PRELIMINARY DRAINAGE REPORT
FOR
STERLING RANCH EAST
PRELIMINARY PLAN / PUD NO. 2

Add additional text for project name:
"FourSquare at Sterling Ranch"

Engineering Review
07/19/2022 12:13:51 PM
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EPC Planning & Community Development Department

PCD-ENGINEERING REVIEW COMMENTS IN BLUE BOXES WITH BLUE TEXT

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Job No. 1183.20

PCD Project No.
PUDSP227

PRELIMINARY DRAINAGE REPORT FOR
STERLING RANCH EAST PRELIMINARY PLAN / PUD NO. 2

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

_____ _____

Marc A. Whorton Colorado P.E. #37155 Date

OWNER'S/DEVELOPER'S STATEMENT:
I, the owner/developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: CLASSIC SRJ LAND, LLC

By: _____

Title: _____

Address: 2138 Flying Horse Club Drive

Colorado Springs, CO 80921

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

_____ _____

For County Engineer, / ECM Administrator Date

Conditions:

CLASSIC CONSULTING ENGINEERS & SURVEYORS

PRELIMINARY DRAINAGE REPORT FOR
STERLING RANCH EAST PRELIMINARY PLAN / PUD NO. 2

TABLE OF CONTENTS:

PURPOSE	Page 4
GENERAL DESCRIPTION	Page 4
EXISTING DRAINAGE CONDITIONS	Page 4
PROPOSED DRAINAGE CONDITIONS	Page 9
DETENTION/SWQ FACILITIES	Page 15
SAND CREEK CHANNEL IMPROVEMENTS	Page 15
DRAINAGE CRITERIA	Page 16
FLOODPLAIN STATEMENT	Page 17
DRAINAGE AND BRIDGE FEES	Page 18
SUMMARY	Page 19
REFERENCES	Page 20

APPENDICES

VICINITY MAP

SOILS MAP (WEB SOIL SURVEY)

F.E.M.A. MAP / LOMR (08-08-0541P)

HYDROLOGIC CALCULATIONS

STORMWATER QUALITY CALCULATIONS

DETENTION POND CALCULATIONS

DRAINAGE MAPS

PURPOSE

The purpose of this Preliminary Drainage Report is to address on-site and off-site drainage quantities and patterns for the proposed development, compare to approved MDDP and identify general drainage improvements and facilities required to minimize impacts to the adjacent properties.

FourSquare...?

GENERAL DESCRIPTION

Classic SRJ Land, LLC (Classic Homes) has recently purchased the remaining portion of the Sterling Ranch property east of Sand Creek from the Jim Morley. This is one of the three initial development proposals east of Sand Creek and will be known as **Sterling Ranch East Preliminary Plan/PUD No. 2.** This PUD consists of development area northwest of the intersection of Briargate Pkwy. and Sterling Ranch Road per the proposed roadway plats, prepared by JR Engineering. The total PUD area is **36.76 acres** and includes the proposed tract for Pond FSD-16. It is located in portions of sections 33 and 34, township 12 south, range 65 west of the sixth principal meridian. The site is bounded on the north, east and west by proposed and future Sterling Ranch East residential development, west and south by the proposed extension of Briargate Pkwy. The site is in the upper portion of both the Sand Creek and East Fork Drainage Basins. Urban single family residential development with a total of **158 lots** is proposed within this PUD.

Sand Creek

The average soil condition reflects Hydrologic Group "A" (Blakeland loamy sand and Columbine gravelly sandy loam) with also some presence of Hydrologic Group "B" (Pring coarse sandy loam) as determined by the "Web Soil Survey of El Paso County Area," prepared by the Natural Resources Conservation Service (see map in Appendix).

EXISTING DRAINAGE CONDITIONS

The Sterling Ranch East Preliminary Plan / PUD No. 2 property is located in the upper portion of the Sand Creek drainage basin on the south edge of Black Forest. However, the easterly portion

of the site lies within the East Fork tributary of Sand Creek. *(See following exhibit and reference the Sterling Ranch MDDP Amendment No. 2, submitted with the Sterling Ranch East Preliminary Plan No. 1 submittal)* Nearly the entire site is mainly covered with native grasses with few or no trees. Some minor disturbance due to utility installation has also taken place within the utility esmt. corridors traversing the site for the future Briargate Pkwy. Other land disturbance including some grading operations by the previous land owner has also taken place just north of the future Briargate Pkwy. alignment and within the parcel south of Briargate Pkwy. and northwest of Sterling Ranch Road. The Sand Creek channel exists approximately 500 feet west of the property. All required improvements to the Sand Creek channel adjacent to this property are described in a separate report prepared by JR Engineering, "Final Design Report for Sand Creek Restoration", dated October 21, 2021. Please reference this report for all adjacent creek improvement requirements and associated wetland mitigation plans and permitting within jurisdictional waters.

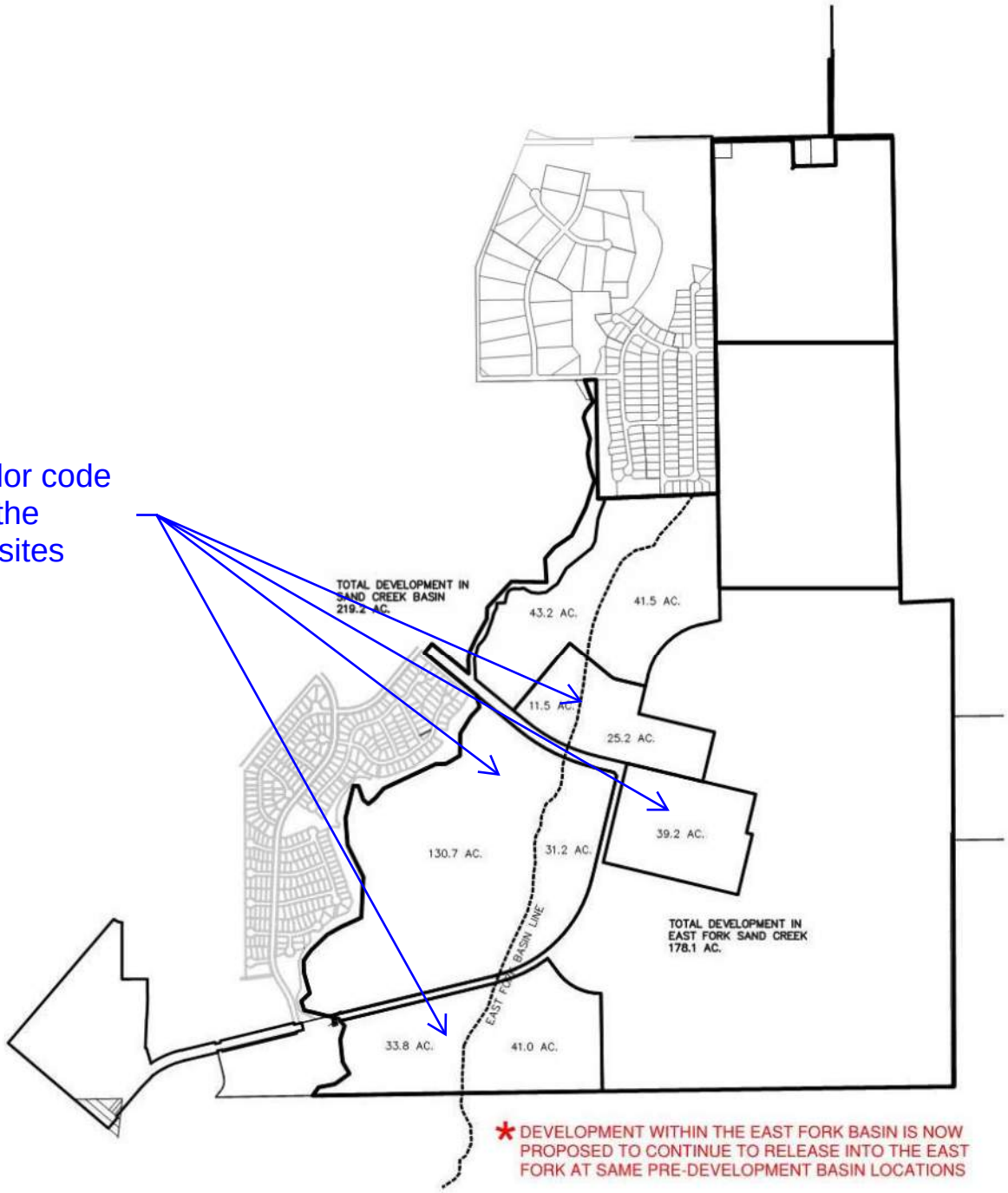
verify latest

clarify this statement

The adjacent Sand Creek portions of this site have been previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Engineering Corporation, March 1996 and more recently in the above-mentioned Sand Creek Restoration Report by JR Engineering, LLC. CORE Consultants is the wetland consultant working with JR Engineering, LLC on this stretch of Sand Creek. They are coordinating the effort with the Corps. of Eng. for the required 404 permitting for all the proposed channel improvements. Two public roadway crossings of Sand Creek are also proposed to serve as direct access for the Sterling Ranch East Preliminary Plan No. 1 development areas. These crossings are currently covered under a 404 permit (Action No. SPA-2015-00428-SCO) with the previous land owner dated February 2016. JR Engineering, LLC is also coordinating a CLOMR/LOMR for this stretch of Sand Creek that is adjacent to the site and defined as Reach SC-8 (south of Briargate Pkwy.) and SC-9 north of Briargate Pkwy.). This entre site was also studied as a part of the "Master Development Drainage Plan for Sterling Ranch", prepared by M&S Civil Consultants, approved November 2018 which includes modeling of this property as well as the large acreage north up to the top of the Sand Creek Basin. The MDDP proposes developed flows within Sand Creek that are significantly lower than both the DBPS and FEMA

Add MDDP amendment submitted with Preliminary Plan?

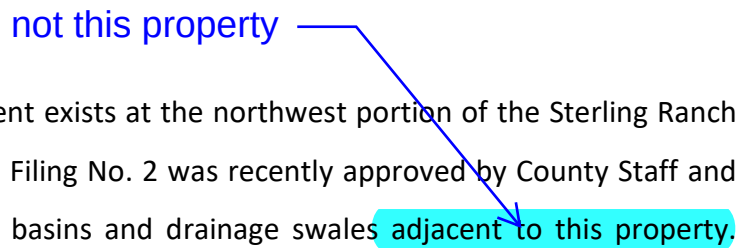
Please color code and label the individual sites



STERLING RANCH EAST INITIAL DEVELOPMENT PHASE
BASIN DEVELOPMENT EXHIBIT

CLASSIC CONSULTING ENGINEERS & SURVEYORS

currently show. These flows are as follows: At Arroya Lane crossing (North of the TimberRidge Development) Q_{10} = 430 cfs Q_{100} = 1487 cfs and Sterling Ranch south property line Q_{10} = 713 cfs Q_{100} = 1911 cfs. However, the focus of this report is not on Sand Creek, but the adjacent residential development proposed. As mentioned earlier, eastern portions of this site lie within the East Fork of Sand Creek. The following descriptions represent the pre-development flow design points for the property consistent with the approved MDDP for Sterling Ranch, yet differentiate Sand Creek main tributary basins verses the East Fork basins. The nomenclature is similar to the MDDP for easy comparison:



Sand Creek Main

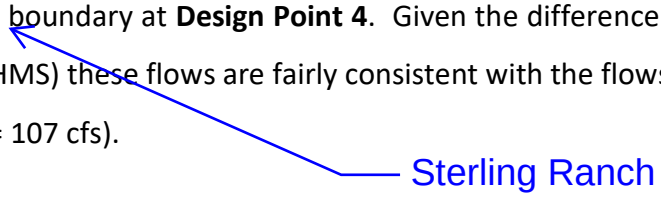
The Retreat at TimberRidge development exists at the northwest portion of the Sterling Ranch East property. Retreat at TimberRidge Filing No. 2 was recently approved by County Staff and proposes several temporary sediment basins and drainage swales adjacent to this property. These facilities will be removed upon construction from this proposed development in these areas. The following basins are off-site basins (outside the proposed Preliminary Plan area but within the overall Sterling Ranch East ownership) accounted for in the Retreat at TimberRidge development and are not tributary to the proposed development:

Basin TR-12 (Q_5 = 2 cfs, Q_{100} = 9 cfs) consists of future large lot residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site into the future Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and future downstream storm facilities. **Basin TR-20 (Q_5 = 10 cfs, Q_{100} = 32 cfs)** consists of future large lot residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site directly into an existing stock pond within the future Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-4 (Q_5 = 2 cfs, Q_{100} = 9 cfs)** consists of future urban residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site into the future Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and downstream storm facilities.

Basin TR-5 (Q_5 = 5 cfs, Q_{100} = 17 cfs) consists of future urban residential area that currently is undeveloped and sheet flows in a southwesterly direction directly into a temporary sediment basin constructed with the Retreat at TimberRidge Filing No. 2 project. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-6 (Q_5 = 1 cfs, Q_{100} = 4 cfs)** consists of a small future urban residential area that currently is undeveloped and sheet flows in a southwesterly direction off-site into the Retreat at TimberRidge development. These flows were anticipated and accounted for within that development and downstream storm facilities. **Basin TR-7 (Q_5 = 1 cfs, Q_{100} = 5 cfs)** consists of a basin that sheet flows towards the Retreat property but then captured by a temporary swale and routed to the west into another temporary sediment basin constructed by the Retreat development.

The following basins are within the proposed Preliminary Plan area and also within the Sand Creek main basin boundary:

Basin EX-7 (Q_5 = 47 cfs, Q_{100} = 107 cfs) consists of approximately 155.2 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP and the east basin line defines the westerly edge of the East Fork basin. The sheet flows become more concentrated towards the south end of the basin as the topography becomes steeper and more defined south of the proposed Sterling Ranch Road crossing. The existing flows exit the property along the south boundary at **Design Point 4**. Given the difference in hydrologic modeling (SWMM 5.1 vs. HEC-HMS) these flows are fairly consistent with the flows determined by the MDDP (Q_5 = 22 cfs, Q_{100} = 107 cfs).



Sand Creek East Fork

Basin EX-9 (Q_5 = 57 cfs, Q_{100} = 124 cfs) consists of approximately 178.1 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP and the west basin line defines the westerly edge of the East Fork basin. This basin incorporates both the MDDP basins EX-8 and EX-9. Unlike the previous basin, the flows seem to remain as sheet flows as they exit

the property along the south boundary at **Design Point 6**. Again, these flows seem consistent with the flows determined by the MDDP (Q_5 = 24 cfs, Q_{100} = 125 cfs).

Basin EX-10 (Q_5 = 105 cfs, Q_{100} = 222 cfs) consists of approximately 265.9 acres of property at the extreme top of the Sand Creek East Fork Basin. The off-site northern portion of this basin is within the Black Forest, heavily treed area. The off-site eastern portion of the basin contains existing 5 ac. lot development (Indian Wells Subd. Filing 1). The flows from this large basin sheet flow in a southerly direction across the northern portion of the Sterling Ranch property and enter Basin EX-10A.

Add sub-basins and DPs per plan redlines

Basin EX-10A (Q_5 = 52 cfs, Q_{100} = 117 cfs) consists of approximately 175.4 acres of property that sheet flows in a southerly direction through the Sterling Ranch property. The combined flows from both basins seem to remain as sheet flow traveling in a southerly direction towards **Design Point 7**. **(Q_5 = 114 cfs, Q_{100} = 259 cfs)** At this location the flows exit the property along the south boundary. Again, these flows are fairly consistent with the flows determined by the MDDP at this location (Q_5 = 57 cfs, Q_{100} = 278 cfs).

PROPOSED DRAINAGE CONDITIONS

As described in the General Description of the report, this proposed Preliminary Plan / PUD development contains 36.72 acres due north of the two major roadways that are being final platted and constructed separately (Briargate Pkwy. and Sterling Ranch Rd.). A single full spectrum detention (FSD) facility is planned with this development. It will be designed to handle these proposed lots, future adjacent development and portions of the other Sterling Ranch East Preliminary Plan No. 1 development. (Submitted concurrently but under separate County file number) Development of these urban lots proposed will consist of overlot grading and utility installation for the planned roadways and lots. Per the El Paso County ECM, Section I.7.1.B, all urban lots are required to provide Water Quality Capture Volume (WQCV). Thus, the proposed FSD facilities within this development will provide WQCV along with an Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume with an outlet control device.

Frequent and infrequent inflows are released at rates approximating undeveloped conditions. This concept provides some mitigation of increased runoff volume by releasing a portion of the increased runoff at a low rate over an extended period of time, up to 72 hours. This means that frequent storms, smaller than the 2-year event, will be reduced to very low flows near or below the sediment carrying threshold value for downstream drainage ways. Also, by incorporating an outlet structure that limits the 100-year runoff to the undeveloped condition rate, the discharge hydrograph for storms between the 2 year and the 100-year event will approximate the hydrograph for the undeveloped conditions and will help effectively mitigate the effects of development. As reasonably possible, WQCV will be provided for all new roads and urban lots.

This report will generally describe overall anticipated developed basins tributary to each of the proposed FSD facilities. Each of these developed basins will then be detailed further in final drainage reports prepared and submitted along with Final Plats and CD's. This final design will include sizing of all inlets, storm systems and finalized FSD facilities including all required appurtenances. It is anticipated that Type-R at-grade and sump inlets ranging from 5' to 15' will be utilized in all street drainage and HGL's will be provided for all RCP storm system design.

The following developed basin descriptions will start at the north end of the project and move south and describe how this development proposes to handle both the off-site and on-site drainage conditions both from an interim standpoint based on construction phasing and the ultimate buildout scenario of the entire Sterling Ranch East ownership:

As described earlier, these first several basins are all at the north end of the Sterling Ranch East overall property and are tributary to the adjacent Retreat at TimberRidge development and are consistent with what that approved report anticipated. (Reference "Final Drainage Report for Retreat at TimberRidge Filing No. 1", prepared by CCES, approved November 2020 and "Final Drainage Report for Retreat at TimberRidge Filing No. 2", prepared by CCES, dated March 2022)

The following basins are all contained within basin SC3-16A as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:

Basin TR-V (Q_5 = 2 cfs, Q_{100} = 6 cfs) consists of rear yards of the adjacent Retreat at TimberRidge Filing No. 2 development. These flows are currently captured in a natural swale along the common property line and routed south and then west towards a temporary sediment basin at the end of Bison Valley Trail that was constructed with the TimberRidge development. With the development of this portion of the proposed Sterling Ranch East Preliminary Plan No. 1, these flows will likely remain being captured by the natural swale along the westerly property line but then be directed into **Basin P1-F (Q_5 = 111 cfs, Q_{100} = 215 cfs).** This basin represents the anticipated future urban residential basin tributary to a future downstream storm system within the northerly extension of Sterling Ranch Road. **Design Point 1 (Q_5 = 112 cfs, Q_{100} = 219 cfs)** represents the anticipated total developed flow at this location upon full build-out. In the interim, before development within this basin, the historic flow patterns may be captured in a temporary sediment basin located just east of Design Point 1. This facility will help mitigate the historic flows from the large upstream basin (EX-10) prior to and during the construction of the extension of Sterling Ranch Road, Pond FSD-16 and the northerly portion of the future Sterling Ranch East development area. The final drainage report(s) for this portion of the development will describe any temporary sediment basins and collection points for these pre-development flows for safe routing further downstream.

Basin TR-W (Q_5 = 3 cfs, Q_{100} = 5 cfs) consists of rear yards and a small portion of the Bison Valley Trail roadway within the adjacent Retreat at TimberRidge Filing No. 2 development. These flows are currently captured in a natural swale along the common property line and routed westerly towards a temporary sediment basin at the end of Bison Valley Trail that was constructed with the TimberRidge development. With the development of the proposed Sterling Ranch East – Phase 1, these temporary facilities will be removed and allowed to flow directly into Basin P1-E. **Basin P1-E (Q_5 = 83 cfs, Q_{100} = 161 cfs)** consists of the proposed urban residential at the north end of this Preliminary Plan, just east of Sand Creek and tributary to a

proposed downstream storm system within the northerly extension of Sterling Ranch Road. **Design Points 2&3 (Q_5 = 42 cfs, Q_{100} = 81 cfs)** represent the anticipated split of flows from this large developed basin. The total developed flow will then combine with the upstream developed flows from Design Point 1 and be routed in a large diameter storm system further south within Sterling Ranch Road.

It appears that this basin needs to be broken up so that flows to Briargate inlets can be calculated.

Basin P1-C (Q_5 = 21 cfs, Q_{100} = 43 cfs) consists of the anticipated tributary area for the Sterling Ranch Road ROW extension north of Briargate Pkwy. and adjacent development. These proposed developed flows will be collected in various at-grade inlets within the roadway, combine with the upstream pipe flows described above and then routed towards the proposed Pond FSD-16. The total developed flow at this pipe outlet location into Pond FSD-16 is represented by **Design Point 4 (Q_5 = 186 cfs, Q_{100} = 374 cfs)**. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report.

and DP7 and DP6?

Basin P1-D (Q_5 = 53 cfs, Q_{100} = 102 cfs) represents the urban residential basin that is made up of this entire Sterling Ranch East Preliminary Plan/PUD No. 2 area and a small portion of this proposed Preliminary Plan area just east of Sand Creek, north of Briargate Pkwy. This basin is tributary to **Design Point 5 (Q_5 = 53 cfs, Q_{100} = 102 cfs)** and a public storm system stub will be provided to connect to the system within Sterling Ranch Road.

outfalling to DP7?

Basins P1-A1 (Q_5 = 11 cfs, Q_{100} = 21 cfs), **Basin P1-A2 (Q_5 = 12 cfs, Q_{100} = 23 cfs), Basin P1-A3 (Q_5 = 5 cfs, Q_{100} = 9 cfs)** and **Basin P1-A4 (Q_5 = 5 cfs, Q_{100} = 10 cfs)** all represent tributary area within the Briargate Pkwy. roadway extension between Vollmer and Sterling Ranch Road. These basins have been studied in the "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021. Reference this report as well as the "Sterling Ranch Road and Briargate Pkwy. Street Plans", prepared by JR Engineering, LLC, dated October 2021 for inlet and pipe sizes through this corridor. These final designed facilities are shown and labeled on the drainage map. However, the designed storm

please clarify this sentence - LP is DP6?

outfall alignment into the Pond FSD-16 will need to be adjusted as the intent of this report is to combine these flows with the previously described Design Point 5 developed flows along the proposed low point in Briargate Pkwy. just east of Sterling Ranch Road into one single outfall into Pond FSD-16 and represented by Design Point 7.

for the south side. (address the north side since there is a median)

Design Point 6 (Q_5 = 17 cfs, Q_{100} = 33 cfs) is the location of the proposed low-point in Briargate Pkwy. just east of Sterling Ranch Road, with the following two basins being tributary to this sump condition. The emergency overflow release is planned to be around the corner and south down Sterling Ranch Road. **Basin P1-A5 (Q_5 = 10 cfs, Q_{100} = 19 cfs)** and **Basin P1-A6 (Q_5 = 7 cfs, Q_{100} = 14 cfs)** consist of the anticipated area within the ROW tributary to this low- point. The collected flows will then be routed via a storm system and combine with the previously described basins further west in Briargate Pkwy. and Design Point 5.

plus any bypass from inlets west and north...

Design Point 7 (Q_5 = 117 cfs, Q_{100} = 229 cfs) represents the total developed flows at this pipe outlet location into Pond FSD-16. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report.

The following basins are all contained within basin SC3-16B as presented in the MDDP for Sterling Ranch, prepared by M&S Civil Consultants, approved in 2018:

Basin P1-B (Q_5 = 55 cfs, Q_{100} = 108 cfs) consists of the anticipated tributary area for the future Sterling Ranch East urban residential area outside of this proposed Preliminary Plan. These anticipated future developed flows will be routed towards a downstream storm system. The total developed flow at this pipe system outlet location into Pond FSD-16 is represented by **Design Point 8 (Q_5 = 55 cfs, Q_{100} = 108 cfs)**. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report. In the interim, before development within this basin, the historic flow patterns and quantities will continue to sheet flow in a southerly direction towards the proposed pond and Briargate Pkwy. The final drainage report(s) will describe any temporary sediment basins and

collection points for these pre-development flows for safe routing around the development area and further downstream.

Basin P1-A (Q_5 = 6 cfs, Q_{100} = 19 cfs) consists of the anticipated tributary area from the adjacent future residential lots (rear yards only) along with the actual pond area itself. The developed sheet flows from this basin will sheet flow directly into the adjacent FSD-16 Pond where they will be formally treated.

As described in the MDDP Amendment submitted with the Sterling Ranch East Preliminary Plan No. 1 development, the two FSD ponds planned in the 2018 MDDP (FSD16A and FSD16B) are now proposed to be combined into one facility (FSD-16) northeast of the intersection of Briargate Pkwy. and Sterling Ranch Road. The total anticipated developed flows entering this facility are as follows. (See Appendix for MHFD-Detention pond design sheets):

<u>Detention Pond FSD-16</u> (Full Spectrum EDB)

Total Tributary Acreage: 245.0 ac.

Revise per FSD redlines

4.822 Ac.-ft. WQCV required

11.124 Ac.-ft. EURV required with 4:1 max. slopes

10.310 Ac.-ft. 100-yr. Storage

26.256 Ac.-ft. Total

Total Peak In-flow: Q_5 = 271 cfs, Q_{100} = 590 cfs

Pond Peak Design Release: Q_5 = 24 cfs, Q_{100} = 157 cfs

Pre-development Release: Q_5 = 52 cfs, Q_{100} = 244 cfs

(Ownership and maintenance by the Sterling Ranch East Metro District)

Delete "East"

This facility will release into a large diameter downstream storm system within Briargate Pkwy. just east of the Sterling Ranch Road intersection. Please reference the "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021 and the "Sterling Ranch Road and Briargate Pkwy. Storm Plans", prepared by JR Engineering, LLC, dated December 2021. These referenced design plans provide a 48" RCP

Specify that although this Q5 exceeds what was shown in the MDDP, it is still less than the pre-development Q5, so it is ok.

Address when this pond will need to be completed and current status.

outfall pipe at this location with an allowable release rate of (Q_5 = 9.2 cfs, Q_{100} = 156.6 cfs). The 2018 MDDP presents a combined total release rate for the originally planned two ponds (FSD16A and FSD16B) of (Q_5 = 8.8 cfs, Q_{100} = 174.9 cfs). As designed on the JR Engineering storm plans, this storm system will run in a southeasterly direction within the Sterling Ranch Roadway towards the crossing of Sand Creek. At this location, the pipe system will outfall into the planned Detention Pond W3. Reference the "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021 for these design documents.

Address the effect of diverting this flow to the main Sand Creek channel, how it will be mitigated, and how historic flows are being matched at the south SR property line where these flows previously went.

DETENTION / STORMWATER QUALITY FACILITES

As required, storm water quality measures will be utilized in order to reduce the amount of sediment, debris and pollutants that are allowed to enter Sand Creek. These features include but are not limited to Full Spectrum Detention Basins and temporary sediment basins. Site Planning and design techniques for urban areas that require detention will provide a Water Quality Capture Volume (WQCV) and Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume that will release the more frequent storms at a slower rate to help minimize the effects of development of the property. The proposed detention/SWQ facilities are to be private facilities with ownership and maintenance by the Sterling Ranch Metropolitan District.

Can you clarify that 100% of the proposed soil disturbances within this PUD will be treated by the WQ pond and/or runoff reduction? It appears to be true from the map on pdf pg 80 below. But would be nice to document this in the text here as well.

If not 100%, state which basins (or portions of basins) will not be treated and which treatment exclusions apply, per the PBMP Applicability Form.

SAND CREEK CHANNEL IMPROVEMENTS

As mentioned previously, the Sand Creek channel exists westerly and outside of this property. All required improvements to the Sand Creek channel adjacent to this property are described in a separate report prepared by JR Engineering, "Final Design Report for Sand Creek Restoration", dated October 21, 2021. Please reference this report for all adjacent creek improvement requirements and associated wetland mitigation plans and permitting within jurisdictional waters. CORE Consultants is the wetland consultant working with JR Engineering, LLC on this stretch of Sand Creek. They are coordinating the effort with the Corps. of Eng. for the required 404 permitting for all the proposed channel improvements. The two public roadway crossings

Update

of Sand Creek (Briargate Pkwy. and Sterling Ranch Road) are currently covered under a 404 permit (Action No. SPA-2015-00428-SCO) with the previous land owner dated February 2016. JR Engineering, LLC is also coordinating a CLOMR/LOMR for this stretch of Sand Creek that is adjacent to the site and defined as Reach SC-8 (south of Briargate Pkwy.) and SC-9 north of Briargate Pkwy.). west of

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. General on-site and off-site basin design used for detention/SWQ basin sizing was calculated using the EPA Storm Water Management Model method (SWMM) Ver. 5.1. Rain Gage inputs based on City of Colorado Springs 2-hr. design storm distributions. Basin imperviousness of the particular land uses in accordance with Table 6-6. The Horton infiltration method used in basin modeling. Mile High Flood District (MHFD)-Detention spreadsheet Ver. 4.05 used for Preliminary Detention/SWQ design. (See Appendix)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

At this point, this site generally adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Proposed urban lot impervious area (roof tops, patios, etc.) will sheet flow across landscape areas (yards) and open space areas to slow runoff and increase time of concentration prior to being conveyed to the proposed public

streets or detention facilities. This will minimize directly connected impervious areas within the project site. Water quality reduction will be employed for specific areas that are anticipated not able to be captured and routed to a SWQ facility.

2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through the front and rear yards, developed flows will travel via curb and gutter within the public streets of the development and eventually public storm systems. These collected flows are then routed directly to the proposed extended detention basin (full-spectrum facility). Sand Creek improvements and restoration plans are being proposed for this entire reach as described in "Final Design Report for Sand Creek Restoration", prepared by JR Engineering, LLC, dated October 21, 2021.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV and excess urban runoff volume (EURV) in the proposed Full-Spectrum permanent Extended Detention Basin designed per current El Paso County drainage criteria.

4. **Consider need for Industrial and Commercial BMPs**: No industrial uses are proposed within this development. A site-specific storm water quality and erosion control plan and narrative will be submitted along with the grading and erosion control plan. Details such as site-specific sediment and erosion control construction BMP's as well as temporary and permanent BMP's were detailed in this plan and narrative to protect receiving waters. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

FLOODPLAIN STATEMENT

No portion of this site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Numbers 08041C 0533G and 08041C 0535G with effective dates of

December 7, 2018 and the previously mentioned LOMR 08-08-0541P with an effective date of July 23, 2009. (See Appendix).

DRAINAGE AND BRIDGE FEES

This site lies entirely within the Sand Creek Drainage Basin boundaries.

Fees are calculated using the following impervious acreage method approved by El Paso County. The final fee estimate will be included in the Final Drainage Report(s), however, the following represent fee estimates based on the Sterling Ranch East Preliminary Plan/PUD submittal with a total area of 35.76 acres with the following different land uses proposed:

16.59 Ac.	Open Space / Pond Tracts
20.17 Ac.	Less than 6000 SF lot size
36.76 Ac.	**Total**

The percent imperviousness for this subdivision is calculated as follows:

Fees for Open Space / Pond Tracts

(Per El Paso County Percent Impervious Chart: 7**%**)

16.59 Ac. x 7% = **1.16 Impervious Ac.**

Fees for less than 6000 SF lots

(Per El Paso County Percent Impervious Chart: 65**%)**

20.17 Ac. x 65% = **13.11 Impervious Ac.**

Total Impervious Acreage: 14.27 Imp. Ac.

The following calculations are based on the 2022 Sand Creek drainage/bridge fees:

ESTIMATED FEE TOTALS:

Bridge Fees

$ 8,923.00 x 14.27 Impervious Ac. = **$ 127,331.21**

Drainage Fees

$ 21,814.00 x 14.27 Impervious Ac. = **$ 311,285.78**

SUMMARY

The proposed Sterling Ranch East Preliminary Plan/PUD No. 2 is within the Sand Creek Drainage Basin. Recommendations are made within this report concerning necessary improvements that will be required as a result of development of this property. The points of storm water release from the proposed site are required to be at or below the calculated historic flow quantities. The development of the proposed site does not significantly impact any downstream facility or property to an extent greater than that which currently exists in the pre-development conditions. All drainage facilities within this report were sized according to the Drainage Criteria Manuals and the full-spectrum storm water quality requirements.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Marc A. Whorton, P.E.
Project Manager

maw/118320/PDR.doc

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

2. "Urban Storm Drainage Criteria Manual Volume 1, 2 & 3" Urban Drainage and Flood Control District, dated January 2016.

3. "Sand Creek Drainage Basin Planning Study," Kiowa Engineering Corporation, dated March 1996.

4. "2018 Sterling Ranch MDDP", M&S Civil Consultants, Inc., June 2018

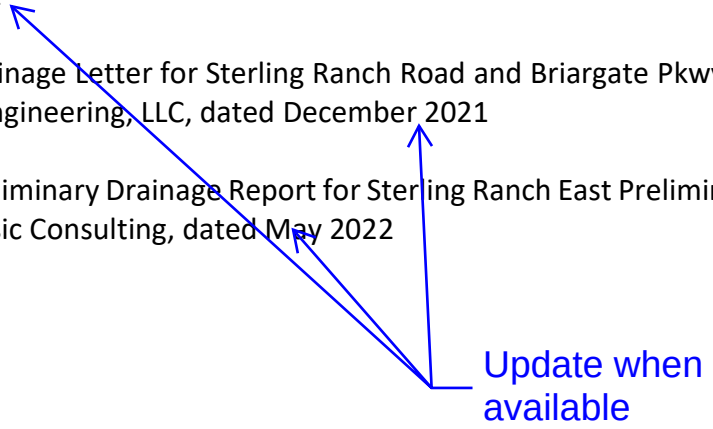
5. "Final Drainage Report for Retreat at TimberRidge Filing No. 1", Classic Consulting, approved November, 2020.

6. "Final Drainage Report for Retreat at TimberRidge Filing No. 2", Classic Consulting, dated March, 2022

7. "Final Design Report for Sand Creek Restoration", JR Engineering, LLC, dated October 21, 2021

8. "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated December 2021

9. "Preliminary Drainage Report for Sterling Ranch East Preliminary Plan No. 1", prepared by Classic Consulting, dated May 2022



APPENDIX

VICINITY MAP

CLASSIC SM
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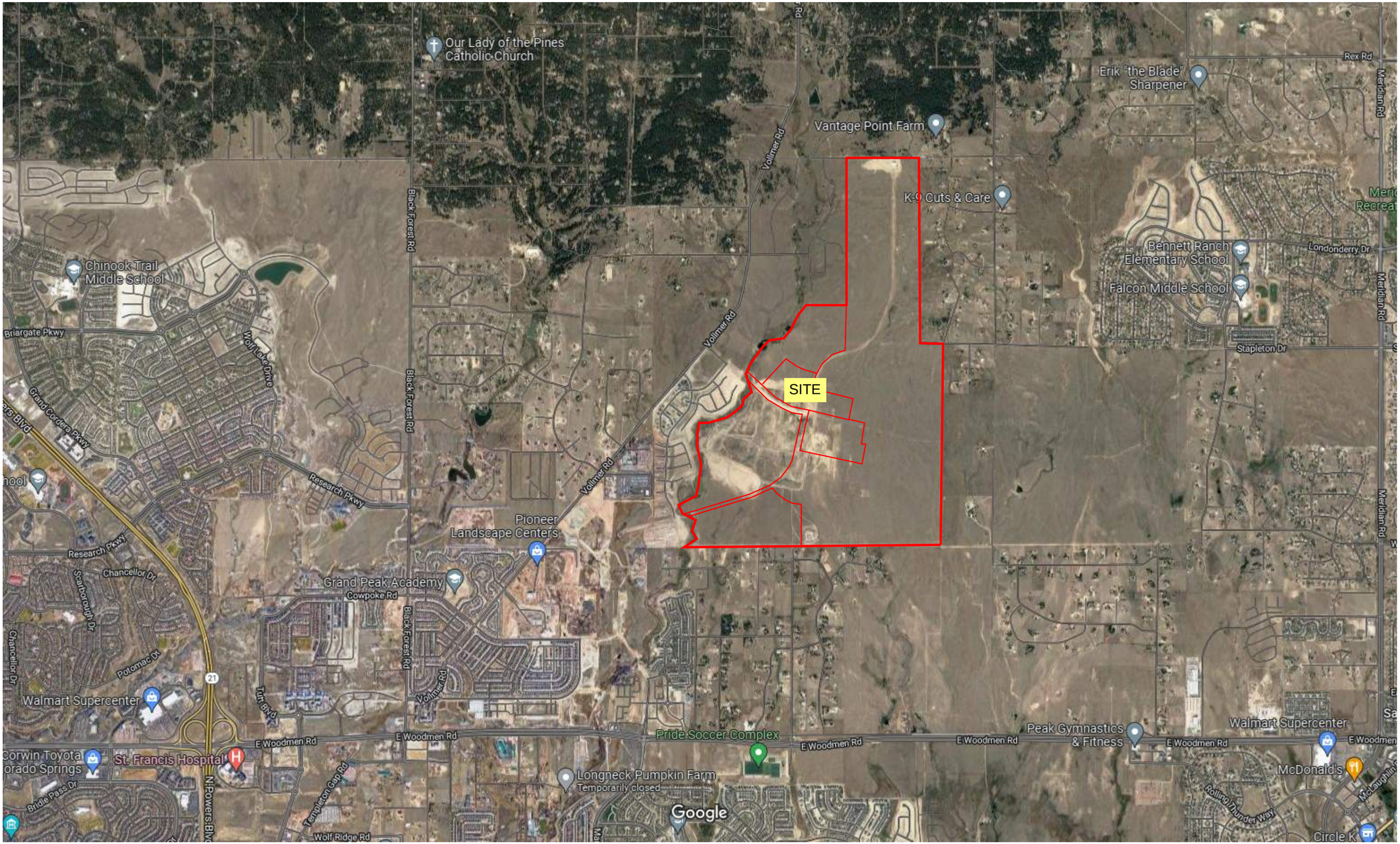
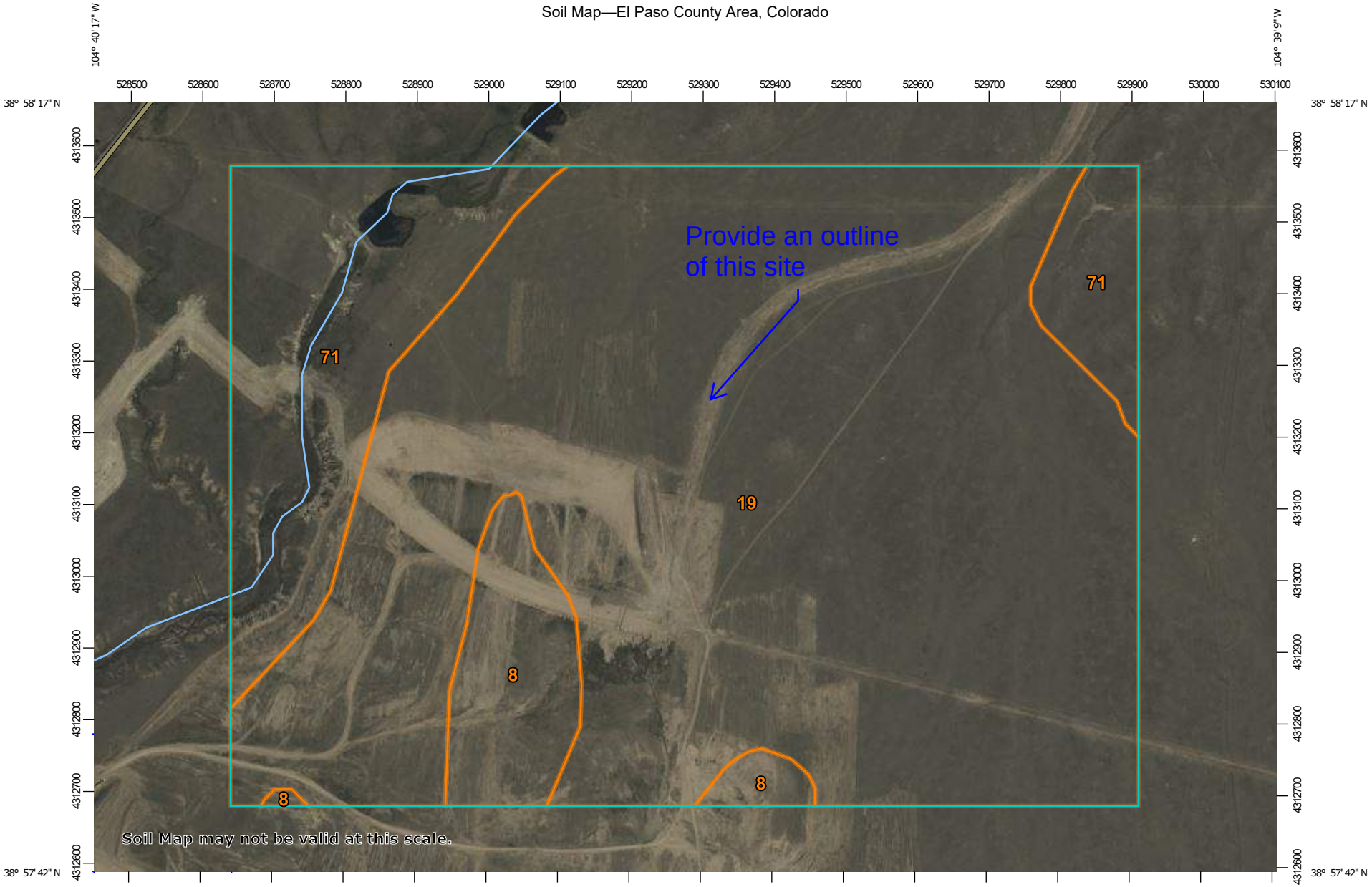


Imagery ©2022 Landsat / Copernicus, Maxar Technologies, USDA/FPAC/GEO, Map data ©2022 2000 ft

VICINITY MAP

SOILS MAP (S.C.S SURVEY)

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS



Map Scale: 1:7,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	17.5	6.2%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	213.6	75.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	50.3	17.9%
Totals for Area of Interest		**281.4**	**100.0%**

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

F.E.M.A. MAP / LOMR (08-08-0541P)

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

EL PASO COUNTY
UNINCORPORATED AREAS
080059

SUBLETTE RD
IC FERRAN RD
TOLTEC LN
THOMAS RD
HUNTSMAN RD
RD
ON RD
GLENSIDE DR
WILDFLOWER RD
POCO RD
PINE MEADO
PINE CONE LN
FAWN LN
TANGLEWILD LN
BUCKSKI
SHIPMAN LN
VOLLMER RD
TAIGA LN
DERRINGTON CT
BENNISON TER
MILLARD WAY
RAYGOR RD
PINE PARK TRL
ROCKI LN
SALBECK LN
RODGWICK HEIGHTS
FLAMING SUN DR
LIMIT OF STUDY
ARROYA LN
ZONE AE
7242
7235
DU
7231
DT
7225
DS
7220
7216
7210
DR
7205
7198
7192
DQ
7187
7183
DP
7177
7169
7162
DO
Sand Creek
7156
DN
7152
7149
7146
7143
7140
7137
7133
7131
7128
DK
DL
DM
DJ
7120
7116
7111
DI
7125
7107
7103
DH
7099
7095
7088
DG
7084
7080
7075
7071
7065
DF
DE
7060
DC
7056
DB
7049
DA
7045
7041
CY
7037
7033
CX
7029
7025
CZ
7020
7017
7012
CW
7008
CV
7004
7000
6996
6992
CU
6987
6979
6972
CT
6967
6964
CS
6949
6944
6940
6935
CR
6928
6924
CQ
6919
6915
6910
6906
6902
6900
6896
6891
CP
6886
6885
SITE
GLIDER LOOP
VOLLMER PL
MOJAVE DR
OTIS CIR
UNEL 0535
MUSTANG PL
MUSTANG RD
COCHISE RD
KENOSHA DR
PONCA RD
MAVERICK RD
MOHAWK RD
BRULE RD
21
22
27
29
28
32
33
34
3
4
5
T. 12 S.
T. 13 S.
ASO COUNTY
RPORATED AREAS
080059
D COUNTY
ORADO SPRINGS
CITY OF COLORADO SPRINGS
080060
EL PASO COUNTY
UNINCORPORATED AREAS
080059

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A — No Base Flood Elevations determined.
- ZONE AE — Base Flood Elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR — Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 (EL 987) — Base Flood Elevation line and value; elevation in feet* / Base Flood Elevation value where uniform within zone; elevation in feet*

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

- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4325000 mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

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

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
150 0 300 600 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0533G

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

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

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0533	G
EL PASO COUNTY	080059	0533	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0535G

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

PANEL 535 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0535	G
EL PASO COUNTY	080059	0535	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0535G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

REFERENCE MATERIAL

HYDROLOGIC CALCULATIONS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

EPA- 600/R-14/413b
Revisied September 2015

Storm Water Management Model User's Manual Version 5.1

by

Lewis A. Rossman
Envronmental Scientist, Emeritus
U.S. Environmental Protection Agency

National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
26 Martin Luther King Drive
Cincinnati, OH 45268

September 2015

5

RAIN GAGE

City of Colorado Springs DCM

2-hr Storm Cumulative Distribution

Table 6-5. 2-Hour Design Storm Distributions by Drainage Basin Area
(DARF-adjusted fraction of 1-Hour Depth)

Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0	0	0	0	0	0	0
5	0.014	0.014	0.014	0.014	0.015	0.015	0.017
10	0.046	0.044	0.041	0.041	0.042	0.042	0.040
15	0.079	0.076	0.074	0.074	0.073	0.070	0.068
20	0.120	0.116	0.109	0.109	0.106	0.102	0.095
25	0.179	0.176	0.169	0.168	0.163	0.157	0.147
30	0.258	0.249	0.239	0.236	0.227	0.216	0.198
35	0.421	0.396	0.354	0.327	0.307	0.276	0.242
40	0.712	0.655	0.559	0.495	0.448	0.381	0.315
45	0.824	0.756	0.637	0.560	0.506	0.422	0.345
50	0.892	0.824	0.700	0.619	0.566	0.479	0.396
55	0.935	0.866	0.740	0.658	0.601	0.512	0.428
60	0.972	0.901	0.774	0.690	0.634	0.543	0.456
65	1.004	0.934	0.806	0.717	0.661	0.570	0.482
70	1.018	0.948	0.821	0.732	0.678	0.589	0.501
75	1.030	0.962	0.835	0.746	0.692	0.603	0.515
80	1.041	0.973	0.849	0.760	0.706	0.617	0.529
85	1.052	0.984	0.863	0.774	0.720	0.631	0.543
90	1.063	0.995	0.875	0.788	0.734	0.645	0.557
95	1.072	1.006	0.886	0.802	0.748	0.659	0.571
100	1.082	1.017	0.896	0.813	0.762	0.673	0.585
105	1.091	1.026	0.907	0.824	0.773	0.687	0.599
110	1.100	1.036	0.918	0.835	0.783	0.698	0.611
115	1.109	1.045	0.929	0.846	0.794	0.709	0.622
120	1.119	1.054	0.938	0.857	0.805	0.720	0.633

5

6

City of Colorado Springs DCM

5-year, 2-hour Storm (Cumulative)

Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.021	0.021	0.021	0.021	0.023	0.023	0.026
10	0.069	0.066	0.062	0.062	0.063	0.063	0.060
15	0.119	0.114	0.111	0.111	0.110	0.105	0.102
20	0.180	0.174	0.164	0.164	0.159	0.153	0.143
25	0.269	0.264	0.254	0.252	0.245	0.236	0.221
30	0.387	0.374	0.359	0.354	0.341	0.324	0.297
35	0.632	0.594	0.531	0.491	0.461	0.414	0.363
40	1.068	0.983	0.839	0.743	0.672	0.572	0.473
45	1.236	1.134	0.956	0.840	0.759	0.633	0.518
50	1.338	1.236	1.050	0.929	0.849	0.719	0.594
55	1.403	1.299	1.110	0.987	0.902	0.768	0.642
60	1.458	1.352	1.161	1.035	0.951	0.815	0.684
65	1.506	1.401	1.209	1.076	0.992	0.855	0.723
70	1.527	1.422	1.232	1.098	1.017	0.884	0.752
75	1.545	1.443	1.253	1.119	1.038	0.905	0.773
80	1.562	1.460	1.274	1.140	1.059	0.926	0.794
85	1.578	1.476	1.295	1.161	1.080	0.947	0.815
90	1.595	1.493	1.313	1.182	1.101	0.968	0.836
95	1.608	1.509	1.329	1.203	1.122	0.989	0.857
100	1.623	1.526	1.344	1.220	1.143	1.010	0.878
105	1.637	1.539	1.361	1.236	1.160	1.031	0.899
110	1.650	1.554	1.377	1.253	1.175	1.047	0.917
115	1.664	1.568	1.394	1.269	1.191	1.064	0.933
120	1.679	1.581	1.407	1.286	1.208	1.080	0.950

6

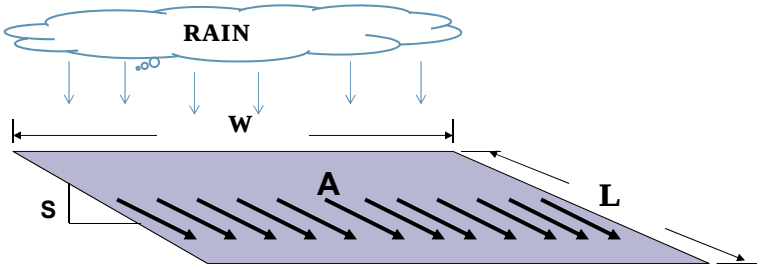
City of Colorado Springs DCM

100-year, 2-hour Storm (Cumulative)

Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.035	0.035	0.035	0.035	0.038	0.038	0.043
10	0.116	0.111	0.103	0.103	0.106	0.106	0.101
15	0.199	0.192	0.186	0.186	0.184	0.176	0.171
20	0.302	0.292	0.275	0.275	0.267	0.257	0.239
25	0.451	0.444	0.426	0.423	0.411	0.396	0.370
30	0.650	0.627	0.602	0.595	0.572	0.544	0.499
35	1.061	0.998	0.892	0.824	0.774	0.696	0.610
40	1.794	1.651	1.409	1.247	1.129	0.960	0.794
45	2.076	1.905	1.605	1.411	1.275	1.063	0.869
50	2.248	2.076	1.764	1.560	1.426	1.207	0.998
55	2.356	2.182	1.865	1.658	1.515	1.290	1.079
60	2.449	2.271	1.950	1.739	1.598	1.368	1.149
65	2.530	2.354	2.031	1.807	1.666	1.436	1.215
70	2.565	2.389	2.069	1.845	1.709	1.484	1.263
75	2.596	2.424	2.104	1.880	1.744	1.520	1.298
80	2.623	2.452	2.139	1.915	1.779	1.555	1.333
85	2.651	2.480	2.175	1.950	1.814	1.590	1.368
90	2.679	2.507	2.205	1.986	1.850	1.625	1.404
95	2.701	2.535	2.233	2.021	1.885	1.661	1.439
100	2.727	2.563	2.258	2.049	1.920	1.696	1.474
105	2.749	2.586	2.286	2.076	1.948	1.731	1.509
110	2.772	2.611	2.313	2.104	1.973	1.759	1.540
115	2.795	2.633	2.341	2.132	2.001	1.787	1.567
120	2.820	2.656	2.364	2.160	2.029	1.814	1.595

7

Subcatchment Conceptual Model



Subcatchment represented as a sloped, rectangular plane

W = width
L = length
S = slope
A = area

8

Percent Impervious

Estimating/Measuring Percent Impervious:

- **If site-specific information is not available, use land use classification**
- **Sometimes, site-specific impervious GIS layers are available**

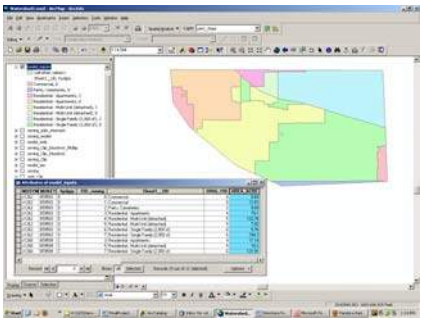


Table RO-3—Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage Imperviousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yard areas	15
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	0
Lawns, clayey soil	0

* See Figures RO-3 through RO-5 for percentage imperviousness.

Source: UDFCD Storm Drainage Criteria Manual

15

City of Colorado Springs DCM - Manning's n

Table 6-11. Roughness Coefficients (Manning's n) for NRCS Overland Flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, bare soil, etc.)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods[3]	
Light underbrush	0.40
Dense underbrush	0.80

16

Table 3-1 Impervious area as a percentage of land use.

Land Use	Percent Impervious Area
Commercial	56
Industrial	76
High density residential	51
Medium density residential	38
Low density residential	19
Institutional	34
Agricultural	2
Forest	1.9
Open Urban Land	11

As mentioned earlier, impervious areas in SWMM are hydraulically (directly) connected to the drainage system – called directly connected impervious areas (DCIA). For instance, if rooftops drain onto adjacent pervious lawn areas, they should not be treated as a hydraulically effective impervious area. Such areas are non-effective impervious areas (Doyle and Miller, 1980). On the other hand, if a driveway drains to a street and then to a stormwater inlet, the driveway would be considered hydraulically connected. Rooftops with downspouts connected directly to a sewer are clearly hydraulically connected. An example of careful measurements and statistics on imperviousness may be found in Field et al. (2000), Lee (2003), and Roy and Shuster (2007). Lee and Heaney (2003) provide detailed comparisons of imperviousness computations and their implications for modeling.

Should rooftops be treated as "pervious," the real surrounding pervious area is subject to more incoming water than rainfall alone and thus might produce runoff sooner than if rainfall alone were considered. In the possible event that this effect is important (a judgment based on infiltration parameters) it can be modeled using the overland flow re-routing option discussed earlier in Section 3.7. For example, if disconnected rooftops comprised 25 percent of the total impervious area of a subcatchment (as opposed to the total DCIA) then one could tell SWMM that this percentage of impervious area should be internally routed onto the pervious sub-area of the subcatchment.

Another method of estimating the effective impervious area given measured data is to plot the runoff (in. or mm) vs. rainfall (in. or mm) for small storms. The slope of the regression line is a good estimate of the effective impervious area (Doyle and Miller, 1980).

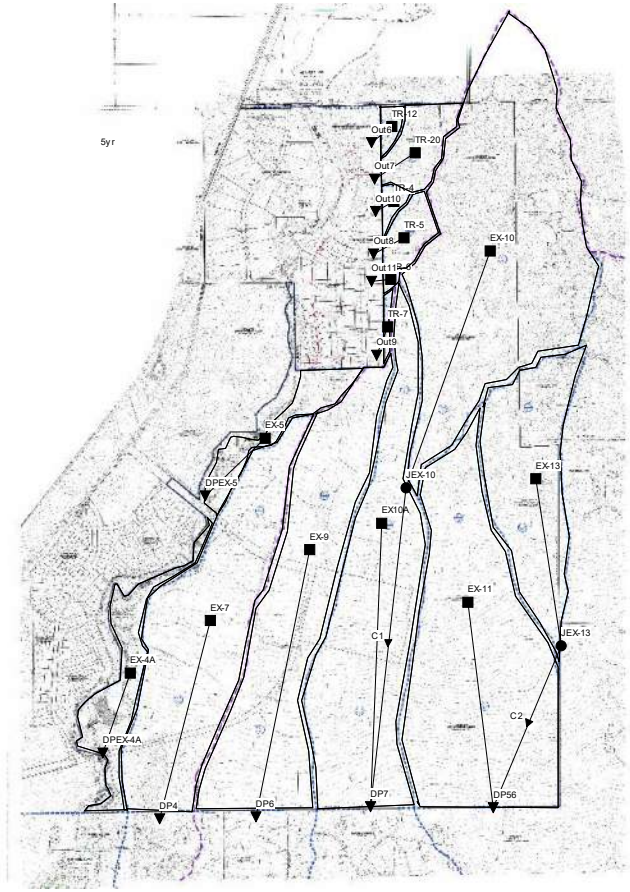
Table 3-5 Estimates of Manning's roughness coefficient for overland flow

Source	Ground Cover	n	Range
Crawford and Linsley (1966)[a]	Smooth asphalt	0.01	
	Asphalt of concrete paving	0.014	
	Packed clay	0.03	
	Light turf	0.20	
	Dense turf	0.35	
	Dense shrubbery and forest litter	0.4	
Engman (1986)[b]	Concrete or asphalt	0.011	0.010-0.013
	Bare sand	0.010	0.01-0.016
	Graveled surface	0.02	0.012-0.03
	Bare clay-loam (eroded)	0.02	0.012-0.033
	Range (natural)	0.13	0.01-0.32
	Bluegrass sod	0.45	0.39-0.63
	Short grass prairie	0.15	0.10-0.20
	Bermuda grass	0.41	0.30-0.48
Yen (2001)[c]	Smooth asphalt pavement	0.012	0.010-0.015
	Smooth impervious surface	0.013	0.011-0.015
	Tar and sand pavement	0.014	0.012-0.016
	Concrete pavement	0.017	0.014-0.020
	Rough impervious surface	0.019	0.015-0.023
	Smooth bare packed soil	0.021	0.017-0.025
	Moderate bare packed soil	0.030	0.025-0.035
	Rough bare packed soil	0.038	0.032-0.045
	Gravel soil	0.032	0.025-0.045
	Mowed poor grass	0.038	0.030-0.045
	Average grass, closely clipped sod	0.050	0.040-0.060
	Pasture	0.055	0.040-0.070
	Timberland	0.090	0.060-0.120
	Dense grass	0.090	0.060-0.120
	Shrubs and bushes	0.120	0.080-0.180
	Business land use	0.022	0.014-0.035
	Semi-business land use	0.035	0.022-0.050
	Industrial land use	0.035	0.020-0.050
	Dense residential land use	0.040	0.025-0.060
	Suburban residential land use	0.055	0.030-0.080
	Parks and lawns	0.075	0.040-0.120

[a]Obtained by calibration of Stanford Watershed Model.
[b]Computed by Engman (1986) by kinematic wave and storage analysis of measured rainfall-runoff data.
[c]Computed on basis of kinematic wave analysis.

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS

04/15/2022 00:05:00



Provide a larger plan. See drainage plan redlines about sub-basins

Not checked with this review

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	1.68	0.00	0.00	1.50	0.18	1.28	105.15	0.106
EX10A	1.68	0.00	0.00	1.53	0.15	0.70	52.19	0.087
EX-11	1.68	0.00	0.00	1.54	0.14	0.80	53.86	0.082
EX-13	1.68	0.00	0.00	1.48	0.20	0.50	35.71	0.117
EX-4A	1.68	0.00	0.00	1.52	0.15	0.18	19.26	0.091
EX-5	1.68	0.00	0.00	1.52	0.16	0.11	11.51	0.093
EX-7	1.68	0.00	0.00	1.54	0.14	0.57	38.87	0.081
EX-9	1.68	0.00	0.00	1.52	0.16	0.77	61.35	0.095
TR-12	1.68	0.00	0.00	1.43	0.25	0.03	1.88	0.148
TR-20	1.68	0.00	0.00	1.45	0.22	0.14	10.01	0.131
TR-4	1.68	0.00	0.00	1.42	0.25	0.03	1.78	0.150
TR-5	1.68	0.00	0.00	1.48	0.20	0.07	4.56	0.116
TR-6	1.68	0.00	0.00	1.38	0.30	0.01	0.83	0.177
TR-7	1.68	0.00	0.00	1.43	0.24	0.02	1.01	0.144

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	79.93	4.43	38.87	0.572
DP56	98.59	8.23	59.57	1.311
DP6	98.59	4.84	61.35	0.771
DP7	98.59	12.48	114.01	1.989
DPEX-4A	61.64	1.84	19.26	0.183
DPEX-5	53.38	1.29	11.51	0.111
Out10	36.27	0.51	1.78	0.030
Out11	34.38	0.22	0.83	0.012
Out6	36.44	0.54	1.88	0.032
Out7	48.80	1.75	10.01	0.138
Out8	41.34	1.09	4.56	0.073
Out9	35.63	0.30	1.01	0.017

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

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE (5 yr.)


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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... KINWAVE
Starting Date ............ 04/15/2022 00:00:00
Ending Date .............. 04/15/2022 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 5.00 sec


*************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
*************************     ---------       -------
Total Precipitation ......       168.488         1.679
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........       152.045         1.515
Surface Runoff ...........        16.032         0.160
Final Storage ............         0.421         0.004
Continuity Error (%) .....        -0.006


*************************        Volume        Volume
```

Flow Routing Continuity	acre-feet	10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	16.032	5.224
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	16.079	5.240
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.002
Continuity Error (%)	-0.326	

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

****
Routing Time Step Summary
****

Minimum Time Step	:	5.00 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-7	1.68	0.00	0.00	1.54	0.14			

```
0.57    38.87   0.081
  EX-9                      1.68       0.00       0.00       1.52       0.16
0.77    61.35   0.095
  EX10A                     1.68       0.00       0.00       1.53       0.15
0.70    52.19   0.087
  EX-11                     1.68       0.00       0.00       1.54       0.14
0.80    53.86   0.082
  EX-13                     1.68       0.00       0.00       1.48       0.20
0.50    35.71   0.117
  EX-10                     1.68       0.00       0.00       1.50       0.18
1.28   105.15   0.106
  TR-7                      1.68       0.00       0.00       1.43       0.24
0.02     1.01   0.144
  TR-6                      1.68       0.00       0.00       1.38       0.30
0.01     0.83   0.177
  TR-5                      1.68       0.00       0.00       1.48       0.20
0.07     4.56   0.116
  TR-4                      1.68       0.00       0.00       1.42       0.25
0.03     1.78   0.150
  TR-12                     1.68       0.00       0.00       1.43       0.25
0.03     1.88   0.148
  TR-20                     1.68       0.00       0.00       1.45       0.22
0.14    10.01   0.131
  EX-4A                     1.68       0.00       0.00       1.52       0.15
0.18    19.26   0.091
  EX-5                      1.68       0.00       0.00       1.52       0.16
0.11    11.51   0.093


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

  ----------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Feet     Feet     Feet  days hr:min        Feet
  ----------------------------------------------------------------------------
  JEX-10               JUNCTION   0.18     1.14  7149.14     0  00:45        1.14
  JEX-13               JUNCTION   0.14     0.84  7070.84     0  00:45        0.84
  DP4                  OUTFALL    0.00     0.00  6998.00     0  00:00        0.00
  DP6                  OUTFALL    0.00     0.00  7026.00     0  00:00        0.00
  DP7                  OUTFALL    0.19     1.01  7017.01     0  00:47        0.98
  DP56                 OUTFALL    0.15     0.64  7008.64     0  00:52        0.63
  Out6                 OUTFALL    0.00     0.00  7270.00     0  00:00        0.00
  Out7                 OUTFALL    0.00     0.00  7246.00     0  00:00        0.00
  Out8                 OUTFALL    0.00     0.00  7230.00     0  00:00        0.00
  Out9                 OUTFALL    0.00     0.00  7190.00     0  00:00        0.00
  Out10                OUTFALL    0.00     0.00  7250.00     0  00:00        0.00
  Out11                OUTFALL    0.00     0.00  7228.00     0  00:00        0.00
```

DPEX-4A	OUTFALL	0.00	0.00	7001.00	0	00:00	0.00
DPEX-5	OUTFALL	0.00	0.00	7144.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
JEX-10	JUNCTION	105.15	105.15	0 00:45	1.28	1.28	0.000
JEX-13	JUNCTION	35.71	35.71	0 00:45	0.505	0.505	0.000
DP4	OUTFALL	38.87	38.87	0 00:45	0.572	0.572	0.000
DP6	OUTFALL	61.35	61.35	0 00:45	0.771	0.771	0.000
DP7	OUTFALL	52.19	114.01	0 00:47	0.699	1.99	0.000
DP56	OUTFALL	53.86	59.57	0 00:45	0.797	1.31	0.000
Out6	OUTFALL	1.88	1.88	0 00:45	0.0317	0.0317	0.000
Out7	OUTFALL	10.01	10.01	0 00:45	0.138	0.138	0.000
Out8	OUTFALL	4.56	4.56	0 00:45	0.0727	0.0727	0.000
Out9	OUTFALL	1.01	1.01	0 00:45	0.0171	0.0171	0.000
Out10	OUTFALL	1.78	1.78	0 00:45	0.0301	0.0301	0.000
Out11	OUTFALL	0.83	0.83	0 00:50	0.0121	0.0121	0.000
DPEX-4A	OUTFALL	19.26	19.26	0 00:45	0.183	0.183	0.000
DPEX-5	OUTFALL	11.51	11.51	0 00:45	0.111	0.111	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP4	79.93	4.43	38.87	0.572
DP6	98.59	4.84	61.35	0.771
DP7	98.59	12.48	114.01	1.989
DP56	98.59	8.23	59.57	1.311
Out6	36.44	0.54	1.88	0.032
Out7	48.80	1.75	10.01	0.138
Out8	41.34	1.09	4.56	0.073
Out9	35.63	0.30	1.01	0.017
Out10	36.27	0.51	1.78	0.030
Out11	34.38	0.22	0.83	0.012
DPEX-4A	61.64	1.84	19.26	0.183
DPEX-5	53.38	1.29	11.51	0.111
System	60.30	37.52	314.03	5.239

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C2	CHANNEL	20.17	0 00:52	2.85	0.01	0.16
C1	CHANNEL	81.10	0 00:47	5.50	0.04	0.25

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue May 24 17:21:52 2022
Analysis ended on: Tue May 24 17:21:52 2022
Total elapsed time: < 1 sec

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	2.82	0.00	0.00	2.12	0.70	5.04	221.82	0.248
EX10A	2.82	0.00	0.00	2.16	0.65	3.10	116.83	0.231
EX-11	2.82	0.00	0.00	2.16	0.66	3.84	129.43	0.234
EX-13	2.82	0.00	0.00	1.98	0.83	2.15	85.43	0.296
EX-4A	2.82	0.00	0.00	2.01	0.80	0.96	49.54	0.285
EX-5	2.82	0.00	0.00	1.97	0.85	0.60	31.56	0.300
EX-7	2.82	0.00	0.00	2.16	0.65	2.75	92.96	0.232
EX-9	2.82	0.00	0.00	2.16	0.66	3.19	131.65	0.234
TR-12	2.82	0.00	0.00	1.66	1.16	0.15	9.32	0.411
TR-20	2.82	0.00	0.00	1.79	1.03	0.65	31.58	0.365
TR-4	2.82	0.00	0.00	1.65	1.16	0.14	8.91	0.413
TR-5	2.82	0.00	0.00	1.81	1.01	0.38	17.25	0.359
TR-6	2.82	0.00	0.00	1.57	1.25	0.05	4.42	0.443
TR-7	2.82	0.00	0.00	1.67	1.14	0.08	4.90	0.405

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	80.51	21.15	92.96	2.751
DP56	98.59	37.64	160.10	5.996
DP6	98.59	20.04	131.65	3.192
DP7	98.59	51.21	258.75	8.157
DPEX-4A	62.08	9.61	49.54	0.964
DPEX-5	53.80	6.93	31.56	0.603
Out10	36.62	2.35	8.91	0.139
Out11	34.56	0.91	4.42	0.051
Out6	36.90	2.48	9.32	0.148
Out7	49.14	8.16	31.58	0.648
Out8	42.15	5.53	17.25	0.376
Out9	37.27	1.34	4.90	0.081

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

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE (100 yr.)

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

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... KINWAVE
Starting Date 04/15/2022 00:00:00
Ending Date 04/15/2022 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 01:00:00
Routing Time Step ..... 5.00 sec

********** Volume Depth
Runoff Quantity Continuity acre-feet inches
********** --------- -------
Total Precipitation 282.987 2.820
Evaporation Loss 0.000 0.000
Infiltration Loss 211.752 2.110
Surface Runoff 70.837 0.706
Final Storage 0.421 0.004
Continuity Error (%) ..... -0.008

********** Volume Volume

Flow Routing Continuity	acre-feet	10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	70.837	23.083
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	70.909	23.107
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.006	0.002
Continuity Error (%)	-0.110	

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

****
Routing Time Step Summary
****

Minimum Time Step	:	5.00 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.01
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-7	2.82	0.00	0.00	2.16	0.65			

2.75 92.96 0.232
  EX-9 2.82 0.00 0.00 2.16 0.66
3.19 131.65 0.234
  EX10A 2.82 0.00 0.00 2.16 0.65
3.10 116.83 0.231
  EX-11 2.82 0.00 0.00 2.16 0.66
3.84 129.43 0.234
  EX-13 2.82 0.00 0.00 1.98 0.83
2.15 85.43 0.296
  EX-10 2.82 0.00 0.00 2.12 0.70
5.04 221.82 0.248
  TR-7 2.82 0.00 0.00 1.67 1.14
0.08 4.90 0.405
  TR-6 2.82 0.00 0.00 1.57 1.25
0.05 4.42 0.443
  TR-5 2.82 0.00 0.00 1.81 1.01
0.38 17.25 0.359
  TR-4 2.82 0.00 0.00 1.65 1.16
0.14 8.91 0.413
  TR-12 2.82 0.00 0.00 1.66 1.16
0.15 9.32 0.411
  TR-20 2.82 0.00 0.00 1.79 1.03
0.65 31.58 0.365
  EX-4A 2.82 0.00 0.00 2.01 0.80
0.96 49.54 0.285
  EX-5 2.82 0.00 0.00 1.97 0.85
0.60 31.56 0.300

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
JEX-10	JUNCTION	0.42	1.58	7149.58	0 00:45	1.58
JEX-13	JUNCTION	0.33	1.25	7071.25	0 00:45	1.24
DP4	OUTFALL	0.00	0.00	6998.00	0 00:00	0.00
DP6	OUTFALL	0.00	0.00	7026.00	0 00:00	0.00
DP7	OUTFALL	0.43	1.42	7017.42	0 00:47	1.38
DP56	OUTFALL	0.34	1.08	7009.08	0 01:11	1.08
Out6	OUTFALL	0.00	0.00	7270.00	0 00:00	0.00
Out7	OUTFALL	0.00	0.00	7246.00	0 00:00	0.00
Out8	OUTFALL	0.00	0.00	7230.00	0 00:00	0.00
Out9	OUTFALL	0.00	0.00	7190.00	0 00:00	0.00
Out10	OUTFALL	0.00	0.00	7250.00	0 00:00	0.00
Out11	OUTFALL	0.00	0.00	7228.00	0 00:00	0.00

DPEX-4A	OUTFALL	0.00	0.00	7001.00	0	00:00	0.00
DPEX-5	OUTFALL	0.00	0.00	7144.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
JEX-10	JUNCTION	221.82	221.82	0 00:45	5.04	5.04	0.000
JEX-13	JUNCTION	85.43	85.43	0 00:45	2.15	2.15	0.000
DP4	OUTFALL	92.96	92.96	0 00:45	2.75	2.75	0.000
DP6	OUTFALL	131.65	131.65	0 00:45	3.19	3.19	0.000
DP7	OUTFALL	116.83	258.75	0 00:47	3.1	8.16	0.000
DP56	OUTFALL	129.43	160.10	0 01:05	3.84	6	0.000
Out6	OUTFALL	9.32	9.32	0 00:50	0.148	0.148	0.000
Out7	OUTFALL	31.58	31.58	0 00:45	0.648	0.648	0.000
Out8	OUTFALL	17.25	17.25	0 00:45	0.376	0.376	0.000
Out9	OUTFALL	4.90	4.90	0 00:50	0.0807	0.0807	0.000
Out10	OUTFALL	8.91	8.91	0 00:50	0.139	0.139	0.000
Out11	OUTFALL	4.42	4.42	0 00:45	0.0509	0.0509	0.000
DPEX-4A	OUTFALL	49.54	49.54	0 00:45	0.964	0.964	0.000
DPEX-5	OUTFALL	31.56	31.56	0 00:45	0.603	0.603	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
DP4	80.51	21.15	92.96	2.751
DP6	98.59	20.04	131.65	3.192
DP7	98.59	51.21	258.75	8.157
DP56	98.59	37.64	160.10	5.996
Out6	36.90	2.48	9.32	0.148
Out7	49.14	8.16	31.58	0.648
Out8	42.15	5.53	17.25	0.376
Out9	37.27	1.34	4.90	0.081
Out10	36.62	2.35	8.91	0.139
Out11	34.56	0.91	4.42	0.051
DPEX-4A	62.08	9.61	49.54	0.964
DPEX-5	53.80	6.93	31.56	0.603
System	60.73	167.35	759.81	23.105

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C2	CHANNEL	61.82	0 01:11	3.58	0.04	0.27
C1	CHANNEL	173.59	0 00:47	6.32	0.08	0.35

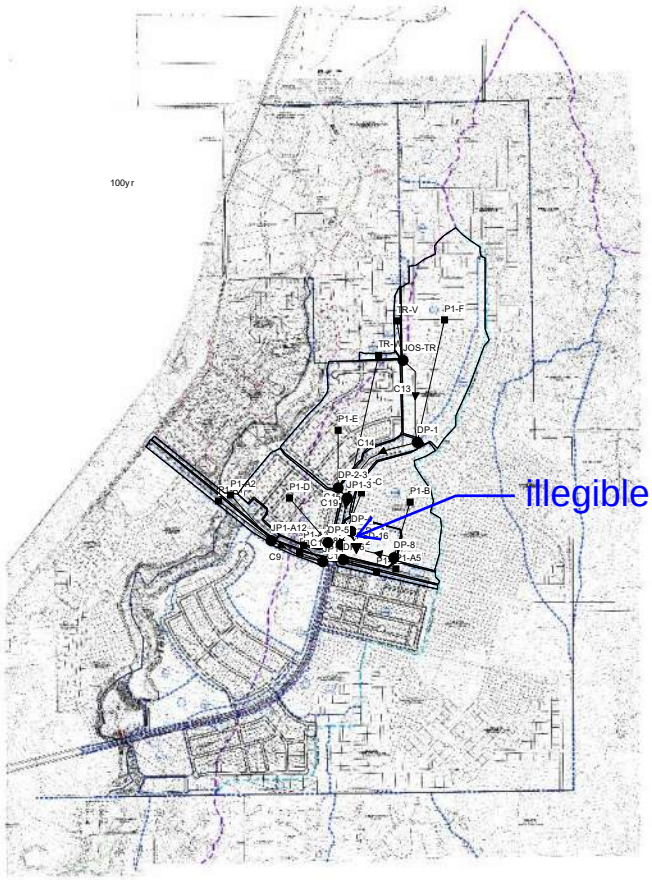
****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue May 24 17:27:15 2022
Analysis ended on: Tue May 24 17:27:15 2022
Total elapsed time: < 1 sec

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2

04/18/2022 00:15:00



Illegible

Provide a larger plan

Not checked with this review

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2 (5yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
P1-A	1.68	0.00	0.00	1.43	0.24	0.08	6.19	0.144
P1-A1	1.68	0.00	0.00	0.86	0.79	0.11	10.79	0.473
P1-A2	1.68	0.00	0.00	0.88	0.77	0.13	11.96	0.457
P1-A3	1.68	0.00	0.00	0.75	0.90	0.04	4.61	0.534
P1-A4	1.68	0.00	0.00	0.76	0.89	0.05	5.08	0.532
P1-A5	1.68	0.00	0.00	0.85	0.80	0.09	9.64	0.479
P1-A6	1.68	0.00	0.00	0.76	0.89	0.07	7.00	0.529
P1-B	1.68	0.00	0.00	1.00	0.65	0.63	55.37	0.387
P1-C	1.68	0.00	0.00	0.95	0.71	0.21	21.19	0.420
P1-D	1.68	0.00	0.00	1.00	0.66	0.56	52.52	0.392
P1-E	1.68	0.00	0.00	1.04	0.61	0.87	83.14	0.365
P1-F	1.68	0.00	0.00	1.12	0.54	1.12	110.51	0.321
TR-V	1.68	0.00	0.00	1.23	0.44	0.02	2.29	0.259
TR-W	1.68	0.00	0.00	0.97	0.69	0.03	2.66	0.410

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2 (5yr. Event)

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
DP-1	JUNCTION	110.51	111.99	0	00:45	1.12	1.15	0.000
DP-2-3	JUNCTION	83.14	83.14	0	00:45	0.869	0.869	0.000
DP-4	JUNCTION	0.00	187.03	0	00:47	0	2.03	0.000
DP-5	JUNCTION	52.52	52.52	0	00:45	0.561	0.561	0.000
DP-6	JUNCTION	16.64	16.64	0	00:45	0.161	0.161	0.000
DP-7	JUNCTION	21.19	117.48	0	00:46	0.205	1.26	0.000
DP-8	JUNCTION	55.37	55.37	0	00:45	0.626	0.626	0.000
FSD-16	OUTFALL	6.19	362.95	0	00:46	0.0832	4	0.000
JOS-TR	JUNCTION	2.29	2.29	0	00:45	0.0248	0.0248	0.000
JP1-3	JUNCTION	2.66	190.10	0	00:46	0.0261	2.04	0.000
JP1-A12	JUNCTION	22.75	22.75	0	00:45	0.241	0.241	0.000
JP1-A34	JUNCTION	9.69	30.20	0	00:46	0.0924	0.333	0.000

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2 (5yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
FSD-16	98.47	25.12	362.95	3.997

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

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE (5 yr.)

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

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... KINWAVE
Starting Date 04/18/2022 00:00:00
Ending Date 04/18/2022 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:15:00
Wet Time Step 00:05:00
Dry Time Step 01:00:00
Routing Time Step ..... 30.00 sec

**********	Volume	Depth
Runoff Quantity Continuity	acre-feet	inches
Total Precipitation	34.280	1.679
Evaporation Loss	0.000	0.000
Infiltration Loss	21.542	1.055
Surface Runoff	12.313	0.603
Final Storage	0.536	0.026
Continuity Error (%)	-0.325	

**********	Volume	Volume

Flow Routing Continuity	acre-feet	10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	12.313	4.012
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	12.265	3.997
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.002	0.001
Continuity Error (%)	0.371	

****
Highest Flow Instability Indexes
****
Link C13 (1)
Link C16 (1)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.71
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff

P1-A6		1.68	0.00	0.00	0.76	0.89	
0.07	7.00	0.529					
P1-A5		1.68	0.00	0.00	0.85	0.80	
0.09	9.64	0.479					
P1-A4		1.68	0.00	0.00	0.76	0.89	
0.05	5.08	0.532					
P1-A		1.68	0.00	0.00	1.43	0.24	
0.08	6.19	0.144					
P1-A1		1.68	0.00	0.00	0.86	0.79	
0.11	10.79	0.473					
P1-A2		1.68	0.00	0.00	0.88	0.77	
0.13	11.96	0.457					
P1-A3		1.68	0.00	0.00	0.75	0.90	
0.04	4.61	0.534					
P1-C		1.68	0.00	0.00	0.95	0.71	
0.21	21.19	0.420					
P1-B		1.68	0.00	0.00	1.00	0.65	
0.63	55.37	0.387					
P1-D		1.68	0.00	0.00	1.00	0.66	
0.56	52.52	0.392					
P1-E		1.68	0.00	0.00	1.04	0.61	
0.87	83.14	0.365					
TR-W		1.68	0.00	0.00	0.97	0.69	
0.03	2.66	0.410					
TR-V		1.68	0.00	0.00	1.23	0.44	
0.02	2.29	0.259					
P1-F		1.68	0.00	0.00	1.12	0.54	
1.12	110.51	0.321					

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
JP1-A12	JUNCTION	0.21	1.35	7105.35	0 00:45	1.31
JP1-A34	JUNCTION	0.22	1.42	7099.42	0 00:46	1.34
DP-7	JUNCTION	10.24	14.00	7110.00	0 00:46	11.41
DP-8	JUNCTION	0.31	1.93	7097.93	0 00:45	1.88
DP-4	JUNCTION	22.42	24.84	7120.84	0 00:47	24.56
JP1-3	JUNCTION	10.32	12.10	7140.10	0 00:46	11.93
DP-1	JUNCTION	10.06	10.35	7165.35	0 00:48	10.29
JOS-TR	JUNCTION	0.05	0.38	7190.38	0 00:45	0.37
DP-6	JUNCTION	0.18	1.36	7099.36	0 00:45	1.32
DP-5	JUNCTION	0.23	1.47	7111.47	0 00:45	1.43
DP-2-3	JUNCTION	0.32	2.18	7134.18	0 00:45	2.12

FSD-16	OUTFALL	0.44	3.38	7098.38	0	00:46	3.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
JP1-A12	JUNCTION	22.75	22.75	0 00:45	0.241	0.241	0.000
JP1-A34	JUNCTION	9.69	30.20	0 00:46	0.0924	0.333	0.000
DP-7	JUNCTION	21.19	117.48	0 00:46	0.205	1.26	0.000
DP-8	JUNCTION	55.37	55.37	0 00:45	0.626	0.626	0.000
DP-4	JUNCTION	0.00	187.03	0 00:47	0	2.03	0.000
JP1-3	JUNCTION	2.66	190.10	0 00:46	0.0261	2.04	0.000
DP-1	JUNCTION	110.51	111.99	0 00:45	1.12	1.15	0.000
JOS-TR	JUNCTION	2.29	2.29	0 00:45	0.0248	0.0248	0.000
DP-6	JUNCTION	16.64	16.64	0 00:45	0.161	0.161	0.000
DP-5	JUNCTION	52.52	52.52	0 00:45	0.561	0.561	0.000
DP-2-3	JUNCTION	83.14	83.14	0 00:45	0.869	0.869	0.000
FSD-16	OUTFALL	6.19	362.95	0 00:46	0.0832	4	0.000

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-7	0.02	0.10	0 00:46	0.000	0.000

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
FSD-16	98.47	25.12	362.95	3.997
System	98.47	25.12	362.95	3.997

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C9	CONDUIT	21.50	0 00:47	7.45	0.39	0.44
C10	CONDUIT	30.13	0 00:46	8.24	0.35	0.41
C11	CONDUIT	120.22	0 00:46	10.86	1.03	0.90
C12	CONDUIT	54.72	0 00:46	9.24	0.47	0.48
C13	CONDUIT	1.96	0 00:48	5.85	0.07	0.17
C14	CONDUIT	107.12	0 00:46	14.03	0.37	0.42
C15	CONDUIT	187.03	0 00:47	15.28	0.53	0.52
C16	CONDUIT	187.29	0 00:47	15.11	0.53	0.52
C17	CONDUIT	51.83	0 00:46	12.57	0.29	0.37
C18	CONDUIT	16.16	0 00:46	6.18	0.56	0.53
C19	CONDUIT	81.88	0 00:46	11.90	0.57	0.54

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2 (100yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
P1-A	2.82	0.00	0.00	1.75	1.07	0.37	18.97	0.380
P1-A1	2.82	0.00	0.00	1.05	1.75	0.24	20.94	0.621
P1-A2	2.82	0.00	0.00	1.15	1.65	0.29	23.30	0.584
P1-A3	2.82	0.00	0.00	0.88	1.92	0.09	9.12	0.682
P1-A4	2.82	0.00	0.00	0.88	1.91	0.10	10.01	0.679
P1-A5	2.82	0.00	0.00	1.02	1.79	0.21	18.89	0.633
P1-A6	2.82	0.00	0.00	0.90	1.90	0.14	13.69	0.674
P1-B	2.82	0.00	0.00	1.36	1.44	1.39	108.03	0.512
P1-C	2.82	0.00	0.00	1.13	1.67	0.49	42.78	0.593
P1-D	2.82	0.00	0.00	1.31	1.49	1.27	101.80	0.529
P1-E	2.82	0.00	0.00	1.37	1.43	2.03	161.09	0.509
P1-F	2.82	0.00	0.00	1.46	1.34	2.80	215.28	0.476
TR-V	2.82	0.00	0.00	1.45	1.36	0.08	5.72	0.483
TR-W	2.82	0.00	0.00	1.19	1.62	0.06	5.23	0.573

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2 (100yr. Event)

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
DP-1	JUNCTION	215.28	219.02	0	00:45	2.8	2.87	0.000
DP-2-3	JUNCTION	161.09	161.09	0	00:45	2.03	2.03	0.000
DP-4	JUNCTION	0.00	372.38	0	00:47	0	4.94	0.000
DP-5	JUNCTION	101.80	101.80	0	00:45	1.27	1.27	0.000
DP-6	JUNCTION	32.58	32.58	0	00:45	0.353	0.353	-0.000
DP-7	JUNCTION	42.78	229.27	0	00:46	0.486	2.83	0.000
DP-8	JUNCTION	108.03	108.03	0	00:45	1.39	1.39	0.000
FSD-16	OUTFALL	18.97	587.24	0	00:48	0.37	9.2	0.000
JOS-TR	JUNCTION	5.72	5.72	0	00:45	0.0777	0.0777	0.000
JP1-3	JUNCTION	5.23	364.91	0	00:46	0.0615	4.95	0.000
JP1-A12	JUNCTION	44.24	44.24	0	00:45	0.524	0.524	0.000
JP1-A34	JUNCTION	19.13	59.50	0	00:46	0.198	0.72	0.000

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2 (100yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
FSD-16	98.47	57.84	587.24	9.202

Not checked with this review

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

STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 2
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE (100 yr.)


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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... KINWAVE
Starting Date ............ 04/18/2022 00:00:00
Ending Date .............. 04/18/2022 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec


*************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
*************************     ---------       -------
Total Precipitation ......        57.575         2.820
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........        27.905         1.367
Surface Runoff ...........        29.351         1.438
Final Storage ............         0.536         0.026
Continuity Error (%) .....        -0.377


*************************        Volume        Volume
```

Flow Routing Continuity	acre-feet	10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	29.351	9.564
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	28.240	9.202
Flooding Loss	1.069	0.348
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.002	0.001
Continuity Error (%)	0.139	

****
Highest Flow Instability Indexes
****
Link C16 (3)
Link C18 (2)
Link C13 (1)
Link C15 (1)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.08
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff

```
--------------------------------------------------------------------------------
--------------------
  P1-A6                     2.82       0.00       0.00       0.90       1.90
0.14    13.69   0.674
  P1-A5                     2.82       0.00       0.00       1.02       1.79
0.21    18.89   0.633
  P1-A4                     2.82       0.00       0.00       0.88       1.91
0.10    10.01   0.679
  P1-A                      2.82       0.00       0.00       1.75       1.07
0.37    18.97   0.380
  P1-A1                     2.82       0.00       0.00       1.05       1.75
0.24    20.94   0.621
  P1-A2                     2.82       0.00       0.00       1.15       1.65
0.29    23.30   0.584
  P1-A3                     2.82       0.00       0.00       0.88       1.92
0.09     9.12   0.682
  P1-C                      2.82       0.00       0.00       1.13       1.67
0.49    42.78   0.593
  P1-B                      2.82       0.00       0.00       1.36       1.44
1.39   108.03   0.512
  P1-D                      2.82       0.00       0.00       1.31       1.49
1.27   101.80   0.529
  P1-E                      2.82       0.00       0.00       1.37       1.43
2.03   161.09   0.509
  TR-W                      2.82       0.00       0.00       1.19       1.62
0.06     5.23   0.573
  TR-V                      2.82       0.00       0.00       1.45       1.36
0.08     5.72   0.483
  P1-F                      2.82       0.00       0.00       1.46       1.34
2.80   215.28   0.476


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

  --------------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                  Type       Feet     Feet     Feet  days hr:min        Feet
  --------------------------------------------------------------------------------
  JP1-A12               JUNCTION   0.31     2.05  7106.05     0  00:45        1.97
  JP1-A34               JUNCTION   0.33     2.12  7100.12     0  00:46        1.98
  DP-7                  JUNCTION  10.44    14.00  7110.00     0  00:41       14.00
  DP-8                  JUNCTION   0.48     3.03  7099.03     0  00:45        2.89
  DP-4                  JUNCTION  22.70    27.50  7123.50     0  00:47       25.90
  JP1-3                 JUNCTION  10.53    15.00  7143.00     0  00:46       12.85
  DP-1                  JUNCTION  10.10    10.57  7165.57     0  00:48       10.46
  JOS-TR                JUNCTION   0.10     0.60  7190.60     0  00:45        0.58
  DP-6                  JUNCTION   0.28     2.50  7100.50     0  00:44        2.50
```

DP-5	JUNCTION	0.36	2.14	7112.14	0	00:45	2.07
DP-2-3	JUNCTION	0.52	4.00	7136.00	0	00:44	4.00
FSD-16	OUTFALL	0.73	5.47	7100.47	0	00:47	4.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min		Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
JP1-A12	JUNCTION	44.24	44.24	0	00:45	0.524	0.524	0.000
JP1-A34	JUNCTION	19.13	59.50	0	00:46	0.198	0.72	0.000
DP-7	JUNCTION	42.78	229.27	0	00:46	0.486	2.83	0.000
DP-8	JUNCTION	108.03	108.03	0	00:45	1.39	1.39	0.000
DP-4	JUNCTION	0.00	372.38	0	00:47	0	4.94	0.000
JP1-3	JUNCTION	5.23	364.91	0	00:46	0.0615	4.95	0.000
DP-1	JUNCTION	215.28	219.02	0	00:45	2.8	2.87	0.000
JOS-TR	JUNCTION	5.72	5.72	0	00:45	0.0777	0.0777	0.000
DP-6	JUNCTION	32.58	32.58	0	00:45	0.353	0.353	-0.000
DP-5	JUNCTION	101.80	101.80	0	00:45	1.27	1.27	0.000
DP-2-3	JUNCTION	161.09	161.09	0	00:45	2.03	2.03	0.000
FSD-16	OUTFALL	18.97	587.24	0	00:48	0.37	9.2	0.000

****

Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
DP-7	0.23	110.83	0 00:46	0.327	0.000
DP-4	0.03	13.28	0 00:48	0.006	0.000
JP1-3	0.03	7.39	0 00:47	0.004	0.000
DP-6	0.05	2.89	0 00:46	0.002	0.000
DP-2-3	0.05	14.39	0 00:46	0.010	0.000

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
FSD-16	98.47	57.84	587.24	9.202
System	98.47	57.84	587.24	9.202

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C9	CONDUIT	42.03	0 00:46	8.77	0.77	0.66
C10	CONDUIT	59.38	0 00:46	9.76	0.68	0.61
C11	CONDUIT	124.40	0 00:54	10.81	1.06	1.00
C12	CONDUIT	106.61	0 00:46	10.66	0.91	0.75
C13	CONDUIT	5.11	0 00:48	7.23	0.18	0.28
C14	CONDUIT	210.70	0 00:46	16.56	0.72	0.63
C15	CONDUIT	372.38	0 00:47	17.66	1.05	0.91
C16	CONDUIT	360.70	0 00:48	17.23	1.02	1.00
C17	CONDUIT	100.31	0 00:46	14.94	0.55	0.53
C18	CONDUIT	30.99	0 00:47	7.03	1.07	0.93
C19	CONDUIT	149.42	0 00:46	13.42	1.04	1.00

STORMWATER QUALITY CALCULATIONS

CLASSIC
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Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: May 30, 2022
Project: Sterling Ranch East Preliminary Plan/PUD No. 2
Location: FSD-16

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 60.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.600

C) Contributing Watershed Area — Area = 245.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)
V_{DESIGN} = ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$
$V_{DESIGN\ OTHER}$ = 4.709 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
i) Percentage of Watershed consisting of Type A Soils — HSG_A = 0 %
ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 100 %
iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

Revise for this PUDSP area

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = 15.993 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)
$EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)
L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)
Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)
V_{FMIN} = 0.141 ac-ft

B) Actual Forebay Volume
V_F = 0.141 ac-ft

C) Forebay Depth (D_F = 30 inch maximum)
D_F = 30.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 589.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)
Q_F = 11.78 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 16.7 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: May 30, 2022
Project: Sterling Ranch East Preliminary Plan/PUD No. 2
Location: FSD-16

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (•) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0060 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 132 sq ft
C) Outlet Type	Choose One: (•) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 4.51 inches
E) Total Outlet Area	A_{ot} = 116.00 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 615 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 66.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 2,910 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*Aluminum Amico-Klemp SR Series with Cross Rods 4" O.C.*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 3779 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 6.5 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 106 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 35.6 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: May 30, 2022
Project: Sterling Ranch East Preliminary Plan/PUD No. 2
Location: FSD-16

Provide

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

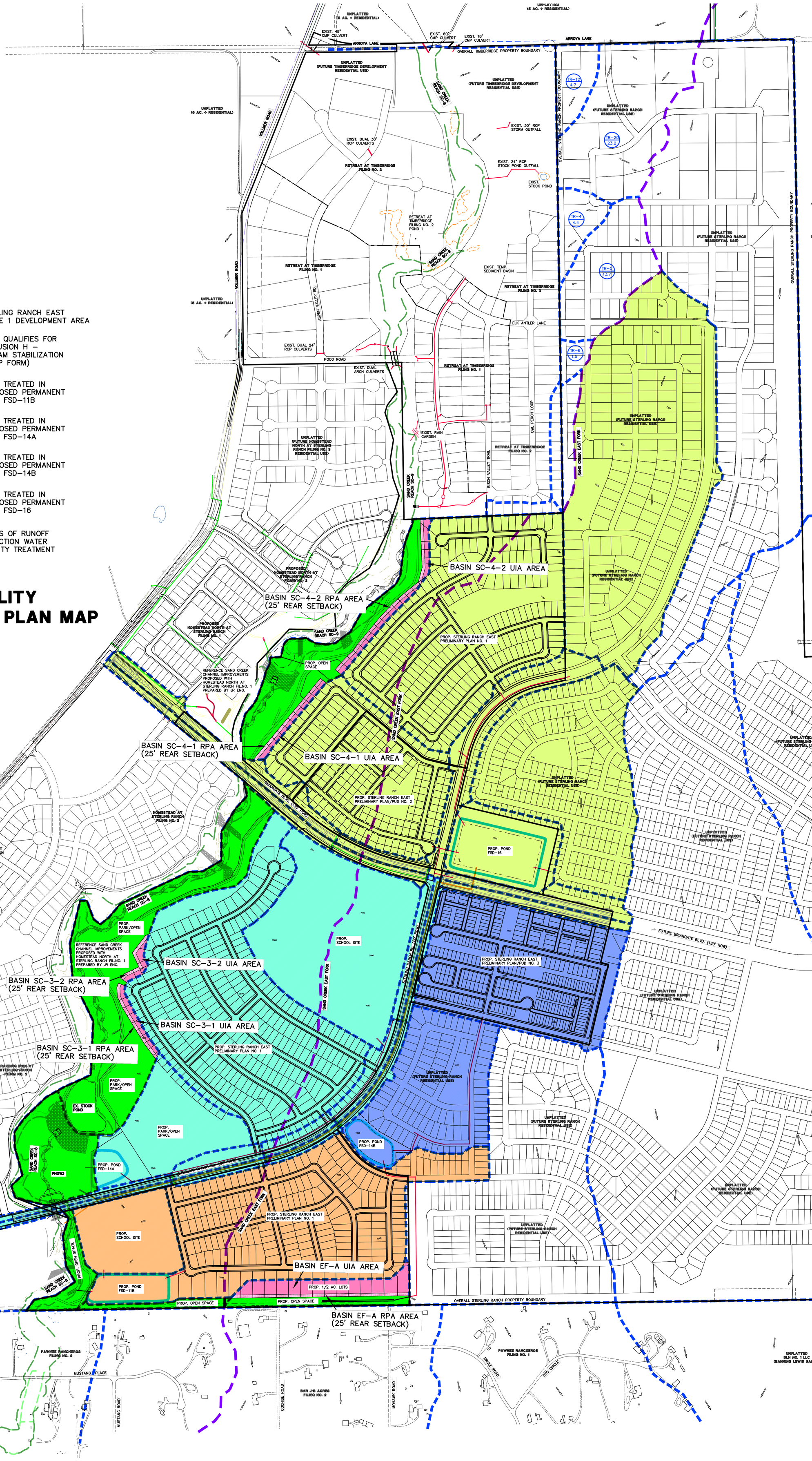
12. Access

A) Describe Sediment Removal Procedures

Notes:

WATER QUALITY TREATMENT PLAN MAP

	STERLING RANCH EAST PHASE 1 DEVELOPMENT AREA
61.1 AC.	AREA QUALIFIES FOR EXCLUSION H – STREAM STABILIZATION (PBMP FORM)
64.5 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–11B
130.8 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–14A
63.1 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–14B
245.0 AC.	AREA TREATED IN PROPOSED PERMANENT POND FSD–16
10.3 AC.	AREAS OF RUNOFF REDUCTION WATER QUALITY TREATMENT



These areas/DPs are not within the PUDSP so this sheet isn't needed.

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: May 31, 2022
Project: Sterling Ranch East Preliminary Plan No. 1
Location: BASINS NOT TRIBUTARY TO PERMANENT SWQ FACILITY

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth = 0.53 inches
Depth of Average Runoff Producing Storm, d_6 = 0.42 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA								
Area ID	EF-A	SC-3-1	SC-3-2	SC-4-1	SC-4-2								
Downstream Design Point ID	SC	SC	SC	SC	SC								
Downstream BMP Type	None	None	None	None	None								
DCIA (ft^2)	--	--	--	--	--								
UIA (ft^2)	40,000	26,790	19,924	30,053	48,697								
RPA (ft^2)	37,188	17,918	12,924	21,985	28,692								
SPA (ft^2)	--	--	--	--	--								
HSG A (%)	0%	0%	0%	0%	0%								
HSG B (%)	100%	100%	100%	100%	100%								
HSG C/D (%)	0%	0%	0%	0%	0%								
Average Slope of RPA (ft/ft)	0.020	0.040	0.030	0.040	0.040								
UIA:RPA Interface Width (ft)	800.00	700.00	400.00	800.00	1000.00								

CALCULATED RUNOFF RESULTS

Area ID	EF-A	SC-3-1	SC-3-2	SC-4-1	SC-4-2							
UIA:RPA Area (ft^2)	77,188	44,708	32,848	52,038	77,389							
L / W Ratio	0.12	0.09	0.21	0.08	0.08							
UIA / Area	0.5182	0.5992	0.6066	0.5775	0.6292							
Runoff (in)	0.00	0.00	0.00	0.00	0.00							
Runoff (ft^3)	0	0	0	0	0							
Runoff Reduction (ft^3)	1433	960	714	1077	1745							

CALCULATED WQCV RESULTS

Area ID	EF-A	SC-3-1	SC-3-2	SC-4-1	SC-4-2							
WQCV (ft^3)	1628	1090	811	1223	1982							
WQCV Reduction (ft^3)	1628	1090	811	1223	1982							
WQCV Reduction (%)	100%	100%	100%	100%	100%							
Untreated WQCV (ft^3)	0	0	0	0	0							

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

Downstream Design Point ID	SC											
DCIA (ft^2)	0											
UIA (ft^2)	165,464											
RPA (ft^2)	118,707											
SPA (ft^2)	0											
Total Area (ft^2)	284,171											
Total Impervious Area (ft^2)	165,464											
WQCV (ft^3)	6,734											
WQCV Reduction (ft^3)	6,734											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

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

Total Area (ft^2)	284,171
Total Impervious Area (ft^2)	165,464
WQCV (ft^3)	6,734
WQCV Reduction (ft^3)	6,734
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

DETENTION POND CALCULATIONS

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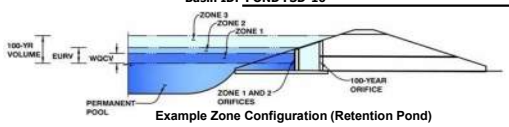
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN / PUD NO. 2

Basin ID: POND FSD-16



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	245.00	acres
Watershed Length =	5,800	ft
Watershed Length to Centroid =	2,900	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	60.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	4.822	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	15.946	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	14.895	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	20.580	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	25.471	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	31.662	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	36.887	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	43.326	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	64.093	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	12.261	acre-feet		
Approximate 5-yr Detention Volume =	16.552	acre-feet		
Approximate 10-yr Detention Volume =	21.333	acre-feet		
Approximate 25-yr Detention Volume =	23.070	acre-feet		
Approximate 50-yr Detention Volume =	24.049	acre-feet		
Approximate 100-yr Detention Volume =	26.256	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	4.822	acre-feet
Zone 2 Volume (EURV - Zone 1) =	11.124	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	10.310	acre-feet
Total Detention Basin Volume =	26.256	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

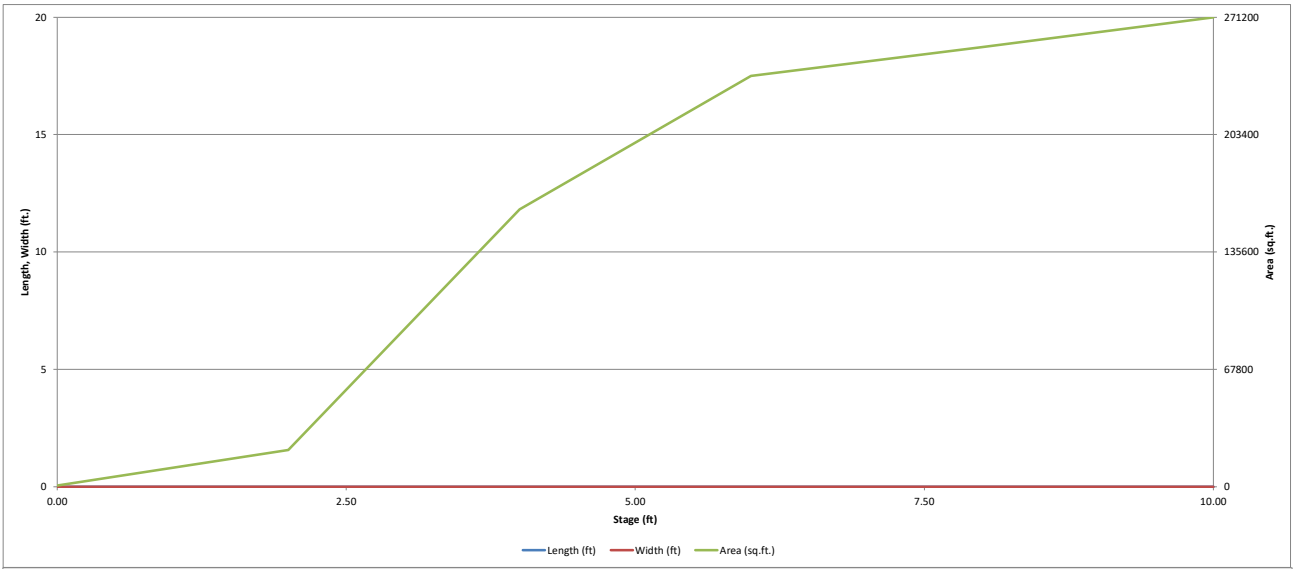
Depth Increment = ft

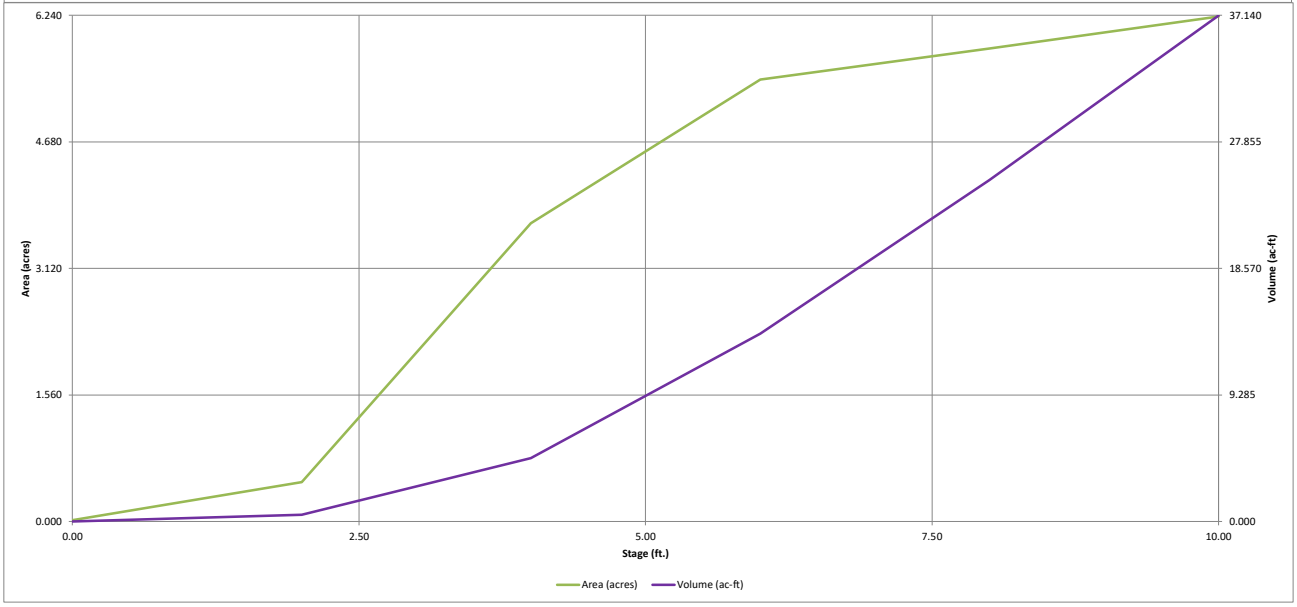
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	683	0.016		
7094	--	2.00	--	--	--	21,230	0.487	21,913	0.503
7096	--	4.00	--	--	--	160,188	3.677	203,330	4.668
7098	--	6.00	--	--	--	237,278	5.447	600,796	13.792
7100	--	8.00	--	--	--	253,964	5.830	1,092,038	25.070
7102	--	10.00	--	--	--	271,164	6.225	1,617,166	37.125

Should be A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



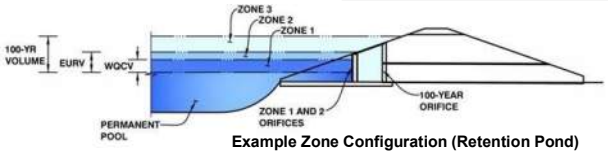


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN / PUD NO. 2

Basin ID: POND FSD-16



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.05	4.822	Orifice Plate
Zone 2 (EURV)	6.40	11.124	Orifice Plate
Zone 3 (100-year)	8.21	10.310	Weir&Pipe (Restrict)
Total (all zones)		26.256	

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

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	6.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	26.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.20	4.40					
Orifice Area (sq. inches)	16.00	20.00	80.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.50	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.56	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	79.10	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	39.55	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			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 Orifice Area =	12.07	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.93	N/A	feet
Restrictor Plate Height Above Pipe Invert =	44.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.56	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.18	feet
Spillway Crest Length =	150.00	feet	Stage at Top of Freeboard =	11.18	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	6.23	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	37.13	acre-ft

Calculated Parameters for Spillway

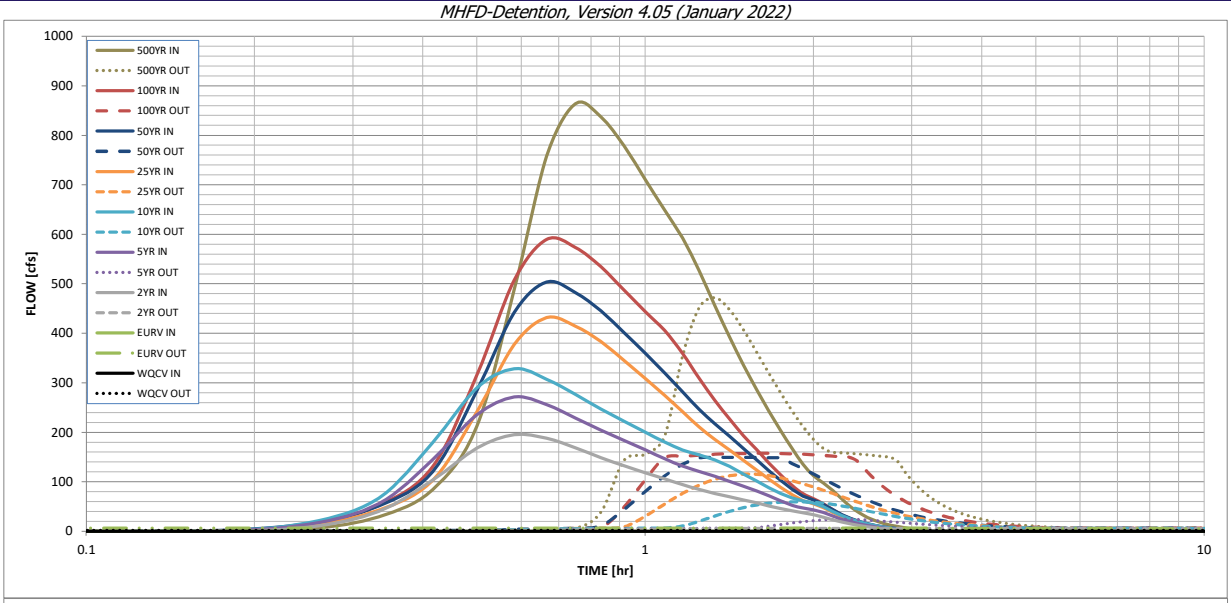
Routed Hydrograph Results

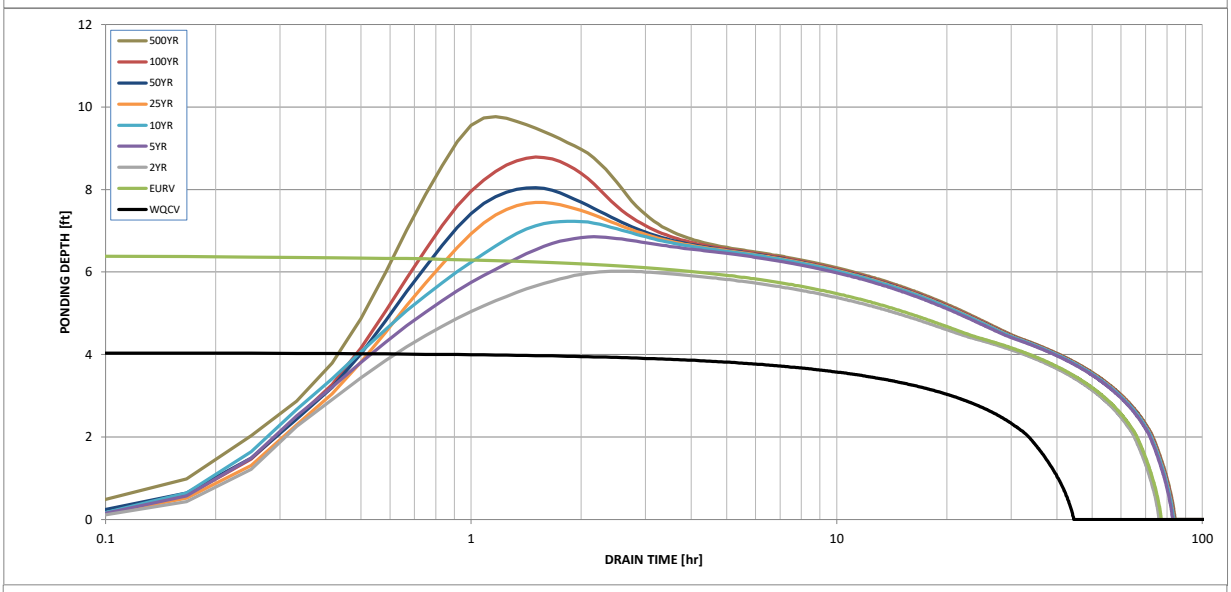
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

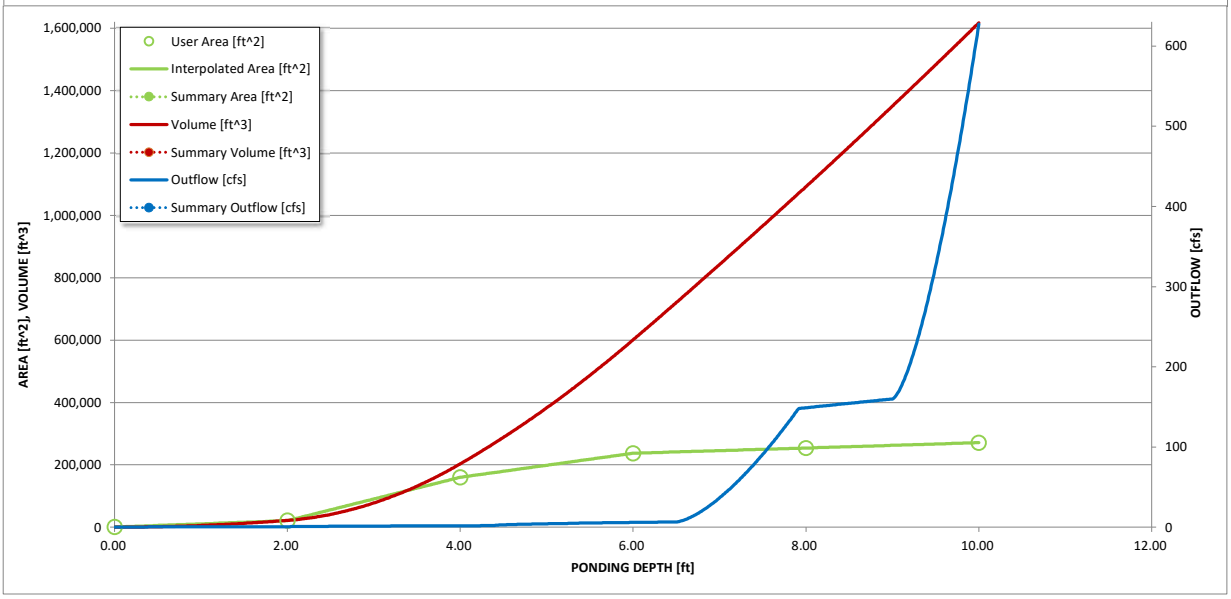
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	4.822	15.946	14.895	20.580	25.471	31.662	36.887	43.326	64.093
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	14.895	20.580	25.471	31.662	36.887	43.326	64.093
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	18.5	52.4	81.6	150.3	189.1	243.5	396.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.21	0.33	0.61	0.77	0.99	1.62
Peak Inflow Q (cfs) =	N/A	N/A	195.2	271.3	328.6	431.7	503.6	589.5	863.9
Peak Outflow Q (cfs) =	2.0	6.5	6.0	24.4	59.3	115.4	149.5	157.6	471.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.8	0.8	0.6	1.2
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.7	1.4	1.8	1.9	2.0
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	67	66	70	69	67	66	64	59
Time to Drain 99% of Inflow Volume (hours) =	**43**	73	72	77	77	76	75	74	71
Maximum Ponding Depth (ft) =	4.05	6.40	6.02	6.85	7.23	7.69	8.04	8.78	9.76
Area at Maximum Ponding Depth (acres) =	3.72	5.52	5.45	5.61	5.68	5.77	5.84	5.98	6.18
Maximum Volume Stored (acre-ft) =	4.853	15.987	13.901	18.492	20.637	23.214	25.303	29.677	35.637

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.10	4.86
	0:15:00	0.00	0.00	8.69	14.20	17.60	11.82	15.77	14.51	29.18
	0:20:00	0.00	0.00	39.89	55.39	66.84	42.38	50.75	52.57	84.21
	0:25:00	0.00	0.00	103.42	144.47	179.21	102.69	120.50	130.45	212.27
	0:30:00	0.00	0.00	168.01	235.50	289.50	241.38	283.75	315.50	488.55
	0:35:00	0.00	0.00	195.18	271.34	328.62	377.22	442.14	507.75	757.70
	0:40:00	0.00	0.00	187.80	256.08	307.18	431.68	503.60	589.49	863.89
	0:45:00	0.00	0.00	168.48	228.93	276.42	414.47	481.99	573.59	837.24
	0:50:00	0.00	0.00	148.80	204.51	247.24	383.29	445.38	534.38	778.69
	0:55:00	0.00	0.00	132.19	183.80	222.54	345.40	401.50	487.50	711.22
	1:00:00	0.00	0.00	118.44	164.51	200.27	309.18	359.91	444.29	648.86
	1:05:00	0.00	0.00	105.97	146.47	180.40	274.73	320.27	405.65	592.59
	1:10:00	0.00	0.00	94.32	131.79	164.21	241.61	281.95	359.41	526.37
	1:15:00	0.00	0.00	84.51	120.99	154.30	210.51	246.07	308.77	455.64
	1:20:00	0.00	0.00	76.57	110.96	144.41	185.79	217.36	264.64	392.21
	1:25:00	0.00	0.00	69.78	100.67	130.97	163.98	191.74	226.94	336.19
	1:30:00	0.00	0.00	63.52	90.95	115.79	143.33	167.25	193.51	285.93
	1:35:00	0.00	0.00	57.41	81.74	101.40	123.73	143.95	164.56	242.53
	1:40:00	0.00	0.00	51.33	71.63	88.16	105.39	122.19	137.93	202.88
	1:45:00	0.00	0.00	45.72	61.18	76.56	88.73	102.49	113.75	166.96
	1:50:00	0.00	0.00	41.31	52.27	67.34	73.89	84.98	92.48	135.68
	1:55:00	0.00	0.00	37.51	46.96	61.68	62.23	71.36	75.94	112.15
	2:00:00	0.00	0.00	33.64	43.42	56.89	55.51	63.50	65.90	97.69
	2:05:00	0.00	0.00	28.70	38.02	49.47	47.78	54.55	55.66	82.64
	2:10:00	0.00	0.00	23.34	30.89	40.17	38.31	43.68	43.79	65.06
	2:15:00	0.00	0.00	18.40	24.20	31.58	29.53	33.63	33.09	49.17
	2:20:00	0.00	0.00	14.56	19.06	24.82	23.01	26.15	25.09	37.26
	2:25:00	0.00	0.00	11.42	14.95	19.32	17.78	20.16	18.89	28.02
	2:30:00	0.00	0.00	8.93	11.64	14.91	13.73	15.52	14.35	21.24
	2:35:00	0.00	0.00	6.95	8.91	11.32	10.50	11.84	11.00	16.21
	2:40:00	0.00	0.00	5.38	6.74	8.55	7.95	8.94	8.38	12.31
	2:45:00	0.00	0.00	4.10	5.09	6.52	6.05	6.79	6.45	9.47
	2:50:00	0.00	0.00	3.09	3.83	4.99	4.65	5.21	4.98	7.31
	2:55:00	0.00	0.00	2.23	2.77	3.66	3.46	3.88	3.71	5.42
	3:00:00	0.00	0.00	1.50	1.91	2.54	2.45	2.74	2.62	3.82
	3:05:00	0.00	0.00	0.93	1.25	1.62	1.61	1.80	1.72	2.49
	3:10:00	0.00	0.00	0.50	0.73	0.92	0.95	1.06	1.01	1.45
	3:15:00	0.00	0.00	0.21	0.35	0.42	0.46	0.51	0.48	0.69
	3:20:00	0.00	0.00	0.07	0.11	0.12	0.14	0.16	0.15	0.20
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DRAINAGE MAPS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	1.68	0.00	0.00	1.50	0.18	1.28	105.15	0.106
EX10A	1.68	0.00	0.00	1.53	0.15	0.70	52.19	0.087
EX-11	1.68	0.00	0.00	1.54	0.14	0.80	53.86	0.082
EX-13	1.68	0.00	0.00	1.48	0.20	0.50	35.71	0.117
EX-4A	1.68	0.00	0.00	1.52	0.15	0.18	19.26	0.091
EX-5	1.68	0.00	0.00	1.52	0.16	0.11	11.51	0.093
EX-7	1.68	0.00	0.00	1.52	0.15	0.64	46.80	0.090
EX-9	1.68	0.00	0.00	1.52	0.15	0.73	56.96	0.090
TR-12	1.68	0.00	0.00	1.43	0.25	0.03	1.88	0.148
TR-20	1.68	0.00	0.00	1.45	0.22	0.14	10.01	0.131
TR-4	1.68	0.00	0.00	1.42	0.25	0.03	1.78	0.150
TR-5	1.68	0.00	0.00	1.48	0.20	0.07	4.56	0.116
TR-6	1.68	0.00	0.00	1.38	0.30	0.01	0.83	0.177
TR-7	1.68	0.00	0.00	1.43	0.24	0.02	1.01	0.144

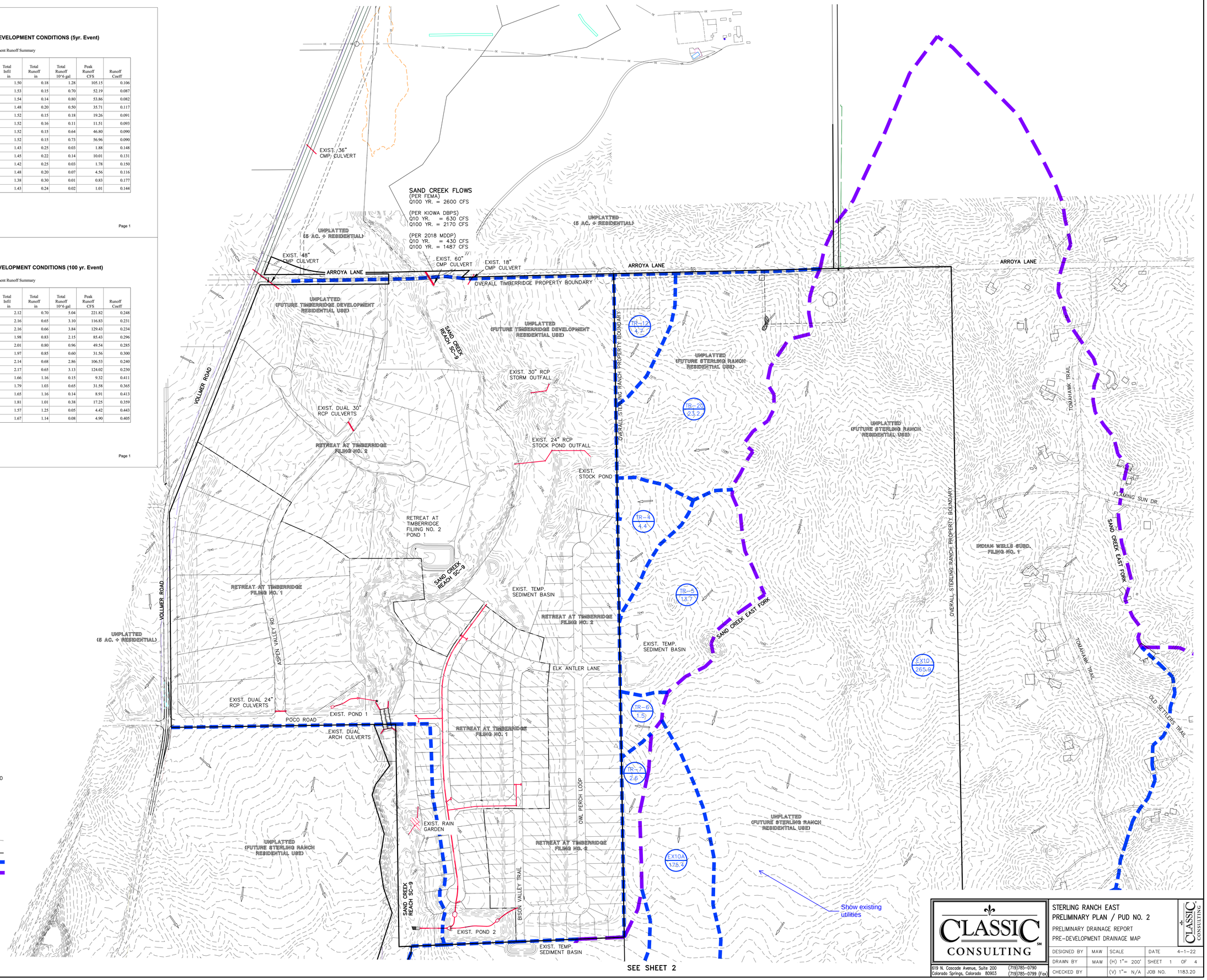
SWMM 5.1 Page 1

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	2.82	0.00	0.00	2.12	0.70	5.04	221.82	0.248
EX10A	2.82	0.00	0.00	2.16	0.65	3.10	116.83	0.231
EX-11	2.82	0.00	0.00	2.16	0.66	3.84	129.43	0.234
EX-13	2.82	0.00	0.00	1.98	0.83	2.15	85.43	0.296
EX-4A	2.82	0.00	0.00	2.01	0.80	0.96	49.54	0.285
EX-5	2.82	0.00	0.00	1.97	0.85	0.60	31.56	0.300
EX-7	2.82	0.00	0.00	2.14	0.68	2.86	106.53	0.240
EX-9	2.82	0.00	0.00	2.17	0.65	3.13	124.02	0.230
TR-12	2.82	0.00	0.00	1.66	1.16	0.15	9.32	0.411
TR-20	2.82	0.00	0.00	1.79	1.03	0.65	31.58	0.365
TR-4	2.82	0.00	0.00	1.65	1.16	0.14	8.91	0.413
TR-5	2.82	0.00	0.00	1.81	1.01	0.38	17.25	0.359
TR-6	2.82	0.00	0.00	1.57	1.25	0.05	4.42	0.443
TR-7	2.82	0.00	0.00	1.67	1.14	0.08	4.90	0.405

SWMM 5.1 Page 1



LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
SAND CREEK EAST FORK BASIN LINE	
DESIGN POINT	4
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN / PUD NO. 2
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	1 OF 4
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

N:\1183\20\REPORTS\FINAL DRAINAGE REPORT\1183\20 PDR HDM.dwg, 5/25/2022 10:16:24 AM, 1:1

SEE SHEET 1

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
SAND CREEK EAST FORK BASIN LINE	
DESIGN POINT	4
BASIN IDENTIFIER / AREA IN ACRES	BB / 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

200 100 0 200 400

SCALE: 1" = 200'

SAND CREEK REACH SC-10

BISON VALLEY

EXIST. POND 2

EXIST. TEMP. SEDIMENT BASIN

INDIAN WELLS SUBD. FILING NO. 1

TOMAHAWK TRAIL

STAPLETON ROAD

BOW VALLEY SUBD.

EX10 265.9

EX-13 94.8

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

OVERALL STERLING RANCH PROPERTY BOUNDARY

(HOMESTEAD NORTH AT STERLING RANCH RESIDENTIAL USE)

HOMESTEAD NORTH PLATTED BOUNDARY

CLASSIC OWNERSHIP BOUNDARY

SAND CREEK REACH SC-9

EX-6 26.8

BRIARGATE BLVD. (130' ROW)

REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG.

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

SAND CREEK EAST FORK

EX-7 155.2

EX-9 178.1

EX10A 175.4

EX-11 214.3

HOMESTEAD AT STERLING RANCH FILING NO. 2

EX-8A 44.6

HOMESTEAD AT STERLING RANCH FILING NO. 1

SAND CREEK REACH SC-8

REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG.

CLASSIC OWNERSHIP BOUNDARY

STERLING RANCH RD. (80' ROW)

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

BRANDING IRON AT STERLING RANCH FILING NO. 2

SEE SHEET 3

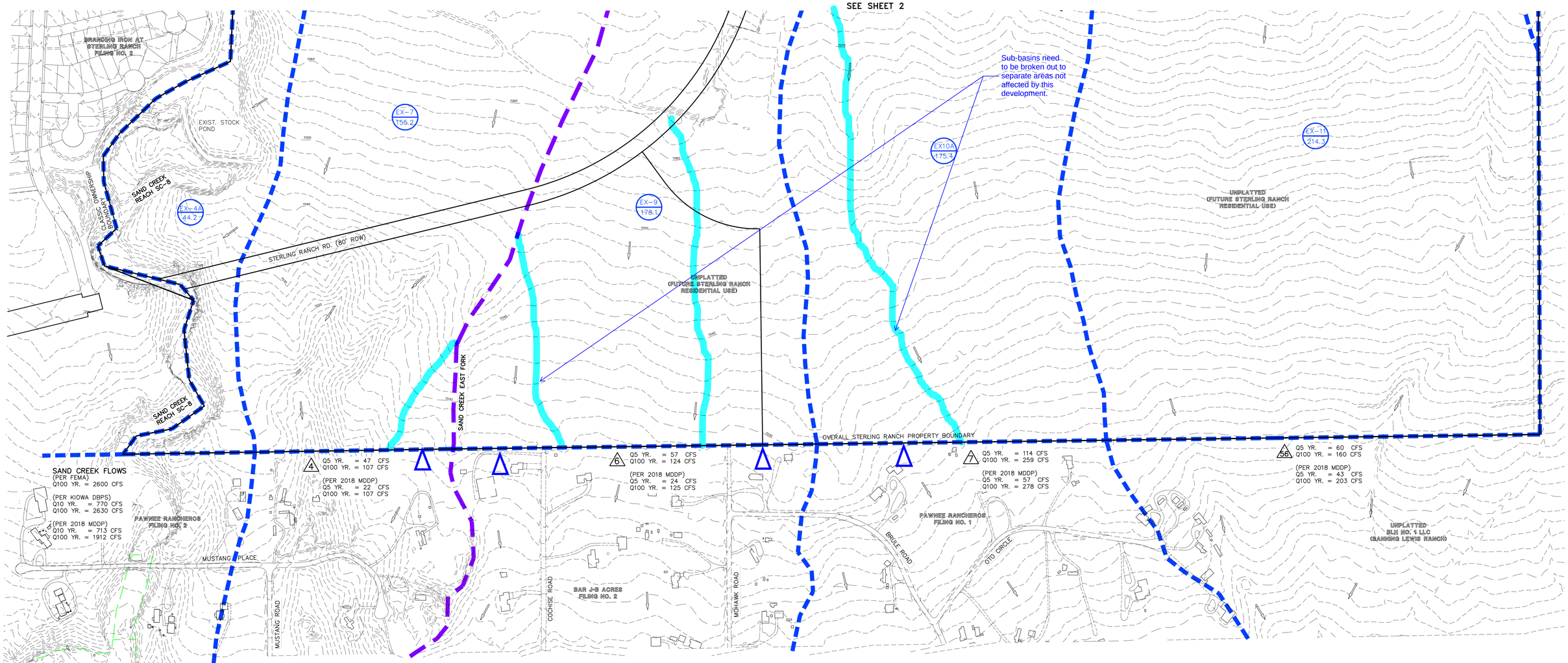
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN / PUD NO. 2
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	2 OF 4
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

N:\1183\20\REPORTS\FINAL DRAINAGE REPORT\1183P20 PDR HDM.dwg, 5/25/2022 10:11:25 AM, 1:1

SEE SHEET 2



STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	91.92	4.30	46.80	0.639
DP56	98.59	8.23	59.57	1.311
DP6	98.59	4.60	56.96	0.733
DP7	98.59	12.48	114.01	1.989
DPEX-4A	61.64	1.84	19.26	0.183
DPEX-5	53.38	1.29	11.51	0.111
Out10	36.27	0.51	1.78	0.030
Out11	34.38	0.22	0.83	0.012
Out6	36.44	0.54	1.88	0.032
Out7	48.80	1.75	10.01	0.138
Out8	41.34	1.09	4.56	0.073
Out9	35.63	0.30	1.01	0.017

SWMM 5.1 Page 1

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	92.55	19.10	106.53	2.856
DP56	98.59	37.64	160.10	5.996
DP6	98.59	19.66	124.02	3.131
DP7	98.59	51.21	258.75	8.157
DPEX-4A	62.08	9.61	49.54	0.964
DPEX-5	53.80	6.93	31.56	0.603
Out10	36.62	2.35	8.91	0.139
Out11	34.56	0.91	4.42	0.051
Out6	36.90	2.48	9.32	0.148
Out7	49.14	8.16	31.58	0.648
Out8	42.15	5.53	17.25	0.376
Out9	37.27	1.34	4.90	0.081

SWMM 5.1 Page 1

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (5yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	1.68	0.00	0.00	1.50	0.18	1.28	105.15	0.106
EX10A	1.68	0.00	0.00	1.53	0.15	0.70	52.19	0.087
EX-11	1.68	0.00	0.00	1.54	0.14	0.80	53.86	0.082
EX-13	1.68	0.00	0.00	1.48	0.20	0.50	35.71	0.117
EX-4A	1.68	0.00	0.00	1.52	0.15	0.18	19.26	0.091
EX-5	1.68	0.00	0.00	1.52	0.16	0.11	11.51	0.093
EX-7	1.68	0.00	0.00	1.52	0.15	0.64	46.80	0.090
EX-9	1.68	0.00	0.00	1.52	0.15	0.73	56.96	0.090
TR-12	1.68	0.00	0.00	1.43	0.25	0.03	1.88	0.148
TR-20	1.68	0.00	0.00	1.45	0.22	0.14	10.01	0.131
TR-4	1.68	0.00	0.00	1.42	0.25	0.03	1.78	0.150
TR-5	1.68	0.00	0.00	1.48	0.20	0.07	4.56	0.116
TR-6	1.68	0.00	0.00	1.38	0.30	0.01	0.83	0.177
TR-7	1.68	0.00	0.00	1.43	0.24	0.02	1.01	0.144

SWMM 5.1 Page 1

STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100 yr. Event)

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-10	2.82	0.00	0.00	2.12	0.70	5.04	221.82	0.248
EX10A	2.82	0.00	0.00	2.16	0.65	3.10	116.83	0.231
EX-11	2.82	0.00	0.00	2.16	0.66	3.84	129.43	0.234
EX-13	2.82	0.00	0.00	1.98	0.83	2.15	85.43	0.296
EX-4A	2.82	0.00	0.00	2.01	0.80	0.96	49.54	0.285
EX-5	2.82	0.00	0.00	1.97	0.85	0.60	31.56	0.300
EX-7	2.82	0.00	0.00	2.14	0.68	2.86	106.53	0.240
EX-9	2.82	0.00	0.00	2.17	0.65	3.13	124.02	0.230
TR-12	2.82	0.00	0.00	1.66	1.16	0.15	9.32	0.411
TR-20	2.82	0.00	0.00	1.79	1.03	0.65	31.58	0.365
TR-4	2.82	0.00	0.00	1.65	1.16	0.14	8.91	0.413
TR-5	2.82	0.00	0.00	1.81	1.01	0.38	17.25	0.359
TR-6	2.82	0.00	0.00	1.57	1.25	0.05	4.42	0.443
TR-7	2.82	0.00	0.00	1.67	1.14	0.08	4.90	0.405

SWMM 5.1 Page 1

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
SAND CREEK EAST FORK BASIN LINE	
DESIGN POINT	4
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

N

200 100 0 200 400

SCALE: 1" = 200'

Add a sheet showing these areas and development outfall facilities post-development

CLASSIC CONSULTING SM
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN / PUD NO. 2
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

CLASSIC CONSULTING

DESIGNED BY	MAW	SCALE	DATE 4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET 3 OF 4
CHECKED BY		(V) 1"= N/A	JOB NO. 1183.20

N:\1183\05\REPORTS\FINAL DRAINAGE REPORT\1183D PDR MDM.dwg, 5/25/2022 10:12:22 AM, 1:1

move basin label down

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
EAST FORK BASIN BOUNDARY	
DESIGN POINT	(15)
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
PROPOSED STORM SEWER	
PROPOSED STORM SEWER PER JR ENG. PLANS	
PROPOSED POND OUTFALL PER JR ENG. PLANS	

N

200 100 0 200 400

SCALE: 1" = 200'

Label this basin

BASIN ID	PEAK FLOWS (CFS) 5YR.	100YR.
TR-V	2	6
SC-4	8	27
P1-A	6	19
P1-B	55	108
P1-C	21	43
P1-D	53	102
P1-E	83	161
P1-F	111	215
P1-A1	11	21
P1-A2	12	23
P1-A3	5	9
P1-A4	5	10
P1-A5	10	19
P1-A6	7	14
DESIGN POINTS		
1	112	219
2	41	80
3	41	80
4	187	372
5	53	102
6	17	33
7	117	229
8	55	108
POND FSD-16	363	587

Label FSD-16 outflow rates

ASPEN VALLEY RD.
POCO ROAD
EXIST. DUAL 24" RCP CULVERTS
EXIST. DUAL ARCH CULVERTS
RETREAT AT TIMBERRIDGE FILING NO. 2
RETREAT AT TIMBERRIDGE FILING NO. 1
ELK ANTLER LANE
OWL PERCH LOOP
BISON VALLEY TRAIL
EXIST. RAIN GARDEN
SAND CREEK REACH SC-9
SAND CREEK EAST FORK
TOMAHAWK TRAIL
UNPLATTED (FUTURE HOMESTEAD NORTH AT STERLING RANCH FILING NO. 5 RESIDENTIAL USE)
PROPOSED HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2
REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG.
STERLING RANCH EAST PRELIMINARY PLAN NO. 1
REFERENCE CDR-2113 FOR BRIARGATE PARKWAY BRIDGE CROSSING PLANS PREPARED BY KIOWA ENG.
HOMESTEAD AT STERLING RANCH FILING NO. 2
BRIARGATE BLVD. (130' ROW)
STERLING RANCH ROAD
PROP. PUBLIC TYPE R INLETS (TYP.)
PROP. PUBLIC RCP STORM (TYP.)
TRACT G
TRACT H
48"-54" RCP STORM OUTFALL SYSTEM FOR BASINS P1-C, P1-D AND BRIARGATE SYSTEM
48"-54" RCP STORM OUTFALL SYSTEM FOR BASINS P1-E AND P1-F
60"-66" RCP STORM OUTFALL SYSTEM FOR BASINS P1-E AND P1-F
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
POND FSD-16 (EDB)
TRIB. AREA = 245 AC.
WQCV = 4.8 AC.-FT.
EURV = 11.1 AC.-FT.
100 YR. = 10.3 AC.-FT.
TOTAL = 26.2 AC.-FT.
POND FSD-16 WILL OUTFALL DIRECTLY INTO 48" RCP PIPE SYSTEM CONSTRUCTED WITH BRIARGATE PKWY. EXTENSION. (REFERENCE JR ENG. STREET/STORM PLANS FOR BRIARGATE PKWY. AND STERLING RANCH RD. FOR OUTFALL DESIGN)
42"-48" RCP STORM OUTFALL SYSTEM FOR FUTURE BASIN P1-B
48" RCP STORM OUTFALL SYSTEM FOR FSD-16 POND (PER BRIARGATE PKWY. PLANS)
20' TYPE R AT-GRADE INLETS (PER BRIARGATE PKWY. PLANS)
30" RCP STORM SYSTEM (PER BRIARGATE PKWY. PLANS)
15' TYPE R AT-GRADE INLETS (PER BRIARGATE PKWY. PLANS)
SCHOOL SITE
STERLING RANCH EAST PRELIMINARY PLAN/PUD NO. 3
FUTURE BRIARGATE BLVD. (130' ROW)
TEMPORARY SEDIMENT BASIN PRIOR TO FUTURE DEVELOPMENT IN THIS AREA. EXACT LOCATION AND SIZING WITH FINAL DRAINAGE REPORTS.
INDIAN WELLS SUBD. FILING NO. 1
STAPLETON ROAD
BROKEN BOW CT.
BOW VALLEY SUBD.
OVERALL STERLING RANCH PROPERTY BOUNDARY

Show existing utilities

Tie outfall to forebay?

Provide an additional plan zoomed in to this development area to show more detail

Call out overflow location and spillway dimensions

Inlets?

There should be a tract here for the pipe and overflow swale

See E911 comments on road names.

Provide DPs

Provide a plan showing the outfall location

CLASSIC CONSULTING ENGINEERS & SURVEYORS SM
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

STERLING RANCH EAST
PRELIMINARY PLAN/PUD NO. 2
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	4 OF 4
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20