detention pond. The differing times to each peak rate will produce a maxim flow of 152.6 cfs and 386.4 cfs for the minor and major storm events, as delineated within Addendum #3 of the DBPS. The site-specific final drainage report for the development shall provide BMP's for the site to address water quality issues for sub-basin PF10.

Cottonwood Creek Drainage Basin

The tributary area for Cordera and Wolf Creek Ranch will drain to a proposed detention pond and then to an existing 8'x12' CBC under the future Powers Boulevard alignment. Upon full development of the basin, an area that has historically drained to Research Boulevard will be rerouted to the proposed detention pond. This will be completed in the future as part of the Wolf Creek Ranch Development. It is the intent of the developers of each master planning area to create a combined detention pond to reduce the land area requirements and eliminate on additional facility for the City of Colorado Springs to maintain. The sizing within this report will have to be verified upon the development of the Wolf Creek Ranch area. There is no defined land plan for Wolf Creek, which may result in different densities, zonings, or areas from what may be planned now. The final size and water quality capture volume must be verified upon future development.

A small drainage basin consisting of some residential and commercial development will follow historic drainage patterns and drain to an existing 48" RCP storm sewer that has been extended to the site as part of the residential development located to the west of Powers Boulevard. Sub-basin CF9 is 22.65 acres in size and will generate peak runoff rates of Q(5)=45.1 cfs and Q(100)=92.6 cfs. Per the *Final Drainage Report for Gatehouse Village at Briargate Filing No. 12*, the 48" RCP storm sewer can accept a maximum peak runoff rate of 125 cfs when this area is developed.

Sub-basins CF1 through CF7 consist of the fully developed Cordera master plan area totaling 140 acres in size. Peak runoff rates are Q(5)=153.4 cfs and Q(100)=444.2 cfs upstream of the proposed detention basin.

Sub-basins A-1 through A-10 consist of the predicted fully developed area for Wolf Creek Ranch totaling approximately 363 acres in size. The area will generate peak runoff rates of Q(5)=259.9 cfs and Q(100)=774.2 cfs at design point DPA. As with the historic conditions, coordination has occurred to determine the tributary area to design point DPA. Data for sub-basins A-1 through A-10 have been obtained from the analysis completed for the Wolf Ranch development.

The runoff from sub-basins CF1 through CF8 and A-1 through A-10 will be combined at design point C8 and enter proposed detention pond DF-1. Peak runoff rates into the pond at this point are Q(5)=385.5 cfs and Q(100)=1183.5 cfs. The peak release rates of the detention pond have been based upon the calculated historic runoff rates for the sub-basin so as not to overwhelm the existing down stream improvements. The peak release rates are Q(5)=48.1 cfs and Q(100)=362.7 cfs. Within the Cottonwood DBPS, a maximum of 901 cfs is allowed. The historic runoff rates have been maintained due to capacity issues at the next downstream detention pond in the Fairfax development and also because of the existing condition of the downstream channel. The channel from Powers Boulevard to Research Boulevard is currently in its historic state and suffering from erosion problems. By installing the proposed detention pond with the water quality capture volume, the downstream flow rates and flow frequency will be reduced helping to stabilize the downstream channel in its natural state.

E. Water Quality Capture Volume

The City of Colorado Springs has moved into the Phase II of providing water quality for new developments. The water quality capture volume required for this project will be combined with the proposed detention ponds. It should be noted that the previously listed required detention volumes do not include water quality volumes. The water quality capture volumes have included a 20% increase in the volume to account for sediment that will be trapped in the detention pond. The water quality portion of a detention pond will be the first portion of the pond to fill up (the lowest volume in the pond).

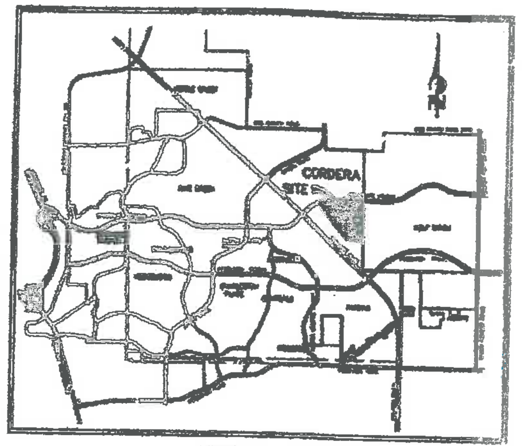
Extended Detention Basin (EDB) and Sedimentation Facility criteria will be used. The detention ponds will be "dry", requiring a 40-hour drain time for the water quality capture volumes. As part of this report, the required additional volumes have been calculated. The final outlet facility will be designed as part of the final construction drawings for the site.

For the Cottonwood Creek Drainage Basin, two conditions were evaluated – the fully developed conditions and interim conditions. See appendix. Upon full build out of the upstream tributary area, it is estimated that 11.2 acre-feet of volume will be required. The final volume will have to be verified once a firm site plan for the adjacent Wolf Creek Ranch is completed. The interim conditions for the development of Cordera Filing No. 1 will require 4.0 acre-feet of water quality capture volume.

For the Pine Creek Drainage Basin, the fully developed conditions will have two detention ponds constructed. The first pond will be located east of the intersection of Briargate Parkway and Powers Boulevard. This pond will ultimately require 5.0 acre-feet of storage. The second pond to be located east of the North Fork of Pine Creek and Powers Boulevard will require 2.4 acre-feet of storage. A third detention pond has been shown off-site of the Cordera development and will be sized by the future developer of the upstream area.

The interim conditions for Pine Creek will only require the one detention pond at Briargate Parkway and Powers Boulevard be constructed. The interim volume required will be 3.3 acre-feet of storage.

SHEET NO. 3



VICINITY MAP:
N.T.S.

SUB-BASIN DATA SUMMARY
EXISTING CONDITIONS

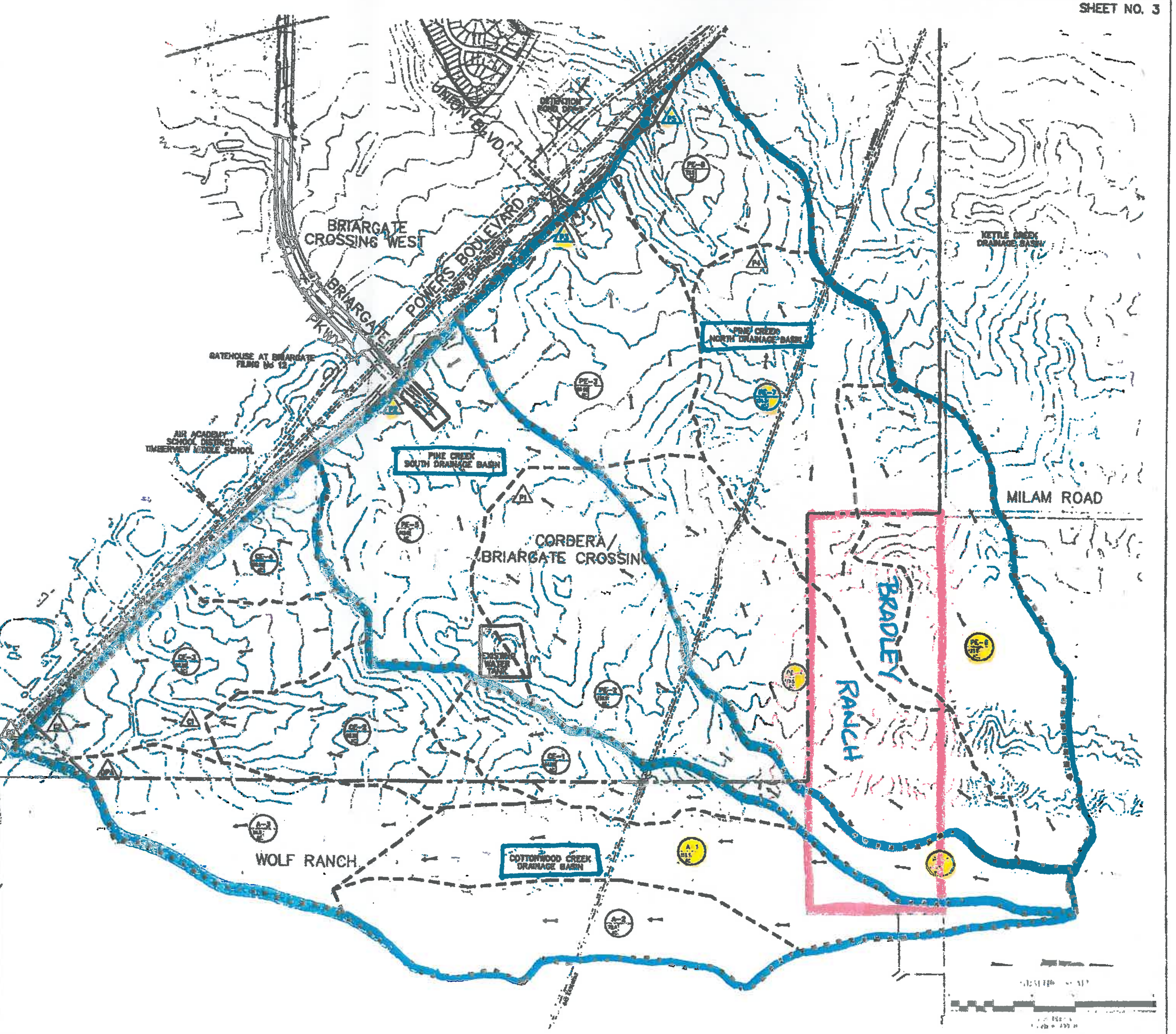
BASIN ID	AREA (AC)	PEAK RUNOFF	
		Q(5) (CFS)	Q(100) (CFS)
CE1	44.00	5.5	37.0
CE2	[illegible]	8.7	60.3
CE3	67.80	7.5	52.5
CE4	28.55	4.2	31.0
A1	116.60	13.6	80.3
A2	70.40	9.5	67.5
A3	84.80	11.8	82.8
PE1	32.07	4.5	30.6
PE2	116.61	13.8	98.5
PE3	88.00	9.9	83.4
PE4	138.48	14.4	102.6
PE5	111.80	16.3	118.7
PE6	123.75	24.1	181.0
PE7	134.33	14.5	109.4
PE8	75.16	8.5	61.3

SUB-BASIN DATA SUMMARY
EXISTING CONDITIONS

DESIGN POINT	PEAK RUNOFF	
	Q(5) (CFS)	Q(100) (CFS)
C1	8.8	58.6
C2	18.2	136.0
C3	42.0	382.3
DPA	37.4	225.8
P1	12.3	110.2
P2	34.9	291.8
P3	9.0	83.4
P4	28.8	244.9
P5	48.7	360.2

LEGEND

FILING LIMITS
DRAINAGE BASIN BOUNDARY
PROPOSED CONTOUR
EXISTING CONTOUR
PROPOSED STORM DRAIN PIPE
EXISTING STORM DRAIN PIPE
DRAINAGE CHANNEL
PROPOSED TYPE 'R' INLET
PROPOSED TYPE I OR II MANHOLE
PROPOSED FLOW DIRECTION ARROW
DESIGN POINT
DESIGN SEGMENT
BASIN DESIGNATION
"C" COEFFICIENT (100 YR)
BASIN AREA (ACRES)



NO.	DATE	DESCRIPTION	BY

REVISIONS

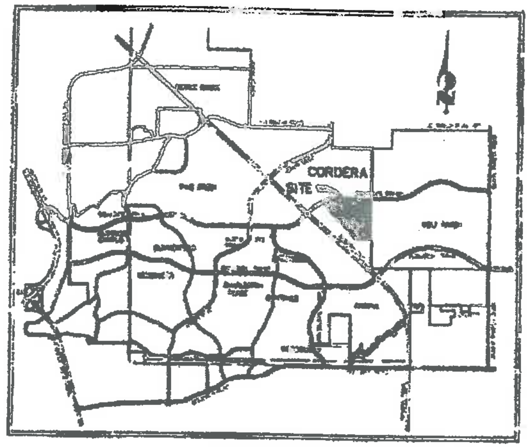
BENCHMARK DATA(ELEV.) ____
(DATUM) ASSUMED
(DESCRIPTION/LOCATION)

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
Integrated Design Solutions
Colorado Springs, CO

CORDERA FILING NO. 1
DRAINAGE REPORT
EXISTING DRAINAGE MAP
SHEET NO. 3 OF 4 SHEETS
DP03

SHEET NO. 1



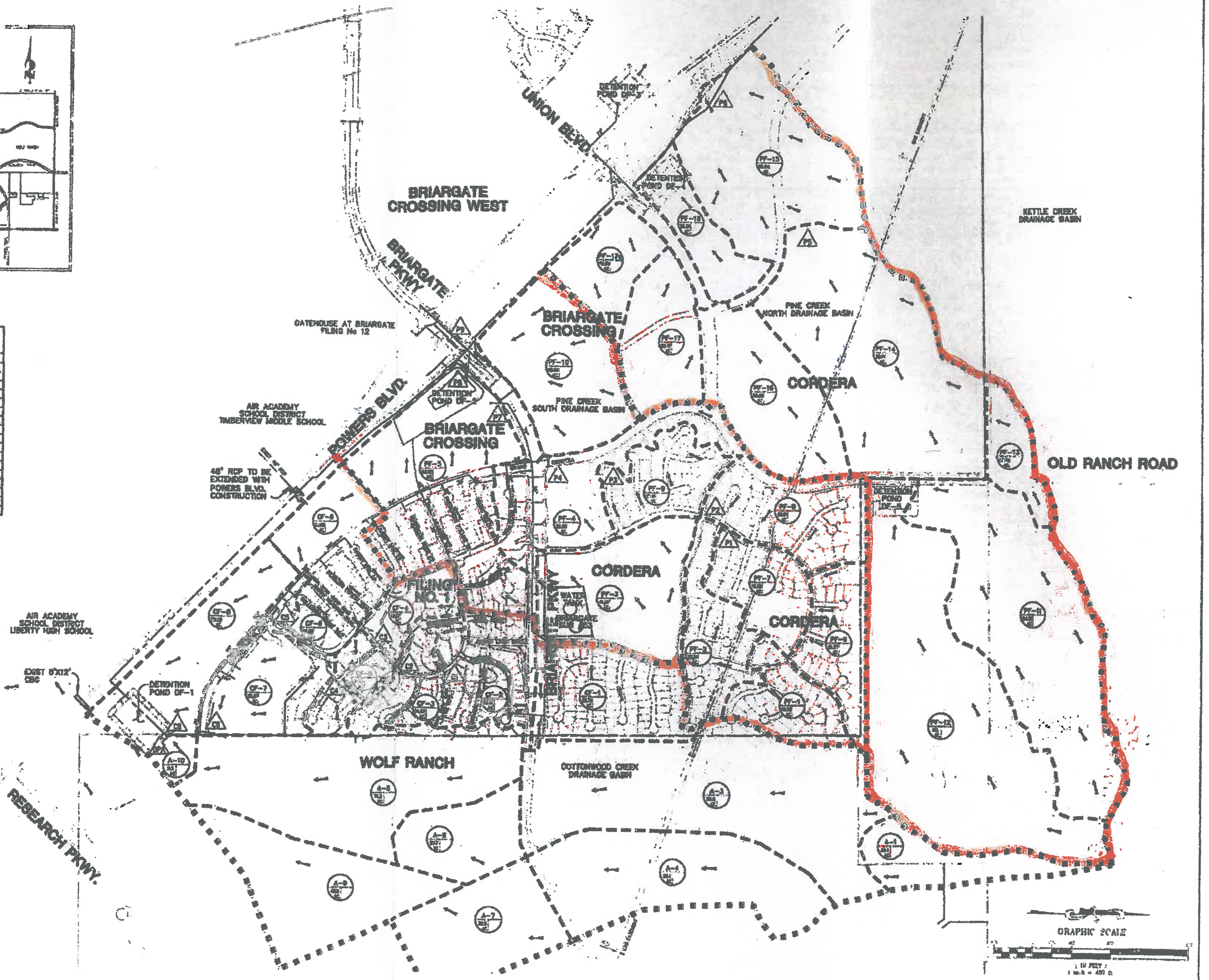
VICINITY MAP:

SUB-BASIN DATA SUMMARY
DEVELOPED CONDITIONS

BASIN NO.	AREA (AC)	PEAK RUNOFF Q(5) (CFS)	Q(100) (CFS)
CF1	52.73	22.9	78.5
CF2	33.35	25.7	72.6
CF3	16.87	13.2	[illegible]
CF4	2.17	4.9	[illegible]
CF5	11.13	8.4	29.4
CF6	13.72	20.2	84.0
CF7	23.47	34.7	93.7
CF8	32.38	84.4	193.7
CF9	37.85	[illegible]	83.8
A2	5.49	5.3	29.2
A3	28.39	35.8	234.4
A4	55.65	29.2	195.4
A5	71.30	49.9	181.5
A6	25.80	35.4	85.6
A7	57.20	14.9	[illegible]
A8	42.77	24.8	78.2
A9	5.60	1.1	8.2
PF1	15.32	11.9	32.3
PF2	23.14	8.4	38.3
PF3	41.87	10.9	138.5
PF4	32.23	6.9	24.7
PF5	63.23	27.3	132.0
PF6a	4.84	3.4	1.8
PF6b	15.40	37.2	42.3
PF6	31.37	14.4	42.3
PF7	15.02	6.5	21.8
PF8	29.80	24.8	47.9
PF9	31.40	13.3	86.3
PF10	42.34	103.9	199.1
PF11	84.40	93.4	273.1
PF12	112.80	103.3	280.0
PF13	12.70	2.7	24.3
PF14	82.11	61.1	231.8
PF15	83.84	42.4	145.2
PF16	31.50	77.4	197.7
PF17	30.47	71.5	198.4
PF18	18.30	36.3	74.9
PF19	33.36	52.7	127.0

SUB-BASIN DATA SUMMARY
DEVELOPED CONDITIONS

DESIGN POINT	PEAK RUNOFF Q(5) (CFS)	Q(100) (CFS)
C1	61.8	155.0
C2	83.8	192.8
C3	98.1	[illegible]
C4	93.9	254.8
C5	95.7	267.0
C6	135.7	370.2
C7	395.8	[illegible]
CFA	258.8	724.2
P1	17.8	[illegible]
P2	87.7	[illegible]
P3	47.4	307.3
P4	145.9	446.7
P5	117.4	318.7
P6	125.6	598.5
P7	313.1	874.4
P8	94.1	379.9
P9	162.7	381.4



LEGEND

- FILING LIMITS
- DRAINAGE BASIN BOUNDARY
- PROPOSED CONTOUR
- EXISTING CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- DRAINAGE CHANNEL
- PROPOSED TYPE 'R' INLET
- PROPOSED TYPE I OR II MANHOLE
- PROPOSED FLOW DIRECTION ARROW
- DESIGN POINT
- BASIN DESIGNATION
- BASIN AREA (ACRES)

NO.	DATE	DESCRIPTION	BY

REVISIONS

BENCHMARK DATA(ELEV.) 6975.66
(DATUM) ASSUMED
(DESCRIPTION/LOCATION) [illegible]

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

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CORDERA FILING NO. 1

DRAINAGE REPORT

FULLY DEVELOPED DRAINAGE MAP

DP01

FINAL DRAINGE REPORT
for
“Cordera Filing No. 3A”

&

MASTER DEVELOPMENT DRAINAGE PLAN
Cordera Filing No. 3

Pine Creek & Kettle Creek
Drainage Basins

Prepared for:
City of Colorado Springs, Colorado
Engineering Division

On Behalf of:
LP47, LLC dba La Plata Investments
1755 Telstar Drive, Suite 450
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Prepared by:
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Infrastructure Engineering
Community Development
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October 2007

06.104.070

MDDP 17272-22
Drain 17272-22

established by the Kettle Creek DBPS. The table below summarizes the flowrates discharged into Kettle Creek under interim developed conditions and the allowable discharge rates.

Table 4.4
Allowable and Proposed Discharge Rates for Detention Facility 6

Storm Event	Interim Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
2-year	22.9 cfs	11.5 cfs	45 cfs
5-year	45.4 cfs	28.0 cfs	60 cfs
10-year	78.7 cfs	35.4 cfs	66 cfs
25-year	152.6 cfs	48.1 cfs	75 cfs
50-year	211.7 cfs	56.7 cfs	81 cfs
100-year	276.8 cfs	62.6 cfs	86 cfs

Sub-basin OK-12 consists of 26.76 acres of undeveloped land located in the northwestern portion of the site. The area generates runoff rates of Q(5) = 5.9 cfs and Q(100) = 39.5 cfs and are routed to Kettle Creek at historic rates via an existing 5' to 10' wide channel along Powers Boulevard.

C. *Fully Developed Conditions*

In anticipation of future development within the Cordera Master Plan area and its neighboring properties, fully developed conditions have been modeled to properly size all detention ponds and respective storm sewer systems within Cordera Filing No. 3. A development plan has not been created for the area north of the CSU gas main; however, a preliminary concept plan has been created. This preliminary concept plan proposes large, single-family lots and areas of open space. A sub-basin layout has been designed based upon this conceptual plan. In addition, the property to the northeast, known as Bradley Ranch, is assumed to be fully developed. The sub-basin descriptions within Filing No. 3 have not changed from the interim developed conditions; therefore, only design points within the Filing No. 3 area are discussed. The Fully Developed Drainage Map shows locations of the basins, while the Storm Sewer Exhibit shows the infrastructure proposed with the basin locations in the background.

Peak runoff rates for localized basin have been calculated using the SCS Method to size storm sewer laterals and inlets. The design points for the project exceed 100 acres in tributary area. A HEC-HMS model has been completed to determine the peak runoff rates at these points to size storm sewer infrastructure.

Pine Creek Drainage Basin (Fully Developed Conditions)

The development detains flow to a peak flow rate in accordance with the Pine Creek DBPS (Amendment 3, March 2003) and the MDDP for Cordera/BXE. Within the Pine Creek Drainage Basin, the detention pond and supporting storm sewer system has been designed to accommodate flows from all developed conditions. The detention pond has been placed in an open space area. Flows ultimately discharge into Pine Creek.

Sub-basin OP-1 consists of 12.28 acres of undeveloped area located at the northeastern corner of the Cordera property line. The peak flow rates of Q(5) = 1.9 cfs and Q(100) = 14.4 cfs are directed to an existing 18 inch CMP located underneath Old Ranch Road. Runoff from this sub-basin is routed through sub-basin PP-1 to design point J21 (detention facility DF-7). In the event this area is developed, the peak 100-year runoff shall be limited to historic flows (Q(100) = 14.4 cfs). This requirement is consistent with the approved Pine Creek DBPS (Q(5) = 8 cfs and Q(100) = 15 cfs).

Sub-basins OP-2 and OP-3 encompasses 199.43 acres of the Bradley Ranch development. It is unknown at this time what kind of development will occur within these areas. As stated within the Pine Creek DBPS and MDDP for Cordera/BXE, detention is required for both of these sub-basins. Runoff rates for the combined basins are restricted to Q(5) = 130 cfs and Q(100) = 239 cfs per the DBPS. These runoff rates have been designated within the Pine Creek DBPS and MDDP for Cordera/BXE. The exact size and water quality requirements for the future pond(s) will be determined when the area is developed. For the purposes of this analysis, flows were reduced to the peak allowable and routed through a detention pond. If development occurs within the Bradley Ranch area prior to the construction of the downstream facilities by La Plata Investments LLC., Bradley Ranch shall discharge to the existing natural channel within sub-basin PP-1 at historic conditions. If development occurs within sub-basin PP-1 prior to the upstream development, care shall be taken to isolate flows. This item will be addressed in the final drainage report for the development of the area. Flows from these sub-basins, OP-6, and OP-7 are combined at design point J2 and routed through a future storm sewer system to design point J2.

The sequential numbering of sub-basins OP-4 and OP-5 have been skipped.

Sub-basin OP-6 comprises of 1.69 acres of the future extension of Milam Road. Runoff from this sub-basin travels south to a proposed sump inlet. Flows of Q(5) = 5.0 cfs and Q(100) = 9.4 cfs are routed through the above detention pond at design point J1.

Sub-basin OP-7 comprises of 1.66 acres of the future extension of Milam Road. Runoff from this sub-basin travels south to a proposed sump inlet. Flows of Q(5) = 5.0 cfs and Q(100) = 9.4 cfs are routed through the above detention pond at design point J1.

Sub-basin OP-8 comprises of 1.01 acres of the future extension of Milam Road. Runoff from this sub-basin travels south to a proposed inlet. Flows of Q(5) = 3.4 cfs and Q(100) = 6.3 cfs are routed through future storm sewer through sub-basin PP-10.

Sub-basin OP-9 comprises of 1.06 acres of the future extension of Milam Road. Runoff from this sub-basin travels north to a proposed inlet. Flows of Q(5) = 3.4 cfs and Q(100) = 6.3 cfs are routed through future storm sewer through sub-basin PP-10.

Please note that the current HEC-HMS model shows OP-6, OP-7, OP-8, and OP-9 discharging into PP-1. The model was not updated for this MDDP level as the changes to these basins were discovered at the last revision and did not significantly affect the results. These four basins will need to be modified with the final drainage report for this area, along with the changes that will occur due to the updated lot layout.

Design point J1 collects runoff from sub-basins OP-6 through OP-9 and design point J2; an area totaling 204.82 acres. Runoff rates of Q(5) = 38.3 cfs and Q(100) = 245.7 cfs are routed through a 54" RCP to detention facility DF-7 at design point J21.

The sequential numbering of sub-basin OP-10 has been skipped.

Sub-basin PP-1 consists of 56.51 acres of single-family development and open space within the future filing of Cordera. At this time, a development plan has not been created for any of the Cordera developments north of the exiting CSU gas main; however, a preliminary concept plan has been created. Major sub-basin boundaries have been established based upon the preliminary concept plan and discharge points have been identified to properly size and locate the proposed storm sewer within the limits of Cordera Filing 3. This sub-basin generates runoff rates of Q(5) = 40.1 cfs and Q(100) = 134.3 cfs. To allow some flexibility in the development of the future Cordera filing and to protect the downstream storm sewer system, a detention pond shall be constructed within sub-basin PP-1 at design point J21.

From the HMS model shown in the Appendix, sub-basins PP-1 through PP-9, PP-11, and PP-12 have been combined to form sub-basin PP-1 shown on the Fully Developed Drainage Map. The sub-basins created within the HMS model are based upon a preliminary concept plan for the future Cordera development north of the existing CSU gas main.

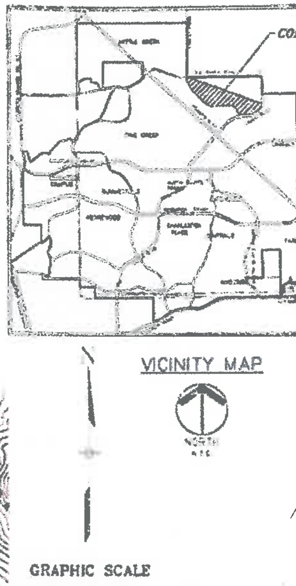
Design point J21 (design point P4 of the interim developed conditions) collects runoff from sub-basins OP-1, PP-1 and design point J1; an area totaling 273.61 acres. Runoff rates of Q(5) = 71.5 cfs and Q(100) = 363.9 cfs are collected by a future detention pond, referred to as Detention Facility DF-7, at this location. Detention Facility DF-7 discharges detained flowrates of Q(5) = 23.6 cfs and Q(100) = 236.0 cfs to a 54" RCP that will be extended from the Cordera Filing 3 area. Runoff from this design point is routed to design point J12. Further design considerations are discussed under part B, Detention and Water Quality, of Section IV.

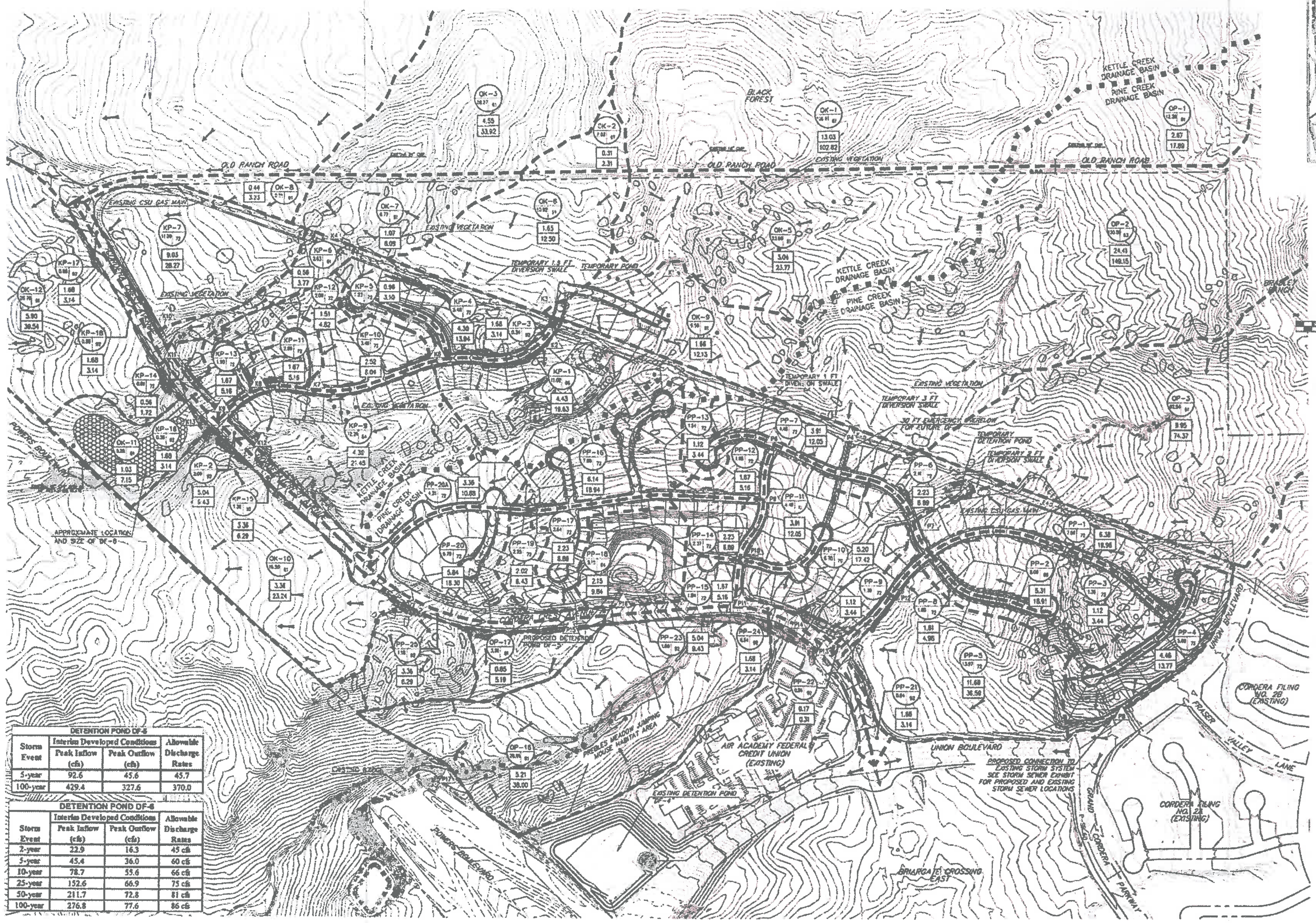
Sub-basin PP-10 encompasses 8.91 acres of single-family development within the future Cordera development north of the existing CSU gas main. From the HMS model, sub-basins PP-10 and PP-13 are combined to form sub-basin PP-10 shown on the Fully Developed Drainage Map. The 30" RCP within Cordera Filing 3 (sub-basin PP-15) will be extended to sub-basin PP-10 to collect flowrates of Q(5) = 6.4 cfs and Q(100) = 21.7 cfs. These flows are routed through the 30" RCP to design point J11.

Design point J3 (Design point P8 of the interim developed conditions) collects runoff from sub-basins PP-22 and PP-23 at rates of Q(5) = 5.6 cfs and Q(100) = 17.2 cfs and is routed through a proposed 24" RCP that connects to an existing 24" RCP within Union Boulevard. Flows from this pipe are routed to an existing detention pond located at the corner of Powers Boulevard and Briargate Parkway.

The sequential numbering of design points J4 through J10 have been skipped.

SHEET NO. 2





DETENTION POND OF-5

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

DETENTION POND DF-6

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

PINE CREEK SUMMARY TABLE

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

KETTLE CREEK SUMMARY TABLE

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

LEGEND

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

NO.	DATE	DESCRIPTION	BY

REVISIONS

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

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
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CORDERA FILING NO. 3

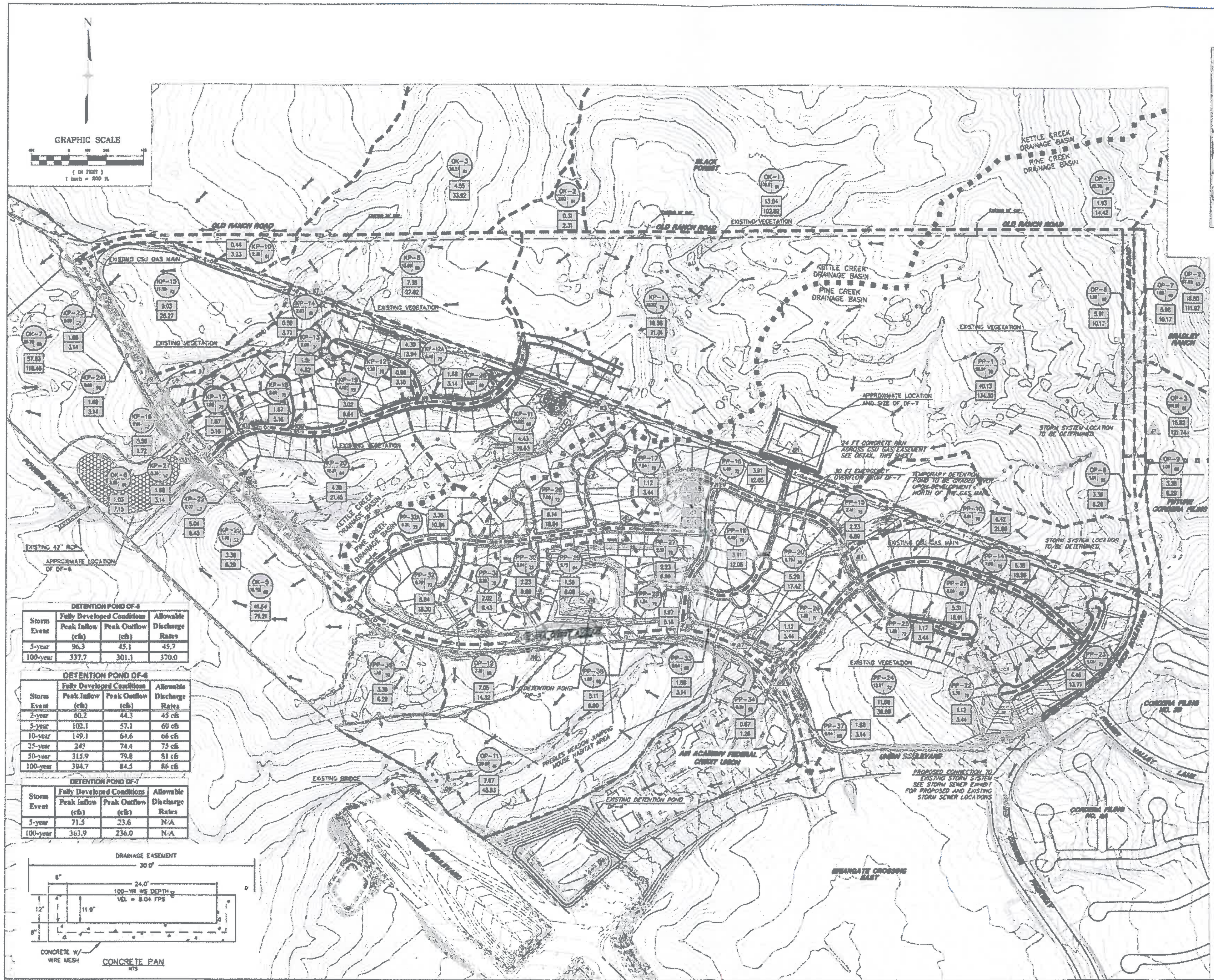
MASTER DEVELOPMENT DRAINAGE PLAN

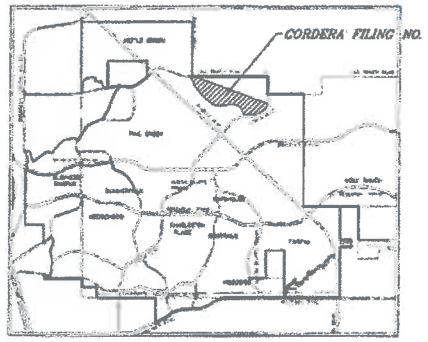
INTERIM DEVELOPED DRAINAGE MAP

DATE ISSUED AUGUST 2007

DP02

SHEET NO. 3





VICINITY MAP

NORTH

DETENTION POND DF-8

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

DETENTION POND DF-6

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

DETENTION POND DF-7

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

PINE CREEK SUMMARY TABLE

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

KETTLE CREEK SUMMARY TABLE

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

LEGEND

▬ ▬ ▬ ▬	SUB-BASIN BOUNDARY
- - 6200 - -	EXISTING CONTOUR
→	FLOW DIRECTION
━━━━	FLOODPLAIN WAY
—— - - ——	LOT LINE
△	DESIGN POINT
X	SUB BASIN DESIGNATION
	SUB BASIN CURVE NUMBER
	SUB BASIN AREA (AC.)
88	5-YEAR STORM EVENT PEAK FLOW (CFS)
88	100-YEAR STORM EVENT PEAK FLOW (CFS)

NO.	DATE	DESCRIPTION	BY

REVISIONS

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

FOR AND ON BEHALF OF
MATRIX DESIGN GROUP, INC.

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

CORDERA FILING NO. 3

MASTER DEVELOPMENT DRAINAGE PLAN

FULLY DEVELOPED DRAINAGE MAP

DP03

Amendment #1 to the
FINAL DRAINAGE REPORT
for
"Cordera Filing No. 3A"

&

Amendment #1 to the
MASTER DEVELOPMENT DRAINAGE PLAN
for
Cordera Filing No. 3

&

FINAL DRAINGE REPORT
for
"Cordera Filing No. 3F"

Pine Creek Drainage Basin

Prepared for:
City of Colorado Springs, Colorado
Engineering Division

On Behalf of:
High Valley Land Co., Inc.
1755 Telstar Drive, Suite 211
Colorado Springs, CO 80920

Prepared by:
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2435 Research Parkway, Suite 300
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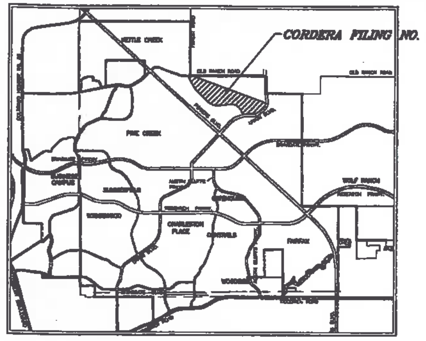
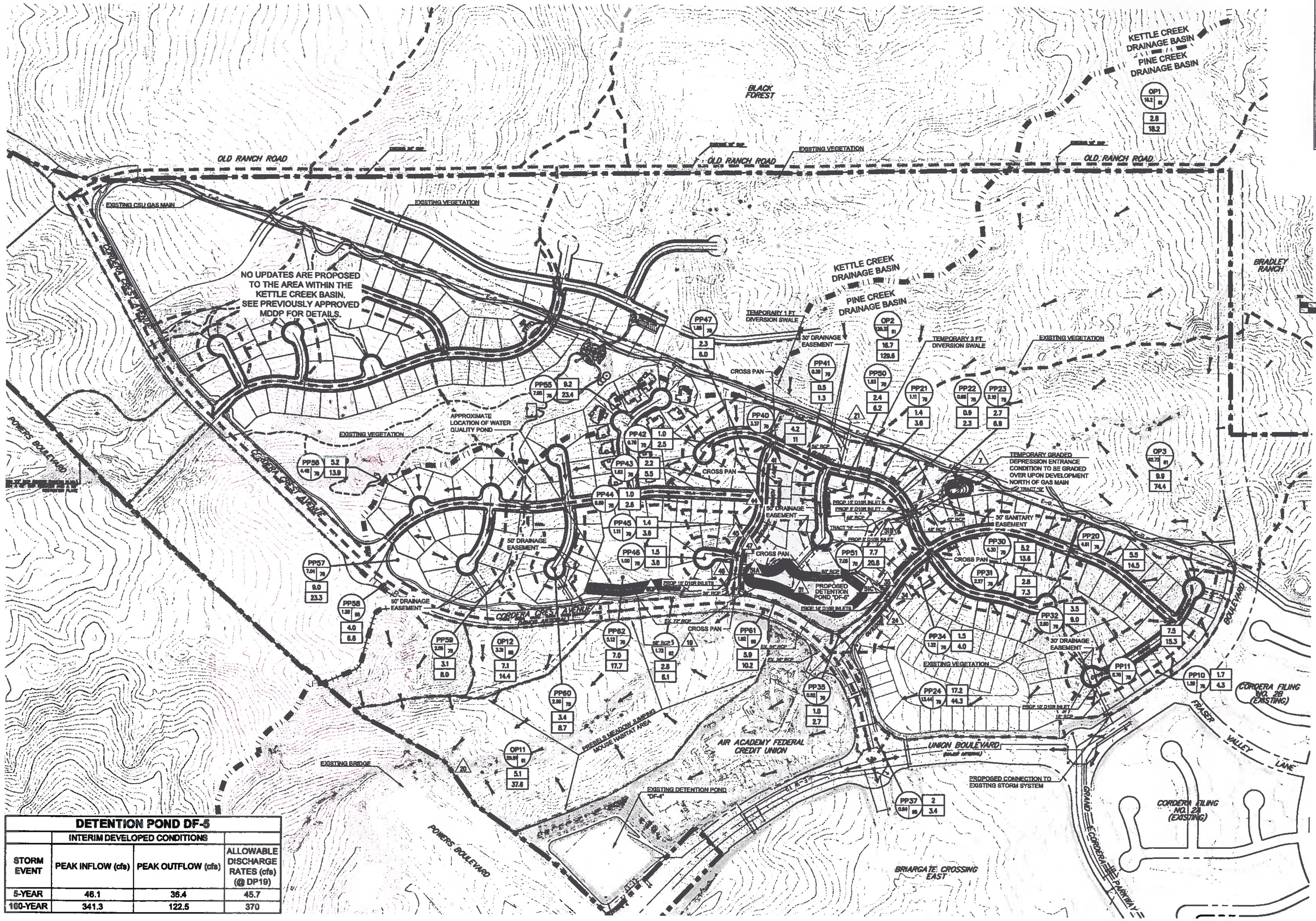
October 2013
13.104.137

SHEET NO. 2



VICINITY MAP

N.T.S.



PINE CREEK SUMMARY TABLE - INTERIM

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
J1-J6	(NOT USED)		
J7	9.9	74.3	OP3
J8-J18	(NOT USED)		
J19	37.6	169.7	JWQP, J51
J20	43.1	182.6	J19, OP11, OP12
J21	18.5	142.1	OP1, OP2
J22-J33	(NOT USED)		
J34	31.8	81.2	PP24, PP30, PP31, PP32, PP33, PP34, PP37
J35	33.4	84.9	PP35
J36-J45	(NOT USED)		
J46	7	17.9	PP42, PP43, PP44, PP45, PP46
J47	13.9	36.1	PP40, PP41, PP47
J48-J50	(NOT USED)		
J51	68.9	122.5	J51A, J51B, J51C,
J51A	13.9	36.1	J45, J46, J47
J51B	13.2	91.1	PP20, PP21, PP22, PP23, J7
J51C	33.4	84.9	J34, J35
JWQP	46.1	90.1	PP55, PP56, PP57, PP58, PP59, PP60, PP61, PP62

NOTES:

THIS PLAN IS AN UPDATE TO THE PREVIOUSLY APPROVED CORDERA FILING NO. 3 MDDP FULLY DEVELOPED PLAN. THE UPDATES ONLY APPLY TO THE PORTIONS OF THE FILING WITHIN THE PINE CREEK DRAINAGE BASIN SHOWN ON THIS PLAN. THE PORTIONS OF CORDERA FILING NO. 3 LOCATED WITHIN THE KETTLE CREEK BASIN ARE NOT UPDATED WITH THE APPROVAL OF THIS PLAN. REFER TO THE PREVIOUSLY APPROVED MDDP PLAN FOR THE KETTLE CREEK BASIN AREA.

EXCEPT SHOWN HEREON, ALL LOTS SHALL HAVE 5' SIDE YARD AND 7' REAR YARD UTILITY AND DRAINAGE EASEMENTS.

TRACTS "G" AND "H" ARE FOR DRAINAGE, UTILITY, AND LANDSCAPING PURPOSES AND WILL BE OWNED BY THE CITY OF COLORADO SPRINGS.

LEGEND

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

DETENTION POND DF-5

STORM EVENT	INTERIM DEVELOPED CONDITIONS		ALLOWABLE DISCHARGE RATES (cfs) (@ DP19)
	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)	
5-YEAR	46.1	36.4	45.7
100-YEAR	341.3	122.5	370

x-title-drainage
x-vege
x-baseF3
x-ex-topo
x-topo-union gcordera
x-util-union gc
x-utilF3
x-basins
x-topo
x-base
x-topoF2B
X-topoF2A
Proposed ponds 5 and WQP
X-Base F3-interim

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\Cordera Filing 3\DWG\DR02.dwg
PCP: Matrix.ctb
PLOT DATE: Oct 16, 2013 9:43am

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

THIS DOCUMENT IS SUBMITTED FOR YOUR REVIEW AND COMMENT. IT IS NOT INTENDED TO FULFILL ALL STANDARD CITY SUBMITTAL REQUIREMENTS. THE INTENT OF THE REVIEW IS TO FOCUS ON OVERALL INFRASTRUCTURE SYSTEMS, THEIR GENERAL CONFIGURATION AND COORDINATION.

SEAL

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

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

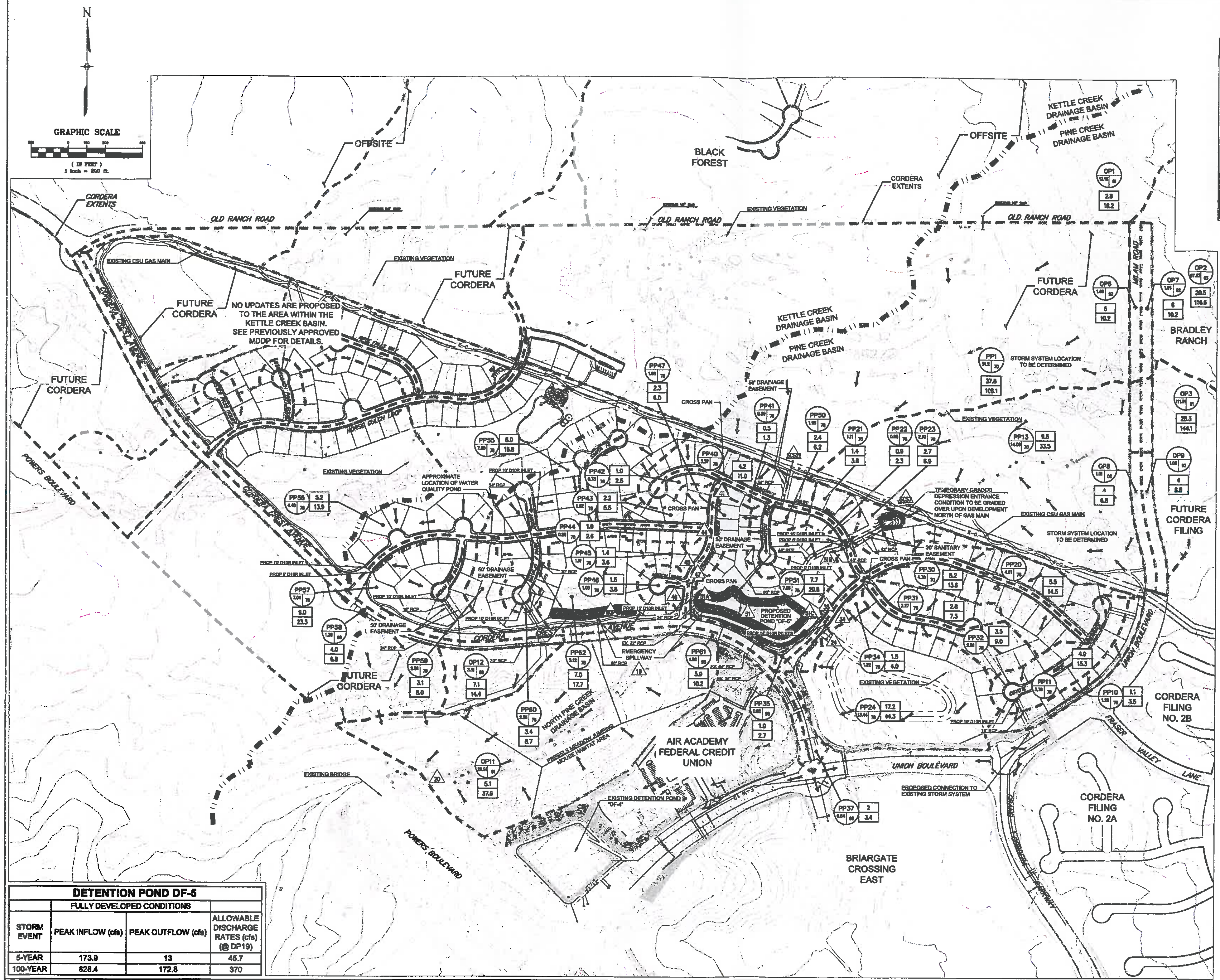
Matrix Design Group, Inc.
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

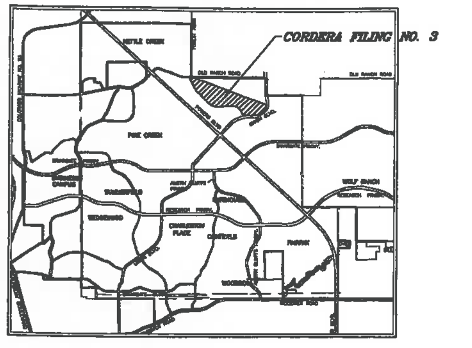
CORDERA FILING NO. 3

MASTER DEVELOPMENT DRAINAGE PLAN

AMMENDMENT #1
INTERIM DEVELOPED DRAINAGE MAP

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





VICINITY MAP

NORTH
N.T.S.

PINE CREEK SUMMARY TABLE - FULLY DEVELOPED

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
J1-J6	(NOT USED)		
J7	43.3	189	PP-13, OP3, OP8, OP9
J8-J18	(NOT USED)		
J19	40.3	247.1	JWQP, J51
J20	45.1	279.1	J19, OP11, OP12
J21	65.6	270.4	PP1, OP1, OP2, OP6, OP7
J22-J33	(NOT USED)		
J34	31.6	81.2	PP24, PP30, PP31, PP32, PP33, PP34, PP37
J35	33.4	84.9	PP35
J36-J45	(NOT USED)		
J46	7	17.9	PP42, PP43, PP44, PP45, PP46
J47	13.9	36.1	PP40, PP41, PP47
J48-J50	(NOT USED)		
J51	173.9	597.9	J51A, J51B, J51C,
J51A	13.9	36.1	J45, J46, J47
J51B	53.6	628.8	PP20, PP21, PP22, PP23, J7
J51C	33.4	84.9	J34, J35
JWQP	43	106.3	PP55, PP56, PP57, PP58, PP59, PP60, PP61, PP62

NOTE:

1. PP-13 SHOWN ON THIS PLAN IS A COMBINATION OFS PP13, PP13a, PP3 AS SHOWN IN THE MODEL SCHEMATIC.
2. PP-1 SHOWN ON THIS PLAN IS A COMBINATION OF PP1, PP2, PP4, PP5, PP6, PP7, PP8, PP9, PP11a, AND PP12 AS SHOWN IN THE MODEL SCHEMATIC.

NOTES:
THIS PLAN IS AN UPDATE TO THE PREVIOUSLY APPROVED CORDERA FILING NO. 3 MDDP FULLY DEVELOPED PLAN. THE UPDATES ONLY APPLY TO THE PORTIONS OF THE FILING WITHIN THE PINE CREEK DRAINAGE BASIN SHOWN ON THIS PLAN. THE PORTIONS OF CORDERA FILING NO. 3 LOCATED WITHIN THE KETTLE CREEK BASIN ARE NOT UPDATED WITH THE APPROVAL OF THIS PLAN. REFER TO THE PREVIOUSLY APPROVED MDDP PLAN FOR THE KETTLE CREEK BASIN AREA.

LEGEND

▬ ▬ ▬	SUB-BASIN BOUNDARY
	EXISTING CONTOUR
→	FLOW DIRECTION
	FLOODPLAIN WAY
	LOT LINE
△	DESIGN POINT
X	SUB BASIN DESIGNATION
	SUB BASIN CURVE NUMBER
	SUB BASIN AREA (AC.)
0.0	5-YEAR STORM EVENT PEAK FLOW (CFS)
0.0	100-YEAR STORM EVENT PEAK FLOW (CFS)
☐	CORDERA EXTENTS

DETENTION POND DF-5

	FULLY DEVELOPED CONDITIONS		
STORM EVENT	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)	ALLOWABLE DISCHARGE RATES (cfs) (@ DP19)
5-YEAR	173.9	13	45.7
100-YEAR	628.4	172.8	370

x-ex-topo
x-topoF2B
x-baseF3
x-utilF3
x-util-union gc
x-utilF2B
x-utilF2A
x-utilF2P1
X-topoF2A
x-topo-union gc
x-vege
x-basins
x-title-drainage
x-topo
x-base
Proposed ponds 5 and WQP

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\Cordero Filing 3\DWG\DR03-PP-Analysis.dwg
PCP: Matrix.ctb
PLOT DATE: Oct 16, 2013 9:48am

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

THIS DOCUMENT IS SUBMITTED FOR YOUR REVIEW AND COMMENT. IT IS NOT INTENDED TO FULFILL ALL STANDARD CITY SUBMITTAL REQUIREMENTS. THE INTENT OF THE REVIEW IS TO FOCUS ON OVERALL INFRASTRUCTURE SYSTEMS, THEIR GENERAL CONFIGURATION AND COORDINATION.

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

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

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

CORDERA FILING NO. 3
MASTER DEVELOPMENT DRAINAGE PLAN
AMMENDMENT #1
FULLY DEVELOPED DRAINAGE MAP

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

Rich,

We do need to get the fee issue resolved. so that the DBPS can be updated & the MDDP approved. Has Nor'wood decided how they want to proceed? Do they want me to set up a meeting with Dave L. & Cam?

Does the Stormwater Enterprise have any impact on how they want to proceed?

Master Development Drainage Plan
Wolf Ranch Development

City of Colorado Springs, Colorado

Prepared For:

Nor'wood Development Group
4065 Sinton Road Suite 200
Colorado Springs, CO 80907

Prepared By:

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904

Project Number 03094
July 2004
Revised November 2004
Revised February 15, 2005

DKm
1/16/06

As shown on Figure 4 the "A" basins discharge to an existing concrete box culvert under Powers Boulevard. The sub-watershed drains a total of .42 square miles at its outfall point along the west boundary of the development. Slopes along the major drainageway range from 3 to 5 percent. Soils are entirely hydrologic soil group B. There is a portion of sub-basin A-1 that lies offsite from Wolf Ranch. The offsite portion of sub-basin A-1 is presently developed into large rural lots ranging in size from 5 to 40 acres. The watershed is well vegetated with native grasses. A small portion of sub-basin A-1 is forested.

The "B" basins discharge to an existing 54-inch reinforced concrete storm sewer that is within Research Parkway west of Powers Boulevard. The sub-watershed drains a total of .15 square miles at its outfall point at Powers Boulevard. Slopes along the major drainageway range from 2 to 5 percent. Soils are entirely hydrologic soil group B. Sub-watershed B lies entirely within Wolf Ranch. The watershed is well vegetated with native grasses.

The "C" basins discharge to an existing 72-inch reinforced concrete storm sewer that is under Powers Boulevard near the southwest corner of the property. The sub-watershed drains a total of .25 square miles at its outfall point at Powers Boulevard. Slopes along the major drainageway range from 2 to 5 percent. Soils are predominantly hydrologic soil group B however a small portion of type A soil exists within sub-basin C-1. Sub-watershed C lies entirely within Wolf Ranch. Most of sub-basin C-2 lies within the Westcreek subdivision Filings 1 through 3. The watershed is well vegetated with native grasses.

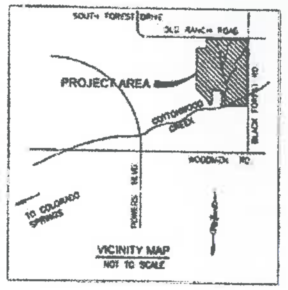
The "D" basins discharge to Cottonwood Creek within an offsite property just upstream of Powers Boulevard. The sub-watershed drains a total of .36 square miles at its outfall point at Cottonwood Creek. Slopes along the major drainageway range from 2 to 5 percent. Soils are predominantly hydrologic soil group B. Sub-watershed D lies mostly within Wolf Ranch however sub-basin D-3 lies within the Goetsch property that lies south of Wolf Ranch. The watershed is well vegetated with native grasses. The major drainageway within sub-basin D-3 is stable and has no improvements such as grade controls or bank lining. The drainageway is poorly defined where it enters Cottonwood Creek.

The "E" basins discharge to the Cottonwood Creek drainageway through an offsite property just upstream of Powers Boulevard. The sub-watershed drains a total of .32 square miles at its outfall point at Cottonwood Creek. Slopes along the major drainageway range from 2 to 5 percent. Soils are entirely hydrologic soil group B.

SUB-BASIN DISCHARGES SUMMARY			
SUB-BASIN	AREA	Q_5 (cfs)	Q_{100} (cfs)
A-1	0.1819	7	85
A-2	0.1098	5	59
A-3	0.1318	12	142
B-1	0.1505	5	55
C-1	0.1300	5	58
C-2	0.0990	4	41
D-1	0.1503	5	60
D-2	0.1660	7	75
D-3	0.0450	4	36
E-1	0.1640	6	66
E-2	0.1520	6	61
F-1	0.1659	10	110
F-2	0.0424	3	29
F-3	0.0942	5	59
F-4	0.2681	13	147
F-5	0.1073	5	52
F-6	0.0310	2	21
F-7	0.0782	5	54

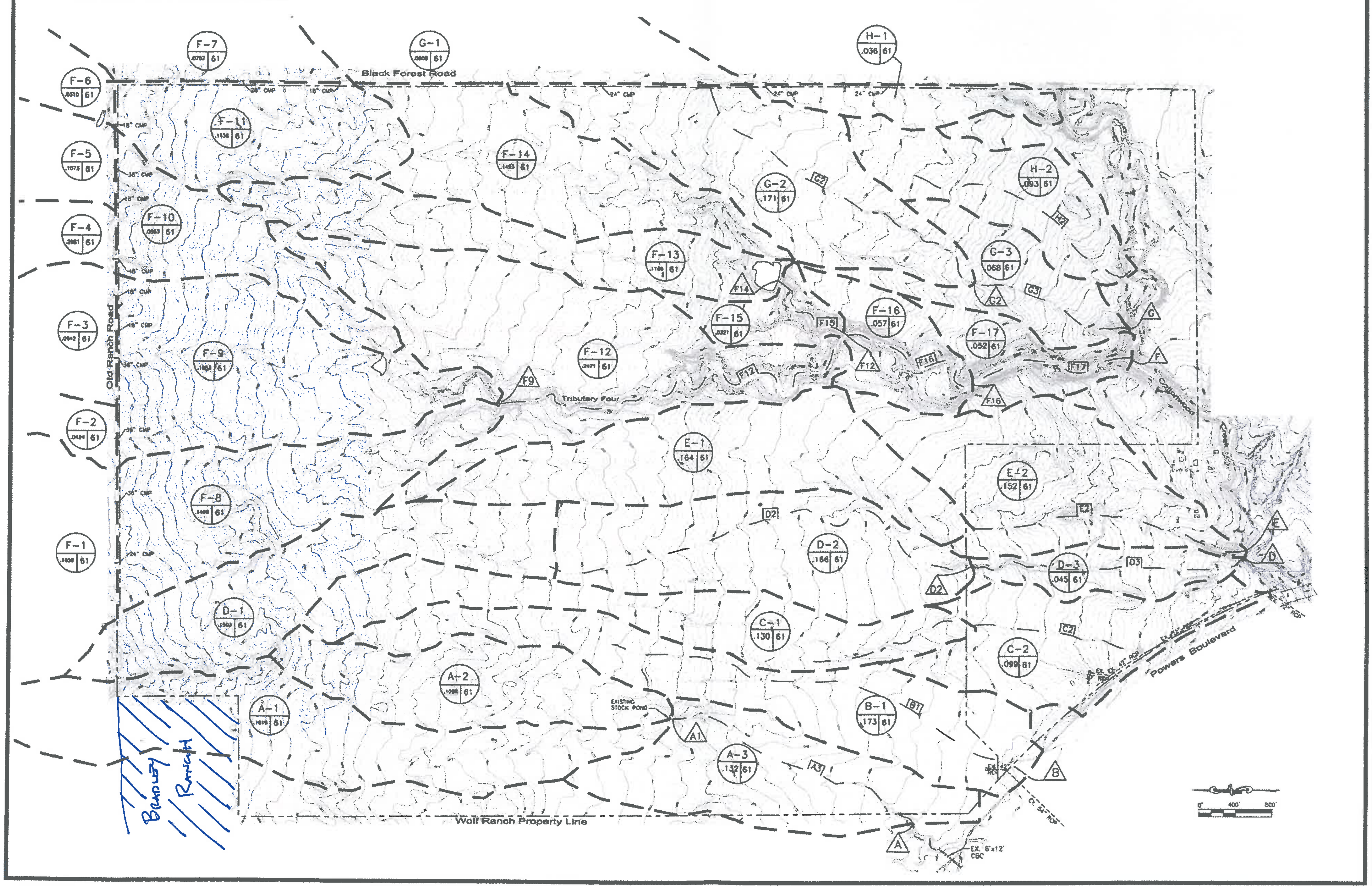
SUB-BASIN DISCHARGES SUMMARY (Con't)			
SUB-BASIN	AREA	Q_5 (cfs)	Q_{100} (cfs)
F-8	0.1499	9	93
F-9	0.1953	10	111
F-10	0.0883	4	49
F-11	0.1136	8	86
F-12	0.2471	11	123
F-13	0.1169	4	47
F-14	0.1493	7	77
F-15	0.0321	3	27
F-16	0.0570	5	53
F-17	0.0520	41	24
G-1	0.0808	5	50
G-2	0.1710	8	87
G-3	0.0680	2	27
H-1	0.0370	5	41
H-2	0.0930	3	36

DESIGN POINT DISCHARGES SUMMARY			
BASIN	AREA	Q_5 (cfs)	Q_{100} (cfs)
A	0.4235	11	157
A1	0.4235	12	42
B	0.1505	5	55
C	0.2510	8	94
D	0.3610	10	107
D2	0.3216	10	103
E	0.3200	11	124
F	1.9900	49	661
F9	1.1100	49	570
F12	1.8800	55	664
F14	0.4900	20	244
F15	0.5200	3	31
F16	1.9400	49	850
G	0.3200	13	155
G2	0.2500	11	130
H	0.0356	28	39



VICINITY MAP
NOT TO SCALE

LEGEND	
G4 / .07 / 61	BASIN NUMBER BASIN AREA/CN-VALUE (SM)
△ 1	DESIGN POINT
— — — —	DRAINAGE BASIN BOUNDARY
C13	CONVEYANCE ELEMENT/ HYDRAULIC STRUCTURE



Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING CONDITION HYDROLOGIC SUB-BASIN MAP
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 05/20/04
Design: RNW
Drawn: MHH
Check: RNW
Revisions:

Fig. 4

DESIGN POINT DISCHARGE SUMMARY w/DETENTION

DESIGN POINT	AREA(sm)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.06	3	32
A3	0.38	127	458
A4	0.17	80	267
A5 (IN)	0.72	274	938
A5 (OUT)	0.72	36	137
A6	0.54	226	724
A7	0.13	83	238
A	0.73	39	145
A9	0.07	29	98
B	0.34	60	122
C3	0.05	33	100
C	0.16	104	314
D2 (IN)	0.10	49	160
D2 (OUT)	0.10	5	54
E5	0.13	85	241
E2 (IN)	0.18	116	336
E2 (OUT)	0.18	8	97

DESIGN POINT DISCHARGE SUMMARY w/DETENTION

DESIGN POINT	AREA(sm)	Q_5 (cfs)	Q_{100} (cfs)
F9	0.21	20	157
F10	0.06	6	48
F11	0.14	13	102
F12	0.43	24	236
F13	0.05	2	30
F14	0.25	45	210
F18 (IN)	0.80	72	572
F18 (OUT)	0.80	29	147
F19 (IN)	0.37	61	349
F19 (OUT)	0.37	21	91
F23	0.05	16	69
F24	0.14	55	203
F25	0.34	67	306
F27	1.29	55	254
F30	0.50	124	515
F28 (IN)	2.07	210	903
F28 (OUT)	2.07	101	554
F	2.14	102	565

DESIGN POINT DISCHARGE SUMMARY w/DETENTION

DESIGN POINT	AREA(sm)	Q_5 (cfs)	Q_{100} (cfs)
G3	0.29	57	278
G (IN)	0.45	57	278
G (OUT)	0.45	34	111

DETENTION BASIN E/D DATA

Q_5 IN = 165 cfs
Q_5 OUT = 13 cfs
VOL_5 = 5.9 AC-FT
VOL_{100} = 14.8 AC-FT
WS_5 = 55.2
WS_{100} = 57.8
Q_{100} IN = 498 cfs
Q_{100} OUT = 151 cfs (1)

(1) TOTAL OUTFLOW OUTFLOW TO BE CONTROLLED TO EXISTING LEVELS AT DP E2 & DP D2

DETENTION BASIN DB18 DATA

Q_5 IN = 72 cfs
Q_5 OUT = 29 cfs
VOL_5 = 2.5 AC-FT
VOL_{100} = 12.0 AC-FT
WS_5 = 7142.8
WS_{100} = 7146.9
Q_{100} IN = 572 cfs
Q_{100} OUT = 147 cfs

DETENTION BASIN DB19 DATA

Q_5 IN = 61 cfs
Q_5 OUT = 21 cfs
VOL_5 = 1.7 AC-FT
VOL_{100} = 8.5 AC-FT
WS_5 = 7142.5
WS_{100} = 7145.6
Q_{100} IN = 349 cfs
Q_{100} OUT = 91 cfs

DETENTION BASIN DB28 DATA

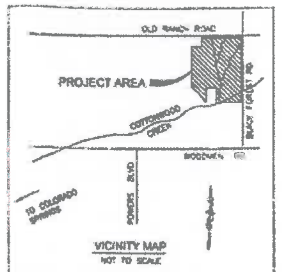
Q_5 IN = 210 cfs
Q_5 OUT = 101 cfs
VOL_5 = 6.2 AC-FT
VOL_{100} = 23.9 AC-FT
WS_5 = 6966.0
WS_{100} = 6972.8
Q_{100} IN = 903 cfs
Q_{100} OUT = 554 cfs

DETENTION BASIN A DATA

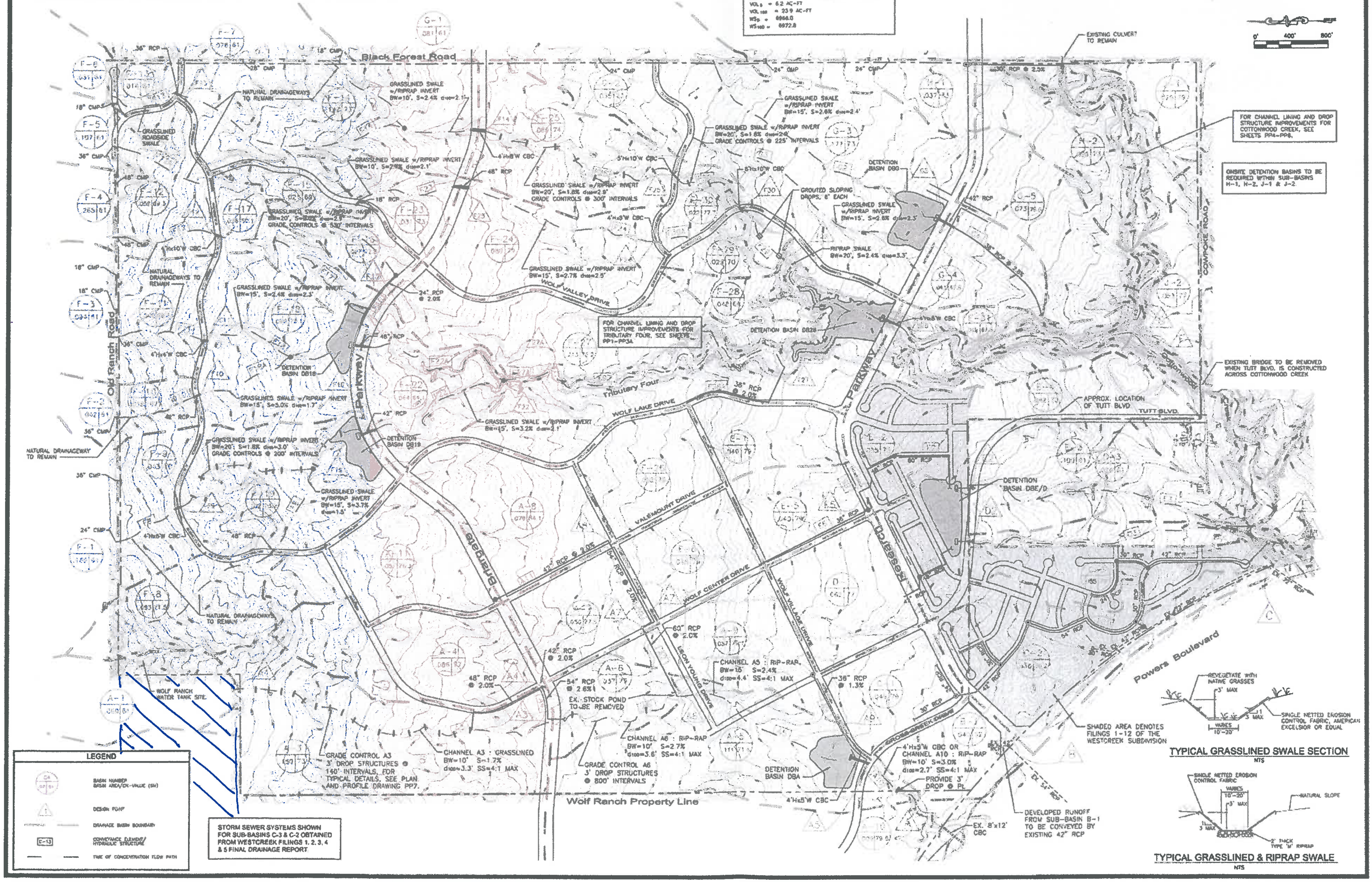
Q_5 IN = 273 cfs
Q_5 OUT = 36 cfs
VOL_5 = 10.8 AC-FT
VOL_{100} = 36.0 AC-FT
WS_5 = 4.1
WS_{100} = 7.1
Q_{100} IN = 936 cfs
Q_{100} OUT = 137 cfs

DETENTION BASIN G DATA

Q_5 IN = 57 cfs
Q_5 OUT = 34 cfs
VOL_5 = 4.2 AC-FT
VOL_{100} = 7.0 AC-FT
WS_5 = 4.1
WS_{100} = 7.0
Q_{100} IN = 278 cfs
Q_{100} OUT = 111 cfs



VICINITY MAP
NOT TO SCALE



TYPICAL GRASSLINED SWALE SECTION
NTS

TYPICAL GRASSLINED & RIPRAP SWALE
NTS

LEGEND

C4	BASIN NUMBER BASIN AREA/CN-VALUE (SM)
△	DESIGN POINT
— — —	DRAINAGE BASIN BOUNDARY
C-13	CONVEYANCE ELEMENT/ HYDRAULIC STRUCTURE
— —	TIME OF CONCENTRATION FLOW PATH

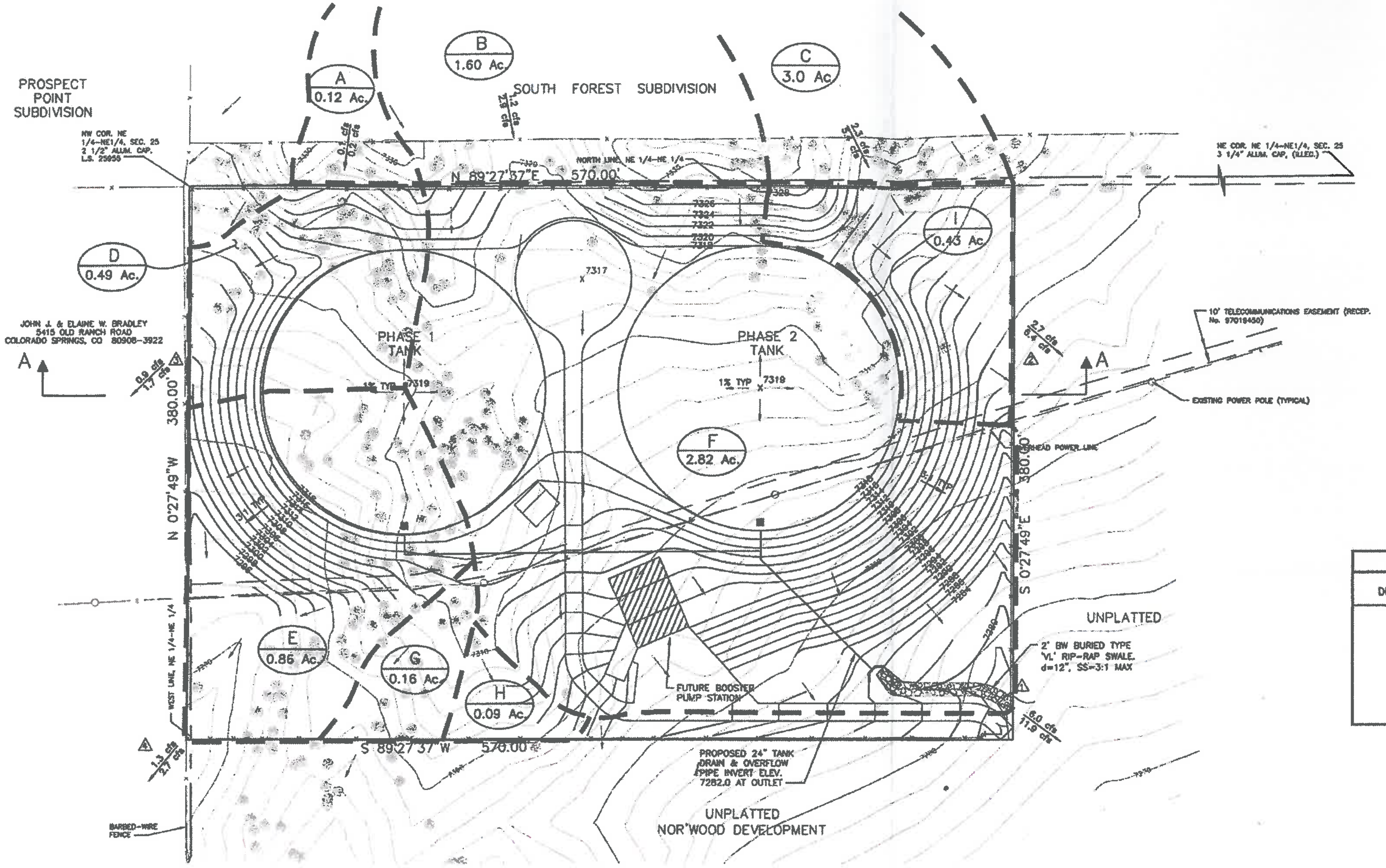
STORM SEWER SYSTEMS SHOWN FOR SUB-BASINS C-3 & C-2 OBTAINED FROM WESTCREEK FILINGS 1, 2, 3, 4 & 5 FINAL DRAINAGE REPORT

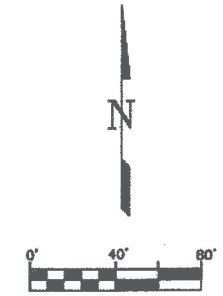
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
PROPOSED FACILITIES
COLORADO SPRINGS, COLORADO

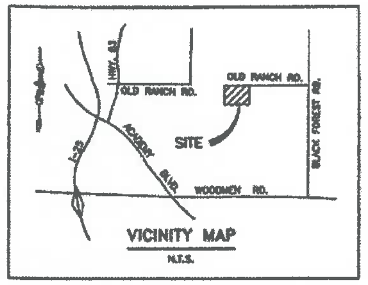
Project No.: 03094
Date: 03/09/2004
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

Fig. 6



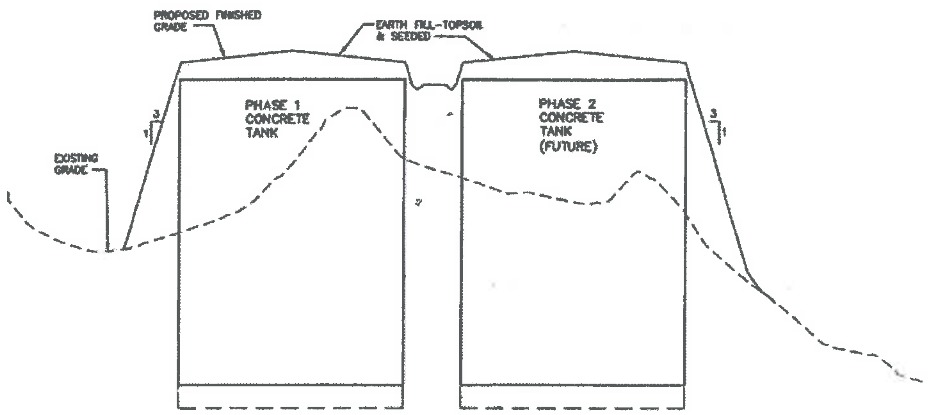


SCALE: 1" = 40'



VICINITY MAP
N.T.S.

DESIGN POINT DISCHARGES (cfs)		
DESIGN POINT	Q_5	Q_{100}
△1	6.0	11.9
△2	2.7	6.4
△3	0.9	1.7
△4	1.3	2.7



SECTION A-A
SCALE N.T.S.

SUB-BASIN DISCHARGES (cfs)		
DESIGN POINT	Q_5	Q_{100}
A	0.1	0.2
B	1.2	2.9
C	2.3	5.4
D	0.8	1.5
E	1.3	2.7
F	5.9	11.7
G	0.2	0.4
H	0.1	0.2
I	0.4	1.0

LEGEND

R	SUB-BASIN DESIGNATION
10.24 ac	SUB-BASIN AREA
3.8 cfs 6.3 cfs	5-YEAR RUNOFF 100-YEAR RUNOFF
△1	DESIGN POINT
— — —	DRAINAGE BASIN BOUNDARY
←	FLOW DIRECTION
①	HYDRAULIC STRUCTURE IDENTIFIER
[1]	PIPE IDENTIFIER

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904 - 4208
(719) 630-7342

WOLF RANCH TANK SITE
PROPOSED HYDROLOGY
FINAL DRAINAGE REPORT
COLORADO SPRINGS, COLORADO

Project No.: 04036
Date: 04/30/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

Fig. 2

04036 Fig2.dwg/May 18, 2004

FINAL DRAINAGE REPORT
for
"Cordera Filing No. 2A"
&
MASTER DEVELOPMENT DRAINAGE PLAN
for
"Cordera Filings 2A-2D"

Pine Creek Drainage Basin

Prepared for:
City of Colorado Springs, Colorado
Engineering Division

On Behalf of:
LP47, LLC dba La Plata Investments
2315 Briargate Parkway, Suite 100
Colorado Springs, CO 80920

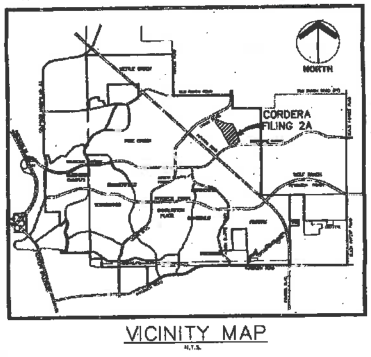
Prepared by:

Matrix Design Group, Inc.
Integrated Design Solutions
Infrastructure Engineering
Community Development
Program Management

2925 Professional Place, Suite 202
Colorado Springs, CO 80904
(719) 575-0100
fax (719) 572-0208

November 2005
Revised, April 2006

04.104.022



VICINITY MAP

N.T.S.

LEGEND

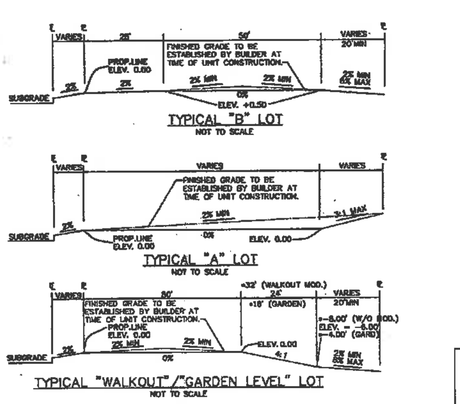
- PROPOSED CONTOUR
- EXISTING CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- DRAINAGE DITCH
- PROPOSED TYPE 'R' INLET
- PROPOSED TYPE I OR II MANHOLE
- PROPOSED FLOW DIRECTION ARROW
- DESIGN POINT
- 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- BASIN DESIGNATION
- "C" COEFFICIENT (100 YR)
- BASIN AREA (ACRES)
- FILING LIMITS
- DRAINAGE BASIN BOUNDARY

PINE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
P1	4.6	18.1	PF1A, PF1B
P2	5.1	21.0	PF1C, PF1D
P3	15.9	62.5	P1, P2, PF1E, PF2C
P4	54.9	211.2	P3, P8, PF2A, PF2B, PF7A, PF8B
P5	6.9	29.1	PF6B, PF6C
P6	9.6	40.6	P5, PF6A
P7	14.7	61.9	P6, PF7C, PF8D
P8	24.7	101.2	P7, PF7B, PF7D, PF8E, PF8G
P10	64.2	243.8	P4, P8, PF8A, PF8C, PF8F
P11	71.4	269.8	P10, PF9C
P12	77.7	291.3	P11, PF9A, PF9B
P13	50.4	133.2	PF3A, PF3B, PF3C, PF3D
P14	128.8	448.1	P12, P13, PF4A, PF4B, PF4C

COTTONWOOD CREEK SUMMARY TABLE

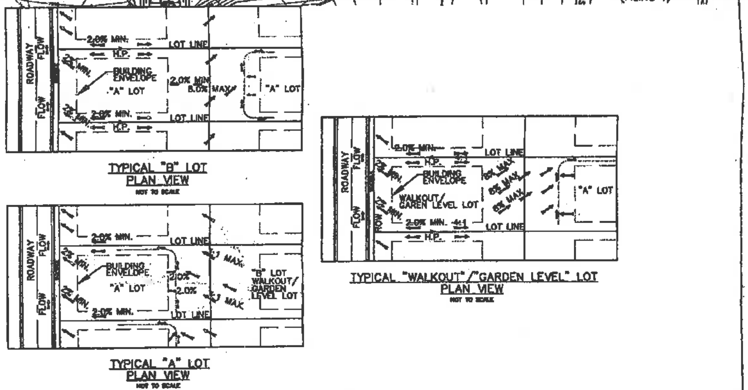
DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
C1	7.6	25.6	CF1E, CF1D
C2	20.6	69.9	C1, CF1A, CF1B, CF1C



TYPICAL "B" LOT
NOT TO SCALE

TYPICAL "A" LOT
NOT TO SCALE

TYPICAL "WALKOUT"/"GARDEN LEVEL" LOT
NOT TO SCALE



TYPICAL "B" LOT
PLAN VIEW
NOT TO SCALE

TYPICAL "A" LOT
PLAN VIEW
NOT TO SCALE

TYPICAL "WALKOUT"/"GARDEN LEVEL" LOT
PLAN VIEW
NOT TO SCALE

Matrix Design Group, Inc.
Integrated Design Solutions 2925 Professional Place, Suite 202
Colorado Springs, CO 80904
Phone 719-575-0100
Fax 719-575-0208

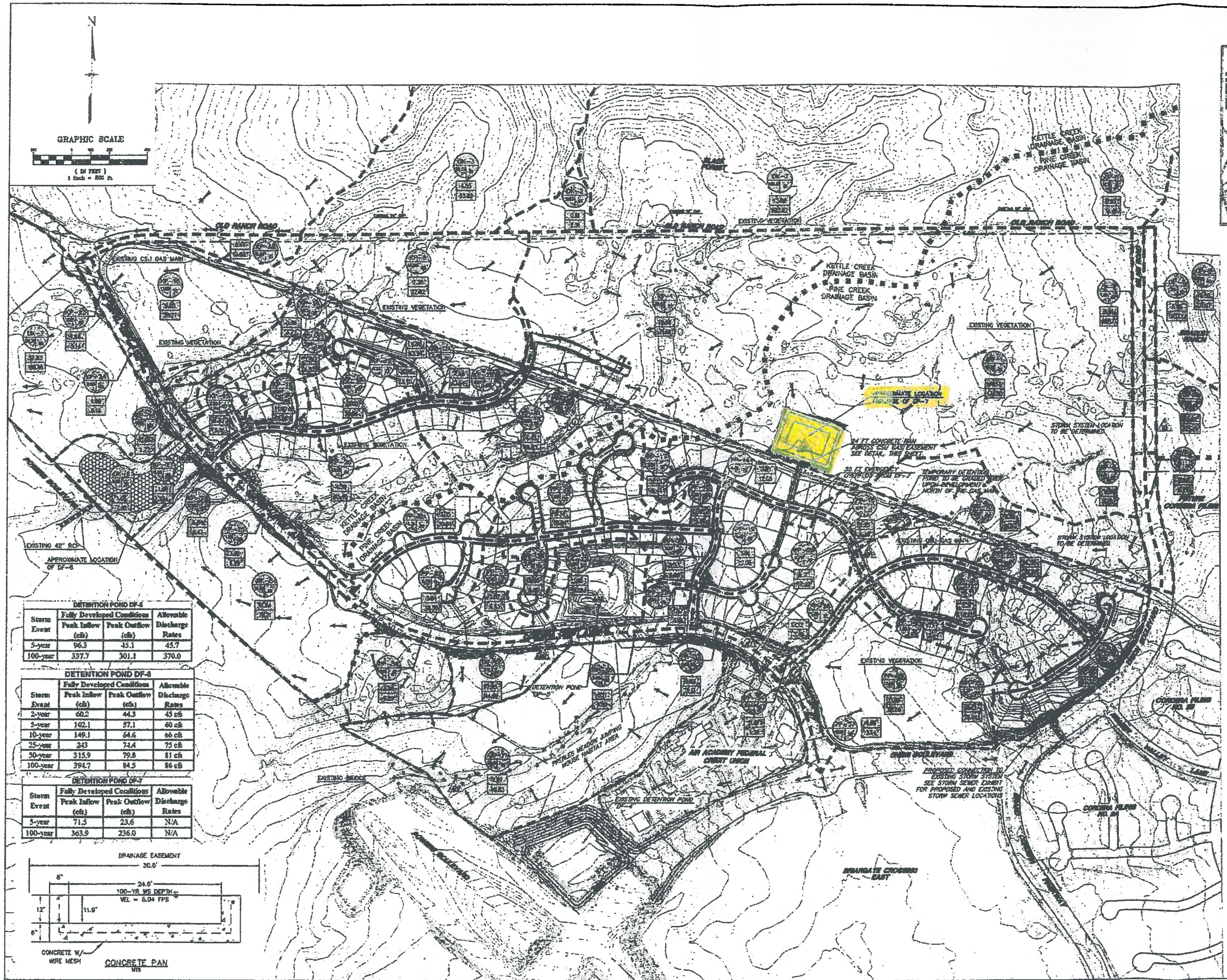
CORDERA FILING NO. 2A

DRAINAGE REPORT

FULLY DEVELOPED DRAINAGE MAP
FILING NO. 2 INFRASTRUCTURE

DESIGNED BY:	RGG	SCALE		DATE ISSUED: NOVEMBER 2003	SHT DP02
DRAWN BY:	BPK	HORIZ:	1"=100'	SHEET NO. 2 OF 3 SHEETS	
CHECKED BY:		VERT:	N/A		

SHEET NO. 3



DETENTION POND DF-5

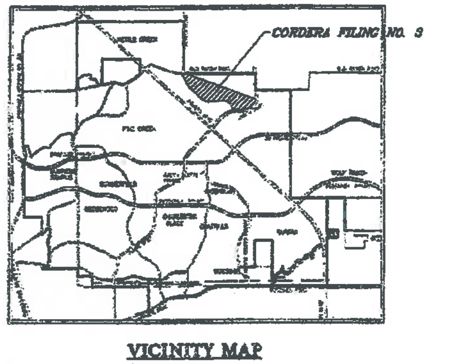
Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
5-year	96.3	45.1	45.7
100-year	337.7	301.1	370.0

DETENTION POND DF-8

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

DETENTION POND DF-7

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



VICINITY MAP

NORTH
NTS

PINE CREEK SUMMARY TABLE

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

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
K1	(NOT USED)		
K2	(NOT USED)		
K3	22.84	152.01	KP1, OK1, OK2
K4	(NOT USED)		
K5	6.16	37.43	KP11, KP20
K6	(NOT USED)		
K7	9.91	58.27	KP8, OK3
K8	15.44	89.82	KP10, KP13, KP14, KP15, K7
K9	27.51	166.15	KP12, KP12A, KP25, K3
K10	29.91	172.76	KP19, K9
K11	30.89	175.16	KP18, K10
K12	39.48	215.68	KP17, KP22, K5, K11
K13	50.56	315.99	K12, K15
K14	(NOT USED)		
K15	22.04	101.78	KP16, KP23, KP24, KP26, KP27, K8

LEGEND

▬ ▬ ▬ ▬	SUB-BASIN BOUNDARY
– – –	EXISTING CONTOUR
→	FLOW DIRECTION
———	FLOODPLAIN WAY
– – – –	LOT LINE
△	DESIGN POINT
◯	SUB BASIN DESIGNATION
	SUB BASIN CURVE NUMBER
	SUB BASIN AREA (AC.)
☐	5-YEAR STORM EVENT PEAK FLOW (CFS)
☐	100-YEAR STORM EVENT PEAK FLOW (CFS)

NO.	DATE	DESCRIPTION	BY

REVISIONS

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

FOR AND ON BEHALF OF
MATRIX DESIGN GROUP, INC.

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

CORDERA FILING NO. 3

MASTER DEVELOPMENT DRAINAGE PLAN

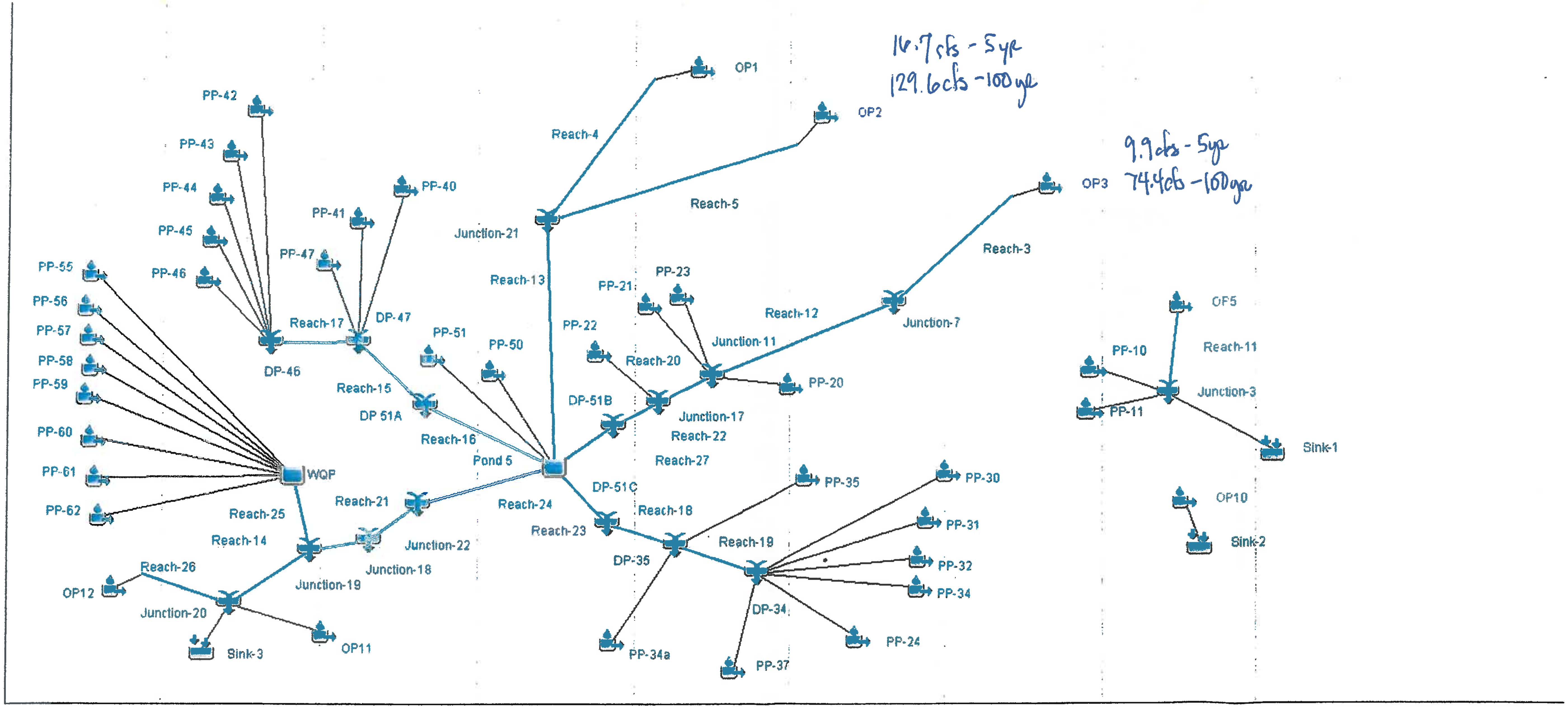
FULLY DEVELOPED DRAINAGE MAP

DP03

Interim Condition - HMS input/Hydrologic Results

Basin Name	Area (mi^2)	Area (acres)	Lag Time	% Impervious	Weighted CN	5-yr Peak (cfs)	100-yr Peak (cfs)
OP1	0.0190	12.16	6.6	0	61	2.8	18.2
OP10	0.0050	3.20	3.9	95	98	9.9	16.9
OP11	0.0470	30.08	10.2	0	61	5.1	37.6
OP12	0.0050	3.20	5.7	72	88	7.1	14.4
OP2	0.1880	120.32	6.3	5	61	16.7	129.6
OP3	0.0980	62.72	5.5	0	61	9.9	74.4
OP5	0.0320	20.48	8.9	0	61	3.8	27.3
PP-10	0.0020	1.28	5.7	25	78	1.7	4.3
PP-11	0.0090	5.76	6.4	25	78	7.5	19.1
PP-20	0.0072	4.61	8.22	25	78	5.5	14.5
PP-21	0.0017	1.11	7.56	25	78	1.4	3.6
PP-22	0.0011	0.68	6.24	25	78	0.9	2.3
PP-23	0.0033	2.09	6.42	25	78	2.7	6.9
PP-24	0.0210	13.44	6.7	25	78	17.2	44.3
PP-30	0.0067	4.30	8.1	25	78	5.2	13.6
PP-31	0.0035	2.27	7.44	25	78	2.8	7.3
PP-32	0.0044	2.80	7.44	25	78	3.5	9
PP-34	0.0019	1.22	6.96	55	78	1.5	4
PP-34a	0.0004	0.26	2.7	85	98	0.8	1.4
PP-35	0.0013	0.82	7.38	55	78	1	2.7
PP-37	0.0010	0.64	3.1	85	98	2	3.4
PP-40	0.0053	3.37	7.2	25	78	4.2	11
PP-41	0.0006	0.39	7.26	25	78	0.5	1.3
PP-42	0.0012	0.77	7.14	25	78	1	2.5
PP-43	0.0025	1.62	5.64	25	78	2.2	5.5
PP-44	0.0013	0.80	7.26	25	78	1	2.6
PP-45	0.0017	1.11	7.2	25	78	1.4	3.6
PP-46	0.0018	1.16	7.14	25	78	1.5	3.8
PP-47	0.0029	1.88	8.1	25	78	2.3	6
PP-50	0.0030	1.93	7.86	25	78	2.4	6.2
PP-51	0.0110	7.06	10.56	25	78	7.7	20.8
PP-55	0.0110	7.04	6.3	25	78	9.2	23.4
PP-56	0.0070	4.48	8.9	25	78	5.2	13.9
PP-57	0.0110	7.04	6.6	25	78	9	23.3
PP-58	0.0020	1.28	5	85	98	4	6.8
PP-59	0.0040	2.56	8.4	25	78	3.1	8
PP-60	0.0040	2.56	5.7	25	78	3.4	8.7
PP-61	0.0030	1.92	5	85	98	5.9	10.2
PP-62	0.0080	5.12	5	25	78	7	17.7

INTERIM CONDITIONS HMS MODEL



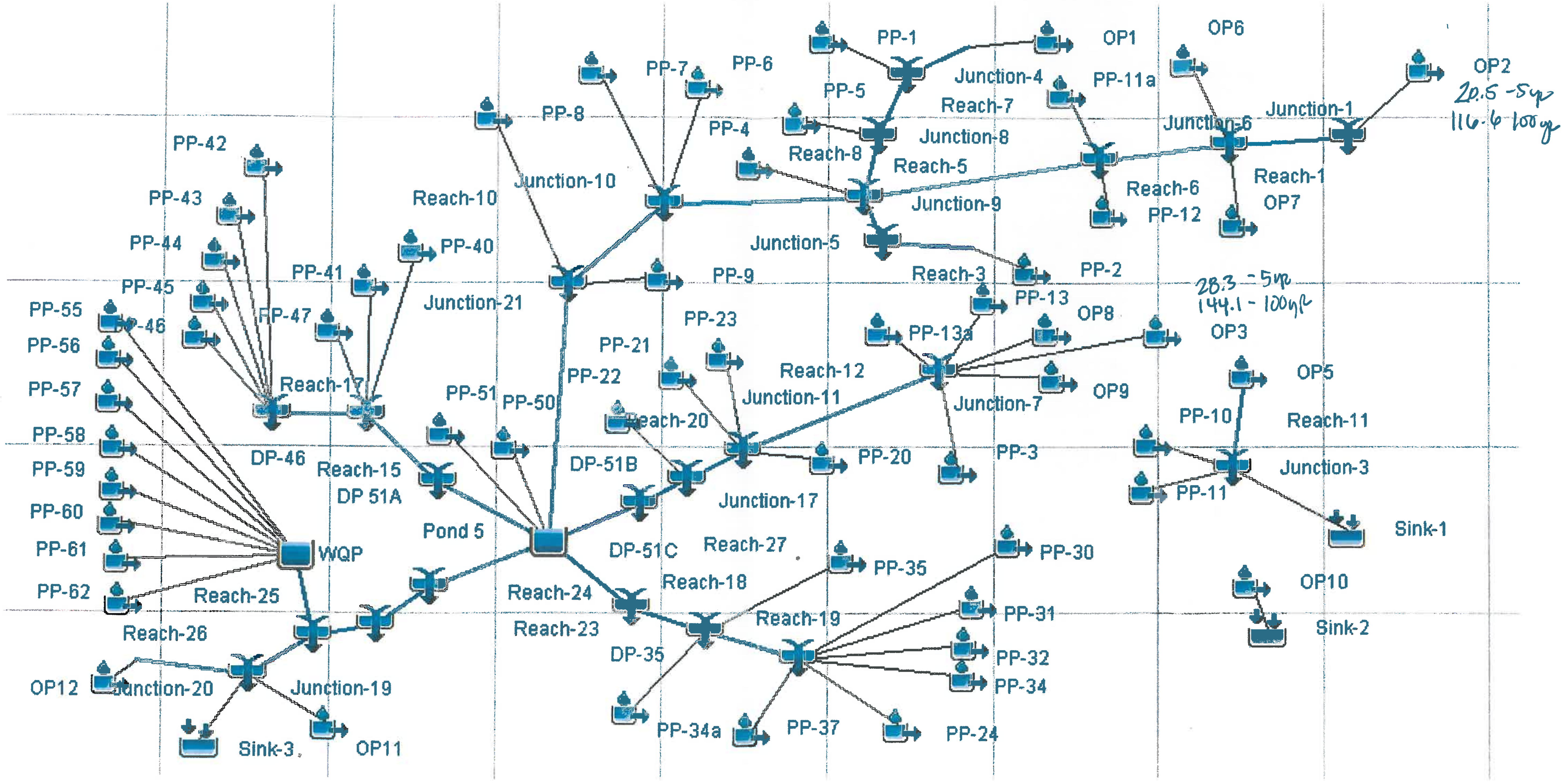
16.7 cfs - 5 yr
129.6 cfs - 100 yr

9.9 cfs - 5 yr
74.4 cfs - 100 yr

Fully Developed Condition - HMS input/Hydrologic Results

Basin Name	Area (mi^2)	Area (acres)	Lag Time	% Impervious	Weighted CN	5-yr Peak (cfs)	100-yr Peak (cfs)
OP1	0.0190	12.16	6.6	0	61	2.8	18.2
OP10	0.0050	3.20	3.9	95	98	9.9	16.9
OP11	0.0470	30.08	10.2	0	61	5.1	37.6
OP12	0.0050	3.20	5.7	72	88	7.1	14.4
OP2	0.1200	76.80	6.3	5	61	20.5	116.6
OP3	0.1420	90.88	5.5	0	61	28.3	144.1
OP5	0.0320	20.48	8.9	0	61	3.8	27.3
OP6	0.0030	1.92	3.4	85	98	6	10.2
OP7	0.0030	1.92	3.4	85	98	6	10.2
OP8	0.0020	1.28	3	85	98	4	6.8
OP9	0.0020	1.28	3	85	98	4	6.8
PP-1	0.0120	7.68	8.5	20	68	4	15.7
PP-10	0.0020	1.28	5.7	25	78	1.1	3.5
PP-11	0.0090	5.76	6.4	25	78	4.9	15.3
PP-11a	0.0020	1.28	3.2	20	98	4	6.8
PP-12	0.0110	7.04	6.1	20	70	5.2	17.4
PP-13	0.0080	5.12	6.5	20	70	3.7	12.4
PP-13a	0.0060	3.84	5.7	20	70	2.9	9.6
PP-2	0.0070	4.48	8.5	20	68	2.4	9.1
PP-20	0.0072	4.61	8.22	25	78	5.5	14.5
PP-21	0.0017	1.11	7.56	25	78	1.4	3.6
PP-22	0.0011	0.68	6.24	25	78	0.9	2.3
PP-23	0.0033	2.09	6.42	25	78	2.7	6.9
PP-24	0.0210	13.44	6.7	25	78	17.2	44.3
PP-3	0.0080	5.12	6.4	20	68	3.1	11.4
PP-30	0.0067	4.30	8.1	25	78	5.2	13.6
PP-31	0.0035	2.27	7.44	25	78	2.8	7.3
PP-32	0.0044	2.80	7.44	25	78	3.5	9
PP-34	0.0019	1.22	6.96	55	78	1.5	4
PP-34a	0.0004	0.26	2.7	85	98	0.8	1.4
PP-35	0.0013	0.82	7.38	55	78	1	2.7
PP-37	0.0010	0.64	3.1	85	98	2	3.4
PP-4	0.0170	10.88	6.4	20	70	7.9	26.5
PP-40	0.0053	3.37	7.2	25	78	4.2	11
PP-41	0.0006	0.39	7.26	25	78	0.5	1.3
PP-42	0.0012	0.77	7.14	25	78	1	2.5
PP-43	0.0025	1.62	5.64	25	78	2.2	5.5
PP-44	0.0013	0.80	7.26	25	78	1	2.6
PP-45	0.0017	1.11	7.2	25	78	1.4	3.6
PP-46	0.0018	1.16	7.14	25	78	1.5	3.8
PP-47	0.0029	1.88	8.1	25	78	2.3	6
PP-5	0.0040	2.56	6.1	20	70	1.9	6.3
PP-50	0.0030	1.93	7.86	25	78	2.4	6.2
PP-51	0.0110	7.06	10.56	25	78	7.7	20.8
PP-55	0.0110	7.04	6.3	25	78	6	18.8
PP-56	0.0070	4.48	8.9	25	78	5.2	13.9
PP-57	0.0110	7.04	6.6	25	78	9	23.3
PP-58	0.0020	1.28	5	85	98	4	6.8
PP-59	0.0040	2.56	8.4	25	78	3.1	8
PP-6	0.0100	6.40	6.6	20	70	4.6	15.5
PP-60	0.0040	2.56	5.7	25	78	3.4	8.7
PP-61	0.0030	1.92	5	85	98	5.9	10.2
PP-62	0.0080	5.12	5	25	78	7	17.7
PP-7	0.0110	7.04	6.8	20	70	5	16.9
PP-8	0.0030	1.92	5.8	20	70	1.4	4.8
PP-9	0.0030	1.92	5.7	20	70	1.4	4.8

FULLY DEVELOPED CONDITIONS HMS MODEL



20.5 -5yr
116.6 100yr

28.3 - 5yr
144.1 - 100yr

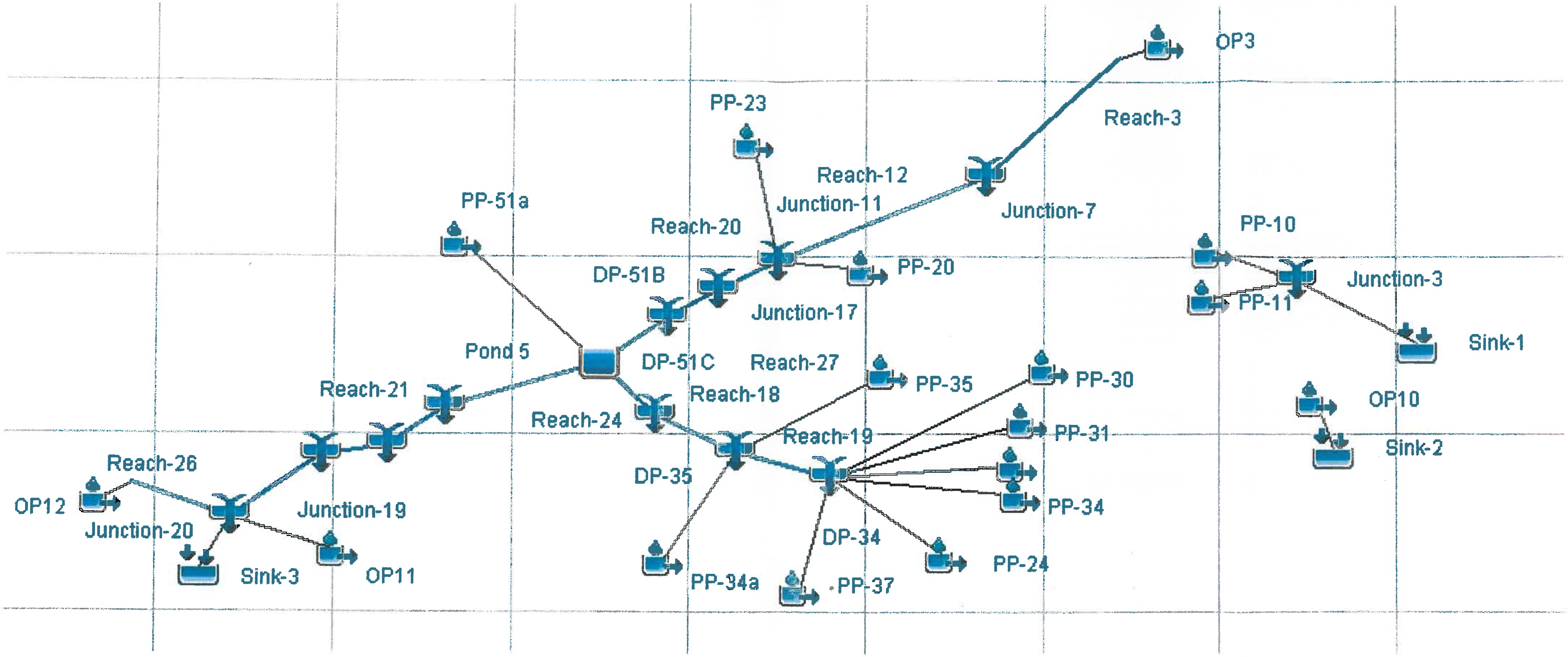
Project: Cordera FLG 3 111706 Simulation Run: 100-yr Pine-PP

Start of Run: 01Jan2007, 00:00
End of Run: 02Jan2007, 00:00
Compute Time: 17Jun2013, 12:17:56

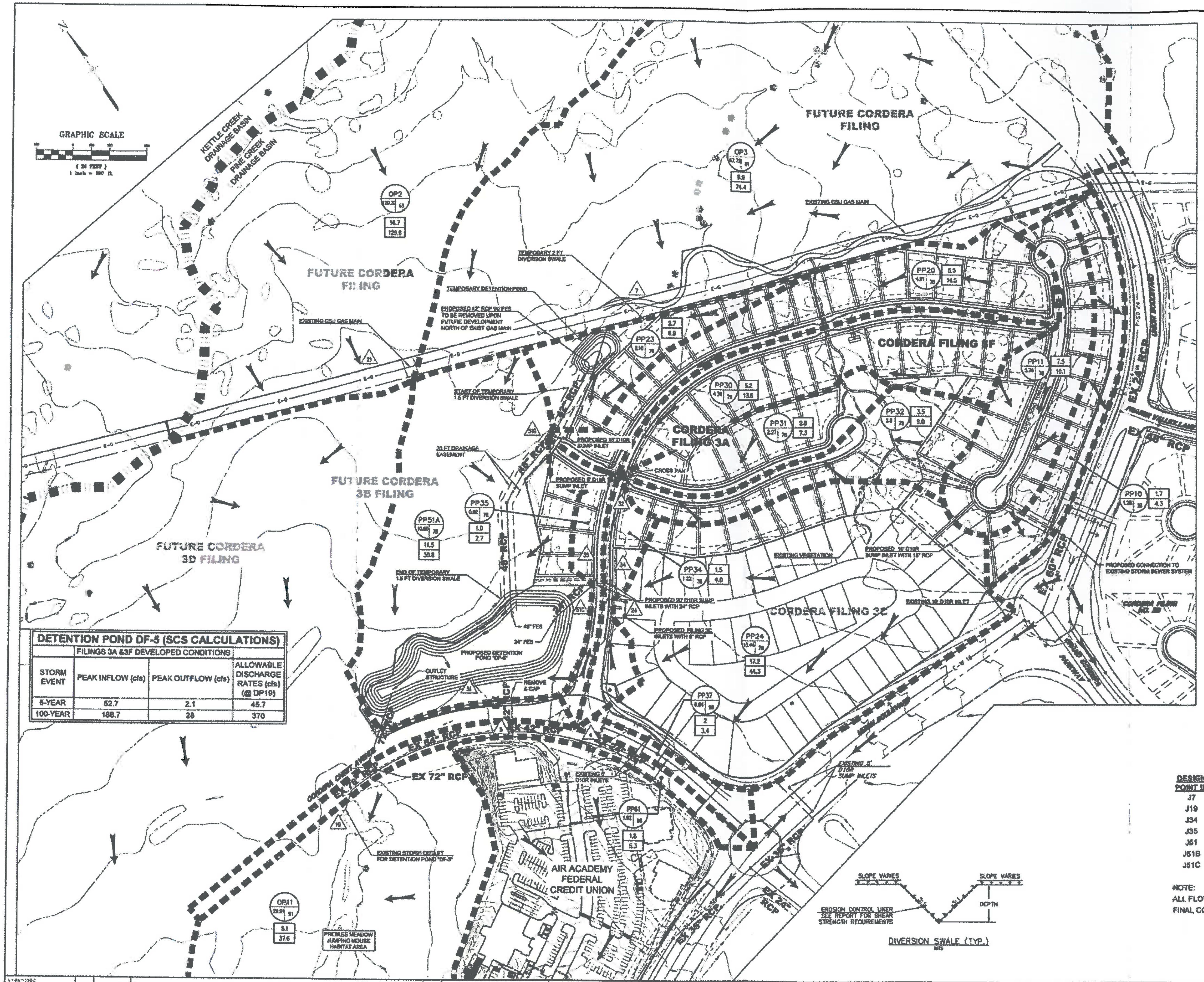
Basin Model: Pine Creek-Flg A & F
Meteorologic Model: Met 2
Control Specifications: Control 1

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
DP-34	0.0385469	81.2	01Jan2007, 06:02	2.26
DP-35	0.0402281	84.9	01Jan2007, 06:02	2.27
DP-51B	0.1084687	87.5	01Jan2007, 06:08	1.13
DP-51C	0.0402281	84.9	01Jan2007, 06:02	2.27
Junction-11	0.1084687	87.5	01Jan2007, 06:08	1.13
Junction-17	0.1084687	87.5	01Jan2007, 06:08	1.13
Junction-18	0.1650968	28	01Jan2007, 06:36	1.27
Junction-19	0.1650968	28	01Jan2007, 06:37	1.27
Junction-20	0.2170968	50.2	01Jan2007, 06:04	1.25
Junction-22	0.1650968	28	01Jan2007, 06:36	1.27
Junction-3	0.011	23.4	01Jan2007, 06:01	2.21
Junction-7	0.098	74.3	01Jan2007, 06:09	1.02
OP10	0.005	16.9	01Jan2007, 06:00	4.16
OP11	0.047	37.6	01Jan2007, 06:05	1.02
OP12	0.005	14.4	01Jan2007, 06:01	3.1
OP3	0.098	74.4	01Jan2007, 06:06	1.02
Pond 5	0.1650968	28	01Jan2007, 06:36	1.27
PP-10	0.002	4.3	01Jan2007, 06:01	2.21
PP-11	0.009	19.1	01Jan2007, 06:02	2.21
PP-20	0.0072031	14.5	01Jan2007, 06:03	2.21
PP-23	0.0032656	6.9	01Jan2007, 06:02	2.21
PP-24	0.021	44.3	01Jan2007, 06:02	2.21
PP-30	0.0067188	13.6	01Jan2007, 06:03	2.21
PP-31	0.0035469	7.3	01Jan2007, 06:02	2.21
PP-32	0.004375	9	01Jan2007, 06:02	2.21
PP-34	0.0019062	4	01Jan2007, 06:02	2.21
PP-34a	0.0004	1.4	01Jan2007, 06:00	4.16

FILING 3A & 3F FINAL CONDITIONS HMS MODEL

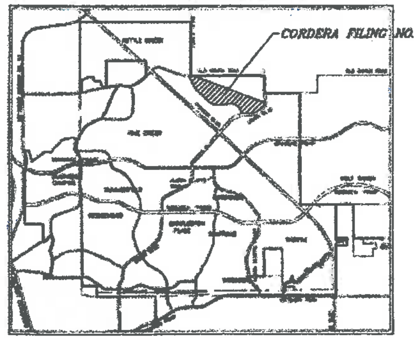


SHEET NO. 2



DIVERSION SWALE (TYP.)
NTS

DETENTION POND DF-5 (SCS CALCULATIONS)			
	FILINGS 3A &3F DEVELOPED CONDITIONS		
STORM EVENT	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)	ALLOWABLE DISCHARGE RATES (cfs) (@ DP19)
5-YEAR	52.7	2.1	45.7
100-YEAR	188.7	28	370



VICINITY MAP

NORTH
N.T.S

LEGEND

SUB-BASIN BOUNDARY
EXISTING CONTOUR
PHASE 3A FILING LIMITS
TEMPORARY DIVERSION SWALE
LOT LINE
DESIGN POINT
SUB BASIN DESIGNATION
SUB BASIN CURVE NUMBER
SUB BASIN AREA (AC.)
5-YEAR STORM EVENT PEAK FLOW (CFS)
100-YEAR STORM EVENT PEAK FLOW (CFS)
FLOW DIRECTION

PINE CREEK SUMMARY TABLE - FILING 3A AND 3F

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
J7	9.9	74.3	OP3
J19	1.2	44.6	J51
J34	23.5	68.7	PP24, PP30, PP31, PP32, PP33, PP34, PP37
J35	24.8	71.9	PP35
J51	37.9	167.2	J51B, J51C.
J51B	11.9	85.8	PP20, PP23, J7
J51C	24.8	71.9	J34, J35

NOTE:
ALL FLOWS SHOWN ON THIS PLAN ARE FROM THE HMS FILING 3A & 3F FINAL CONDITIONS MODEL.

ATTACHMENT FOR CORDERA FILING NO. 3B & 3D FDR

FOR REFERENCE ONLY

X-BK-TOPO
X-VEGE
X-TOPOF2B
X-TITLE-DRAINAGE
X-TAPE-UNION BORDERS
X-TOPO
X-BASE
X-TOPOF2A
X-BASE F3
X-UTIF3
X-BASINS 3A & 3F
X-UTIF2B
X-UTIL-UNION GC
Proposed ponds 5 and 4
X-BASE F2A3F

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\13.104.140 (Cordera F3B)\Dwg\Drainage\DR01-F3D.dwg
PCP: Matrix.ctb
PLOT DATE: Jan 14, 2014 11:31am

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

THIS DOCUMENT IS SUBMITTED FOR YOUR REVIEW AND COMMENT. IT IS NOT INTENDED TO FULFILL ALL STANDARD CITY SUBMITTAL REQUIREMENTS. THE INTENT OF THE REVIEW IS TO FOCUS ON OVERALL INFRASTRUCTURE SYSTEMS, THEIR GENERAL CONFIGURATION AND COORDINATION.

SEAL

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

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

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

CORDERA FILING NO. 3

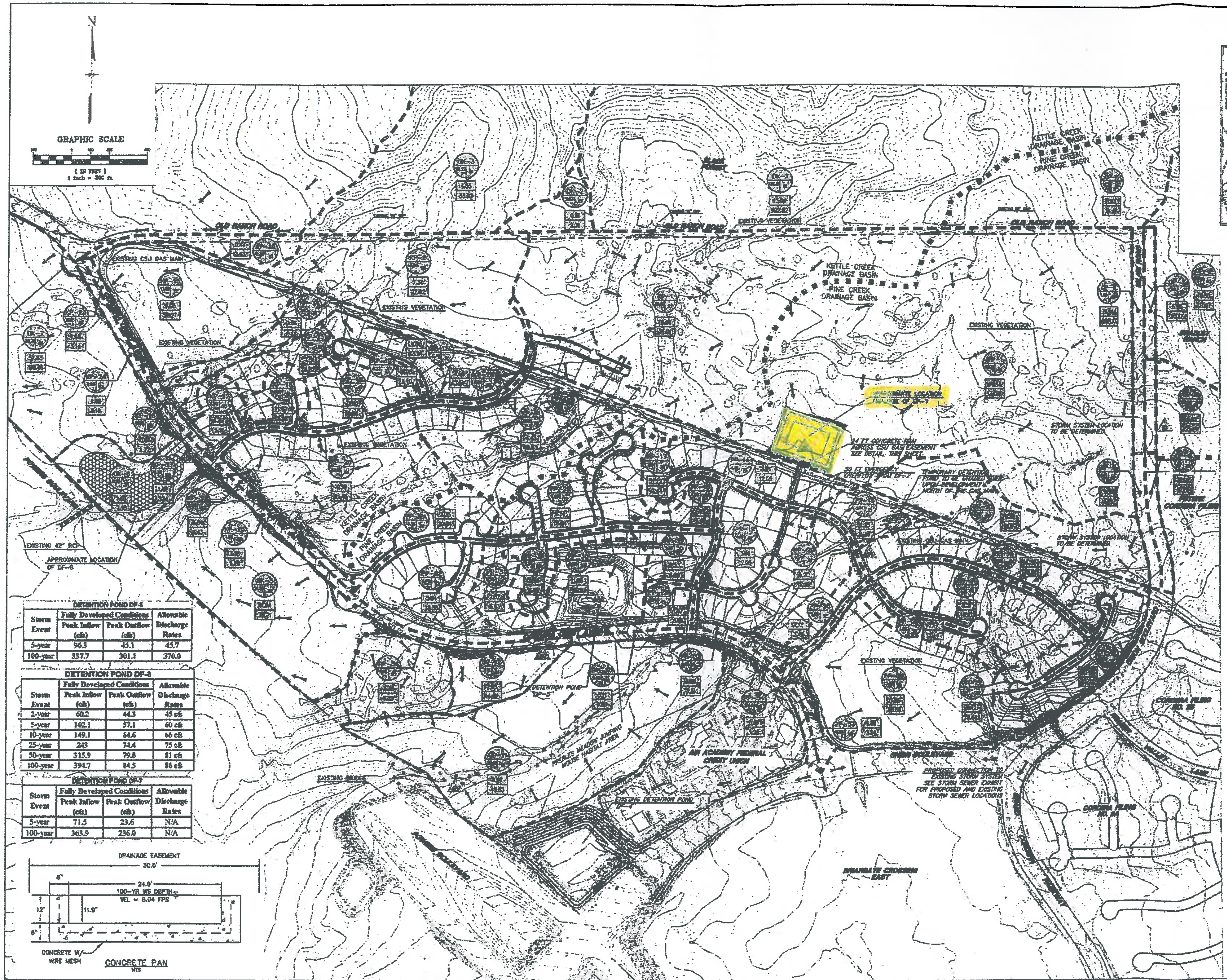
MASTER DEVELOPMENT DRAINAGE PLAN

EXISTING CONDITIONS DRAINAGE MAP FILING 3A-1 (AMMENDMENT #1) AND 3F SCS CALCULATIONS

DESIGNED BY: ZD
DRAWN BY: ZD
CHECKED BY: [illegible]
SCALE HORIZ: 1"=100'
VERT: N/A
DATE ISSUED: OCTOBER 2007
SHEET NO. 2 OF 4 SHEETS

DP02

SHEET NO. 3



DETENTION POND DF-5

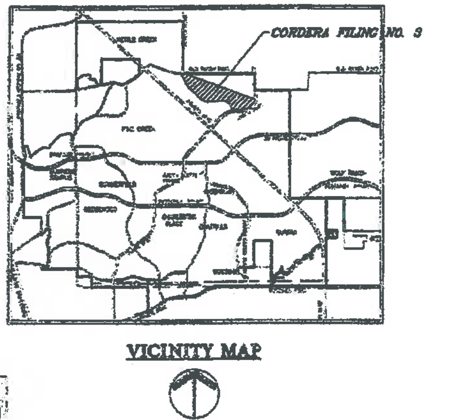
Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
5-year	96.3	45.1	45.7
100-year	337.7	301.1	370.0

DETENTION POND DF-6

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

DETENTION POND DF-7

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



VICINITY MAP

PINE CREEK SUMMARY TABLE

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

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
K1	(NOT USED)		
K2	(NOT USED)		
K3	22.84	152.01	KP1, OK1, OK2
K4	(NOT USED)		
K5	6.16	37.43	KP11, KP20
K6	(NOT USED)		
K7	9.91	58.27	KP8, OK3
K8	15.44	89.82	KP10, KP13, KP14, KP15, K7
K9	27.51	166.15	KP12, KP12A, KP26, K3
K10	29.91	172.76	KP19, K9
K11	30.89	175.16	KP18, K10
K12	39.48	215.68	KP17, KP22, K5, K11
K13	50.56	315.99	K12, K15
K14	(NOT USED)		
K15	22.04	101.78	KP16, KP23, KP24, KP25, KP27, K8

LEGEND

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

NO.	DATE	DESCRIPTION	BY

REVISIONS

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

FOR AND ON BEHALF OF
MATRIX DESIGN GROUP, INC.

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

CORDERA FILING NO. 3

MASTER DEVELOPMENT DRAINAGE PLAN

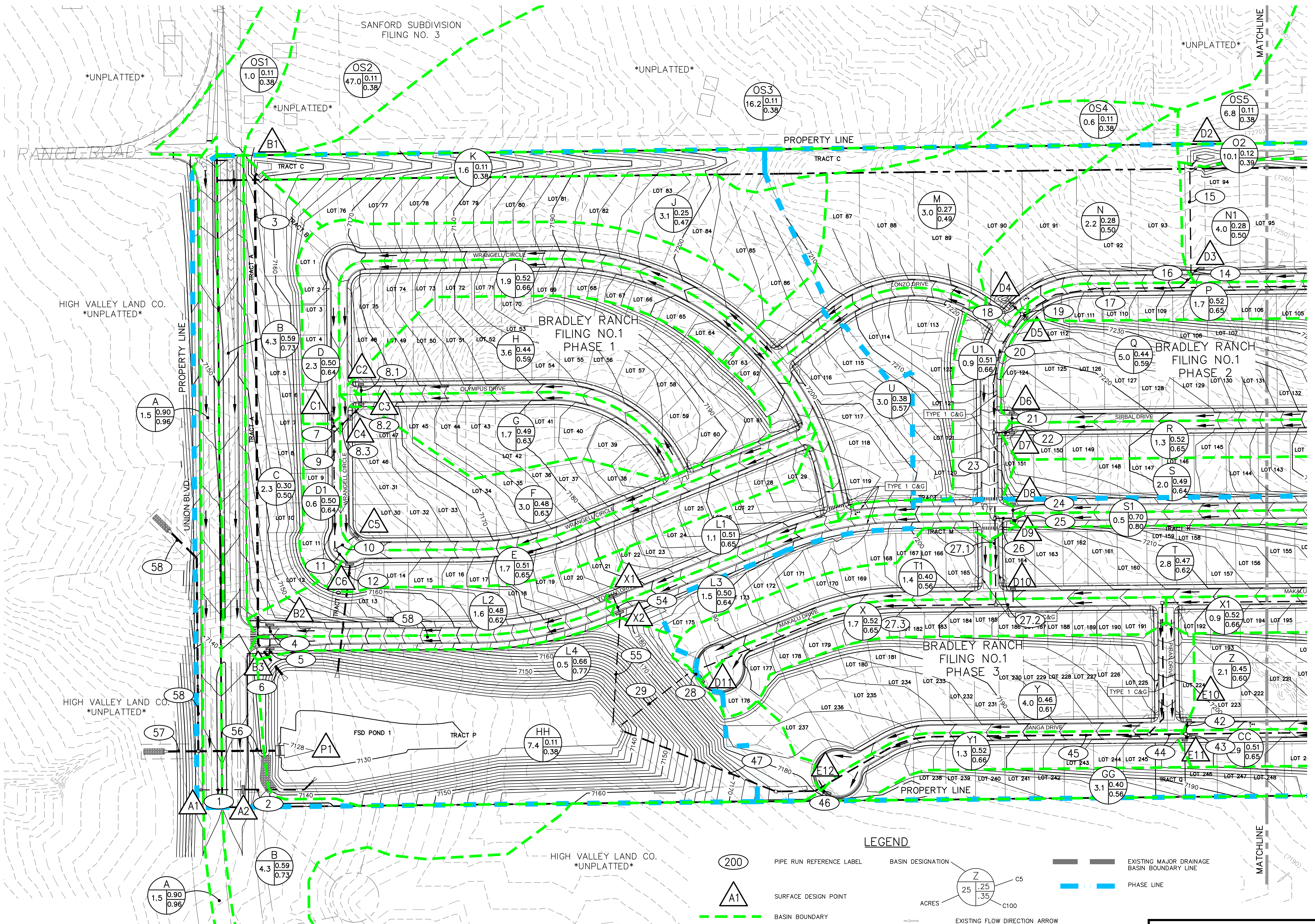
FULLY DEVELOPED DRAINAGE MAP

DP03

DRAINAGE MAPS

BRADLEY RANCH

MASTER DEVELOPMENT DRAINAGE PLAN MAP
AUGUST 2017



NOTE:
ALL CURB AND GUTTER ARE TYPE 5 UNLESS OTHERWISE NOTED.

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN, FB, PR	STRUCTURE
A1	5.7	10.3	A	6' D–10–R SUMP INLET
A2	10.1	25.7	B,C DPB2,DPB3	14' D–10–R @ GRADE INLET
B1	15.6	86.4	J,K,OS2,OS3	CULVERT
B2	3.5	12.2	L2 X1	14' D–10–R @ GRADE INLET
B3	1.5	12.9	L4 X2	14' D–10–R @ GRADE INLET
C1	4.6	9.9	D	10' D–10–R @ GRADE INLET
C2	6.2	10.7	H	12' D–10–R @ GRADE INLET
C3	3.3	10.6	G	12' D–10–R @ GRADE INLET
C4	4.0	8.5	I DPC2,DPC3	12' D–10–R @ GRADE INLET
C5	6.4	14.3	F DPC4	12' D–10–R SUMP INLET
C6	5.1	14.0	D1,E DPC1	12' D–10–R SUMP INLET
D2	3.5	20.3	O2,OS5	CULVERT
D3	3.9	12.9	N1,O1	10' D–10–R @ GRADE INLET
D4	2.3	9.4	N DPD3	12' D–10–R @ GRADE INLET
D5	3.7	10.6	P	12' D–10–R @ GRADE INLET
D6	8.6	12.6	Q	14' D–10–R @ GRADE INLET
D7	2.9	13.7	R	14' D–10–R @ GRADE INLET
D8	4.4	9.5	S	12' D–10–R @ GRADE INLET
D9	1.7	3.2	S1	6' D–10–R @ GRADE INLET
D10	10.8	24.8	T,V1 E7	16' D–10–R @ GRADE INLET
D11	6.7	20.0	T1,X,X1,DPE8,DPD10	16' D–10–R SUMP INLET
E10	6.6	14.1	Z,AA DPE9	16' D–10–R @ GRADE INLET
E11	5.8	15.8	CC	16' D–10–R @ GRADE INLET
E12	8.4	22.5	Y,Y1 DPE10,DPE11	16' D–10–R SUMP INLET
X1	10.1	19.4	L1,U,U1,M,OS4 DPD4,DPD8	14' D–10–R @ GRADE INLET
X2	3.4	26.5	L3 DPD9	14' D–10–R @ GRADE INLET

STORM SEWER SUMMARY			
PIPE RUN	Q_5	Q_{100}	PIPE SIZE
2	14.3	33.3	30" RCP
3	15.6	86.4	48" RCP
4	3.5	10.0	24" RCP
5	3.9	15.5	24" RCP
6	18.1	96.1	48" RCP
7	4.5	7.3	30" RCP
8.1	6.1	8.9	18" RCP
8.2	9.4	17.7	24" RCP
8.3	13.2	25.0	30" RCP
9	17.1	31.2	30" RCP
10	6.4	14.3	24" RCP
11	22.3	43.0	36" RCP
12	26.6	54.8	36" RCP
14	3.9	8.4	18" RCP
15	3.5	20.3	24" RCP
16	7.4	27.6	36" RCP
17	10.9	48.8	36" RCP
19	3.7	8.8	18" RCP
20	16.0	63.3	42" RCP
21	8.2	10.6	18" RCP
22	10.9	20.8	24" RCP
23	25.6	81.2	42" RCP
24	4.4	7.8	18" RCP
25	1.7	2.6	18" RCP
26	6.0	10.3	18" RCP
27.1	30.4	89.4	48" RCP
27.2	10.4	17.0	24" RCP
27.3	39.1	103.2	48" RCP
28	6.7	20.0	24" RCP
29	43.4	117.2	48" RCP
42	6.6	12.3	24" RCP
43	5.8	13.2	24" RCP
44	17.0	34.6	30" RCP
45	34.6	100.2	48" RCP
46	8.4	22.5	24" RCP
47	41.3	118.1	48" RCP
54	9.6	14.4	24" RCP
55	12.3	27.3	30" RCP
56	28.4	148.9	48" RCP
57	7.2	41.5	42" RCP
58	21.2	107.4	42" RCP

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
A	1.53	5.7	10.3
B	4.32	9.7	19.8
C	2.32	2.5	7.1
CC	2.91	5.8	12.4
D	2.26	4.6	9.9
D1	0.57	1.2	2.6
E	1.72	3.8	8.1
F	3.01	6.4	13.9
G	1.72	3.3	7.2
GG	3.14	6.3	14.7
H	3.56	6.2	14.1
HH	7.41	3.0	17.5
I	1.87	4.0	8.5
J	3.06	2.7	8.6
K	1.64	0.6	3.8
L1	1.15	2.6	5.6
L2	1.61	3.6	7.8
L3	1.50	3.4	7.2
L4	0.51	1.6	3.1
M	3.01	3.1	9.7
N	2.22	2.6	7.8
N1	4.01	3.7	12.0
O2	0.63	0.3	1.5
P	1.69	3.7	8.0
Q	4.96	8.6	19.5
R	1.31	2.9	6.2
S	2.01	4.4	9.5
S1	0.50	1.7	3.2
T	2.84	6.0	13.2
T1	1.42	2.8	5.9
U	2.80	4.1	10.3
U1	1.16	2.3	5.4
X	1.71	3.6	7.6
X1	0.88	2.1	4.4
Y	3.99	6.8	15.1
Y1	1.26	2.7	5.7
Z	2.13	3.6	8.1
OS1	0.98	0.4	2.4
OS2	47.03	10.2	59.2
OS3	16.17	5.1	29.8
OS4	0.63	0.3	1.8
OS5	6.81	3.2	18.6

POND 1 FULL SPECTRUM DETENTION BASIN DATA

WQ WATER SURFACE EL=7131.28
WQ VOLUME=2.264 AC–FT
EURV WATER SURFACE EL=7132.81
EURV VOLUME=5.820 AC–FT
100–YR WATER SURFACE EL=7137.77
SPILLWAY CREST EL=7136.22
TOP OF EMBANKMENT EL=7140.00
100–YR VOLUME=15.280 AC–FT
100–YR INFLOW=412.6 CFS
100–YR RELEASE=148.9 CFS

LEGEND

200	PIPE RUN REFERENCE LABEL
A1	SURFACE DESIGN POINT
▬ ▬ ▬	BASIN BOUNDARY
– –(6920)– –	EXISTING CONTOUR
——6920——	PROPOSED CONTOUR
— — —	STORM SEWER PIPE
	CROSSPAN
▭	INLET
2.5% →	STREET GRADE W/DIRECTION
Z / 25 / .25 / .35	BASIN DESIGNATION; ACRES; C5; C100
⇦	EXISTING FLOW DIRECTION ARROW
	EMERGENCY OVERFLOW DIRECTION
←	FLOW DIRECTION
	FLARED END SECTION
→· · — · ·→	PERIMETER SWALE
— – – —	PROPERTY LINE
H.P. ×	HIGH POINT
L.P. ×	LOW POINT
11	LOT NUMBER
▬ ▬	EXISTING MAJOR DRAINAGE BASIN BOUNDARY LINE
▬ ¦ ▬	PHASE LINE

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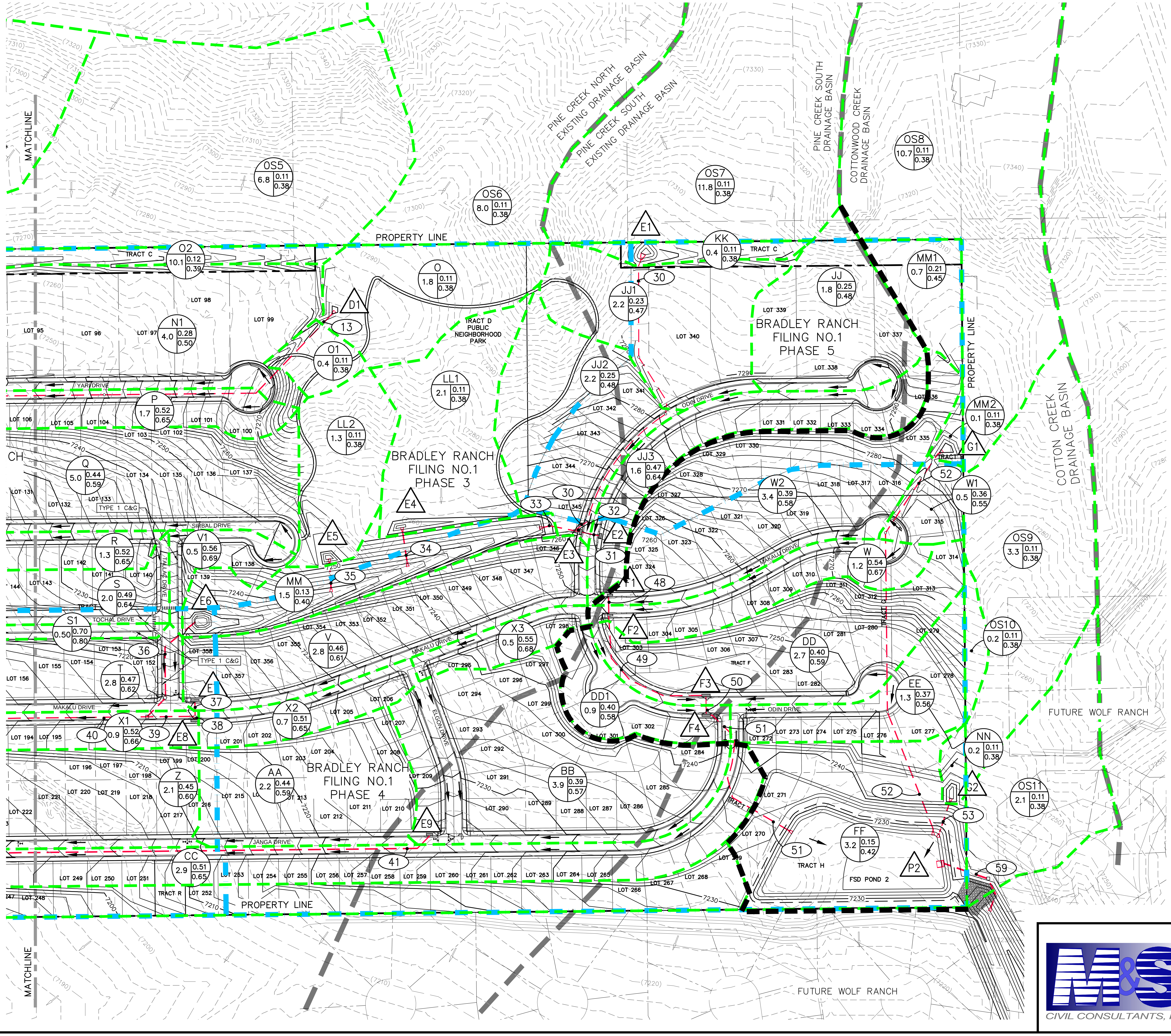
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

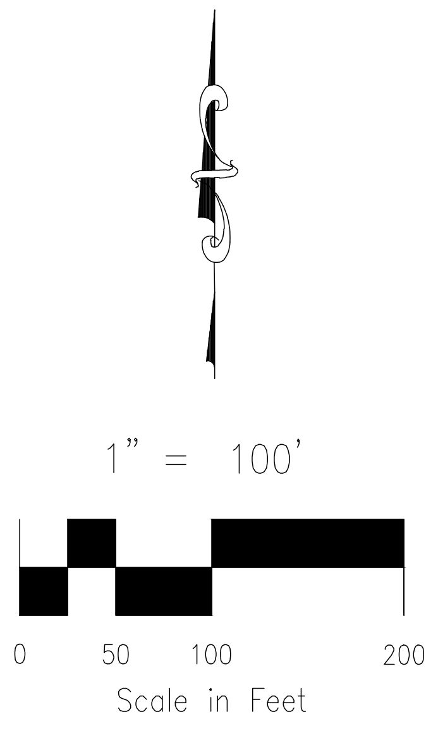
BRADLEY RANCH
MDDP MAP (PROPOSED CONDITIONS)
PROJECT NO. 43–093
DESIGNED BY: CN
DRAWN BY: CN
CHECKED BY: DM
SCALE:
HORIZONTAL: 1"=100'
VERTICAL: N/A
DATE: 06/16/2017
SHEET 1 OF 2
D1

File: O:\43093A\Bradley Ranch\dwg\Dev Plan\D1-2.dwg Plotstamp: 8/11/2017 11:38 AM

BRADLEY RANCH

MASTER DEVELOPMENT DRAINAGE PLAN MAP
AUGUST 2017





LEGEND

200	PIPE RUN REFERENCE LABEL
A1	SURFACE DESIGN POINT
	BASIN BOUNDARY
(6920)	EXISTING CONTOUR
6920	PROPOSED CONTOUR
	PROP STORM SEWER PIPE
	PROP CROSSPAN
	PROP INLET
	EXISTING MAJOR DRAINAGE BASIN BOUNDARY LINE
	PHASE LINE

BASIN DESIGNATION — Z; ACRES — 25; C5 — .25; C100 — .35

	EXISTING FLOW DIRECTION ARROW
	EMERGENCY OVERFLOW DIRECTION
	PROP FLOW DIRECTION
	PROP FLARED END SECTION
	PROP PERIMETER SWALE
	PROPERTY LINE
11	LOT NUMBER
2.5%	STREET GRADE W/DIRECTION
H.P. ×	HIGH POINT
L.P. ×	LOW POINT

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN, FB, PR	STRUCTURE
D1	3.9	22.5	O,OS6	CULVERT
E1	4.9	28.4	KK,OS7	CULVERT
E2	3.0	13.7	JJ3	14' D–10–R @ GRADE INLET
E3	6.1	13.2	JJ,JJ1,JJ2	14' D–10–R @ GRADE INLET
E4	0.9	5.5	LL1	CULVERT
E5	0.6	3.6	LL2	CULVERT
E6	13.6	54.1	MM PR33,PR34,PR35	CULVERT
E7	5.3	12.1	V DPF1,DPE2,DPE3	16' D–10–R @ GRADE INLET
E8	2.7	11.9	X2,X3 DPF2	16' D–10–R @ GRADE INLET
E9	5.5	13.4	BB	14' D–10–R @ GRADE INLET
F1	6.0	10.1	W1,W2	14' D–10–R @ GRADE INLET
F2	3.1	12.4	W	14' D–10–R @ GRADE INLET
F3	4.6	10.2	DD	8' D–10–R SUMP INLET
F4	3.5	9.9	DD1,EE,OS10	8' D–10–R SUMP INLET
P2	22.9	79.5	FF,OS11,PR51,PR52,PR53, FSD POND 2	OUTLET STRUCTURE

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE
13	3.9	22.5	24" RCP
30	4.9	28.4	30" RCP
30	4.9	28.4	30" RCP
31	3.0	11.5	24" RCP
32	9.0	22.4	24" RCP
33	13.5	49.9	36" RCP
34	0.9	5.5	18" RCP
35	0.6	3.6	18" RCP
36	13.6	54.1	36" RCP
37	5.3	11.2	24" RCP
38	2.7	11.1	24" RCP
39	7.9	22.2	36" RCP
40	19.7	70.8	42" RCP
41	5.5	11.0	18" RCP
48	6.0	9.3	18" RCP
49	9.0	18.9	24" RCP
50	12.9	27.6	30" RCP
51	16.3	37.3	30" RCP
52	4.3	23.9	30" RCP
53	1.2	7.1	18" RCP
55	12.3	27.3	30" RCP
59	3.4	31.9	30" RCP

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
AA	2.16	3.7	8.3
BB	3.88	5.5	13.4
CC	2.91	5.8	12.4
DD	2.73	4.6	11.2
DD1	0.86	1.4	3.4
EE	1.28	1.9	4.9
FF	3.17	1.8	8.5
JJ	1.83	2.2	7.2
JJ1	2.23	2.0	6.8
JJ2	2.23	2.5	7.8
JJ3	1.57	3.0	6.8
KK	0.35	0.2	0.9
LL1	2.11	0.9	5.5
LL2	1.33	0.6	3.6
MM	1.54	0.8	4.1
MM1	0.72	0.6	2.3
MM2	0.13	0.1	0.4
N1	4.01	3.7	12.0
NN	0.15	0.1	0.4
O	1.76	0.8	4.7
O1	0.39	0.2	1.1
O2	0.63	0.3	1.5
P	1.69	3.7	8.0
Q	4.96	8.6	19.5
R	1.31	2.9	6.2
S	2.01	4.4	9.5
S1	0.50	1.7	3.2
T	2.84	6.0	13.2
V	2.75	5.4	11.9
V1	0.53	1.4	2.9
W	1.18	3.1	6.5
W1	0.47	0.7	1.9
W2	3.42	5.5	13.6
X1	0.88	2.1	4.4
X2	0.74	1.7	3.7
X3	0.51	1.3	2.7
Z	2.13	3.6	8.1
OS5	6.81	3.2	18.6
OS6	7.99	3.3	19.3
OS7	11.84	4.8	27.6
OS8	10.69	3.8	22.3
OS9	3.32	1.3	7.5
OS10	0.22	0.1	0.6
OS11	2.07	0.9	5.2

POND 2 FULL SPECTRUM DETENTION BASIN DATA

WQ WATER SURFACE EL=7226.09
WQ VOLUME=0.303 AC–FT
EURV WATER SURFACE EL=7226.78
EURV VOLUME=0.688 AC–FT
100–YR WATER SURFACE EL=7229.34
SPILLWAY CREST EL=7228.44
TOP OF EMBANKMENT EL=7230.68
100–YR VOLUME=2.111 AC–FT
100–YR INFLOW=79.5 CFS
100–YR RELEASE=31.9 CFS

NOTE:

ALL CURB AND GUTTER ARE TYPE 5 UNLESS OTHERWISE NOTED.

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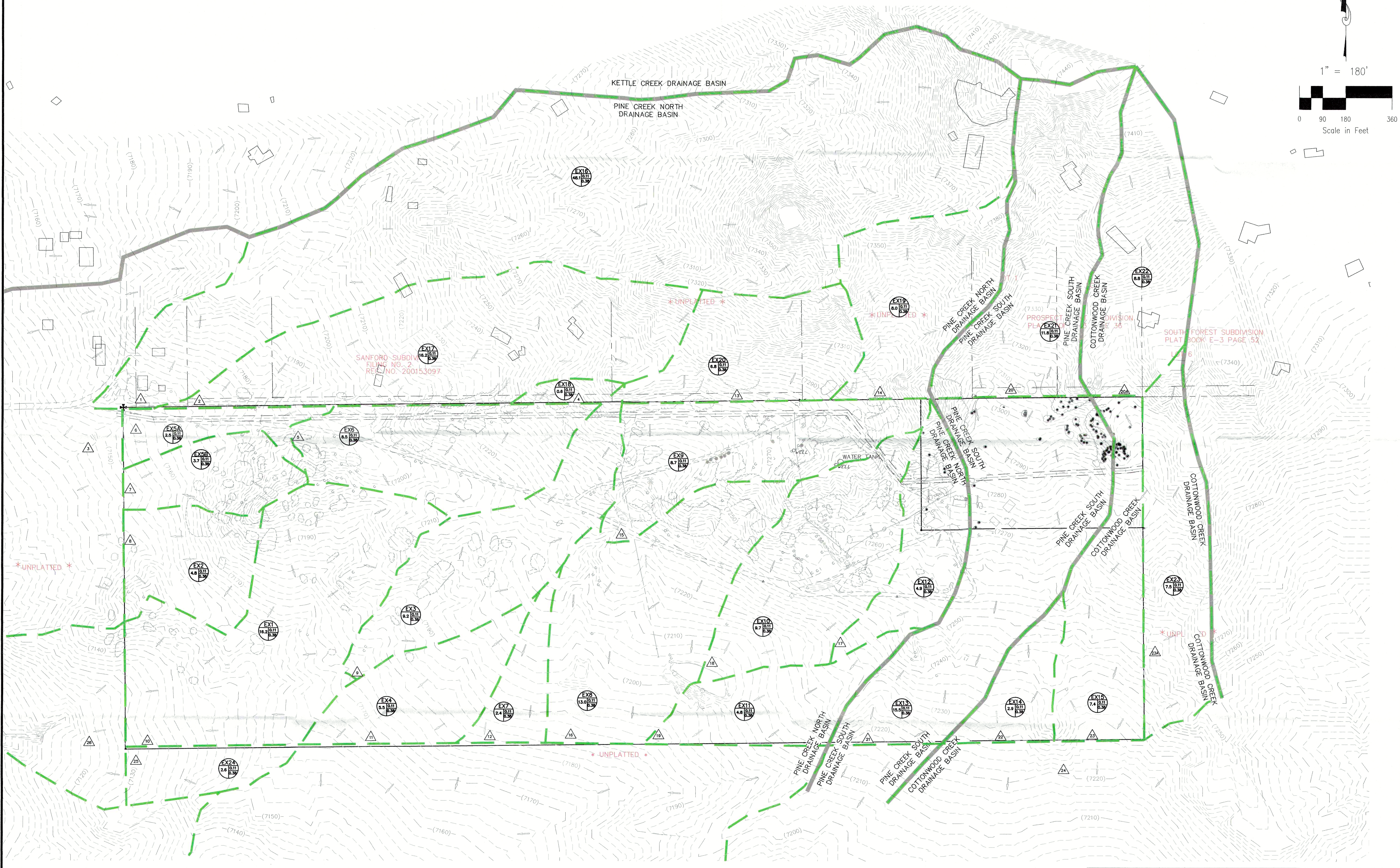
BRADLEY RANCH
MDDP MAP (PROPOSED CONDITIONS)

PROJECT NO. 43–093	SCALE:	DATE: 06/16/2017
DESIGNED BY: CN DRAWN BY: CN CHECKED BY: DM	HORIZONTAL: 1"=100' VERTICAL: N/A	SHEET 2 OF 2 — D2

BRADLEY RANCH

MASTER DEVELOPMENT DRAINAGE PLAN MAP
JUNE 2017



LEGEND

BASIN DESIGNATION — Z
ACRES — 25
C5 — .25
C100 — .35

EXISTING FLOW DIRECTION ARROW

2A SURFACE DESIGN POINT

🟩 EXISTING BASIN BOUNDARY

▨ MAJOR BASIN BOUNDARY

DESIGN POINT SUMMARY

DESIGN POINT	Q5	Q100
1	10.4	60.5
2	5.1	29.8
3	22.3	129.3
4	0.3	1.8
5	3.1	17.8
6	7.9	45.9
7	1.7	9.9
8	2.1	12.4
9	2.9	17.0
10	6.5	37.6
11	2.1	12.0
12	0.9	5.4
13	3.2	18.6
14	3.3	19.3
15	7.3	42.6
16	9.3	53.7
17	2.0	11.5
18	5.2	30.0
19	6.1	35.6
20	4.0	23.0
20A	3.2	18.8
21	6.5	37.9
22	1.2	6.8
23A	2.5	14.5
23	6.4	37.1
24	7.2	41.6
25	1.0	5.6
26	7.2	41.5

BASIN SUMMARY

BASIN	AREA (ACRES)	Q5	Q100
EX1	16.2	5.0	28.8
EX2	4.8	2.1	12.4
EX3	9.2	2.9	17.0
EX4	5.5	2.1	12.0
EX5A	2.5	0.9	5.3
EX5B	3.7	1.7	9.9
EX6	8.5	2.9	16.6
EX7	2.4	0.9	5.4
EX8	13.0	4.6	26.7
EX9	8.7	2.9	17.0
EX10	9.7	3.5	20.1
EX11	4.8	1.8	10.3
EX12	4.9	2.0	11.5
EX13	15.5	4.8	27.8
EX14	2.9	1.2	6.8
EX15	7.4	2.5	14.6
EX16	48.1	10.4	60.5
EX17	16.2	5.1	29.8
EX18	0.6	0.3	1.8
EX19	8.0	3.3	19.3
EX20	6.8	3.2	18.6
EX21	11.8	4.8	27.6
EX22	8.8	3.2	18.8
EX23	7.5	2.5	14.5
EX24	2.6	1.0	5.6

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BRADLEY RANCH

MDDP MAP (EXISTING CONDITIONS)

PROJECT NO. 43-093
FILE: \dwg\Eng Exhibits\EDM (New).dwg
DESIGNED BY: DM
DRAWN BY: CMN
CHECKED BY: DM
SCALE
HORIZ: 1"=180'
VERT: N/A
DATE: 08/29/2017
SHEET 1 OF 1
EDM