PRELIMINARY DRAINAGE REPORT
FOR
FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD

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Job No. 1183.20

PCD Project No.
PUD SP-227

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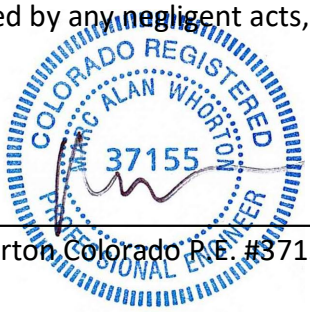
FOURSQUARE AT STERLING RANCH PRELIMINARY PLAN / PUD

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: 4/5/2023

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: Loren J. McKeland

Title: Vice President

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

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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.

GENERAL DESCRIPTION

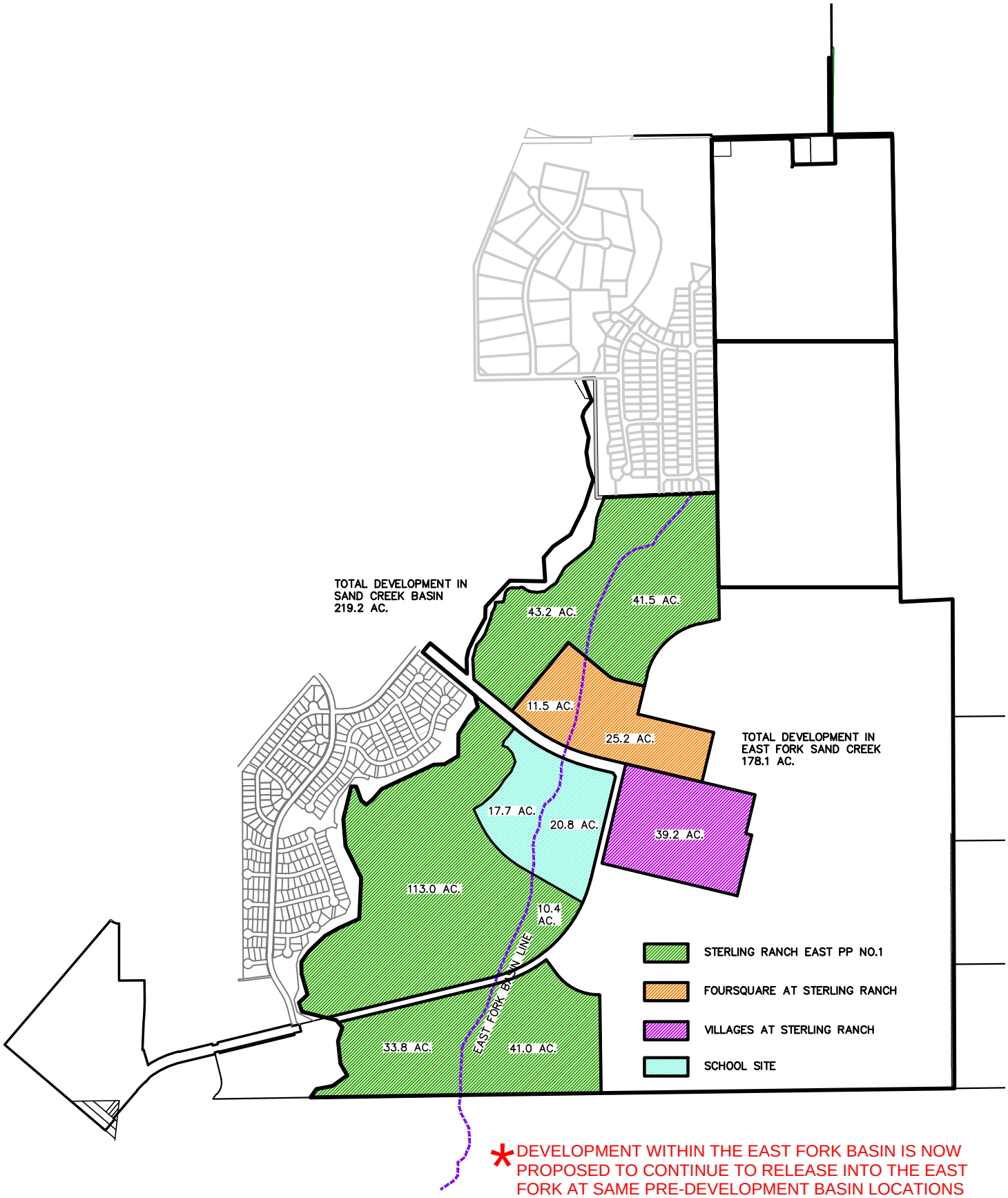
Classic SRJ Land, LLC (Classic Homes) has recently purchased the remaining portion of the Sterling Ranch property east of Sand Creek from the Jim Morley. This is one of the three initial development proposals east of Sand Creek and will be known as **Foursquare at Sterling Ranch Preliminary Plan/PUD.** 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 Sand Creek Drainage Basins. Urban single family residential development with a total of **158 lots** is proposed within this PUD.

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). However, the majority of the site does exhibit Group "A" soils and these will be used in existing runoff hydrologic calculations.

EXISTING DRAINAGE CONDITIONS

The Foursquare at Sterling Ranch Preliminary Plan / PUD 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 within the Sterling Ranch property are described in a separate report prepared by JR Engineering, "Final Design Report for Sand Creek Restoration", dated September 2022. Please reference this report for all Sand Creek improvement requirements and associated wetland mitigation plans and permitting within jurisdictional waters.

Two public roadway crossings of Sand Creek are also proposed to serve as direct access for the Sterling Ranch development east of Sand Creek (Extension of Briargate Parkway and Sterling Ranch Road). 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. 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. An MDDP Amendment, prepared by Classic Consulting, submitted along with the Sterling Ranch East Preliminary Plan No. 1 (currently under review) discusses the removal of the East Fork Sand Creek basin transfer, combining Ponds FSD-16A and FSD-16B into one facility and a few other minor internal sub-basin transfers. Both the original MDDP and the Amendment propose developed flows within Sand Creek that are



*DEVELOPMENT WITHIN THE EAST FORK BASIN IS NOW PROPOSED TO CONTINUE TO RELEASE INTO THE EAST FORK AT SAME PRE-DEVELOPMENT BASIN LOCATIONS

STERLING RANCH EAST INITIAL DEVELOPMENT PHASE BASIN DEVELOPMENT EXHIBIT

significantly lower than both the DBPS and FEMA currently show. These flows are as follows: At Arroya Lane crossing (DP-77) Q_{10} = 581 cfs Q_{100} = 1468 cfs and Sterling Ranch south property line (DP-63) Q_{10} = 713 cfs Q_{100} = 1912 cfs. However, the focus of this report is not on Sand Creek, but the residential development proposed east of Sand Creek. 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 north of this property and was recently approved by County Staff. 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 4.7 ac. 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 23.2 ac. 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 4.4 ac. 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 13.7 ac. 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 of 1.5 ac. 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 2.6 ac. 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 basin is tributary to the proposed Preliminary Plan / PUD area and also within the Sand Creek main basin boundary:

Basin EX-7 (Q_5 = 46 cfs, Q_{100} = 105 cfs) consists of approximately 152.8 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 Sterling Ranch boundary within the well-defined natural channel 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 at DP-4 (Q_5 = 21.5 cfs, Q_{100} = 107.4 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review) and the construction of Pond FSD-11B, nearly all of the tributary area for this existing basin will be captured and treated. Thus, the downstream natural channel corridor through the existing rural lots within the Pawnee Rancheros Filing 2 Subd. and south of Mustang Place, just east of Mustang Road will continue to handle these off-site flows adequately.

Basin EX-7A (Q_5 = 1 cfs, Q_{100} = 5 cfs) consists of a small basin of only 2.4 ac. that sheet flows in a southerly direction. The MDDP included this small basin as a part of Basin EX-7. However, a more detailed look at this area finds that the larger basin EX-7 seems to all be tributary to the defined natural channel while Basin EX-7A appears to sheet flow off-site towards the Mustang Place cul-

de-sac. These minor sheet flows ultimately combine with the pre-developed flows from Basin EX-7 south of Mustang Place within the natural channel. Again, with the construction of the Pond FSD-11B, the majority of the tributary area for this existing basin will be captured and treated. Thus, the downstream natural channel corridor will continue to handle these off-site flows adequately.

Sand Creek East Fork

Basin EX-8 (Q_5 = 5 cfs, Q_{100} = 23 cfs) consists of approximately 32.2 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP and the north portion of the west basin line defines the westerly edge of the East Fork basin. This basin incorporates the majority of MDDP basins EX-8. The flows seem to remain as sheet flows as they exit the property along the south boundary at **Design Point 5**. Again, these flows seem consistent with the flows determined by the MDDP at DP-5 (Q_5 = 1.7 cfs, Q_{100} = 20.5 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), the majority of the tributary area to this basin will be routed towards Pond FSD-11B. The remaining large lot rear yard sheet flows from Basin EF-A will be treated by runoff reduction techniques through long buffer areas and then continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-8A (Q_5 = 2 cfs, Q_{100} = 9 cfs) consists of a small basin of 6.6 ac. that sheet flows in a southerly direction. The MDDP included this small basin as a part of Bain EX-8. However, a more detailed look at this area finds that the larger basin EX-8 seems to sheet flow through properties east of Cochise Road while Basin EX-8A sheet flows off-site directly down the Cochise Road corridor. These off-site flows seem to ultimately combine further south within the Cochise Road corridor. Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), the majority of the tributary area to this basin will be routed towards Pond FSD-11B. The remaining large lot rear yard sheet flows from Basin EF-A will be treated by runoff reduction techniques through long buffer areas and then continue to sheet

flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-9 (Q_5 = 59 cfs, Q_{100} = 122 cfs) consists of approximately 139.3 acres of property that sheet flows in a southerly direction. This basin is similar to the MDDP with the northern portion of the west basin line defining the westerly edge of the East Fork 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 at DP-6 (Q_5 = 23.9 cfs, Q_{100} = 125.2 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), the majority of the tributary area to this basin will be routed towards Pond FSD-11B. The remaining large lot rear yard sheet flows from Basin EF-A will be treated by runoff reduction techniques through long buffer areas and then continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-9A (Q_5 = 7 cfs, Q_{100} = 19 cfs) consists of a smaller basin of 21.8 ac. that sheet flows in a southerly direction. The MDDP included this basin as a part of Basin EX-10A. However, a more detailed look at this area finds that the larger basin EX-10A seems to be tributary to Oto Circle east of the high point in the road while Basin EX-9A appears to sheet flow off-site west of the high point, towards the intersection of Brule Road and Oto Circle. These sheet flows seem to ultimately combine with the pre-developed flows from Basin Ex-10A further south and east of Brule Road. Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), much of the upstream tributary area to this basin will be routed towards Ponds FSD-11B and FSD-14B. The remaining undeveloped property will continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

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.

Basin EX-10A (Q_5 = 46 cfs, Q_{100} = 103 cfs) consists of approximately 153.5 acres of property that sheet flows in a southerly direction through the Sterling Ranch property. The combined flows from both basins EX-10 and EX-10A seem to remain as sheet flow traveling in a southerly direction towards **Design Point 7 (Q_5 = 110 cfs, Q_{100} = 249 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 DP-7 (Q_5 = 57.1 cfs, Q_{100} = 277.9 cfs). Upon development of the Sterling Ranch East Preliminary Plan No. 1 area (PCD No. SP-22-004 – currently under review), much of the upstream tributary area to this basin will be routed internally elsewhere. The remaining undeveloped property will continue to sheet flow off-site where the downstream properties will continue to adequately handle these less than historic sheet flows.

Basin EX-13 (Q_5 = 36 cfs, Q_{100} = 85 cfs) consists of approximately 94.8 acres of property at the extreme eastern edge of the Sterling Ranch property. The off-site northern portion of this basin contains existing 5 ac. lot development (Indian Wells Subd. Filing 1). The flows from this basin sheet flow in a southeasterly direction towards the eastern boundary of the Sterling Ranch property. To be consistent with the MDDP, the flows then seem to run along the eastern property boundary and enter Basin EX-11 near the Southeast corner of the property.

Basin EX-11 (Q_5 = 54 cfs, Q_{100} = 129 cfs) consists of approximately 214.3 acres of property that sheet flows across the southeastern corner of the Sterling Ranch property. The combined flows from both basins seem to remain as sheet flow traveling in a southerly direction towards **Design Point 56**. **(Q_5 = 60 cfs, Q_{100} = 160 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 DP-

56 (Q_5 = 42.5 cfs, Q_{100} = 202.9 cfs). No development is proposed within this basin at this time. Thus, the downstream corridor will not be affected.

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. (PCD No. SP-22-004 – currently under review) 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:

The following represent the basins and design points north of Briargate Pkwy.:

As described earlier, these first several basins (TR-12, TR-20, TR-4, TR-5 and TR-6) 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) Basin TR-12 (4.7 Ac.) is currently routed through the Retreat at TimberRidge development and then directly into Sand Creek. Upon development of Retreat at TimberRidge Filing 3, this basin is planned to be captured by the public storm system and then formally treated downstream in the Retreat at TimberRidge Pond 2. Basin TR-20 (23.2 Ac.) is currently tributary to the existing stock pond within the Retreat at TimberRidge development, which outfalls into a storm system directly into Sand Creek. Upon future development within this basin, formal stormwater quality treatment must take place on-site with the release into the existing storm system directly to Sand Creek. Basins TR-4 (4.4 Ac.), TR-5 (13.7 Ac.) and TR-6 (1.5 Ac.) are all currently accounted for and routed through the Retreat at TimberRidge development for formal treatment. Upon future development within these basins, formal treatment is still planned to be handled in the downstream Retreat at TimberRidge Pond 2.

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 = 3 cfs, Q_{100} = 7 cfs) consists of 2.1 Ac. of rear yards of the adjacent Retreat at TimberRidge Filing No. 2 development. As previously described in the existing conditions part of this report, Basin TR-7 in the developed condition is included in the on-site Basin P1-F. 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 adjacent to Retreat at TimberRidge but then be directed into Basin P1-F and continue within a constructed swale in a southerly direction along the western edge of Basin P1-F. These flows are then routed to Design Point 1. **Basin P1-F (Q_5 = 125 cfs, Q_{100} = 243 cfs)** represents 76.6 Ac. of the anticipated future urban residential basin. The western half of this basin is tributary to the downstream storm system at Design Point 1, while the eastern half of the basin will be captured in a temporary sediment basin just east of Design Point 1. However, to allow for the appropriate sizing of these downstream storm facilities and Pond FSD-16, **Design Point 1 (Q_5 = 127 cfs, Q_{100} = 248 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 this proposed Preliminary Plan 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 = 2 cfs, Q_{100} = 5 cfs) consists of 1.4 Ac. 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 constructed 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-E1 through rear and side yard swales within the proposed lots and then directly into the public street and future downstream storm system. **Basin P1-E1 (Q_5 = 66 cfs, Q_{100} = 128 cfs)** consists of 30.4 Ac. 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 at **Design Point 2 (Q_5 = 69 cfs, Q_{100} = 133 cfs)**. These developed flows 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. Prior to development of this portion of the Sterling Ranch East Preliminary Plan No. 1, the existing temporary sediment pond at the end of Bison Valley Trail will remain and the natural sheet flows from Basin P1-E1 will continue to travel in a southwesterly direction into Basin P1-E2.

Basin P1-E2 (Q_5 = 53 cfs, Q_{100} = 102 cfs) consists of 21.8 Ac. of the proposed urban residential at the north end of this Preliminary Plan, again just east of Sand Creek and tributary to a proposed downstream storm system within the northerly extension of Sterling Ranch Road at **Design Point 3 (Q_5 = 53 cfs, Q_{100} = 102 cfs)**. These developed flows will then combine with the upstream developed flows from Design Points 1 & 2 and be routed in a large diameter storm system further south within Sterling Ranch Road. Again, prior to development of this portion of the Sterling Ranch East Preliminary Plan No. 1, the combined natural sheet flows from Basins P1-E2 and P1-E1 will continue to travel in a southwesterly direction towards a temporary sediment pond just north of Idaho Falls Drive. The exact location and sizing of this facility will be shown in the final drainage report for this development.

Basin P1-C (Q_5 = 31 cfs, Q_{100} = 59 cfs) consists of 8.9 Ac. 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. Any by-pass flows will continue south as curb and gutter flow and combine with Basin P1-A5 developed flows to Design Point 7. The total developed flow at this northerly pipe outlet location into Pond FSD-16 is represented by **Design Point 4 (Q_5 = 167 cfs, Q_{100} = 376 cfs)**. The design of the required concrete forebay, impact structure and trickle channel at this outfall will be provided with the Final Drainage Report.

Basin P1-D (Q_5 = 72 cfs, Q_{100} = 142 cfs) represents 31.4 Ac. of site development for the 158 urban residential lots proposed within this Villages at Sterling Ranch PUDSP. This basin also includes a small portion of the Sterling Ranch East Preliminary Plan No. 1 (PCD No. SP-22-004 – currently under review) just east of Sand Creek, north of Briargate Pkwy. This basin will contain multiple designed low points planned for public Type R sump inlets with all the captured flows being routed to **Design Point 5 (Q_5 = 72 cfs, Q_{100} = 142 cfs).** This location represents the easterly pipe outlet into Pond FSD-16. The design of the required concrete forebay, impact structure, trickle channel at this outfall and individual inlet and pipe sizing will be provided with the Final Drainage Report. For further drainage basin details reference sheet 7 of 7. 100% of the Foursquare at Sterling Ranch site will have stormwater quality treatment through Pond FSD-16, constructed with this development and off-site Pond FSD-14A, constructed with Sterling Ranch East Filing No. 1.

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 = 71 cfs, Q_{100} = 140 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 6 (Q_5 = 71 cfs, Q_{100} = 140 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 previously mentioned Sterling Ranch MDDP Amendment, 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):

Detention Pond FSD-16 (Full Spectrum EDB)		**Full Build-out Scenario**
Total Tributary Acreage:	**220.9 ac.**	
	Estimated	**Provided**
Zone 1 (WQCV)	**3.60 Ac.-ft.**	**3.60 Ac.-ft.**
Zone 2 (EURV)	**7.68 Ac.-ft.**	**7.70 Ac.-ft.**
Zone 3 (100-yr.)	**7.54 Ac.-ft.**	**10.26 Ac.-ft.**
Total	**18.83 Ac.-ft.**	**21.56 Ac. ft.**

Total Peak In-flow (SWMM Model): **Q_5 = 307 cfs, Q_{100} = 496 cfs**

Pond Peak Design Release (MHFD Sheet): **Q_5 = 3.6 cfs, Q_{100} = 117.4 cfs**

Pre-development Release (MHFD Sheet): **Q_5 = 4.5 cfs, Q_{100} = 204.0 cfs**

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

With the anticipated phasing of construction within the Sterling Ranch East overall development, this facility will be designed with two separate orifice plate designs to be swapped out upon full build-out. However, the overall pond size and outlet box size will remain consistent. The interim development phase includes development within all tributary basins except **P1-B and P1-F** (future residential development NOT within this initial Preliminary Plan). These basins are assumed to remain native under this scenario.

The total anticipated developed flows entering the facility under the interim development scenario are as follows. (See Appendix for MHFD-Detention pond design sheets):

Detention Pond FSD-16 (Full Spectrum EDB) **Interim Development Scenario**

Total Tributary Acreage: 220.9 ac.

	Estimated	**Provided**
Zone 1 (WQCV)	**2.55 Ac.-ft.**	**2.55 Ac.-ft.**
Zone 2 (EURV)	**3.04 Ac.-ft.**	**3.05 Ac.-ft.**
Zone 3 (100-yr.)	**5.92 Ac.-ft.**	**12.17 Ac.-ft.**
Total	**11.51 Ac.-ft.**	**17.78 Ac.-ft.**

Total Peak In-flow (SWMM Model): **Q_5 = 197 cfs, Q_{100} = 410 cfs**

Pond Peak Design Release (MHFD Sheet): **Q_5 = 2.5 cfs, Q_{100} = 66.0 cfs**

Pre-development Release (MHFD Sheet): **Q_5 = 4.5 cfs, Q_{100} = 204.0 cfs**

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

In both scenarios, 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 September 2022. These referenced design plans provide a 48" RCP outfall pipe at this location with an allowable release rate of (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_{100} = 174.9 cfs). As designed on the JR Engineering storm plans, this storm system will run in a southwesterly 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 September 2022 for these design documents. The developer acknowledges that construction timing for the Sand Creek channel improvements, including Pond W3 and the two culvert crossings of Briargate Parkway and Sterling Ranch Road is key for the development of the Foursquare at Sterling Ranch. The final drainage report will further discuss this off-site construction timing/sequencing and any interim facilities that may be needed.

As shown on Drainage Map 2 of 7, the proposed development site straddles two existing basins within the Sand Creek and East Fork Sand Creek. (Basin EX-9 and EX-10A) Upon development of Foursquare at Sterling Ranch and the construction of Briargate Parkway, Sterling Ranch Road and Pond FSD-16, all the area within these two basins north of Briargate Parkway and Sterling Ranch Road will be routed via the proposed 48" RCP storm system within Sterling Ranch Road and ultimately enter Sand Creek at the crossing with Sterling Ranch Road. These developed flows are no longer tributary to the East Fork Sand Creek. The remaining portion of these basins south and east of the newly constructed major roadways, along with historic basins EX-8, EX-8A and EX-9A will continue to sheet flow in a southerly direction within the East Fork Sand Creek Drainage Basin towards the south property line of the overall Sterling Ranch property. The ultimate intent for the overall Sterling Ranch development east of Sand Creek is to maintain the pre-developed release rates and locations to the greatest extent possible. As further development takes place within the Sterling Ranch East Preliminary Plan No. 1 (PCD No. SP-22-004 – currently under review) and the Villages at Sterling Ranch (PCD No. PUDSP-226 – currently under review), more developed flows will be routed from the East Fork Sand Creek into Sand Creek. However, as presented on Drainage Map 6 of 7, the release into the East Fork Sand Creek will be re-balanced with the construction of Pond FSD-14B and the use of level spreaders along the south boundary line. Release into Sand Creek is re-balanced with the

construction of Ponds FSD-14A and FSD-11B. All three of these facilities are planned to be full spectrum detention ponds.

Basins P1-A1 (Q_5 = 15 cfs, Q_{100} = 29 cfs), **Basin P1-A2 (Q_5 = 16 cfs, Q_{100} = 32 cfs), Basin P1-A3 (Q_5 = 6 cfs, Q_{100} = 12 cfs)** and **Basin P1-A4 (Q_5 = 7 cfs, Q_{100} = 13 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 September 2022. Reference this report as well as the "Sterling Ranch Road and Briargate Pkwy. Street Plans", prepared by JR Engineering, LLC, dated September 2022 for inlet and pipe sizes through this corridor. These final designed facilities are shown and labeled on the drainage map. However, as described in the referenced Sterling Ranch MDDP Amendment, these final storm plans will be adjusted prior to formal storm sewer approval to show these developed flows now being routed south down Sterling Ranch Road.

Design Point 7 (Q_5 = 28 cfs, Q_{100} = 53 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. **Basin P1-A5 (Q_5 = 18 cfs, Q_{100} = 35 cfs)** and **Basin P1-A6 (Q_5 = 9 cfs, Q_{100} = 18 cfs)** consist of 5.7 Ac. and 2.8 Ac. respectively, 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 then south down Sterling Ranch Road. The anticipated storm system at this point is a 42" RCP. The emergency overflow release for this low point in Briargate Pkwy. is planned to be maximum ponding of 8", per criteria for Principal Arterial and then around the corner and south down Sterling Ranch Road. Final design of the roadway in this area will be determined in the Final Drainage Report and may allow for a median break for this emergency release from the north side of the road.

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.

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 September 2022. 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 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 west of the site and defined as Reach SC-8 (south of Briargate Pkwy.) and SC-9 north of Briargate Pkwy.).

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 September 2022

8. "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated September 2022

9. "Master Development Drainage Plan Amendment for Sterling Ranch", prepared by JR Engineering, LLC, dated September 2022

APPENDIX

VICINITY MAP

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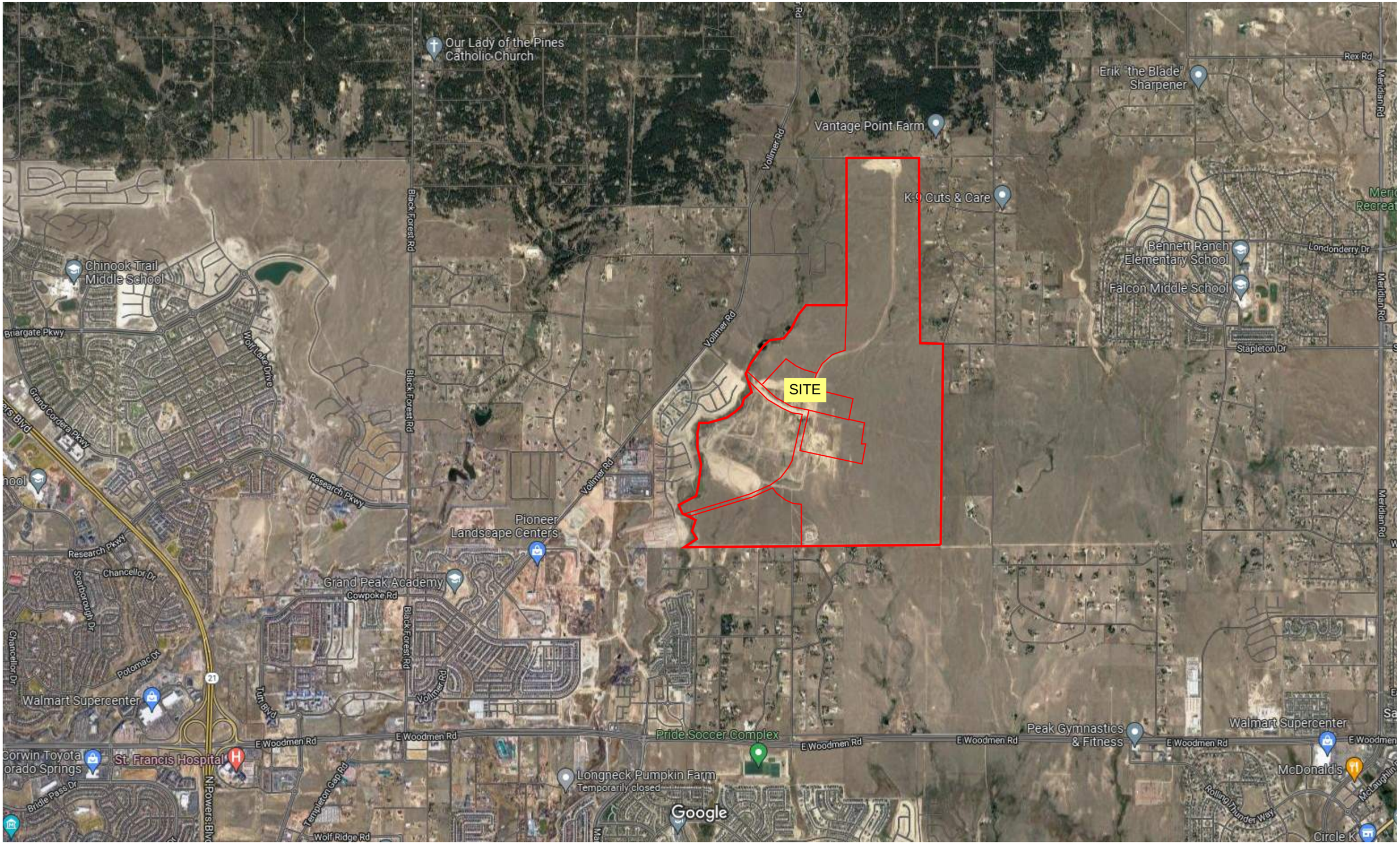

Imagery ©2022 Landsat / Copernicus, Maxar Technologies, USDA/FPAC/GEO, Map data ©2022 2000 ft

VICINITY MAP

SOILS MAP (S.C.S SURVEY)

CLASSIC SM
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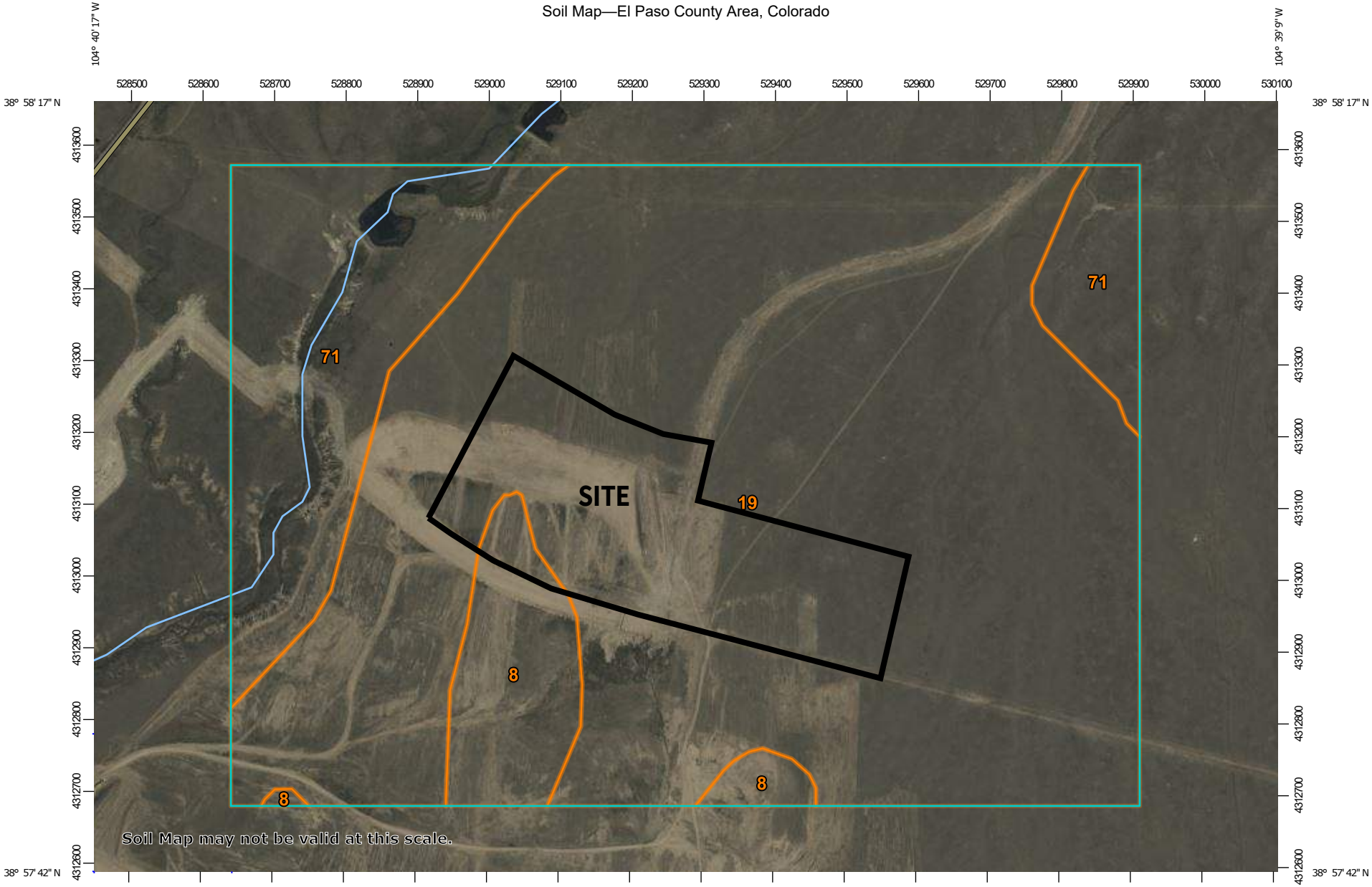
ENGINEERS & SURVEYORS



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
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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

MASTER DEVELOPMENT DRAINAGE PLAN FOR STERLING RANCH

OCTOBER 2018

Prepared for:

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Project #09-002
SKP-18-003
SF-17-024

at DP87 culminating in peak runoff rates within Sand Creek of Q5 = 374.6 cfs, Q100 = 1905.9 cfs.

Basin SC3-16A (Q5 = 120.4 cfs, Q100 = 351.8 cfs) consists of a 168.1 acre area located within Sterling Ranch, that is located north of Briargate Parkway and east of Sand Creek Channel. This portion of Sterling Ranch is planned to house residential development that ranges from low density rural lots 1 acres in size to medium density urban residential with lots ranging in size from 0.1 to 0.2 acres. Runoff from the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond (FSD16A), at the northwest corner of Briargate Parkway and Sterling Ranch Road. The treated detained flows from the pond will discharge to DP22 at peak flow rates of 8.8 cfs and 128.3 cfs in the 5 and 100 year events respectively.

Basin SC3-16B (Q5 = 53.7 cfs, Q100 = 143.8 cfs) consists of a 50.7 acre area located within Sterling Ranch, that is located north of Briargate Parkway and east of Sand Creek Channel. This portion of Sterling Ranch is planned for a low to medium density residential lots ranging in size from 0.1 to 0.2 acres lots and portions of roadways. Runoff from the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond (FSD16B), at the northeast corner of Briargate Parkway and Sterling Ranch Road. The treated detained flows from the pond will discharge to DP22 at peak flow rates of 0.4 cfs and 28.1 cfs in the 5 and 100 year events respectively. The combined peak flow rates from SC3-16B and FSD14A (DP22, Q5=8.8 cfs and Q100=174.9 cfs) will be conveyed south via storm sewer system to DP21.

Basin SC3-14B (Q5 = 34.3 cfs, Q100 = 94.1 cfs) consists of a 34.7 acre area located within of Sterling. Ranch, that is located between south of Briargate Parkway and east of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch is planned for a low to medium density residential lots ranging in size from 0.1 to 0.33 acres lots and portions of roadways. Runoff from the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond (FSD14B), at the south end of the basin. The treated detained flows from the pond will discharge to DP21 at peak flow rates of 0.3 cfs and 19.3 cfs in the 5 and 100 year events respectively. The combined peak flow rates from DP22 and FSD14B (DP21, Q5=8.8 cfs and Q100=174.9 cfs) will be conveyed to Pond W3 above the intersection of Sand Creek channel and Sterling Ranch Road.

Basin SC3-14A (Q5 = 175.4 cfs, Q100 = 466.3 cfs) consists of a 164.9 acre area located within of Sterling. Ranch, that is located between south of Briargate Parkway and east of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch is planned for a k-8 school site, several single family residential lots ranging in size from 0.2 to 0.33 acres lots as well as portions of park and open space. Runoff from the basin shall be collected and conveyed within street and storm sewer systems and directed to a full spectrum detention pond (FSD14A), at the southwest corner of the basin. The treated detained flows from the pond will discharge to Pond W3 at peak flow rates of 7.5 cfs and 142.2 cfs in the 5 and 100 year events respectively.

Basin SC3-13 (Q5 = 57.8 cfs, Q100 = 136.9 cfs) consists of a 41.0 acre area located within of Sterling. Ranch, that is located just the east of the Barbarick Subdivision and north of Sterling Ranch Road. This portion of Sterling Ranch is planned for residential lots ranging in size from 0.1 to 0.2 acres in size. Runoff from the basin shall be collected by storm sewer systems and conveyed to a full spectrum detention pond (FSD13) located in the south end of the basin, adjacent to sand creek. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 4.2 cfs and 47.2 cfs in the 5 and 100 year events respectively.

Runoff from DP87, DP21 and from FSD Ponds 13, and 14A will combine within the Sand Creek Channel at proposed Regional Pond Detention Facility W3. The purpose of the regional pond is to reduce the post development flow rates within the Sand Creek Channel at the Southern Sterling Ranch boundary to at or below the existing flow rates calculated by this report. The pond is also necessary due to the drainage basin diversion, as discussed in other parts of this report. The total combined discharge reaching the regional facility (Pond W-3) has been calculated at 374.5 cfs and 2204.1 cfs in the 5 and 100 year events respectively.

As conceptually designed the proposed facility will utilize a check/diversion wall located upstream of the existing stock pond and proposed detention facility that will function to divert base flows within the channel to aid in retaining a fixed water surface within the existing stock pond and in larger storm events diverted flows safely around the amenity to the west side to detention Pond W3. A small controlled outlet structure along with an improved downstream embankment will be added to the existing stock pond to stabilize it and retain a fixed maximum water surface elevation. In the larger detention pond eight (8) small 24" storm sewer pipe located within a separate embankment will allow for free flow discharge of 2 year runoff and begin to detain flows of 5 years and larger events. Flows exiting the small storm pipes or overtopping the separated embankment will enter a concrete forebay that conveys drainage to two (2) cell 8'h x10'w concrete box culvert (CBC) under Proposed Sterling Ranch Road to DP68. As the anticipated flow rate leaving the pond is planned to be less than 1,500 cfs, and the proposed culvert crossing is conceptually planned to have an open area of less than 200 ft sq of open area and thus will need to meet the headwater requirements of Table 6-5 of the DCM, which in this concept design is a ratio of about ~1.3. The total combined discharge calculated to leave the regional facility (Pond W-3) has been calculated at 200.3 cfs and 1,350.6 cfs in the 5 and 100 year events respectively, with a maximum 100 year water surface of 7017.3, a

HW/D ratio of ~1.3. The peak detained volume has been estimated at 78.2 ac-ft. A low point in Sterling Ranch Road will be designed adjacent to the facility to provide a safe overflow route. An exhibit showing the concept design and its various elements is included in the appendix of this report.

As previously discussed a Condition Letter of Map Revision and Letter of Map Revision (CLOMR/LOMR) will need to be processed through the Federal Emergency Management Agency (FEMA) to revise the hydrology to the Sand Creek Channel and allow for the remapping of the revised floodplains. It should be noted that the DBPS flow rates for Reach SC-8 (Reach 163) adjacent to this location were estimate to be 2,630 cfs and that the effective FEMA 100 year flow rate is 2,600cfs. A comparison table of the various flow rates is provided later in this text and on the accompanying drainage maps.

The final design of the culvert crossing and final determination of approved rates as well as the final pond design will be discussed within the future Sterling Ranch Channel Design Report and Sand Creek CLOMR/LOMR documents. No deviations for this pond and accompanying outlet structure are anticipated at this time.

It is important to note that the planned discharge outlet pipe for the FSD pond located to the west of the pond W3 will need to be extended to the downstream outlet side of the culvert to ensure that the 100 year water surface elevation with W3 does not affect the functionality of the adjacent FSD and its storm sewer systems.

In regards to timing, the need to construction this facility can be tied to the Sand Creek Channel improvements which is discussed within this report and also within the Subdivision Improvements Agreement. In no case should runoff from the East Fork of Sand Creek be diverted to the Main Branch of the Sand Creek Channel prior to the construction and of this facility.

Basin SC3-11A (Q5 = 7.8 cfs, Q100 = 24.3 cfs) consists of a 10.7 acre area located within of Sterling. Ranch, that is south of Sterling Ranch Road, west of Sand Creek. This portion of Sterling Ranch consists of single family residential for lots ranging in size from 0.2 to 0.3 acres in size and open space associated with the Sand Creek Channel. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond FSD11A. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 0.9 cfs and 12.3 cfs in the 5 and 100 year events respectively just upstream of DP-63. It should be noted that this detention facility may not be necessary if grading can be oriented to force surface runoff to the west.

Basin SC3-11B (Q5 = 81.3 cfs, Q100 = 213.7 cfs) consists of a 76.6 acre area located within of Sterling. Ranch, that is south of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch consists of single family residential planned for lots ranging in size from 0.2 to 0.3 acres in size and a portion of a park site and collector roadways. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems westward to a full spectrum detention pond FSD11B. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 4.5 cfs and 69.5 cfs in the 5 and 100 year events respectively. The runoff from DP68 and from FSD ponds 11A and 11B combine at DP63 at peak flow rates of Q5 = 201.0 cfs, Q100 = 1385.1, which is less than the anticipated existing modeled flow rates of Q5 = 430.7 cfs, Q100 = 1911.5 at DP63. Runoff from DP63 continues south within the Sand Creek Channel toward DP61.

Basin SC3-7 (Q5 = 69.9 cfs, Q100 = 157.2 cfs) consists of a 45.7 acre industrial zoned area, referred to as the Barbarick Subdivision, located outside of Sterling Ranch. Per the Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3and 4 the filing consists of four lots which upon which development will be constructed which will include adding a proposed Extended Detention Basin within Lot 4. This detention basin will provide water quality treatment for portions of Lots 1 & 2, and Lots 3 & 4. The EBD will structure will outfall at the south end of Lot 4 at the Barbarick Subdivision/Sterling Ranch property line. Per the report the proposed total outflow from the EDB pond will be Q5 = 0.3 cfs, Q100 = 45.9** cfs(**which includes pass through flows of 29.4 cfs). A second Sand Filter Basin water quality detention catchment will be provided at the southeast/downstream end of Lot 2. The SFB will outfall at the southeast corner of the Lot 2 at the Barbarick Subdivision/Sterling Ranch property line. Per the report the proposed total outflow the SFB pond will be Q5 = 0.1 cfs, Q100 = 3.6 cfs. At the initial writing of this report, neither EDB nor SFB structure has been fully constructed, and thus the assumption was made to utilize the full un-detained untreated runoff from the offsite development for onsite drainage planning purposes. Thus the downstream facilities planned within Sterling Ranch will account for the total un-detained runoff from the parcel of Q5 = 69.9 cfs, Q100 = 157.2 cfs and will plan to treat the total runoff onsite facilities. This provides a conservative approach for master planning. Runoff discharged from the property will be collected by proposed storm sewer within Sterling Ranch and routed to DP64. These facilities and their effects on drainage will be re-reviewed with subsequent drainage report and shall be implemented into final design and construction.

Basin SC3-6B (Q5=43.4 cfs, Q100=102.7 cfs) consists of a 30.9 acre area located within of Sterling Ranch, that is north of Sterling

Step 2 **Implement BMPs that provide a water quality capture volume with slow release.** – Using Full Spectrum Detention Facilities which will incorporate water quality capture volumes that are intended to slowly drain in 40 hours and excess urban runoff volumes that are intended to drain within 72 hours. All storage facilities will be designed to meet State Statue SB15-212/ §37-92-602(8).

Step 3 **Stabilize streams.** – With the full spectrum detention facility in place, the runoff from the developments will be reduced to predevelopment conditions. The developed discharge from the sites will be less than existing and therefore is not anticipated to have negative effects on downstream drainage ways.

Step 4 **Consider need for Industrial and Commercial BMPs.** – No industrial land uses are proposed with this development. The proposed commercial development area will implement a Stormwater Management Plan (SWMP) incorporation proper housekeeping procedures. Onsite drainage will be routed through private Full Spectrum Detention (FSD) basins to minimize introduction of contaminates to the county's public drainage systems.

INTERBASIN TRANSFER EAST FORK SAND CREEK TO MAIN STEM SAND CREEK

It should be noted that the proposed development plan for the ~1444 acre of Sterling Ranch redistributes a small percentage of the historic watershed between the Sand Creek and East Fork of Sand Creek watershed.

Based upon the survey and contour mapping, prior to development approximately 682 acres of Sterling Ranch runoff was collected by the Sand Creek watershed with the remaining 762 acres was directed to the East Fork of Sand Creek.

After development approximately 267 acres will be redirected from the East Fork Sand Creek into the Sand Creek Basin, resulting in 949 acres of Sterling Ranch directed to the Sand Creek Basin with the remaining 495 acres directed to East Fork Sand Creek.

This modification is driven primarily by maximizing the area of land that can be delivered to the sanitary sewer lift station. It should be noted that the East Fork of Sand Creek is still tributary to the Main Branch of Sand Creek, and thus this transfer is between minor watersheds, not major watershed, and that the development as planned will still function to limit discharged runoff into Sand Creek and East Tributary to the historic flow rates. An exhibit was added to the appendix, which also accompanies the deviation request that shows this basin diversion.

It should be noted that the Developed Conditions Map (provided in the appendix) illustrated the diverted acreage based upon the DPBS mapped boundary(as mapped within the SCDBPS) and diversion based upon the actual field contour data.

Drainage Basin Descriptions

Developed Sand Creek (Main Stem) Basin Flows

Basin SC3-82 (Q5 = 33.2 cfs, Q100 = 132.3 cfs) which is located north of Sterling Ranch and Burgess Road to the east Basin SC3-81, assumes that the 117.8 is primarily undeveloped, pine forested land. In this undeveloped condition runoff from the basin continues south overland into Basin SC3-74.

Basin SC3-74 (Q5 = 36.5 cfs, Q100 = 140.7cfs) is a 119.7 acre area of 5 and 10-acre lots covered with a mixture of native prairie grasses and pine trees land located north of Sterling Ranch and south of Burgess Road to the west and north of Basins SC3-73 and SC3-75. Runoff from Basins SC3-74 and SC3-82, combine at DP-74 (Q5 = 65.3 cfs, Q100 = 262.8 cfs), which is equivalent to the anticipated existing modeled flow rates of Q5 = 65.3 cfs, Q100 = 262.8 cfs.

Basin SC3-73 (Q5 = 26.4 cfs, Q100 = 102.0 cfs) is a 90.0 acre area of 5 to 40 acres lots covered with a mixture of native prairie grasses and pine trees land located north of Sterling Ranch to the northeast of Vollmer Road. Runoff from the Basin SC3-73 will combine with runoff from DP-74 and will continue overland towards DP-75.

Basin SC3-81 (Q5 = 70.2 cfs, Q100 = 275.7 cfs) which is located north of Sterling Ranch (approx 1 mile) between Shoup and Burgess Roads, assumes that the 262.9 acre area of primarily undeveloped, pine forested, land. In this undeveloped condition runoff from the basin continues south overland into Basin SC3-75.

LEGEND

BASIN ID — SC3-77

DESIGN POINT — 87

REACH IDENTIFIER — RT-17A

PROPERTY BNDRY

BASIN BOUNDARY

FLOW DIRECTION

STORM SEWER

FULL SPECTRUM DETENTION POND — FSD16

DETENTION POND — PNDW3

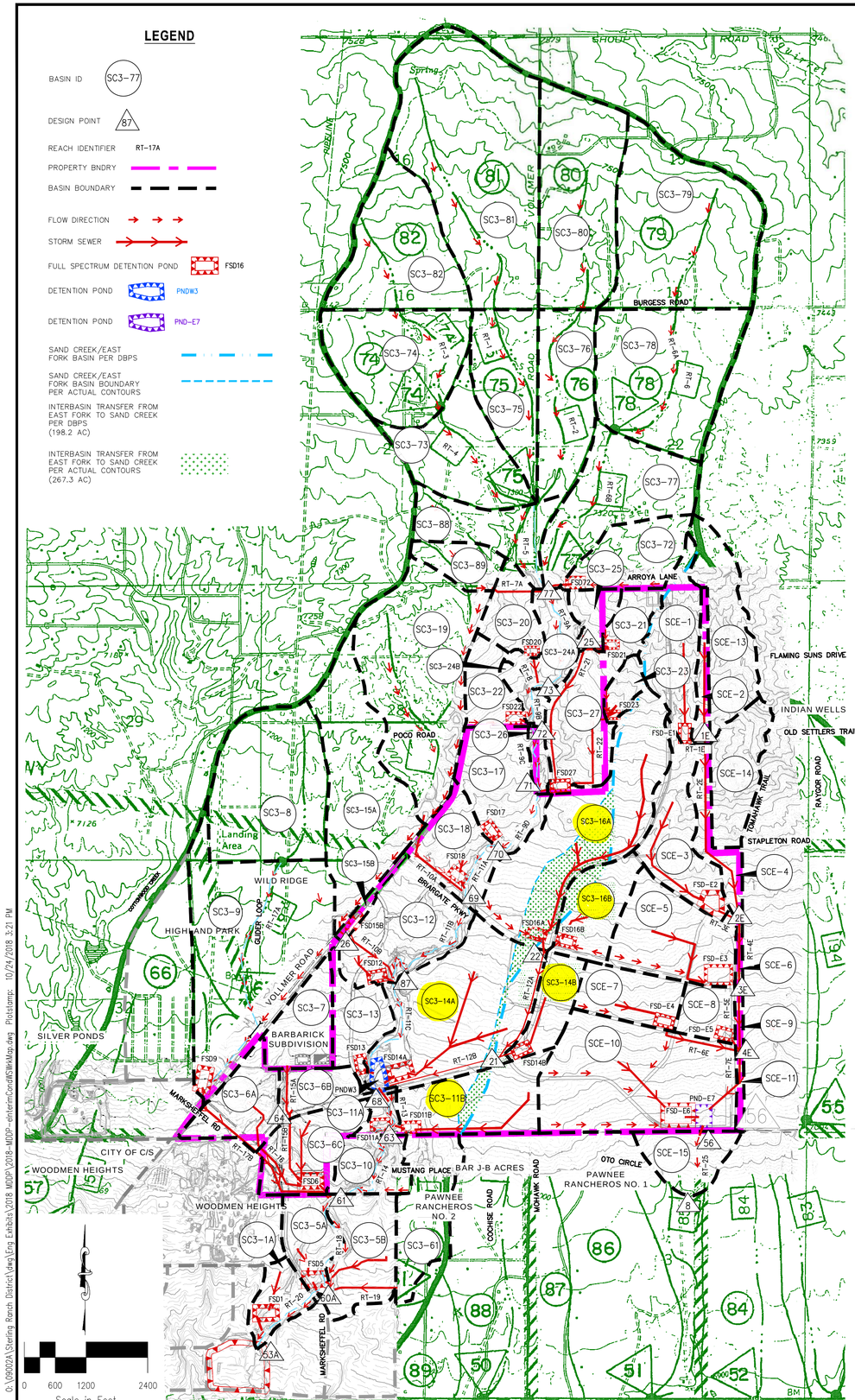
DETENTION POND — PND-E7

SAND CREEK/EAST FORK BASIN PER DBPS

SAND CREEK/EAST FORK BASIN BOUNDARY PER ACTUAL CONTOURS

INTERBASIN TRANSFER FROM EAST FORK TO SAND CREEK PER DBPS (198.2 AC)

INTERBASIN TRANSFER FROM EAST FORK TO SAND CREEK PER ACTUAL CONTOURS (267.3 AC)



BASIN SUMMARY

BASIN	CN	AREA (ACRES)	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)
SC3-1A	73	27.8	0.044	16.3	23.3	33.0	45.8	57.1	68.9
SC3-5A	84	39.1	0.061	40.6	53.7	71.0	92.4	110.6	129.1
SC3-5B	81	63.0	0.098	53.8	73.0	98.5	130.8	158.6	187.0
SC3-6A	88	49.3	0.077	61.4	79.3	102.2	130.1	153.6	177.1
SC3-6B	85	30.9	0.048	32.9	43.4	57.0	73.9	88.2	102.7
SC3-6C	82	58.0	0.091	53.9	72.5	97.1	128.0	154.5	181.5
SC3-7	88	45.7	0.071	54.0	69.9	90.3	115.2	136.2	157.2
SC3-8	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
SC3-9	66	217.4	0.340	45.8	71.5	108.6	158.9	204.9	254.0
SC3-10	63	36.0	0.056	7.6	12.3	19.4	29.1	38.0	47.7
SC3-11A	70	10.7	0.017	5.3	7.8	11.3	15.9	20.0	24.3
SC3-11B	80	76.6	0.120	59.4	81.3	110.8	148.1	180.5	213.7
SC3-12	81	88.2	0.138	77.8	105.6	142.5	189.1	229.1	270.0
SC3-13	85	41.0	0.064	43.9	57.8	76.0	98.5	117.6	136.9
SC3-14A	79	164.9	0.258	127.6	175.4	239.8	321.9	393.2	466.3
SC3-14B	77	34.7	0.054	24.6	34.3	47.4	64.2	79.0	94.1
SC3-15A	62	139.7	0.218	21.3	35.5	56.3	85.3	112.1	141.0
SC3-15B	87	7.9	0.012	10.8	14.0	18.2	23.3	27.6	31.9
SC3-16A	74	168.1	0.263	84.4	120.4	170.0	234.8	292.2	351.8
SC3-16B	78	50.7	0.079	39.0	53.7	73.6	99.0	121.1	143.8
SC3-17	73	70.6	0.110	41.8	59.6	85.2	119.0	149.1	180.6
SC3-18	81	53.8	0.084	49.3	67.1	91.0	121.2	147.3	174.0
SC3-19	62	184.0	0.287	28.8	47.7	75.7	114.4	150.2	188.8
SC3-20	65	34.2	0.053	9.9	15.5	23.8	35.1	45.5	56.6
SC3-21	66	23.3	0.036	7.0	10.8	16.3	23.7	30.4	37.5
SC3-22	65	33.9	0.053	9.4	14.8	22.5	32.9	42.5	52.6
SC3-23	67	14.5	0.023	5.5	8.3	12.4	18.0	23.0	28.4
SC3-24A	65	35.7	0.056	13.0	20.4	31.1	45.7	59.0	73.2
SC3-24B	65	12.2	0.019	3.4	5.3	8.1	11.8	15.2	18.9
SC3-25	66	19.0	0.030	5.8	8.9	13.4	19.5	25.1	31.0
SC3-26	63	10.0	0.016	2.5	4.0	6.2	9.2	12.1	15.1
SC3-27	71	70.0	0.109	35.1	51.2	73.8	103.7	130.3	158.3
SC3-61	63	65.5	0.102	13.7	22.2	34.4	51.6	67.6	84.8
SC3-72	64	56.2	0.088	12.8	20.2	31.4	46.7	60.9	76.0
SC3-73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
SC3-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
SC3-75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
SC3-76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
SC3-77	62	106.9	0.167	16.6	27.6	43.8	66.2	87.0	109.4
SC3-78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
SC3-79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
SC3-80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
SC3-81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
SC3-82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.1
SC3-88	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0
SC3-89	62	27.5	0.043	6.1	10	15.7	23.6	30.8	38.6
SCE-1	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4
SCE-2	64	15.0	0.023	4.4	7.0	10.8	15.9	20.7	25.7
SCE-3	70	67.5	0.105	30.6	45.2	65.9	93.3	118.0	143.9
SCE-4	70	29.5	0.046	13.3	19.6	28.6	40.6	257.8	62.6
SCE-5	87	85.5	0.134	100.4	130.6	169.6	217.4	257.8	298.4
SCE-6	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6
SCE-7	89	44.9	0.070	58.9	75.5	96.6	122.2	143.7	165.2
SCE-8	92	25.5	0.040	38.6	48.4	60.7	75.4	87.7	99.9
SCE-9	64	4.0	0.006	1.5	2.4	3.6	5.3	6.8	8.5
SCE-10	83	174.3	0.272	7.6	189.4	19.4	29.1	398.9	467.5
SCE-11	64	5.8	0.009	2.3	3.6	5.5	8.0	10.3	12.8
SCE-13	63	78.6	0.123	19.6	31.3	48.7	73.1	95.7	120.0
SCE-14	63	52.5	0.082	13.2	21.2	33.3	49.9	65.2	81.7
SCE-15	51	39.7	0.062	2.2	5.1	10.1	17.7	25.1	33.4

DESIGN POINT SUMMARY

DESIGN POINT	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)	LOCATION
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	262.8	
DP-75	1.413	141.2	235.1	376.6	566.6	750.9	950.5	
DP-77	2.343	209.9	351.9	580.6	886.6	1168.4	1467.7	ARROYA LANE X-ING
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP-73	2.471	207.5	354.3	588.5	897.1	1187.2	1506.7	
DP-72	2.543	206.2	352.5	586.7	897.2	1195.3	1518.6	POCO ROAD X-ING
DP-71	2.757	205.9	349.3	610.5	932.4	1226.9	1612.2	STERLING RANCH NORTHERN BNDRY
DP-70	2.867	205.3	349.8	614.0	940.1	1260.6	1636.7	
DP-69	3.238	212.7	366.6	653.7	1010.6	1364.1	1775.7	BRIARGATE PARKWAY X-ING
DP-87	3.594	216.9	374.6	681.9	1072.1	1471.5	1905.9	
DP-68	4.312	214.6	374.5	714.9	1187.6	1674.9	2204.1	UPSTREAM OF POND W3
DP-64	0.119	85.9	112.1	145.9	187.5	222.6	258.0	
DP-63	4.449	154.4	201.0	375.7	815.9	1112.1	1385.1	STERLING RANCH SOUTHERN BNDRY
DP-61	5.356	156.6	223.9	428.0	928.2	1287.3	1620.1	COLORADO SPRINGS/EL PASO BNDRY
DP-60A	5.617	161.6	224.8	439.1	950.4	1320.5	1661.8	MARKSHEFFEL X-ING
DP-53A	5.661	161.6	225.7	441.8	951.1	1326.0	1668.9	SAND CREEK AND POND 3
DP-1E	0.247	23.9	38.3	70.1	132.8	173.0	220.9	
DP-2E	0.486	48.9	76.8	123.0	228.7	319.7	419.4	
DP-3E	0.626	48.5	75.7	122.2	271.1	387.1	500.1	
DP-4E	0.745	48.1	76.2	122.4	286.9	407.3	534.8	
DP-56	1.017	23.1	35.3	71.5	108.3	152.1	196.4	NEAR SE PROP CORNER
DP-8	1.079	24.1	37.2	73.5	111.3	155.4	200.7	BELOW SE PROP CORNER
DP-21	0.396	0.6	8.8	17.8	57.1	116.8	174.9	
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4	
DP-25	0.066	5.9	9.1	16.3	35.1	46.4	58.2	
DP-26	0.012	0.1	1.1	3.2	7.3	9.5	12.0	

DESIGN POINT SUMMARY (VOLUME)

DESIGN POINT	AREA (SQ MI)	V_2 (AC-FT)	V_5 (AC-FT)	V_{10} (AC-FT)	V_{25} (AC-FT)	V_{50} (AC-FT)	V_{100} (AC-FT)	LOCATION
DP-74	0.371	5.9	9.0	13.6	19.8	25.5	31.6	
DP-75	1.413	22.7	34.5	51.7	75.4	97.1	120.5	
DP-77	2.343	37.7	57.4	85.9	125.1	161.1	199.9	ARROYA LANE X-ING
DP-78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP-73	2.471	40.0	60.8	91.0	132.5	170.7	211.7	
DP-72	2.543	41.3	62.9	94.0	136.8	176.2	218.5	POCO ROAD X-ING
DP-71	2.757	46.3	70.0	104.3	151.3	194.5	240.8	STERLING RANCH NORTHERN BNDRY
DP-70	2.867	49.5	74.5	110.6	160.1	205.4	254.0	
DP-69	3.238	57.5	86.1	127.4	183.8	235.3	290.6	BRIARGATE PARKWAY X-ING
DP-87	3.594	66.5	98.9	145.6	209.1	267.1	329.1	
DP-68	4.312	81.8	123.7	183.9	264.9	338.0	415.8	UPSTREAM OF POND W3
DP-64	0.119	7.0	9.1	11.8	15.2	18.1	21.1	
DP-63	4.449	85.6	129.5	192.3	276.7	352.8	433.5	STERLING RANCH SOUTHERN BNDRY
DP-61	5.356	103.7	157.8	235.1	338.4	431.3	529.8	COLORADO SPRINGS/EL PASO BNDRY
DP-60A	5.617	111.0	168.6	250.4	359.5	457.7	561.5	MARKSHEFFEL X-ING
DP-53A	5.661	112.0	170.0	252.6	362.6	461.7	566.5	SAND CREEK AND POND 3
DP-1E	0.247	3.1	5.2	8.4	12.7	16.6	20.9	
DP-2E	0.480	6.1	10.4	16.9	25.7	33.7	42.2	
DP-3E	0.620	7.0	13.7	23.4	36.1	47.4	59.3	
DP-4E	0.736	7.6	15.6	27.2	43.0	57.2	72.0	
DP-56	1.017	7.7	16.1	28.6	51.3	71.7	92.9	NEAR SE PROP CORNER
DP-8	1.079	8.0	16.7	26.6	53.0	74.0	95.9	BELOW SE PROP CORNER
DP-21	0.396	6.3	11.3	18.3	27.5	35.6	44.0	
DP-22	0.736	6.3	10.7	16.7	24.6	31.5	38.7	
DP-25	1.017	1.3	1.9	2.8	4.1	5.2	6.4	
DP-26	1.079	0.7	0.9	1.2	1.5	1.8	2.1	

WATER QUALITY & DETENTION POND SUMMARY

FSD1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	16.3	23.3	33.0	45.8	57.1	68.9
ALLOWABLE RELEASE (CFS)	0.1	1.7	3.3	10.9	17.5	25.5
MODELED RELEASE (CFS)	0.1	1.6	3.2	10.9	17.4	25.4
STORED VOLUME (AC-FT)	2.4	2.6	3.0	3.6	1.9	2.2

FSD5						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	40.6	53.7	71.0	92.4	110.6	129.1
ALLOWABLE RELEASE (CFS)	0.1	1.4	2.6	11.3	19.8	30.2
MODELED RELEASE (CFS)	0.1	1.4	2.6	11.2	19.7	30.1
STORED VOLUME (AC-FT)	3.0	3.2	3.8	4.1	4.7	5.2

FSD6						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	196.5	258.5	339.1	438.7	523.3	608.6
ALLOWABLE RELEASE (CFS)	0.5	7.6	14.6	58.4	99.6	149.7
MODELED RELEASE (CFS)	0.5	7.5	14.5	58.2	99.6	149.6
STORED VOLUME (AC-FT)	15.5	16.4	18.7	20.8	23.3	26.0

FSD9						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	64.6	105.6	169.5	252.3	327.1	410.1
ALLOWABLE RELEASE (CFS)	1.7	24.9	49.8	141.1	207.2	290.0
MODELED RELEASE (CFS)	1.7	24.9	49.8	141.1	207.0	289.9
STORED VOLUME (AC-FT)	8.7	8.7	9.6	10.8	12.3	13.8

FSD11A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	5.3	7.8	11.3	15.9	20.0	24.3
ALLOWABLE RELEASE (CFS)	0.1	1.6	3.2	7.5	9.7	12.4
MODELED RELEASE (CFS)	0.2	0.9	3.0	7.5	9.7	12.3
STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6

FSD11B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	59.4	81.3	110.8	148.1	180.5	213.7
ALLOWABLE RELEASE (CFS)	0.3	4.5	8.7	29.6	47.7	69.6
MODELED RELEASE (CFS)	0.3	4.5	8.6	29.5	47.7	69.5
STORED VOLUME (AC-FT)	4.8	4.9	5.5	6.4	7.3	8.2

FSD12						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	77.8	105.6	142.5	189.1	229.1	270.0
ALLOWABLE RELEASE (CFS)	0.9	13.2	26.7	62.0	80.2	103.2
MODELED RELEASE (CFS)	0.9	9.0	26.7	61.9	80.1	103.1
STORED VOLUME (AC-FT)	5.2	5.5	5.8	6.7	7.8	8.9

FSD13						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	43.9	57.8	76.0	98.5	117.6	136.9
ALLOWABLE RELEASE (CFS)	0.4	6.1	12.3	28.6	37.0	47.6
MODELED RELEASE (CFS)	0.4	4.2	12.3	28.6	36.9	47.2
STORED VOLUME (AC-FT)	3.1	3.1	3.3	3.8	4.4	5.0

FSD14A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	127.6	175.4	239.8	321.9	393.2	466.3
ALLOWABLE RELEASE (CFS)	0.5	7.5	14.4	56.2	95.2	142.4
MODELED RELEASE (CFS)	0.5	7.5	14.4	56.2	95.1	142.2
STORED VOLUME (AC-FT)	9.9	10.6	11.9	13.5	15.3	17.3

FSD14B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	24.6	34.3	47.4	64.2	79.0	94.1
ALLOWABLE RELEASE (CFS)	0.0	0.3	0.5	5.7	11.8	19.3
MODELED RELEASE (CFS)	0.0	0.3	0.5	4.5	11.8	19.3
STORED VOLUME (AC-FT)	1.9	2.5	3.3	3.5	3.5	3.8

FSD15B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	10.8	14.0	18.2	23.3	27.6	31.9
ALLOWABLE RELEASE (CFS)	0.1	1.6	3.2	7.3	9.5	12.0
MODELED RELEASE (CFS)	0.1	1.1	3.2	7.3	9.5	12.0
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0

FSD16A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	84.4	120.4	170.0	234.8	292.2	351.8
ALLOWABLE RELEASE (CFS)	0.6	8.8	17.3	56.2	88.4	128.3
MODELED RELEASE (CFS)	0.6	8.8	17.3	56.2	88.3	128.3
STORED VOLUME (AC-FT)	7.6	7.7	8.9	10.4	12.1	13.8

SAND CREEK FLOW COMPARISON CHART

DESIGN POINT	AREA (SQ MI)	Q_{100} (CFS)	DESCRIPTION
DP-77	2.343	1468	PROPOSED CONDITION
	2.91	2262	SAND CREEK DBPS
		2600	FEMA
DP-71	2.757	1612	PROPOSED CONDITION
		2260	SAND CREEK DBPS
DP-63	4.449	1385	PROPOSED CONDITION
	4.33	2630	SAND CREEK DBPS
		2600	FEMA
DP-60A	5.661	1662	PROPOSED CONDITION
	5.38	3295	SAND CREEK DBPS

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (SQ MI)	Q_{10} (CFS) (EXIST)	Q_{100} (CFS) (EXIST)	AREA (SQ MI)	Q_{10} (CFS) (PROP)	Q_{100} (CFS) (PROP)
DP-50	0.32	47.0	195.7	0.32	146.7	370.3
DP-51 (BASIN 86)	0.33	17.7	74.1	0.33	110.0	233.5
DP-52	1.67	80.5	456.5	1.67	1207.9	2123.0
DP-56	0.79	63.6	265.0	0.79	513.0	908.2

Values reported from SCDBPS, (DP 50, 51, 52 Not analyzed as a part of this study)
DBPS Reach: 85(Basin91)=Q10=28.8cfs Q100=115.2cfs / Q10=345.7cfs Q100=588.9cfs
(EXISTING) (PROPOSED)

WATER QUALITY & DETENTION POND SUMMARY

FSD16B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	39.0	53.7	73.6	99.0	121.1	143.8
ALLOWABLE RELEASE (CFS)	0.0	0.4	0.7	8.3	17.2	28.2
MODELED RELEASE (CFS)	0.0	0.4	0.7	7.9	17.2	28.1
STORED VOLUME (AC-FT)	3.0	3.9	5.1	5.1	5.3	5.8

FSD17						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	41.8	59.6	85.2	119.0	149.1	180.6
ALLOWABLE RELEASE (CFS)	0.7	11.1	22.5	52.0	67.2	86.3
MODELED RELEASE (CFS)	0.7	8.4	22.4	52.0	67.2	86.1
STORED VOLUME (AC-FT)	2.6	2.6	2.8	3.4	4.0	4.7

FSD18						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	49.3	67.1	91.0	121.2	147.3	174.0
ALLOWABLE RELEASE (CFS)	0.6	9.2	18.4	42.2	54.6	69.9
MODELED RELEASE (CFS)	0.6	6.3	18.4	42.2	54.6	69.6
STORED VOLUME (AC-FT)	3.2	3.2	3.4	4.0	4.7	5.3

FSD20						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	9.9	15.5	23.8	35.1	45.5	56.6
ALLOWABLE RELEASE (CFS)	0.4	5.5	11.1	25.7	33.2	42.5
MODELED RELEASE (CFS)	0.4	2.8	10.9	25.7	33.0	42.4
STORED VOLUME (AC-FT)	0.7	0.8	0.8	0.9	1.0	1.2

FSD21						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	7.0	10.8	16.3	23.7	30.4	37.5
ALLOWABLE RELEASE (CFS)	0.3	4.0	8.0	18.3	23.7	30.3
MODELED RELEASE (CFS)	0.3	3.3	8.0	18.3	23.7	30.1
STORED VOLUME (AC-FT)	0.5	0.5	0.5	0.6	0.7	0.8

FSD22						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	9.4	14.8	22.5	32.9	42.5	52.6
ALLOWABLE RELEASE (CFS)	0.4	5.8	11.5	26.5	34.3	43.9
MODELED RELEASE (CFS)	0.4	5.8	11.4	26.5	34.3	43.8
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0

FSD23						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	5.5	8.3	12.4	18.0	23.0	28.4
ALLOWABLE RELEASE (CFS)	0.2	2.4	4.9	11.2	14.5	18.6
MODELED RELEASE (CFS)	0.2	2.0	4.9	11.2	14.5	18.6
STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6

FSD27						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	38.8	57.6	84.1	119.7	159.2	206.3
ALLOWABLE RELEASE (CFS)	1.4	21.1	42.4	97.8	126.4	161.9
MODELED RELEASE (CFS)	1.4	18.4	42.3	97.7	126.2	161.9
STORED VOLUME (AC-FT)	2.7	2.8	2.9	3.2	3.7	4.2

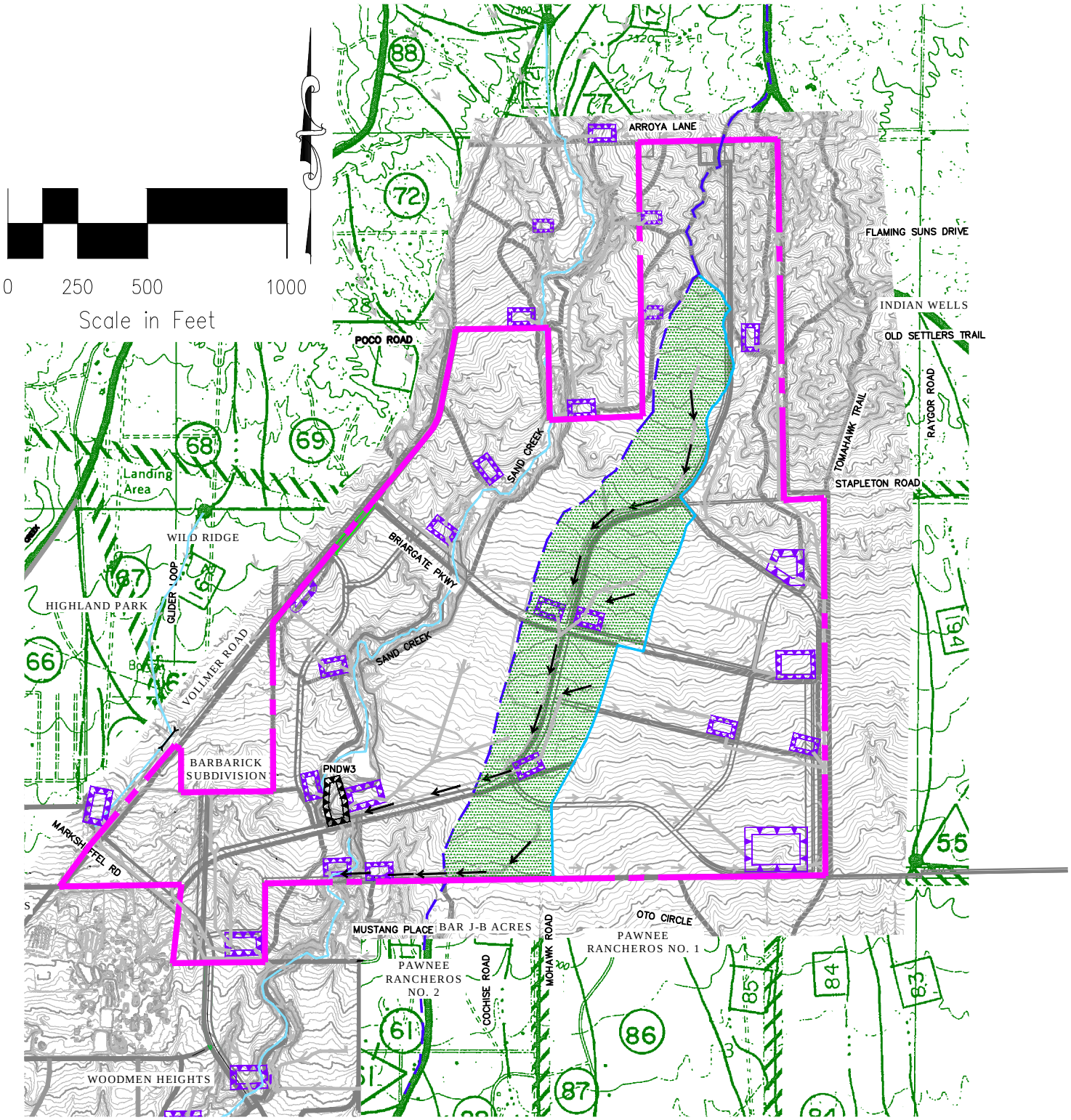
FSD72						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	12.8	20.2	31.4	46.7	60.9	76.0
ALLOWABLE RELEASE (CFS)	0.6	9.6	19.3	44.4	57.4	73.4
MODELED RELEASE (CFS)	0.6	9.3	19.2	44.4	57.4	73.4
STORED VOLUME (AC-FT)	1.0	1.0	1.1	1.1	1.2	1.3

PNDW3						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	214.6	374.5	714.9	1187.6	1674.9	2204.1
MODELED RELEASE (CFS)	154.3	200.3	366.8	799.9	1085.6	1350.6
STORED VOLUME (AC-FT)	2.8	9.5	26.3	41.2	57.2	78.2

FSD-E1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	23.3	35.9	53.8	79.1	102.4	127.4
ALLOWABLE RELEASE (CFS)	0.7	11.0	22.1	50.9	65.7	84.1
MODELED RELEASE (CFS)	0.7	5.4	19.9	48.9	62.8	84.0
STORED VOLUME (AC-FT)	1.3	1.3	1.5	1.8	2.1	2.5

FSD-E2						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	30.6	45.2	65.9	93.3	118.0	143.9
ALLOWABLE RELEASE (CFS)	0.6	9.5	19.2	45.5	59.8	77.6
MODELED RELEASE (CFS)	0.6	3.2	18.5	41.3	58.5	74.7
STORED VOLUME (AC-FT)	2.1

STERLING RANCH DRAINAGE DIVERSION EXHIBIT



PROPERTY BNDRY

HISTORIC SC/EFSC BNDRY LINE

PROPOSED SC/EFSC BNDRY LINE

BASIN DIVERSION AREA (EAST FORK SAND CREEK TO SAND CREEK) * ~267.3 AC

PNDW3 POND W3 WILL BE UTILIZED TO AID IN REDUCING CHANNELIZED RUNOFF TO HISTORIC LEVELS.

POTENTIAL LOCATION FOR FULL SPECTRUM DETENTION POND

*ALL DIVERTED RUNOFF SHALL BE DIRECTED TO FULL SPECTRUM DETENTION PONDS PRIOR TO DISCHARGE INTO SAND CREEK CHANNEL. WHENEVER POSSIBLE ADDITIONAL LID BMP'S WILL BE UTILIZED TO REDUCE INCREASES IN RUNOFF VOLUMES.

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SHEET 1 OF 1

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

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September 2015

SWMM MODEL RAIN GAGE INPUT PARAMETERS (PER DCM CPT. 6)

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where Z= 6,840 ft/100

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

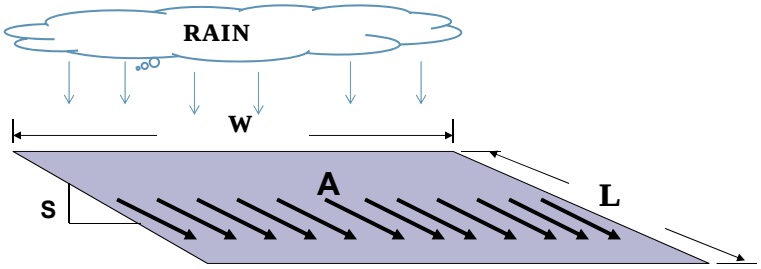
City of Colorado Springs DCM

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

SWMM MODEL SUBCATCHMENT INPUT PARAMETERS

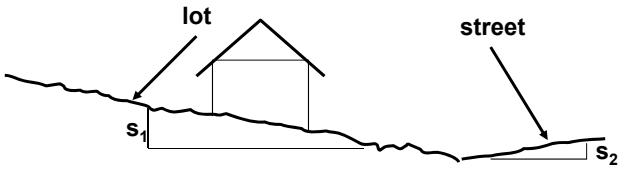
Subcatchment Conceptual Model



Subcatchment represented as a sloped, rectangular plane

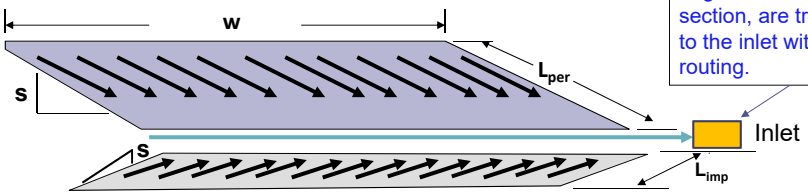
W = width
L = length
S = slope
A = area

Subcatchment Conceptual Model



Pervious and Impervious areas are processed independently and are then combined.
Both have the same tributary width (W).

Flows calculated at edge for rectangular section, are transferred to the inlet without flow routing.



You can set them up as separate subcatchments.

Width Parameter

NEVER use default value

Approx. Width = (Area) ÷ (Length)

Length = average overland sheet flow length of runoff

Suggested Rules of Thumb:

Undeveloped:

- **Maximum length = 100- to 500-feet**

Residential Catchments:

- **Maximum length = 100 to 300 feet**
- **back of lot to street gutter (100-175 ft)**

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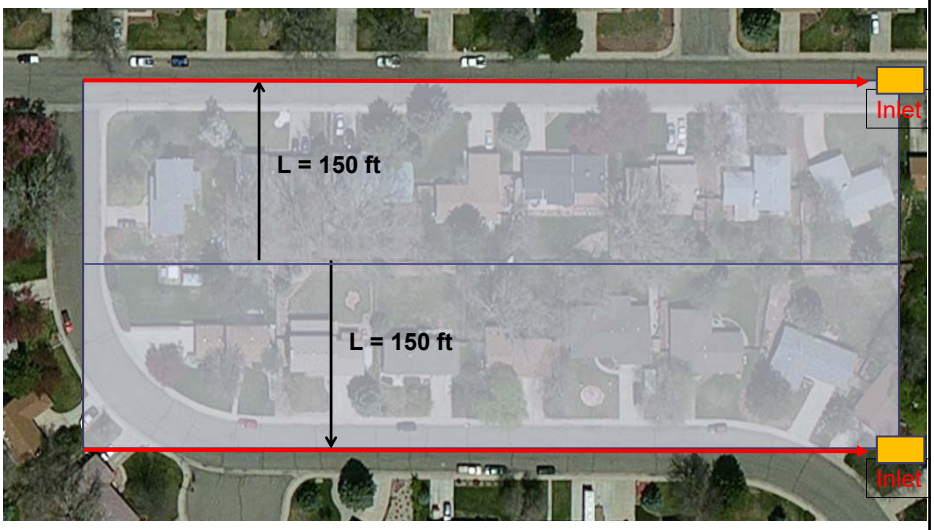
Width Parameter



11

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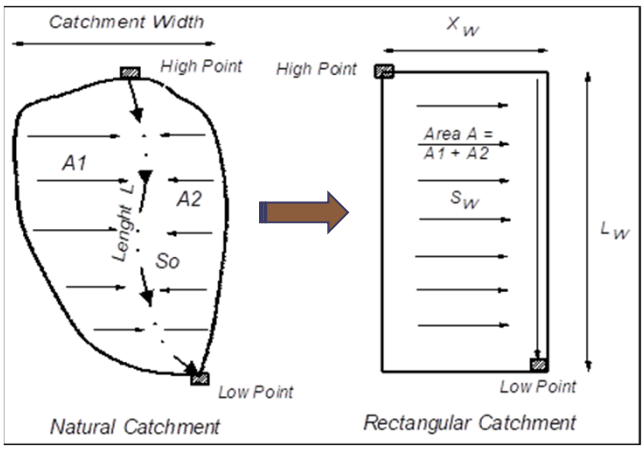
Transforming Subcatchment Shape to a Rectangle

Equations Suggested by Guo and Urbonas, 2009



Dimensionless Variables:

$X = {}^{A}/_{L^2}$

$Y = {}^{L_w}/_{L}$

Skewness:

$Z = max(A1, A2)/A$

$0.5 \le Z \le 1.0$

$$Y = \frac{Lw}{L} = (1.5 - Z)(2.286X - 0.286X^2) \Rightarrow {}^{L_w}/_{L} = (1.5 - Z)\left\{2.286\left({}^{A}/_{L^2}\right) - 0.286\left({}^{A}/_{L^2}\right)^2\right\}$$

$${}^{S_o}/_{S_w} = ({}^{X}/_{Y} + Y) \Rightarrow {}^{S_o}/_{S_w} = {}^{A}/_{LL_w} + {}^{L_w}/_{L}$$

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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**

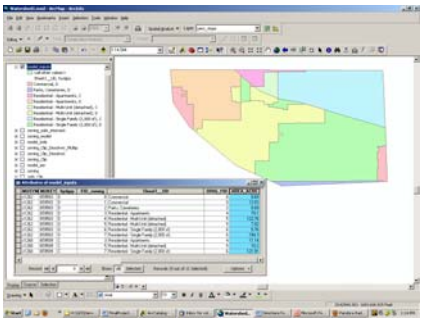


Table RO-3—Recommended Percentage Imperviousness Values

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

City of Colorado Springs DCM - Manning's n

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

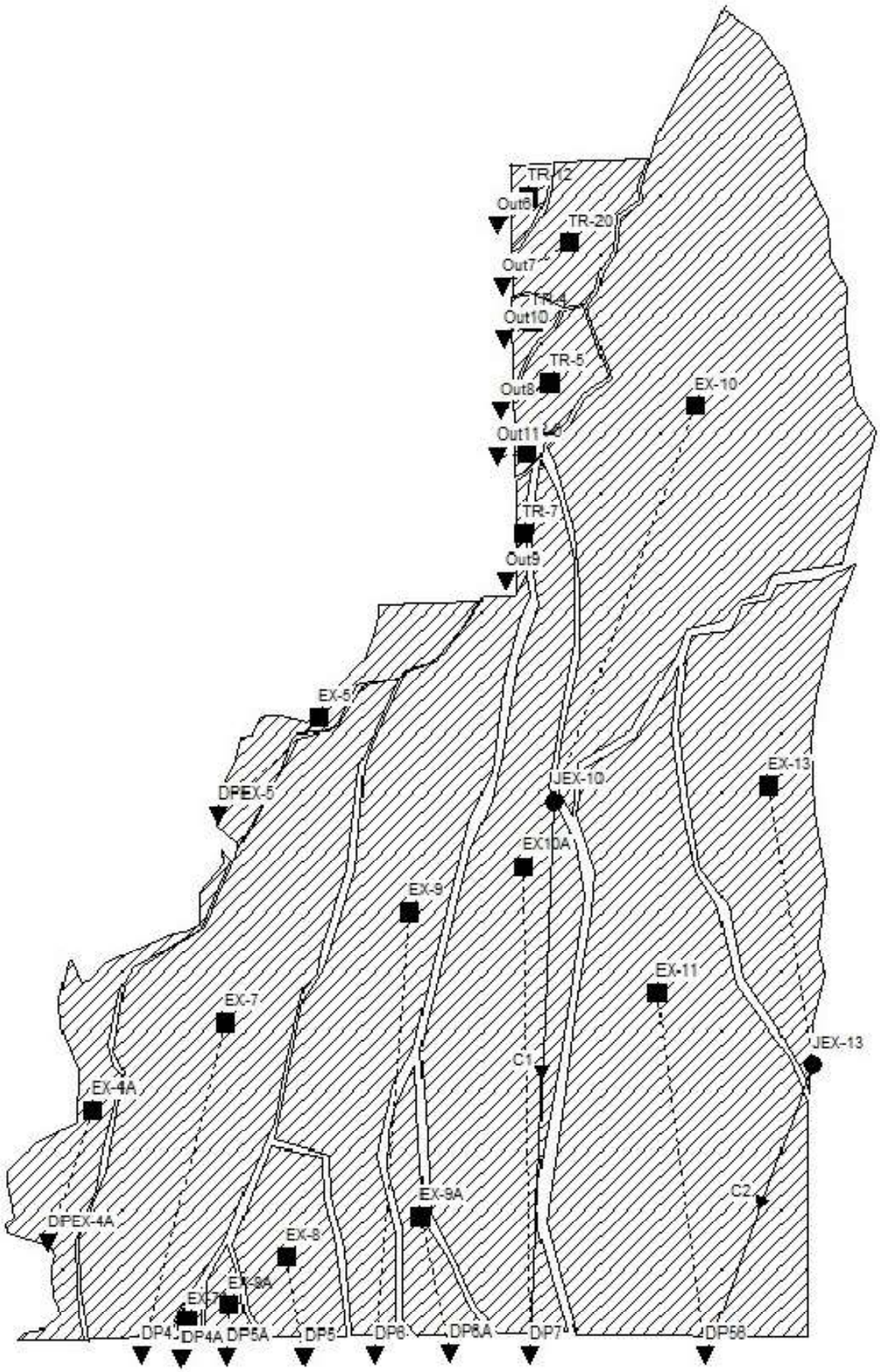
Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, bare soil, etc.)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods [3]	
Light underbrush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

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.

EXISTING CONDITIONS SWMM MODEL MAP



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.)

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 18
Number of nodes 18
Number of links 2
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
5YR	5yr	CUMULATIVE	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
EX-7	152.80	2234.00	5.00	3.1300	5YR	DP4
EX-9	139.30	1837.00	7.50	3.1900	5YR	DP6
EX10A	153.50	1857.00	5.00	4.0500	5YR	DP7
EX-11	214.30	3255.00	4.00	3.0100	5YR	DP56
EX-13	94.80	1877.00	6.00	3.9700	5YR	JEX-13
EX-10	265.90	3365.00	7.00	3.4100	5YR	JEX-10
TR-7	2.60	233.00	5.00	5.8400	5YR	

Out9					
TR-6	1.50	519.00	5.00	1.5500	5YR
Out11					
TR-5	13.70	990.00	5.00	2.7000	5YR
Out8					
TR-4	4.40	645.00	5.00	2.7600	5YR
Out10					
TR-12	4.70	544.00	5.00	4.1300	5YR
Out6					
TR-20	23.20	1388.00	7.00	3.2100	5YR
Out7					
EX-4A	44.20	3355.00	8.00	1.0900	5YR
DPEX-4A					
EX-5	26.20	1959.00	8.00	1.6500	5YR
DPEX-5					
EX-7A	2.40	416.00	2.00	2.7000	5YR
DP4A					
EX-8A	6.60	698.00	2.00	1.8000	5YR
DP5A					
EX-8	32.20	1679.00	2.00	1.4700	5YR
DP5					
EX-9A	21.80	786.00	5.00	3.0100	5YR
DP6A					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
JEX-10	JUNCTION	7148.00	4.00	0.0	
JEX-13	JUNCTION	7070.00	4.00	0.0	
DP4	OUTFALL	6998.00	0.00	0.0	
DP6	OUTFALL	7026.00	0.00	0.0	
DP7	OUTFALL	7016.00	4.00	0.0	
DP56	OUTFALL	7008.00	4.00	0.0	
Out6	OUTFALL	7270.00	0.00	0.0	
Out7	OUTFALL	7246.00	0.00	0.0	
Out8	OUTFALL	7230.00	0.00	0.0	
Out9	OUTFALL	7190.00	0.00	0.0	
Out10	OUTFALL	7250.00	0.00	0.0	
Out11	OUTFALL	7228.00	0.00	0.0	
DPEX-4A	OUTFALL	7001.00	0.00	0.0	
DPEX-5	OUTFALL	7144.00	0.00	0.0	
DP4A	OUTFALL	7021.00	0.00	0.0	
DP5A	OUTFALL	7024.50	0.00	0.0	
DP5	OUTFALL	7025.00	0.00	0.0	
DP6A	OUTFALL	7022.00	0.00	0.0	

```
  ************
  Link Summary
  ************
  Name             From Node        To Node          Type            Length
%Slope Roughness

-------------------------------------------------------------------------------
---------
  C2               JEX-13           DP56             CONDUIT         2650.0
2.3403    0.0500
  C1               JEX-10           DP7              CONDUIT         2500.0
5.2874    0.0500


  *********************
  Cross Section Summary
  *********************
                                      Full     Full     Hyd.     Max.   No. of
Full
  Conduit          Shape              Depth     Area     Rad.    Width  Barrels
Flow

-------------------------------------------------------------------------------
---
  C2               Natchannel          4.00   184.00     2.12    86.00        1
1381.03
  C1               Natchannel          4.00   184.00     2.12    86.00        1
2075.83



  ****************
  Transect Summary
  ****************

  Transect Natchannel
  Area:
              0.0030     0.0066     0.0110     0.0160     0.0217
              0.0282     0.0353     0.0431     0.0517     0.0609
              0.0708     0.0814     0.0927     0.1047     0.1174
              0.1308     0.1449     0.1597     0.1751     0.1913
              0.2082     0.2257     0.2440     0.2630     0.2826
              0.3030     0.3240     0.3457     0.3682     0.3913
              0.4151     0.4397     0.4649     0.4908     0.5174
              0.5447     0.5727     0.6014     0.6308     0.6609
              0.6917     0.7231     0.7553     0.7882     0.8217
              0.8560     0.8910     0.9266     0.9630     1.0000
  Hrad:
              0.0336     0.0620     0.0875     0.1112     0.1338
```

```
            0.1556     0.1768     0.1975     0.2180     0.2382
            0.2582     0.2780     0.2977     0.3173     0.3367
            0.3561     0.3755     0.3947     0.4140     0.4331
            0.4523     0.4714     0.4905     0.5095     0.5285
            0.5475     0.5665     0.5854     0.6044     0.6233
            0.6422     0.6611     0.6800     0.6989     0.7178
            0.7366     0.7555     0.7743     0.7932     0.8120
            0.8308     0.8496     0.8684     0.8873     0.9061
            0.9248     0.9436     0.9624     0.9812     1.0000
Width:
            0.0884     0.1070     0.1256     0.1442     0.1628
            0.1814     0.2000     0.2186     0.2372     0.2558
            0.2744     0.2930     0.3116     0.3302     0.3488
            0.3674     0.3860     0.4047     0.4233     0.4419
            0.4605     0.4791     0.4977     0.5163     0.5349
            0.5535     0.5721     0.5907     0.6093     0.6279
            0.6465     0.6651     0.6837     0.7023     0.7209
            0.7395     0.7581     0.7767     0.7953     0.8140
            0.8326     0.8512     0.8698     0.8884     0.9070
            0.9256     0.9442     0.9628     0.9814     1.0000


***********************************************************
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
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	168.474	1.679
Evaporation Loss	0.000	0.000
Infiltration Loss	151.675	1.512
Surface Runoff	16.375	0.163
Final Storage	0.434	0.004
Continuity Error (%)	-0.006	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	16.375	5.336
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	16.422	5.351
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 (%)	-0.319	

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	1.52	0.15	0.63	46.09	0.090
EX-9	1.68	0.00	0.00	1.49	0.19	0.70	58.50	0.111
EX10A	1.68	0.00	0.00	1.53	0.15	0.62	45.86	0.088
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
EX-7A	1.68	0.00	0.00	1.49	0.19	0.01	0.95	0.115
EX-8A	1.68	0.00	0.00	1.54	0.14	0.03	1.54	0.084
EX-8	1.68	0.00	0.00	1.58	0.09	0.08	5.26	0.055
EX-9A	1.68	0.00	0.00	1.54	0.14	0.08	6.99	0.084

****
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	0.18	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
DP4A	OUTFALL	0.00	0.00	7021.00	0 00:00	0.00
DP5A	OUTFALL	0.00	0.00	7024.50	0 00:00	0.00
DP5	OUTFALL	0.00	0.00	7025.00	0 00:00	0.00
DP6A	OUTFALL	0.00	0.00	7022.00	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 46.09 46.09 0 00:45 0.63
0.63 0.000
DP6 OUTFALL 58.50 58.50 0 00:45 0.704
0.704 0.000
DP7 OUTFALL 45.86 109.89 0 00:47 0.618
1.91 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
DP4A OUTFALL 0.95 0.95 0 00:50 0.0126
0.0126 0.000
DP5A OUTFALL 1.54 1.54 0 00:45 0.0252
0.0252 0.000
DP5 OUTFALL 5.26 5.26 0 00:45 0.0814
0.0814 0.000
DP6A OUTFALL 6.99 6.99 0 00:45 0.0831
0.0831 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	91.46	4.26	46.09	0.630
DP6	98.59	4.42	58.50	0.704
DP7	98.59	11.98	109.89	1.908
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
DP4A	33.84	0.23	0.95	0.013
DP5A	35.09	0.44	1.54	0.025
DP5	39.88	1.26	5.26	0.081
DP6A	47.89	1.07	6.99	0.083
System	55.74	39.43	326.74	5.351

****
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: Fri Mar 03 15:18:52 2023
Analysis ended on: Fri Mar 03 15:18:52 2023
Total elapsed time: < 1 sec

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

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	0.62	45.86	0.088
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	0.63	46.09	0.090
EX-7A	1.68	0.00	0.00	1.49	0.19	0.01	0.95	0.115
EX-8	1.68	0.00	0.00	1.58	0.09	0.08	5.26	0.055
EX-8A	1.68	0.00	0.00	1.54	0.14	0.03	1.54	0.084
EX-9	1.68	0.00	0.00	1.49	0.19	0.70	58.50	0.111
EX-9A	1.68	0.00	0.00	1.54	0.14	0.08	6.99	0.084
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

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

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
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 (5-yr.)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	91.46	4.26	46.09	0.630
DP4A	33.84	0.23	0.95	0.013
DP5	39.88	1.26	5.26	0.081
DP56	98.59	8.23	59.57	1.311
DP5A	35.09	0.44	1.54	0.025
DP6	98.59	4.42	58.50	0.704
DP6A	47.89	1.07	6.99	0.083
DP7	98.59	11.98	109.89	1.908
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 (100 yr.)

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 18
Number of nodes 18
Number of links 2
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100YR	100yr	CUMULATIVE	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
EX-7	152.80	2234.00	5.00	3.1300	100YR	DP4
EX-9	139.30	1837.00	7.50	3.1900	100YR	DP6
EX10A	153.50	1857.00	5.00	4.0500	100YR	DP7
EX-11	214.30	3255.00	4.00	3.0100	100YR	DP56
EX-13	94.80	1877.00	6.00	3.9700	100YR	JEX-13
EX-10	265.90	3365.00	7.00	3.4100	100YR	JEX-10
TR-7	2.60	233.00	5.00	5.8400	100YR	

Out9					
TR-6	1.50	519.00	5.00	1.5500	100YR
Out11					
TR-5	13.70	990.00	5.00	2.7000	100YR
Out8					
TR-4	4.40	645.00	5.00	2.7600	100YR
Out10					
TR-12	4.70	544.00	5.00	4.1300	100YR
Out6					
TR-20	23.20	1388.00	7.00	3.2100	100YR
Out7					
EX-4A	44.20	3355.00	8.00	1.0900	100YR
DPEX-4A					
EX-5	26.20	1959.00	8.00	1.6500	100YR
DPEX-5					
EX-7A	2.40	416.00	2.00	2.7000	100YR
DP4A					
EX-8A	6.60	698.00	2.00	1.8000	100YR
DP5A					
EX-8	32.20	1679.00	2.00	1.4700	100YR
DP5					
EX-9A	21.80	786.00	5.00	3.0100	100YR
DP6A					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
JEX-10	JUNCTION	7148.00	4.00	0.0	
JEX-13	JUNCTION	7070.00	4.00	0.0	
DP4	OUTFALL	6998.00	0.00	0.0	
DP6	OUTFALL	7026.00	0.00	0.0	
DP7	OUTFALL	7016.00	4.00	0.0	
DP56	OUTFALL	7008.00	4.00	0.0	
Out6	OUTFALL	7270.00	0.00	0.0	
Out7	OUTFALL	7246.00	0.00	0.0	
Out8	OUTFALL	7230.00	0.00	0.0	
Out9	OUTFALL	7190.00	0.00	0.0	
Out10	OUTFALL	7250.00	0.00	0.0	
Out11	OUTFALL	7228.00	0.00	0.0	
DPEX-4A	OUTFALL	7001.00	0.00	0.0	
DPEX-5	OUTFALL	7144.00	0.00	0.0	
DP4A	OUTFALL	7021.00	0.00	0.0	
DP5A	OUTFALL	7024.50	0.00	0.0	
DP5	OUTFALL	7025.00	0.00	0.0	
DP6A	OUTFALL	7022.00	0.00	0.0	

```
  ************
  Link Summary
  ************
  Name             From Node        To Node          Type            Length
%Slope Roughness

-------------------------------------------------------------------------------
---------
  C2               JEX-13           DP56             CONDUIT         2650.0
2.3403    0.0500
  C1               JEX-10           DP7              CONDUIT         2500.0
5.2874    0.0500


  *********************
  Cross Section Summary
  *********************
                                      Full     Full     Hyd.     Max.   No. of
Full
  Conduit          Shape              Depth     Area     Rad.    Width  Barrels
Flow

-------------------------------------------------------------------------------
---
  C2               Natchannel          4.00   184.00     2.12    86.00        1
1381.03
  C1               Natchannel          4.00   184.00     2.12    86.00        1
2075.83



  ****************
  Transect Summary
  ****************

  Transect Natchannel
  Area:
              0.0030     0.0066     0.0110     0.0160     0.0217
              0.0282     0.0353     0.0431     0.0517     0.0609
              0.0708     0.0814     0.0927     0.1047     0.1174
              0.1308     0.1449     0.1597     0.1751     0.1913
              0.2082     0.2257     0.2440     0.2630     0.2826
              0.3030     0.3240     0.3457     0.3682     0.3913
              0.4151     0.4397     0.4649     0.4908     0.5174
              0.5447     0.5727     0.6014     0.6308     0.6609
              0.6917     0.7231     0.7553     0.7882     0.8217
              0.8560     0.8910     0.9266     0.9630     1.0000
  Hrad:
              0.0336     0.0620     0.0875     0.1112     0.1338
```

```
            0.1556     0.1768     0.1975     0.2180     0.2382
            0.2582     0.2780     0.2977     0.3173     0.3367
            0.3561     0.3755     0.3947     0.4140     0.4331
            0.4523     0.4714     0.4905     0.5095     0.5285
            0.5475     0.5665     0.5854     0.6044     0.6233
            0.6422     0.6611     0.6800     0.6989     0.7178
            0.7366     0.7555     0.7743     0.7932     0.8120
            0.8308     0.8496     0.8684     0.8873     0.9061
            0.9248     0.9436     0.9624     0.9812     1.0000
Width:
            0.0884     0.1070     0.1256     0.1442     0.1628
            0.1814     0.2000     0.2186     0.2372     0.2558
            0.2744     0.2930     0.3116     0.3302     0.3488
            0.3674     0.3860     0.4047     0.4233     0.4419
            0.4605     0.4791     0.4977     0.5163     0.5349
            0.5535     0.5721     0.5907     0.6093     0.6279
            0.6465     0.6651     0.6837     0.7023     0.7209
            0.7395     0.7581     0.7767     0.7953     0.8140
            0.8326     0.8512     0.8698     0.8884     0.9070
            0.9256     0.9442     0.9628     0.9814     1.0000


***********************************************************
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
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	282.964	2.820
Evaporation Loss	0.000	0.000
Infiltration Loss	210.039	2.093
Surface Runoff	72.514	0.723
Final Storage	0.434	0.004
Continuity Error (%)	-0.008	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	72.514	23.630
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	72.586	23.653
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 (%)	-0.108	

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	2.14	0.68	2.81	104.96	0.241
EX-9	2.82	0.00	0.00	2.10	0.71	2.70	122.34	0.253
EX10A	2.82	0.00	0.00	2.16	0.66	2.75	103.21	0.234
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
EX-7A	2.82	0.00	0.00	1.75	1.07	0.07	4.97	0.380
EX-8A	2.82	0.00	0.00	1.89	0.93	0.17	8.52	0.330
EX-8	2.82	0.00	0.00	2.10	0.72	0.63	23.05	0.255
EX-9A	2.82	0.00	0.00	2.03	0.79	0.47	19.45	0.279

****
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
DP4A	OUTFALL	0.00	0.00	7021.00	0 00:00	0.00
DP5A	OUTFALL	0.00	0.00	7024.50	0 00:00	0.00
DP5	OUTFALL	0.00	0.00	7025.00	0 00:00	0.00
DP6A	OUTFALL	0.00	0.00	7022.00	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 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	104.96	104.96	0	00:45	2.81
2.81	0.000						
DP6		OUTFALL	122.34	122.34	0	00:45	2.7
2.7	0.000						
DP7		OUTFALL	103.21	248.99	0	00:47	2.75
7.8	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						
DP4A		OUTFALL	4.97	4.97	0	00:50	0.0698
0.0698	0.000						
DP5A		OUTFALL	8.52	8.52	0	00:50	0.167
0.167	0.000						
DP5		OUTFALL	23.05	23.05	0	00:55	0.629
0.629	0.000						
DP6A		OUTFALL	19.45	19.45	0	00:45	0.466
0.466	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	92.11	18.91	104.96	2.815
DP6	98.59	16.93	122.34	2.697
DP7	98.59	48.99	248.99	7.803
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
DP4A	35.35	1.22	4.97	0.070
DP5A	40.16	2.57	8.52	0.167
DP5	47.45	8.20	23.05	0.629
DP6A	48.31	5.97	19.45	0.466
System	56.98	177.75	800.99	23.651

****
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: Fri Mar 03 14:31:11 2023
Analysis ended on: Fri Mar 03 14:31:11 2023
Total elapsed time: < 1 sec

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

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	0.66	2.75	103.21	0.234
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	2.81	104.96	0.241
EX-7A	2.82	0.00	0.00	1.75	1.07	0.07	4.97	0.380
EX-8	2.82	0.00	0.00	2.10	0.72	0.63	23.05	0.255
EX-8A	2.82	0.00	0.00	1.89	0.93	0.17	8.52	0.330
EX-9	2.82	0.00	0.00	2.10	0.71	2.70	122.34	0.253
EX-9A	2.82	0.00	0.00	2.03	0.79	0.47	19.45	0.279
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

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

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
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

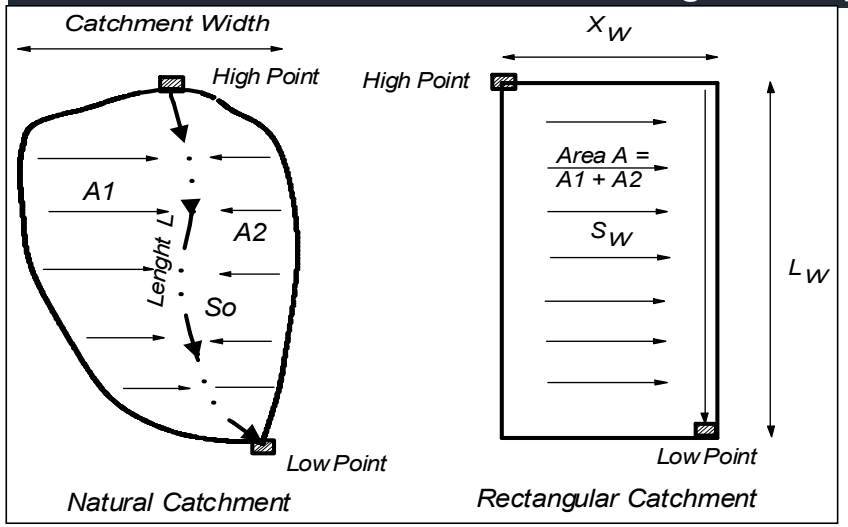
STERLING RANCH EAST PRE-DEVELOPMENT CONDITIONS (100-yr)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DP4	92.11	18.91	104.96	2.815
DP6	98.59	16.93	122.34	2.697
DP7	98.59	48.99	248.99	7.803
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
DP4A	35.35	1.22	4.97	0.070
DP5A	40.16	2.57	8.52	0.167
DP5	47.45	8.20	23.05	0.629
DP6A	48.31	5.97	19.45	0.466

CATCHMENT SHAPE PARAMETER FINDER

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	X=A/L²	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
EX-7	152.80	82.00	70.80	6,430	7160.0	6997.0	0.54	0.16	0.35	2,234	2,980	2.53	0.81	3.13
EX-9	139.30	65.00	74.30	7,190	7190.0	7026.0	0.53	0.12	0.26	1,837	3,302	2.28	0.71	3.19
EX10A	153.50	75.00	78.50	8,030	7,236	7,015	0.51	0.10	0.23	1,857	3,600	2.75	0.68	4.05
EX10	265.90	120.00	145.90	7,280	7,380	7,148	0.55	0.22	0.46	3,365	3,442	3.19	0.94	3.41
EX-11	214.30	100.00	114.30	6,140	7,192	7,008	0.53	0.25	0.53	3,255	2,867	3.00	1.00	3.01
EX-13	94.80	47.00	47.80	4,900	7,232	7,070	0.50	0.17	0.38	1,877	2,200	3.31	0.83	3.97
TR-4	4.40	2.20	2.20	640	7,270	7,244	0.50	0.47	1.01	645	297	4.06	1.47	2.76
TR-5	13.70	7.50	6.20	1,250	7,273	7,230	0.55	0.38	0.79	990	603	3.44	1.27	2.70
TR-6	1.50	0.75	0.75	250	7,238	7,228	0.50	1.05	2.08	519	126	4.00	2.58	1.55
TR-7	2.60	1.30	1.30	1,100	7,234	7,192	0.50	0.09	0.21	233	487	3.82	0.65	5.84
TR-12	4.70	2.50	2.20	800	7,300	7,262	0.53	0.32	0.68	544	377	4.75	1.15	4.13
TR-20	23.20	12.00	11.20	1,550	7,314	7,246	0.52	0.42	0.90	1,388	728	4.39	1.37	3.21
EX-4A	44.20	22.10	22.10	750	7,044	7,001	0.50	3.42	4.47	3,355	574	5.73	5.24	1.09
EX-5	26.20	13.10	13.10	1,200	7,186	7,144	0.50	0.79	1.63	1,959	583	3.50	2.12	1.65
EX-7A	2.40	1.20	1.20	550	7,039	7,021	0.50	0.35	0.76	416	251	3.27	1.21	2.70
EX-8A	6.60	3.30	3.30	900	7,045	7,025	0.50	0.35	0.78	698	412	2.22	1.23	1.80
EX-8A	32.20	17.00	15.20	1,750	7,062	7,025	0.53	0.46	0.96	1,679	835	2.11	1.44	1.47
EX-9A	21.80	11.80	10.00	2,600	7,082	7,022	0.54	0.14	0.30	786	1,208	2.31	0.77	3.01

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Surface Routing

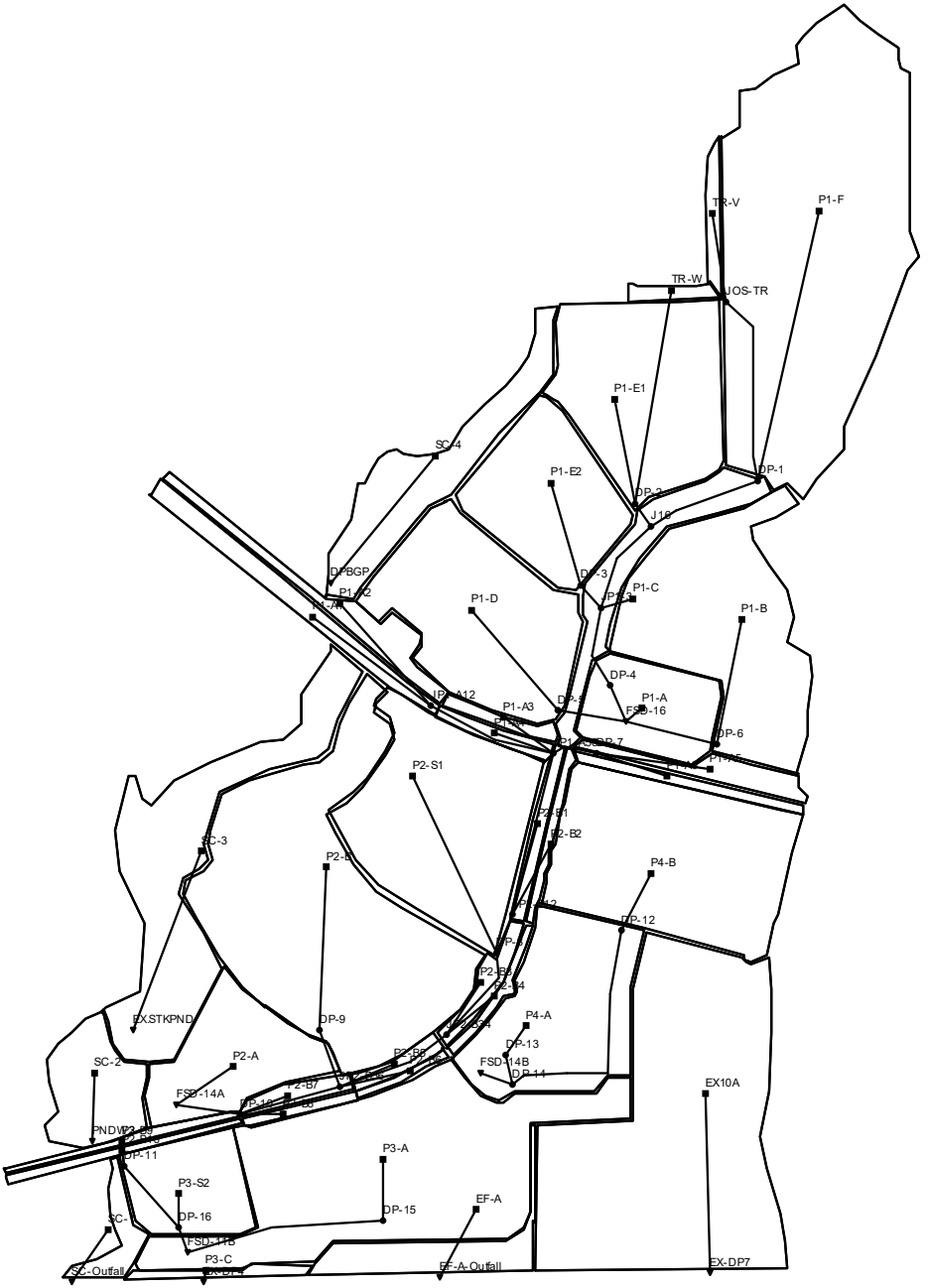
Design Point (South Bndy.)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
4	46	105
4A	1	5
5	5	23
5A	2	9
6	59	122
6A	7	19
7	110	249
56	60	160

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	*SWMM Width (Lw) (ft.)	*SWMM Slope (Sw) (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	3365	3.41%	105	222
EX10A	153.5	5%	1857	4.05%	46	103
EX-11 +	214.3	4%	3255	3.01%	54	129
EX-13 +	94.8	6%	1877	3.97%	36	85
EX-4A	44.2	8%	3355	1.09%	19	50
EX-5	26.2	8%	1959	1.65%	12	32
EX-7	152.8	5%	2234	3.13%	46	105
EX-7A	2.4	2%	416	2.70%	1	5
EX-8	32.2	2%	1679	1.47%	5	23
EX-8A	6.6	2%	698	1.80%	2	9
EX-9	139.3	8%	1837	3.19%	59	122
EX-9A	21.8	5%	786	3.01%	7	19
TR-12 +	4.7	5%	544	4.13%	2	9
TR-20 +	23.2	7%	1388	3.21%	10	32
TR-4 +	4.4	5%	645	2.76%	2	9
TR-5 +	13.7	5%	990	2.70%	5	17
TR-6 +	1.5	5%	519	1.55%	1	4
TR-7 +	2.6	5%	233	5.84%	1	5

* Reference SWMM Catchment Shape Parameter Finder for calculations

DEVELOPED CONDITIONS SWMM MODEL MAP



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

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE (5 yr.)

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 41
Number of nodes 37
Number of links 24
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
5yr	5yr	CUMULATIVE	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
P2-B10	1.70	187.00	70.00	3.4300	5yr	DP-11
P2-B9	2.00	226.00	70.00	3.2700	5yr	DP-11
P3-S2	11.90	1103.00	50.00	1.2700	5yr	DP-16
P3-A	52.60	1290.00	57.00	1.3700	5yr	DP-15

P3-C	1.70	446.00	11.00	1.3100	5yr	EX-DP4
EF-A	8.20	1064.00	15.00	1.5700	5yr	EF-A-Outfall
P2-B8	1.20	141.00	70.00	2.3400	5yr	DP-10
P2-B7	2.50	272.00	25.00	1.7800	5yr	DP-10
P2-B5	1.90	230.00	50.00	1.8600	5yr	JP2-B56
P2-B6	1.10	141.00	70.00	2.2800	5yr	JP2-B56
P2-A	24.40	2164.00	7.00	2.1100	5yr	FSD-14A
P2-B3	2.80	245.00	50.00	2.1500	5yr	JP2-B34
P2-B4	1.60	138.00	70.00	2.4900	5yr	JP2-B34
P4-A	25.80	920.00	57.00	1.2100	5yr	DP-13
P2-B	57.80	1215.00	57.00	1.6400	5yr	DP-9
P2-S1	35.60	1756.00	50.00	1.4400	5yr	DP-8
P2-B1	2.50	201.00	50.00	3.3700	5yr	JP2-B12
P2-B2	1.90	148.00	70.00	3.5400	5yr	JP2-B12
P4-B	37.30	1773.00	60.00	1.3400	5yr	DP-12
P1-A6	2.80	205.00	70.00	1.7500	5yr	DP-7
P1-A5	5.70	417.00	70.00	1.3800	5yr	DP-7
P1-A4	2.00	208.00	70.00	1.1200	5yr	JP1-A56
P1-A	12.70	1276.00	8.00	1.2900	5yr	FSD-16
P1-A1	5.00	258.00	70.00	1.6600	5yr	JP1-A12
P1-A2	6.40	258.00	70.00	0.7700	5yr	JP1-A12
P1-A3	1.80	196.00	70.00	1.1700	5yr	JP1-A56
P1-C	8.90	581.00	70.00	3.6900	5yr	JP1-3
P1-B	35.50	873.00	55.00	1.3600	5yr	DP-6
P1-D	31.40	1033.00	60.00	1.2700	5yr	DP-5
P1-E1	30.40	1148.00	50.00	1.5600	5yr	DP-2
TR-W	1.40	90.00	32.00	1.3000	5yr	DP-2
TR-V	2.10	162.00	27.00	4.1300	5yr	JOS-TR
P1-F	76.70	2322.00	35.00	2.1800	5yr	DP-1
SC-2	10.80	1211.00	8.00	2.4400	5yr	PNDW3
SC-3	27.20	616.00	8.00	2.6800	5yr	EX.STKPND
SC-4	16.40	1918.00	8.00	1.4800	5yr	DPBGP
SC-1	3.60	306.00	8.00	2.2000	5yr	SC-Outfall
EX10A	60.40	2452.00	5.00	1.7900	5yr	EX-DP7
P1-E2	21.80	1048.00	55.00	1.2300	5yr	DP-3
EX-9	6.00	578.00	5.00	1.7000	5yr	EX-DP6
EX-9A	12.70	1080.00	5.00	1.9400	5yr	EX-DP6A

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DP-12	JUNCTION	7080.00	4.00	0.0	
DP-9	JUNCTION	7046.00	4.00	0.0	
DP-10	JUNCTION	7032.00	10.30	0.0	
DP-11	JUNCTION	7017.00	2.50	0.0	
JP2-B12	JUNCTION	7072.00	11.50	0.0	
DP-8	JUNCTION	7067.00	5.00	0.0	
JP2-B34	JUNCTION	7055.00	6.00	0.0	
JP2-B56	JUNCTION	7044.00	6.50	0.0	
JP1-A12	JUNCTION	7104.00	3.00	0.0	
JP1-A56	JUNCTION	7096.00	3.50	0.0	
DP-6	JUNCTION	7096.00	3.50	0.0	
DP-4	JUNCTION	7096.00	27.50	0.0	
JP1-3	JUNCTION	7128.00	18.00	0.0	
DP-1	JUNCTION	7159.00	12.00	0.0	
JOS-TR	JUNCTION	7190.00	2.00	0.0	
DP-15	JUNCTION	7030.00	4.00	0.0	
DP-7	JUNCTION	7098.00	3.00	0.0	
DP-5	JUNCTION	7110.00	3.50	0.0	
DP-3	JUNCTION	7132.00	4.00	0.0	
DP-13	JUNCTION	7060.00	3.50	0.0	
DP-16	JUNCTION	7012.00	5.50	0.0	
DP-14	JUNCTION	7058.00	19.50	0.0	
DP-2	JUNCTION	7152.00	3.50	0.0	
J16	JUNCTION	7151.00	5.00	0.0	
EF-A-Outfall	OUTFALL	7025.00	0.00	0.0	
EX-DP4	OUTFALL	7000.00	0.00	0.0	
FSD-11B	OUTFALL	7010.00	11.50	0.0	
FSD-14A	OUTFALL	7014.00	17.80	0.0	
FSD-14B	OUTFALL	7056.00	4.50	0.0	
FSD-16	OUTFALL	7095.00	16.00	0.0	
PNDW3	OUTFALL	7001.00	0.00	0.0	
EX.STKPND	OUTFALL	7030.00	0.00	0.0	
DPBGP	OUTFALL	7100.00	0.00	0.0	

EX-DP7	OUTFALL	7015.00	0.00	0.0
SC-Outfall	OUTFALL	7000.00	0.00	0.0
EX-DP6A	OUTFALL	7020.00	0.00	0.0
EX-DP6	OUTFALL	7028.00	0.00	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CP4-B	DP-12	DP-14	CONDUIT	1775.0	0.3662	0.0130
C2	DP-11	DP-16	CONDUIT	350.0	0.5714	0.0130
C3	JP2-B12	DP-8	CONDUIT	280.0	1.6074	0.0130
C4	DP-8	JP2-B34	CONDUIT	750.0	1.4668	0.0130
C5	JP2-B34	JP2-B56	CONDUIT	650.0	1.4617	0.0130
C6	JP2-B56	DP-10	CONDUIT	800.0	0.9625	0.0130
C7	DP-10	FSD-14A	CONDUIT	600.0	1.0334	0.0130
C8	DP-9	JP2-B56	CONDUIT	100.0	1.5002	0.0130
C9	JP1-A12	JP1-A56	CONDUIT	900.0	0.8889	0.0130
C12	DP-6	FSD-16	CONDUIT	150.0	0.6000	0.0130
C13	JOS-TR	DP-1	CONDUIT	1500.0	1.4001	0.0130
C15	JP1-3	DP-4	CONDUIT	900.0	1.1112	0.0130
C16	DP-4	FSD-16	CONDUIT	130.0	0.7693	0.0130
CP3-A	DP-15	FSD-11B	CONDUIT	1100.0	1.1364	0.0130
C17	DP-5	FSD-16	CONDUIT	250.0	1.0001	0.0130
C19	DP-3	JP1-3	CONDUIT	200.0	1.0001	0.0130
C20	DP-13	DP-14	CONDUIT	150.0	1.0001	0.0130
C21	DP-16	FSD-11B	CONDUIT	150.0	1.3335	0.0130
C22	DP-14	FSD-14B	CONDUIT	150.0	1.3335	0.0130
C23	DP-1	J16	CONDUIT	600.0	1.3335	0.0130
C24	DP-2	J16	CONDUIT	100.0	1.0001	0.0130
C25	J16	JP1-3	CONDUIT	600.0	1.6669	0.0130
C26	JP1-A56	JP2-B12	CONDUIT	1180.0	1.3561	0.0130
C27	DP-7	JP1-A56	CONDUIT	280.0	0.5357	0.0130

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Cross Section Summary

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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
CP4-B	CIRCULAR	4.00	12.57	1.00	4.00	1	86.92
C2	CIRCULAR	2.50	4.91	0.63	2.50	1	31.01
C3	CIRCULAR	3.50	9.62	0.88	3.50	1	127.55
C4	CIRCULAR	5.00	19.63	1.25	5.00	1	315.43
C5	CIRCULAR	5.00	19.63	1.25	5.00	1	314.88
C6	CIRCULAR	6.00	28.27	1.50	6.00	1	415.50
C7	CIRCULAR	6.00	28.27	1.50	6.00	1	430.52
C8	CIRCULAR	4.00	12.57	1.00	4.00	1	175.94
C9	CIRCULAR	3.00	7.07	0.75	3.00	1	62.89
C12	CIRCULAR	3.50	9.62	0.88	3.50	1	77.93
C13	CIRCULAR	2.00	3.14	0.50	2.00	1	26.77
C15	CIRCULAR	5.50	23.76	1.38	5.50	1	353.98
C16	CIRCULAR	5.50	23.76	1.38	5.50	1	294.53
CP3-A	CIRCULAR	4.00	12.57	1.00	4.00	1	153.13
C17	CIRCULAR	3.50	9.62	0.88	3.50	1	100.61
C19	CIRCULAR	4.00	12.57	1.00	4.00	1	143.65
C20	CIRCULAR	3.50	9.62	0.88	3.50	1	100.61
C21	CIRCULAR	3.50	9.62	0.88	3.50	1	116.18
C22	CIRCULAR	4.50	15.90	1.13	4.50	1	227.08
C23	CIRCULAR	4.50	15.90	1.13	4.50	1	227.08
C24	CIRCULAR	3.50	9.62	0.88	3.50	1	100.61
C25	CIRCULAR	5.00	19.63	1.25	5.00	1	336.25
C26	CIRCULAR	3.50	9.62	0.88	3.50	1	117.16
C27	CIRCULAR	3.00	7.07	0.75	3.00	1	48.82

```
*****************************************************
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 ............ 03/02/2023 00:00:00
Ending Date .............. 03/02/2023 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec


**********************
Control Actions Taken
**********************


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......        91.813         1.679
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........        51.625         0.944
Surface Runoff ...........        38.776         0.709
Final Storage ............         1.741         0.032
Continuity Error (%) .....        -0.358


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
```

************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	38.775	12.635
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	38.623	12.586
Flooding Loss	0.018	0.006
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.010	0.003
Continuity Error (%)	0.320	

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

****
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	:	1.80
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

	Total Precip	Total Runon	Total Evap	Total Infil	Total Runoff	Total Runoff	Peak Runoff	Runoff Coeff

Subcatchment	in	in	in	in	in	10^6 gal	CFS	
P2-B10	1.68	0.00	0.00	0.43	1.21	0.06	6.23	0.723
P2-B9	1.68	0.00	0.00	0.43	1.21	0.07	7.33	0.723
P3-S2	1.68	0.00	0.00	0.76	0.89	0.29	30.04	0.531
P3-A	1.68	0.00	0.00	0.69	0.95	1.36	106.87	0.566
P3-C	1.68	0.00	0.00	1.31	0.36	0.02	1.27	0.216
EF-A	1.68	0.00	0.00	1.30	0.38	0.08	7.24	0.224
P2-B8	1.68	0.00	0.00	0.43	1.21	0.04	4.34	0.721
P2-B7	1.68	0.00	0.00	1.14	0.52	0.04	3.48	0.311
P2-B5	1.68	0.00	0.00	0.74	0.91	0.05	5.04	0.543
P2-B6	1.68	0.00	0.00	0.43	1.21	0.04	4.01	0.722
P2-A	1.68	0.00	0.00	1.44	0.23	0.16	10.80	0.140
P2-B3	1.68	0.00	0.00	0.75	0.90	0.07	7.24	0.536
P2-B4	1.68	0.00	0.00	0.44	1.20	0.05	5.60	0.716
P4-A	1.68	0.00	0.00	0.68	0.96	0.67	58.66	0.572
P2-B	1.68	0.00	0.00	0.69	0.95	1.49	114.40	0.565
P2-S1	1.68	0.00	0.00	0.78	0.87	0.84	81.84	0.516
P2-B1	1.68	0.00	0.00	0.74	0.91	0.06	6.56	0.540
P2-B2	1.68	0.00	0.00	0.43	1.20	0.06	6.71	0.718
P4-B	1.68	0.00	0.00	0.62	1.02	1.03	96.98	0.608
P1-A6	1.68	0.00	0.00	0.44	1.19	0.09	9.29	0.710
P1-A5	1.68	0.00	0.00	0.45	1.19	0.18	18.48	0.708
P1-A4	1.68	0.00	0.00	0.44	1.20	0.06	6.78	0.713
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	0.45	1.18	0.16	15.30	0.703
P1-A2	1.68	0.00	0.00	0.47	1.16	0.20	15.99	0.691
P1-A3	1.68	0.00	0.00	0.44	1.20	0.06	6.17	0.714
P1-C	1.68	0.00	0.00	0.44	1.20	0.29	30.79	0.715
P1-B	1.68	0.00	0.00	0.72	0.92	0.89	70.56	0.547
P1-D	1.68	0.00	0.00	0.63	1.01	0.86	72.49	0.599
P1-E1	1.68	0.00	0.00	0.79	0.86	0.71	66.34	0.511
TR-W	1.68	0.00	0.00	1.07	0.59	0.02	2.29	0.353
TR-V	1.68	0.00	0.00	1.11	0.56	0.03	3.15	0.333
P1-F	1.68	0.00	0.00	1.04	0.62	1.29	125.34	0.368
SC-2	1.68	0.00	0.00	1.40	0.27	0.08	5.63	0.163
SC-3	1.68	0.00	0.00	1.50	0.18	0.13	11.89	0.106
SC-4	1.68	0.00	0.00	1.42	0.26	0.11	8.25	0.153
SC-1	1.68	0.00	0.00	1.43	0.25	0.02	1.78	0.148

EX10A	1.68	0.00	0.00	1.53	0.15	0.24	17.80	0.088
P1-E2	1.68	0.00	0.00	0.70	0.94	0.56	52.69	0.560
EX-9	1.68	0.00	0.00	1.48	0.20	0.03	2.01	0.120
EX-9A	1.68	0.00	0.00	1.48	0.20	0.07	4.21	0.117

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Node Depth Summary
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Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
DP-12	JUNCTION	0.47	4.00	7084.00	0 00:44	4.00
DP-9	JUNCTION	0.41	2.35	7048.35	0 00:45	2.27
DP-10	JUNCTION	4.88	7.87	7039.87	0 00:47	7.67
DP-11	JUNCTION	0.15	1.16	7018.16	0 00:45	1.13
JP2-B12	JUNCTION	8.30	9.90	7081.90	0 00:47	9.75
DP-8	JUNCTION	0.81	2.48	7069.48	0 00:47	2.35
JP2-B34	JUNCTION	1.38	3.43	7058.43	0 00:47	3.25
JP2-B56	JUNCTION	1.89	4.03	7048.03	0 00:47	3.85
JP1-A12	JUNCTION	0.25	1.50	7105.50	0 00:45	1.45
JP1-A56	JUNCTION	0.73	2.11	7098.11	0 00:46	2.02
DP-6	JUNCTION	0.42	2.61	7098.61	0 00:45	2.50
DP-4	JUNCTION	22.51	25.57	7121.57	0 00:47	25.20
JP1-3	JUNCTION	13.40	15.70	7143.70	0 00:46	15.52
DP-1	JUNCTION	10.07	10.43	7169.43	0 00:48	10.42
JOS-TR	JUNCTION	0.07	0.46	7190.46	0 00:45	0.45
DP-15	JUNCTION	0.42	2.46	7032.46	0 00:45	2.38
DP-7	JUNCTION	0.23	1.62	7099.62	0 00:45	1.57
DP-5	JUNCTION	0.35	2.20	7112.20	0 00:45	2.12
DP-3	JUNCTION	0.26	1.68	7133.68	0 00:45	1.63
DP-13	JUNCTION	0.31	1.92	7061.92	0 00:45	1.86
DP-16	JUNCTION	3.15	4.14	7016.14	0 00:46	4.08
DP-14	JUNCTION	15.96	18.88	7076.88	0 00:48	18.68
DP-2	JUNCTION	0.31	2.12	7154.12	0 00:45	2.05
J16	JUNCTION	0.40	2.71	7153.71	0 00:46	2.59

EF-A-Outfall	OUTFALL	0.00	0.00	7025.00	0	00:00	0.00
EX-DP4	OUTFALL	0.00	0.00	7000.00	0	00:00	0.00
FSD-11B	OUTFALL	7.92	9.91	7019.91	0	00:46	9.72
FSD-14A	OUTFALL	12.38	15.34	7029.34	0	00:48	15.19
FSD-14B	OUTFALL	0.41	2.57	7058.57	0	00:48	2.44
FSD-16	OUTFALL	12.85	14.69	7109.69	0	00:46	14.58
PNDW3	OUTFALL	0.00	0.00	7001.00	0	00:00	0.00
EX.STKPND	OUTFALL	0.00	0.00	7030.00	0	00:00	0.00
DPBGP	OUTFALL	0.00	0.00	7100.00	0	00:00	0.00
EX-DP7	OUTFALL	0.00	0.00	7015.00	0	00:00	0.00
SC-Outfall	OUTFALL	0.00	0.00	7000.00	0	00:00	0.00
EX-DP6A	OUTFALL	0.00	0.00	7020.00	0	00:00	0.00
EX-DP6	OUTFALL	0.00	0.00	7028.00	0	00:00	0.00

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Node Inflow Summary
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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
DP-12	JUNCTION	96.98	96.98	0	00:45	1.03	1.03	-0.000
DP-9	JUNCTION	114.40	114.40	0	00:45	1.49	1.49	0.000
DP-10	JUNCTION	7.82	281.98	0	00:47	0.0749	3.47	0.000
DP-11	JUNCTION	13.57	13.57	0	00:45	0.122	0.122	0.000
JP2-B12	JUNCTION	13.28	78.34	0	00:47	0.124	0.88	0.000
DP-8	JUNCTION	81.84	150.94	0	00:46	0.838	1.72	0.000
JP2-B34	JUNCTION	12.84	161.73	0	00:46	0.121	1.83	0.000
JP2-B56	JUNCTION	9.05	276.84	0	00:46	0.0832	3.4	0.000
JP1-A12	JUNCTION	31.29	31.29	0	00:45	0.362	0.362	0.000
JP1-A56	JUNCTION	12.95	68.91	0	00:46	0.124	0.759	0.000
DP-6	JUNCTION	70.56	70.56	0	00:45	0.885	0.885	0.000
DP-4	JUNCTION	0.00	167.23	0	00:47	0	2.89	0.000
JP1-3	JUNCTION	30.79	269.97	0	00:46	0.29	2.89	0.000
DP-1	JUNCTION	125.34	127.43	0	00:45	1.29	1.32	0.000

JOS-TR	JUNCTION	3.15	3.15	0	00:45	0.0319	0.0319	0.000
DP-15	JUNCTION	106.87	106.87	0	00:45	1.36	1.36	0.000
DP-7	JUNCTION	27.77	27.77	0	00:45	0.275	0.275	0.000
DP-5	JUNCTION	72.49	72.49	0	00:45	0.858	0.858	0.000
DP-3	JUNCTION	52.69	52.69	0	00:45	0.557	0.557	0.000
DP-13	JUNCTION	58.66	58.66	0	00:45	0.673	0.673	0.000
DP-16	JUNCTION	30.04	42.67	0	00:45	0.288	0.41	0.000
DP-14	JUNCTION	0.00	101.43	0	00:47	0	1.7	0.000
DP-2	JUNCTION	68.63	68.63	0	00:45	0.731	0.731	0.000
J16	JUNCTION	0.00	192.60	0	00:46	0	2.05	0.000
EF-A-Outfall	OUTFALL	7.24	7.24	0	00:45	0.0838	0.0838	0.000
EX-DP4	OUTFALL	1.27	1.27	0	00:45	0.0168	0.0168	0.000
FSD-11B	OUTFALL	0.00	143.95	0	00:46	0	1.76	0.000
FSD-14A	OUTFALL	10.80	290.03	0	00:48	0.155	3.62	0.000
FSD-14B	OUTFALL	0.00	101.36	0	00:48	0	1.7	0.000
FSD-16	OUTFALL	6.19	307.12	0	00:47	0.0832	4.71	0.000
PNDW3	OUTFALL	5.63	5.63	0	00:45	0.0804	0.0804	0.000
EX.STKPND	OUTFALL	11.89	11.89	0	00:45	0.132	0.132	0.000
DPBGP	OUTFALL	8.25	8.25	0	00:45	0.115	0.115	0.000
EX-DP7	OUTFALL	17.80	17.80	0	00:45	0.242	0.242	0.000
SC-Outfall	OUTFALL	1.78	1.78	0	00:45	0.0243	0.0243	0.000
EX-DP6A	OUTFALL	4.21	4.21	0	00:45	0.068	0.068	0.000
EX-DP6	OUTFALL	2.01	2.01	0	00:45	0.0328	0.0328	0.000

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Node Flooding Summary
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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-12	0.06	8.39	0 00:46	0.006	0.000

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
EF-A-Outfall	50.14	1.03	7.24	0.084
EX-DP4	37.22	0.28	1.27	0.017
FSD-11B	98.19	11.11	143.95	1.763
FSD-14A	98.47	22.76	290.03	3.621
FSD-14B	97.64	10.77	141.36	1.699
FSD-16	98.47	29.59	407.12	4.708
PNDW3	42.78	1.16	5.63	0.080
EX.STKPND	69.44	1.17	11.89	0.132
DPBGP	46.25	1.54	8.25	0.115
EX-DP7	58.33	2.57	17.80	0.242
SC-Outfall	40.00	0.38	1.78	0.024
EX-DP6A	41.11	1.02	4.21	0.068
EX-DP6	38.61	0.53	2.01	0.033
System	62.82	83.91	1020.32	12.585

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
CP4-B	CONDUIT	89.25	0	00:48	8.67	1.03	0.87
C2	CONDUIT	13.26	0	00:46	6.18	0.43	0.45
C3	CONDUIT	78.13	0	00:47	13.94	0.61	0.57
C4	CONDUIT	150.27	0	00:47	15.97	0.48	0.49

C5	CONDUIT	161.05	0	00:47	16.19	0.51	0.51
C6	CONDUIT	275.69	0	00:47	15.79	0.66	0.60
C7	CONDUIT	281.00	0	00:48	16.26	0.65	0.59
C8	CONDUIT	113.32	0	00:45	14.91	0.64	0.59
C9	CONDUIT	29.92	0	00:46	8.95	0.48	0.48
C12	CONDUIT	70.05	0	00:46	9.22	0.90	0.74
C13	CONDUIT	2.77	0	00:48	6.12	0.10	0.21
C15	CONDUIT	267.23	0	00:47	16.62	0.75	0.65
C16	CONDUIT	267.25	0	00:47	14.05	0.91	0.75
CP3-A	CONDUIT	103.23	0	00:46	13.23	0.67	0.60
C17	CONDUIT	71.87	0	00:46	11.44	0.71	0.62
C19	CONDUIT	51.99	0	00:46	10.59	0.36	0.42
C20	CONDUIT	57.96	0	00:46	10.89	0.58	0.55
C21	CONDUIT	42.41	0	00:46	11.17	0.36	0.42
C22	CONDUIT	141.36	0	00:48	15.09	0.62	0.57
C23	CONDUIT	125.34	0	00:46	14.75	0.55	0.53
C24	CONDUIT	67.82	0	00:45	11.26	0.67	0.60
C25	CONDUIT	190.59	0	00:46	17.79	0.57	0.54
C26	CONDUIT	67.21	0	00:47	12.86	0.57	0.54
C27	CONDUIT	27.35	0	00:46	7.17	0.56	0.53

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Conduit Surcharge Summary
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	Hours Full			Hours Above Full	Hours Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
CP4-B	0.05	0.05	0.05	0.03	0.05

Analysis begun on: Thu Mar 02 17:21:59 2023
Analysis ended on: Thu Mar 02 17:21:59 2023
Total elapsed time: < 1 sec

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

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
EF-A	1.68	0.00	0.00	1.30	0.38	0.08	7.24	0.224
EX10A	1.68	0.00	0.00	1.53	0.15	0.24	17.80	0.088
EX-9	1.68	0.00	0.00	1.48	0.20	0.03	2.01	0.120
EX-9A	1.68	0.00	0.00	1.48	0.20	0.07	4.21	0.117
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	0.45	1.18	0.16	15.30	0.703
P1-A2	1.68	0.00	0.00	0.47	1.16	0.20	15.99	0.691
P1-A3	1.68	0.00	0.00	0.44	1.20	0.06	6.17	0.714
P1-A4	1.68	0.00	0.00	0.44	1.20	0.06	6.78	0.713
P1-A5	1.68	0.00	0.00	0.45	1.19	0.18	18.48	0.708
P1-A6	1.68	0.00	0.00	0.44	1.19	0.09	9.29	0.710
P1-B	1.68	0.00	0.00	0.72	0.92	0.89	70.56	0.547
P1-C	1.68	0.00	0.00	0.44	1.20	0.29	30.79	0.715
P1-D	1.68	0.00	0.00	0.63	1.01	0.86	72.49	0.599
P1-E1	1.68	0.00	0.00	0.79	0.86	0.71	66.34	0.511
P1-E2	1.68	0.00	0.00	0.70	0.94	0.56	52.69	0.560

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

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-F	1.68	0.00	0.00	1.04	0.62	1.29	125.34	0.368
P2-A	1.68	0.00	0.00	1.44	0.23	0.16	10.80	0.140
P2-B	1.68	0.00	0.00	0.69	0.95	1.49	114.40	0.565
P2-B1	1.68	0.00	0.00	0.74	0.91	0.06	6.56	0.540
P2-B10	1.68	0.00	0.00	0.43	1.21	0.06	6.23	0.723
P2-B2	1.68	0.00	0.00	0.43	1.20	0.06	6.71	0.718
P2-B3	1.68	0.00	0.00	0.75	0.90	0.07	7.24	0.536
P2-B4	1.68	0.00	0.00	0.44	1.20	0.05	5.60	0.716
P2-B5	1.68	0.00	0.00	0.74	0.91	0.05	5.04	0.543
P2-B6	1.68	0.00	0.00	0.43	1.21	0.04	4.01	0.722
P2-B7	1.68	0.00	0.00	1.14	0.52	0.04	3.48	0.311
P2-B8	1.68	0.00	0.00	0.43	1.21	0.04	4.34	0.721
P2-B9	1.68	0.00	0.00	0.43	1.21	0.07	7.33	0.723
P2-S1	1.68	0.00	0.00	0.78	0.87	0.84	81.84	0.516
P3-A	1.68	0.00	0.00	0.69	0.95	1.36	106.87	0.566
P3-C	1.68	0.00	0.00	1.31	0.36	0.02	1.27	0.216
P3-S2	1.68	0.00	0.00	0.76	0.89	0.29	30.04	0.531

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

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
P4-A	1.68	0.00	0.00	0.68	0.96	0.67	58.66	0.572
P4-B	1.68	0.00	0.00	0.62	1.02	1.03	96.98	0.608
SC-1	1.68	0.00	0.00	1.43	0.25	0.02	1.78	0.148
SC-2	1.68	0.00	0.00	1.40	0.27	0.08	5.63	0.163
SC-3	1.68	0.00	0.00	1.50	0.18	0.13	11.89	0.106
SC-4	1.68	0.00	0.00	1.42	0.26	0.11	8.25	0.153
TR-V	1.68	0.00	0.00	1.11	0.56	0.03	3.15	0.333
TR-W	1.68	0.00	0.00	1.07	0.59	0.02	2.29	0.353

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

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	125.34	127.43	0	00:45	1.29	1.32	0.000
DP-10	JUNCTION	7.82	281.98	0	00:47	0.0749	3.47	0.000
DP-11	JUNCTION	13.57	13.57	0	00:45	0.122	0.122	0.000
DP-12	JUNCTION	96.98	96.98	0	00:45	1.03	1.03	-0.000
DP-13	JUNCTION	58.66	58.66	0	00:45	0.673	0.673	0.000
DP-14	JUNCTION	0.00	101.43	0	00:47	0	1.7	0.000
DP-15	JUNCTION	106.87	106.87	0	00:45	1.36	1.36	0.000
DP-16	JUNCTION	30.04	42.67	0	00:45	0.288	0.41	0.000
DP-2	JUNCTION	68.63	68.63	0	00:45	0.731	0.731	0.000
DP-3	JUNCTION	52.69	52.69	0	00:45	0.557	0.557	0.000
DP-4	JUNCTION	0.00	167.23	0	00:47	0	2.89	0.000
DP-5	JUNCTION	72.49	72.49	0	00:45	0.858	0.858	0.000
DP-6	JUNCTION	70.56	70.56	0	00:45	0.885	0.885	0.000
DP-7	JUNCTION	27.77	27.77	0	00:45	0.275	0.275	0.000
DP-8	JUNCTION	81.84	150.94	0	00:46	0.838	1.72	0.000
DP-9	JUNCTION	114.40	114.40	0	00:45	1.49	1.49	0.000

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

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
DPBGP	OUTFALL	8.25	8.25	0	00:45	0.115	0.115	0.000
EF-A-Outfall	OUTFALL	7.24	7.24	0	00:45	0.0838	0.0838	0.000
EX.STKPND	OUTFALL	11.89	11.89	0	00:45	0.132	0.132	0.000
EX-DP4	OUTFALL	1.27	1.27	0	00:45	0.0168	0.0168	0.000
EX-DP6	OUTFALL	2.01	2.01	0	00:45	0.0328	0.0328	0.000
EX-DP6A	OUTFALL	4.21	4.21	0	00:45	0.068	0.068	0.000
EX-DP7	OUTFALL	17.80	17.80	0	00:45	0.242	0.242	0.000
FSD-11B	OUTFALL	0.00	143.95	0	00:46	0	1.76	0.000
FSD-14A	OUTFALL	10.80	290.03	0	00:48	0.155	3.62	0.000
FSD-14B	OUTFALL	0.00	101.36	0	00:48	0	1.7	0.000
FSD-16	OUTFALL	6.19	307.12	0	00:47	0.0832	4.71	0.000
J16	JUNCTION	0.00	192.60	0	00:46	0	2.05	0.000
JOS-TR	JUNCTION	3.15	3.15	0	00:45	0.0319	0.0319	0.000
JP1-3	JUNCTION	30.79	269.97	0	00:46	0.29	2.89	0.000
JP1-A12	JUNCTION	31.29	31.29	0	00:45	0.362	0.362	0.000
JP1-A56	JUNCTION	12.95	68.91	0	00:46	0.124	0.759	0.000
JP2-B12	JUNCTION	13.28	78.34	0	00:47	0.124	0.88	0.000

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

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
JP2-B34	JUNCTION	12.84	161.73	0	00:46	0.121	1.83	0.000
JP2-B56	JUNCTION	9.05	276.84	0	00:46	0.0832	3.4	0.000
PNDW3	OUTFALL	5.63	5.63	0	00:45	0.0804	0.0804	0.000
SC-Outfall	OUTFALL	1.78	1.78	0	00:45	0.0243	0.0243	0.000

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (5-yr Developed Condition)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DPBGP	46.25	1.54	8.25	0.115
EF-A-Outfall	50.14	1.03	7.24	0.084
EX.STKPND	69.44	1.17	11.89	0.132
EX-DP4	37.22	0.28	1.27	0.017
EX-DP6	38.61	0.53	2.01	0.033
EX-DP6A	41.11	1.02	4.21	0.068
EX-DP7	58.33	2.57	17.80	0.242
FSD-11B	98.19	11.11	143.95	1.763
FSD-14A	98.47	22.76	290.03	3.621
FSD-14B	97.64	10.77	101.36	1.699
FSD-16	98.47	29.59	307.12	4.708
PNDW3	42.78	1.16	5.63	0.080
SC-Outfall	40.00	0.38	1.78	0.024

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

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE (100 yr.)

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 41
Number of nodes 37
Number of links 24
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr	100yr	CUMULATIVE	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
P2-B10	1.70	187.00	70.00	3.4300	100yr	DP-11
P2-B9	2.00	226.00	70.00	3.2700	100yr	DP-11

P3-S2	11.90	1103.00	50.00	1.2700	100yr	DP-16
P3-A	52.60	1290.00	57.00	1.3700	100yr	DP-15
P3-C	1.70	446.00	11.00	1.3100	100yr	EX-DP4
EF-A	8.20	1064.00	15.00	1.5700	100yr	EF-A-Outfall
P2-B8	1.20	141.00	70.00	2.3400	100yr	DP-10
P2-B7	2.50	272.00	25.00	1.7800	100yr	DP-10
P2-B5	1.90	230.00	50.00	1.8600	100yr	JP2-B56
P2-B6	1.10	141.00	70.00	2.2800	100yr	JP2-B56
P2-A	24.40	2164.00	7.00	2.1100	100yr	FSD-14A
P2-B3	2.80	245.00	50.00	2.1500	100yr	JP2-B34
P2-B4	1.60	138.00	70.00	2.4900	100yr	JP2-B34
P4-A	25.80	920.00	57.00	1.2100	100yr	DP-13
P2-B	57.80	1215.00	57.00	1.6400	100yr	DP-9
P2-S1	35.60	1756.00	50.00	1.4400	100yr	DP-8
P2-B1	2.50	201.00	50.00	3.3700	100yr	JP2-B12
P2-B2	1.90	148.00	70.00	3.5400	100yr	JP2-B12
P4-B	37.30	1773.00	60.00	1.3400	100yr	DP-12
P1-A6	2.80	205.00	70.00	1.7500	100yr	DP-7
P1-A5	5.70	417.00	70.00	1.3800	100yr	DP-7
P1-A4	2.00	208.00	70.00	1.1200	100yr	JP1-A56
P1-A	12.70	1276.00	8.00	1.2900	100yr	FSD-16
P1-A1	5.00	258.00	70.00	1.6600	100yr	JP1-A12
P1-A2	6.40	258.00	70.00	0.7700	100yr	JP1-A12
P1-A3	1.80	196.00	70.00	1.1700	100yr	JP1-A56
P1-C	8.90	581.00	70.00	3.6900	100yr	JP1-3
P1-B	35.50	873.00	55.00	1.3600	100yr	DP-6
P1-D	31.40	1033.00	60.00	1.2700	100yr	DP-5
P1-E1	30.40	1148.00	50.00	1.5600	100yr	DP-2
TR-W	1.40	90.00	32.00	1.3000	100yr	DP-2
TR-V	2.10	162.00	27.00	4.1300	100yr	JOS-TR
P1-F	76.70	2322.00	35.00	2.1800	100yr	DP-1
SC-2	10.80	1211.00	8.00	2.4400	100yr	PNDW3
SC-3	27.20	616.00	8.00	2.6800	100yr	EX.STKPND
SC-4	16.40	1918.00	8.00	1.4800	100yr	DPBGP
SC-1	3.60	306.00	8.00	2.2000	100yr	SC-Outfall
EX10A	60.40	2452.00	5.00	1.7900	100yr	EX-DP7

P1-E2	21.80	1048.00	55.00	1.2300	100yr	DP-3
EX-9	6.00	578.00	5.00	1.7000	100yr	EX-DP6
EX-9A	12.70	1080.00	5.00	1.9400	100yr	EX-DP6A

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DP-12	JUNCTION	7080.00	4.00	0.0	
DP-9	JUNCTION	7046.00	4.00	0.0	
DP-10	JUNCTION	7032.00	10.30	0.0	
DP-11	JUNCTION	7017.00	2.50	0.0	
JP2-B12	JUNCTION	7072.00	11.50	0.0	
DP-8	JUNCTION	7067.00	5.00	0.0	
JP2-B34	JUNCTION	7055.00	6.00	0.0	
JP2-B56	JUNCTION	7044.00	6.50	0.0	
JP1-A12	JUNCTION	7104.00	3.00	0.0	
JP1-A56	JUNCTION	7096.00	3.50	0.0	
DP-6	JUNCTION	7096.00	3.50	0.0	
DP-4	JUNCTION	7096.00	27.50	0.0	
JP1-3	JUNCTION	7128.00	18.00	0.0	
DP-1	JUNCTION	7159.00	12.00	0.0	
JOS-TR	JUNCTION	7190.00	2.00	0.0	
DP-15	JUNCTION	7030.00	4.00	0.0	
DP-7	JUNCTION	7098.00	3.00	0.0	
DP-5	JUNCTION	7110.00	3.50	0.0	
DP-3	JUNCTION	7132.00	4.00	0.0	
DP-13	JUNCTION	7060.00	3.50	0.0	
DP-16	JUNCTION	7012.00	5.50	0.0	
DP-14	JUNCTION	7058.00	19.50	0.0	
DP-2	JUNCTION	7152.00	3.50	0.0	
J16	JUNCTION	7151.00	5.00	0.0	
EF-A-Outfall	OUTFALL	7025.00	0.00	0.0	

EX-DP4	OUTFALL	7000.00	0.00	0.0
FSD-11B	OUTFALL	7010.00	11.50	0.0
FSD-14A	OUTFALL	7014.00	17.80	0.0
FSD-14B	OUTFALL	7056.00	4.50	0.0
FSD-16	OUTFALL	7095.00	16.00	0.0
PNDW3	OUTFALL	7001.00	0.00	0.0
EX.STKPND	OUTFALL	7030.00	0.00	0.0
DPBGP	OUTFALL	7100.00	0.00	0.0
EX-DP7	OUTFALL	7015.00	0.00	0.0
SC-Outfall	OUTFALL	7000.00	0.00	0.0
EX-DP6A	OUTFALL	7020.00	0.00	0.0
EX-DP6	OUTFALL	7028.00	0.00	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CP4-B	DP-12	DP-14	CONDUIT	1775.0	0.3662	0.0130
C2	DP-11	DP-16	CONDUIT	350.0	0.5714	0.0130
C3	JP2-B12	DP-8	CONDUIT	280.0	1.6074	0.0130
C4	DP-8	JP2-B34	CONDUIT	750.0	1.4668	0.0130
C5	JP2-B34	JP2-B56	CONDUIT	650.0	1.4617	0.0130
C6	JP2-B56	DP-10	CONDUIT	800.0	0.9625	0.0130
C7	DP-10	FSD-14A	CONDUIT	600.0	1.0334	0.0130
C8	DP-9	JP2-B56	CONDUIT	100.0	1.5002	0.0130
C9	JP1-A12	JP1-A56	CONDUIT	900.0	0.8889	0.0130
C12	DP-6	FSD-16	CONDUIT	150.0	0.6000	0.0130
C13	JOS-TR	DP-1	CONDUIT	1500.0	1.4001	0.0130
C15	JP1-3	DP-4	CONDUIT	900.0	1.1112	0.0130
C16	DP-4	FSD-16	CONDUIT	130.0	0.7693	0.0130
CP3-A	DP-15	FSD-11B	CONDUIT	1100.0	1.1364	0.0130
C17	DP-5	FSD-16	CONDUIT	250.0	1.0001	0.0130
C19	DP-3	JP1-3	CONDUIT	200.0	1.0001	0.0130
C20	DP-13	DP-14	CONDUIT	150.0	1.0001	0.0130

C21	DP-16	FSD-11B	CONDUIT	150.0	1.3335	0.0130
C22	DP-14	FSD-14B	CONDUIT	150.0	1.3335	0.0130
C23	DP-1	J16	CONDUIT	600.0	1.3335	0.0130
C24	DP-2	J16	CONDUIT	100.0	1.0001	0.0130
C25	J16	JP1-3	CONDUIT	600.0	1.6669	0.0130
C26	JP1-A56	JP2-B12	CONDUIT	1180.0	1.3561	0.0130
C27	DP-7	JP1-A56	CONDUIT	280.0	0.5357	0.0130

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
CP4-B	CIRCULAR	4.00	12.57	1.00	4.00	1	86.92
C2	CIRCULAR	2.50	4.91	0.63	2.50	1	31.01
C3	CIRCULAR	3.50	9.62	0.88	3.50	1	127.55
C4	CIRCULAR	5.00	19.63	1.25	5.00	1	315.43
C5	CIRCULAR	5.00	19.63	1.25	5.00	1	314.88
C6	CIRCULAR	6.00	28.27	1.50	6.00	1	415.50
C7	CIRCULAR	6.00	28.27	1.50	6.00	1	430.52
C8	CIRCULAR	4.00	12.57	1.00	4.00	1	175.94
C9	CIRCULAR	3.00	7.07	0.75	3.00	1	62.89
C12	CIRCULAR	3.50	9.62	0.88	3.50	1	77.93
C13	CIRCULAR	2.00	3.14	0.50	2.00	1	26.77
C15	CIRCULAR	5.50	23.76	1.38	5.50	1	353.98
C16	CIRCULAR	5.50	23.76	1.38	5.50	1	294.53
CP3-A	CIRCULAR	4.00	12.57	1.00	4.00	1	153.13
C17	CIRCULAR	3.50	9.62	0.88	3.50	1	100.61
C19	CIRCULAR	4.00	12.57	1.00	4.00	1	143.65
C20	CIRCULAR	3.50	9.62	0.88	3.50	1	100.61
C21	CIRCULAR	3.50	9.62	0.88	3.50	1	116.18
C22	CIRCULAR	4.50	15.90	1.13	4.50	1	227.08
C23	CIRCULAR	4.50	15.90	1.13	4.50	1	227.08
C24	CIRCULAR	3.50	9.62	0.88	3.50	1	100.61

C25	CIRCULAR	5.00	19.63	1.25	5.00	1	336.25
C26	CIRCULAR	3.50	9.62	0.88	3.50	1	117.16
C27	CIRCULAR	3.00	7.07	0.75	3.00	1	48.82

****
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 03/02/2023 00:00:00
Ending Date 03/02/2023 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:05:00
Dry Time Step 01:00:00
Routing Time Step ..... 30.00 sec

****

Control Actions Taken
****

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	154.207	2.820
Evaporation Loss	0.000	0.000
Infiltration Loss	65.250	1.193
Surface Runoff	87.873	1.607
Final Storage	1.745	0.032
Continuity Error (%)	-0.428	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	87.871	28.634
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	83.271	27.135
Flooding Loss	4.785	1.559
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.010	0.003
Continuity Error (%)	-0.221	

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

****
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 : 2.07
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
P2-B10	2.82	0.00	0.00	0.48	2.31	0.11	12.16	0.819
P2-B9	2.82	0.00	0.00	0.48	2.31	0.13	14.32	0.819
P3-S2	2.82	0.00	0.00	0.89	1.91	0.62	59.00	0.677
P3-A	2.82	0.00	0.00	0.89	1.89	2.70	212.85	0.671
P3-C	2.82	0.00	0.00	1.51	1.32	0.06	4.80	0.469
EF-A	2.82	0.00	0.00	1.53	1.29	0.29	19.75	0.458
P2-B8	2.82	0.00	0.00	0.49	2.30	0.08	8.43	0.817
P2-B7	2.82	0.00	0.00	1.35	1.47	0.10	7.93	0.520
P2-B5	2.82	0.00	0.00	0.85	1.95	0.10	10.24	0.693
P2-B6	2.82	0.00	0.00	0.48	2.31	0.07	7.81	0.818
P2-A	2.82	0.00	0.00	1.74	1.08	0.72	36.58	0.383
P2-B3	2.82	0.00	0.00	0.87	1.93	0.15	14.41	0.685
P2-B4	2.82	0.00	0.00	0.50	2.29	0.10	10.78	0.813
P4-A	2.82	0.00	0.00	0.85	1.93	1.36	114.68	0.686

P2-B	2.82	0.00	0.00	0.90	1.88	2.96	228.89	0.668
P2-S1	2.82	0.00	0.00	0.96	1.84	1.78	158.17	0.652
P2-B1	2.82	0.00	0.00	0.86	1.94	0.13	13.20	0.689
P2-B2	2.82	0.00	0.00	0.49	2.30	0.12	12.96	0.815
P4-B	2.82	0.00	0.00	0.75	2.04	2.07	187.55	0.723
P1-A6	2.82	0.00	0.00	0.51	2.28	0.17	17.81	0.808
P1-A5	2.82	0.00	0.00	0.52	2.27	0.35	35.45	0.805
P1-A4	2.82	0.00	0.00	0.50	2.28	0.12	13.01	0.810
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	0.53	2.25	0.31	29.47	0.799
P1-A2	2.82	0.00	0.00	0.57	2.20	0.38	31.80	0.781
P1-A3	2.82	0.00	0.00	0.50	2.29	0.11	11.85	0.811
P1-C	2.82	0.00	0.00	0.50	2.29	0.55	59.20	0.812
P1-B	2.82	0.00	0.00	0.94	1.85	1.78	140.22	0.655
P1-D	2.82	0.00	0.00	0.79	1.99	1.70	142.47	0.707
P1-E1	2.82	0.00	0.00	0.99	1.81	1.49	128.46	0.641
TR-W	2.82	0.00	0.00	1.32	1.49	0.06	4.56	0.528
TR-V	2.82	0.00	0.00	1.29	1.52	0.09	7.17	0.538
P1-F	2.82	0.00	0.00	1.34	1.46	3.04	243.09	0.517
SC-2	2.82	0.00	0.00	1.66	1.17	0.34	20.21	0.415
SC-3	2.82	0.00	0.00	2.05	0.77	0.57	26.44	0.272
SC-4	2.82	0.00	0.00	1.70	1.12	0.50	27.41	0.399
SC-1	2.82	0.00	0.00	1.73	1.10	0.11	5.65	0.389
EX10A	2.82	0.00	0.00	2.02	0.80	1.32	50.17	0.285
P1-E2	2.82	0.00	0.00	0.86	1.93	1.14	101.88	0.685
EX-9	2.82	0.00	0.00	1.79	1.03	0.17	7.84	0.366
EX-9A	2.82	0.00	0.00	1.81	1.02	0.35	15.97	0.361

****
Node Depth Summary
****

	Average Depth	Maximum Depth	Maximum HGL	Time of Max Occurrence	Reported Max Depth

Node	Type	Feet	Feet	Feet	days	hr:min	Feet
DP-12	JUNCTION	0.67	4.00	7084.00	0	00:40	4.00
DP-9	JUNCTION	0.59	4.00	7050.00	0	00:43	4.00
DP-10	JUNCTION	5.15	10.30	7042.30	0	00:45	10.30
DP-11	JUNCTION	0.20	1.78	7018.78	0	00:45	1.71
JP2-B12	JUNCTION	8.42	11.50	7083.50	0	00:45	11.50
DP-8	JUNCTION	0.93	4.00	7071.00	0	00:46	3.57
JP2-B34	JUNCTION	1.54	4.68	7059.68	0	00:46	4.41
JP2-B56	JUNCTION	2.09	6.50	7050.50	0	00:44	6.50
JP1-A12	JUNCTION	0.33	2.39	7106.39	0	00:45	2.28
JP1-A56	JUNCTION	0.82	3.50	7099.50	0	00:45	3.50
DP-6	JUNCTION	0.61	3.50	7099.50	0	00:41	3.50
DP-4	JUNCTION	22.82	27.50	7123.50	0	00:42	27.50
JP1-3	JUNCTION	13.66	18.00	7146.00	0	00:43	18.00
DP-1	JUNCTION	10.12	12.00	7171.00	0	00:45	12.00
JOS-TR	JUNCTION	0.11	0.71	7190.71	0	00:45	0.68
DP-15	JUNCTION	0.61	4.00	7034.00	0	00:43	4.00
DP-7	JUNCTION	0.32	3.00	7101.00	0	00:45	3.00
DP-5	JUNCTION	0.51	3.50	7113.50	0	00:43	3.50
DP-3	JUNCTION	0.37	2.49	7134.49	0	00:45	2.40
DP-13	JUNCTION	0.44	3.50	7063.50	0	00:44	3.50
DP-16	JUNCTION	3.20	4.75	7016.75	0	00:46	4.61
DP-14	JUNCTION	16.17	19.50	7077.50	0	00:43	19.50
DP-2	JUNCTION	0.47	3.50	7155.50	0	00:43	3.50
J16	JUNCTION	0.63	5.00	7156.00	0	00:47	3.80
EF-A-Outfall	OUTFALL	0.00	0.00	7025.00	0	00:00	0.00
EX-DP4	OUTFALL	0.00	0.00	7000.00	0	00:00	0.00
FSD-11B	OUTFALL	8.10	11.50	7021.50	0	00:45	11.50
FSD-14A	OUTFALL	12.62	17.04	7031.04	0	00:46	16.67
FSD-14B	OUTFALL	0.57	3.18	7059.18	0	00:46	3.14
FSD-16	OUTFALL	13.01	16.00	7111.00	0	00:44	16.00
PNDW3	OUTFALL	0.00	0.00	7001.00	0	00:00	0.00
EX.STKPND	OUTFALL	0.00	0.00	7030.00	0	00:00	0.00
DPBGP	OUTFALL	0.00	0.00	7100.00	0	00:00	0.00
EX-DP7	OUTFALL	0.00	0.00	7015.00	0	00:00	0.00

SC-Outfall	OUTFALL	0.00	0.00	7000.00	0	00:00	0.00
EX-DP6A	OUTFALL	0.00	0.00	7020.00	0	00:00	0.00
EX-DP6	OUTFALL	0.00	0.00	7028.00	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
DP-12	JUNCTION	187.55	187.55	0	00:45	2.07	2.07	0.000
DP-9	JUNCTION	228.89	228.89	0	00:45	2.96	2.96	0.000
DP-10	JUNCTION	16.36	455.91	0	00:45	0.175	6.76	-0.000
DP-11	JUNCTION	26.48	26.48	0	00:45	0.232	0.232	0.000
JP2-B12	JUNCTION	26.16	145.73	0	00:48	0.25	1.69	0.000
DP-8	JUNCTION	158.17	283.32	0	00:46	1.78	3.44	0.000
JP2-B34	JUNCTION	25.20	304.20	0	00:46	0.246	3.68	0.000
JP2-B56	JUNCTION	18.05	493.95	0	00:47	0.17	6.73	0.000
JP1-A12	JUNCTION	61.27	61.27	0	00:45	0.689	0.689	0.000
JP1-A56	JUNCTION	24.86	132.74	0	00:46	0.236	1.45	0.000
DP-6	JUNCTION	140.22	140.22	0	00:45	1.78	1.78	-0.000
DP-4	JUNCTION	0.00	375.93	0	00:51	0	6.04	0.000
JP1-3	JUNCTION	59.20	487.28	0	00:46	0.553	6.32	0.000
DP-1	JUNCTION	243.09	247.91	0	00:45	3.04	3.12	0.000
JOS-TR	JUNCTION	7.17	7.17	0	00:45	0.0866	0.0866	-0.000
DP-15	JUNCTION	212.85	212.85	0	00:45	2.7	2.7	0.000
DP-7	JUNCTION	53.26	53.26	0	00:45	0.525	0.525	0.000
DP-5	JUNCTION	142.47	142.47	0	00:45	1.7	1.7	-0.000
DP-3	JUNCTION	101.88	101.88	0	00:45	1.14	1.14	0.000
DP-13	JUNCTION	114.68	114.68	0	00:45	1.36	1.36	0.000
DP-16	JUNCTION	59.00	83.60	0	00:45	0.617	0.849	0.000

DP-14	JUNCTION	0.00	193.05	0	00:46	0	3.13	0.000
DP-2	JUNCTION	133.03	133.03	0	00:45	1.55	1.55	-0.000
J16	JUNCTION	0.00	338.87	0	00:47	0	4.63	0.000
EF-A-Outfall	OUTFALL	19.75	19.75	0	00:45	0.288	0.288	0.000
EX-DP4	OUTFALL	4.80	4.80	0	00:45	0.0611	0.0611	0.000
FSD-11B	OUTFALL	0.00	236.32	0	00:46	0	3.45	0.000
FSD-14A	OUTFALL	36.58	488.03	0	00:46	0.716	7.46	0.000
FSD-14B	OUTFALL	0.00	192.60	0	00:46	0	3.13	0.000
FSD-16	OUTFALL	18.97	495.50	0	00:53	0.37	9.38	0.000
PNDW3	OUTFALL	20.21	20.21	0	00:45	0.343	0.343	0.000
EX.STKPND	OUTFALL	26.44	26.44	0	00:45	0.566	0.566	0.000
DPBGP	OUTFALL	27.41	27.41	0	00:45	0.501	0.501	0.000
EX-DP7	OUTFALL	50.17	50.17	0	00:45	1.32	1.32	0.000
SC-Outfall	OUTFALL	5.65	5.65	0	00:45	0.107	0.107	0.000
EX-DP6A	OUTFALL	15.97	15.97	0	00:45	0.351	0.351	0.000
EX-DP6	OUTFALL	7.84	7.84	0	00:50	0.168	0.168	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-12	0.25	97.15	0	00:46	0.295	0.000
DP-9	0.12	49.96	0	00:46	0.079	0.000
DP-10	0.07	18.96	0	00:45	0.017	0.000
JP2-B12	0.09	17.06	0	00:47	0.028	0.000
JP2-B56	0.13	77.98	0	00:47	0.159	0.000
JP1-A56	0.07	14.83	0	00:46	0.014	0.000
DP-6	0.23	60.33	0	00:46	0.176	0.000

DP-4	0.20	70.43	0	00:51	0.267	0.000
JP1-3	0.14	130.85	0	00:46	0.284	0.000
DP-1	0.04	16.44	0	00:46	0.010	0.000
DP-15	0.14	56.81	0	00:46	0.105	0.000
DP-7	0.03	3.32	0	00:46	0.002	0.000
DP-5	0.13	39.64	0	00:46	0.071	0.000
DP-13	0.06	12.20	0	00:46	0.010	0.000
DP-2	0.10	29.96	0	00:46	0.041	0.000
J16	0.02	1.31	0	00:47	0.001	0.000

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
EF-A-Outfall	50.56	3.52	19.75	0.288
EX-DP4	37.36	1.01	4.80	0.061
FSD-11B	98.33	21.73	236.32	3.452
FSD-14A	98.47	46.92	488.03	7.465
FSD-14B	97.92	19.79	192.60	3.130
FSD-16	98.47	58.99	495.50	9.384
PNDW3	42.92	4.95	20.21	0.343
EX.STKPND	70.14	4.99	26.44	0.566
DPBGP	46.53	6.66	27.41	0.501
EX-DP7	58.75	13.86	50.17	1.316
SC-Outfall	41.53	1.60	5.65	0.107
EX-DP6A	42.92	5.07	15.97	0.351
EX-DP6	41.53	2.51	7.84	0.168
System	63.49	191.59	1578.74	27.133

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Link Flow Summary
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Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
CP4-B	CONDUIT	93.92	0	00:57	8.66	1.08	1.00
C2	CONDUIT	25.87	0	00:46	7.22	0.83	0.69
C3	CONDUIT	136.14	0	00:49	15.59	1.07	1.00
C4	CONDUIT	281.28	0	00:46	18.37	0.89	0.74
C5	CONDUIT	302.48	0	00:47	18.44	0.96	0.79
C6	CONDUIT	443.73	0	00:52	17.59	1.07	1.00
C7	CONDUIT	451.96	0	00:46	17.88	1.05	0.92
C8	CONDUIT	188.33	0	00:44	16.07	1.07	1.00
C9	CONDUIT	58.66	0	00:46	10.41	0.93	0.76
C12	CONDUIT	83.68	0	00:42	9.43	1.07	1.00
C13	CONDUIT	6.42	0	00:48	7.35	0.24	0.33
C15	CONDUIT	375.93	0	00:51	17.93	1.06	1.00
C16	CONDUIT	315.37	0	00:53	14.27	1.07	1.00
CP3-A	CONDUIT	165.30	0	00:51	14.60	1.08	1.00
C17	CONDUIT	104.37	0	00:50	12.25	1.04	1.00
C19	CONDUIT	100.21	0	00:46	12.46	0.70	0.62
C20	CONDUIT	108.13	0	00:46	12.07	1.07	1.00
C21	CONDUIT	83.19	0	00:46	13.18	0.72	0.62
C22	CONDUIT	192.60	0	00:46	16.09	0.85	0.71
C23	CONDUIT	238.26	0	00:47	16.80	1.05	0.92
C24	CONDUIT	108.43	0	00:44	12.14	1.08	1.00
C25	CONDUIT	346.98	0	00:47	20.09	1.03	0.89
C26	CONDUIT	126.74	0	00:48	14.69	1.08	0.93
C27	CONDUIT	51.44	0	00:46	8.09	1.05	0.92

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Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
CP4-B	0.24	0.24	0.24	0.27	0.24
C3	0.08	0.08	0.08	0.08	0.08
C6	0.13	0.13	0.13	0.04	0.13
C7	0.04	0.04	0.04	0.06	0.04
C8	0.11	0.11	0.11	0.03	0.11
C12	0.23	0.23	0.23	0.23	0.23
C15	0.13	0.13	0.13	0.13	0.13
C16	0.19	0.19	0.19	0.19	0.19
CP3-A	0.13	0.13	0.13	0.14	0.13
C17	0.13	0.13	0.13	0.13	0.13
C20	0.05	0.05	0.05	0.05	0.05
C23	0.03	0.03	0.03	0.03	0.03
C24	0.09	0.09	0.09	0.10	0.09
C25	0.01	0.01	0.01	0.01	0.01
C26	0.06	0.06	0.06	0.06	0.06
C27	0.03	0.03	0.03	0.03	0.03

Analysis begun on: Thu Mar 02 17:01:57 2023
Analysis ended on: Thu Mar 02 17:01:57 2023
Total elapsed time: < 1 sec

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

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
EF-A	2.82	0.00	0.00	1.53	1.29	0.29	19.75	0.458
EX10A	2.82	0.00	0.00	2.02	0.80	1.32	50.17	0.285
EX-9	2.82	0.00	0.00	1.79	1.03	0.17	7.84	0.366
EX-9A	2.82	0.00	0.00	1.81	1.02	0.35	15.97	0.361
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	0.53	2.25	0.31	29.47	0.799
P1-A2	2.82	0.00	0.00	0.57	2.20	0.38	31.80	0.781
P1-A3	2.82	0.00	0.00	0.50	2.29	0.11	11.85	0.811
P1-A4	2.82	0.00	0.00	0.50	2.28	0.12	13.01	0.810
P1-A5	2.82	0.00	0.00	0.52	2.27	0.35	35.45	0.805
P1-A6	2.82	0.00	0.00	0.51	2.28	0.17	17.81	0.808
P1-B	2.82	0.00	0.00	0.94	1.85	1.78	140.22	0.655
P1-C	2.82	0.00	0.00	0.50	2.29	0.55	59.20	0.812
P1-D	2.82	0.00	0.00	0.79	1.99	1.70	142.47	0.707
P1-E1	2.82	0.00	0.00	0.99	1.81	1.49	128.46	0.641
P1-E2	2.82	0.00	0.00	0.86	1.93	1.14	101.88	0.685

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

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-F	2.82	0.00	0.00	1.34	1.46	3.04	243.09	0.517
P2-A	2.82	0.00	0.00	1.74	1.08	0.72	36.58	0.383
P2-B	2.82	0.00	0.00	0.90	1.88	2.96	228.89	0.668
P2-B1	2.82	0.00	0.00	0.86	1.94	0.13	13.20	0.689
P2-B10	2.82	0.00	0.00	0.48	2.31	0.11	12.16	0.819
P2-B2	2.82	0.00	0.00	0.49	2.30	0.12	12.96	0.815
P2-B3	2.82	0.00	0.00	0.87	1.93	0.15	14.41	0.685
P2-B4	2.82	0.00	0.00	0.50	2.29	0.10	10.78	0.813
P2-B5	2.82	0.00	0.00	0.85	1.95	0.10	10.24	0.693
P2-B6	2.82	0.00	0.00	0.48	2.31	0.07	7.81	0.818
P2-B7	2.82	0.00	0.00	1.35	1.47	0.10	7.93	0.520
P2-B8	2.82	0.00	0.00	0.49	2.30	0.08	8.43	0.817
P2-B9	2.82	0.00	0.00	0.48	2.31	0.13	14.32	0.819
P2-S1	2.82	0.00	0.00	0.96	1.84	1.78	158.17	0.652
P3-A	2.82	0.00	0.00	0.89	1.89	2.70	212.85	0.671
P3-C	2.82	0.00	0.00	1.51	1.32	0.06	4.80	0.469
P3-S2	2.82	0.00	0.00	0.89	1.91	0.62	59.00	0.677

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

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
P4-A	2.82	0.00	0.00	0.85	1.93	1.36	114.68	0.686
P4-B	2.82	0.00	0.00	0.75	2.04	2.07	187.55	0.723
SC-1	2.82	0.00	0.00	1.73	1.10	0.11	5.65	0.389
SC-2	2.82	0.00	0.00	1.66	1.17	0.34	20.21	0.415
SC-3	2.82	0.00	0.00	2.05	0.77	0.57	26.44	0.272
SC-4	2.82	0.00	0.00	1.70	1.12	0.50	27.41	0.399
TR-V	2.82	0.00	0.00	1.29	1.52	0.09	7.17	0.538
TR-W	2.82	0.00	0.00	1.32	1.49	0.06	4.56	0.528

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

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	243.09	247.91	0	00:45	3.04	3.12	0.000
DP-10	JUNCTION	16.36	455.91	0	00:45	0.175	6.76	-0.000
DP-11	JUNCTION	26.48	26.48	0	00:45	0.232	0.232	0.000
DP-12	JUNCTION	187.55	187.55	0	00:45	2.07	2.07	0.000
DP-13	JUNCTION	114.68	114.68	0	00:45	1.36	1.36	0.000
DP-14	JUNCTION	0.00	193.05	0	00:46	0	3.13	0.000
DP-15	JUNCTION	212.85	212.85	0	00:45	2.7	2.7	0.000
DP-16	JUNCTION	59.00	83.60	0	00:45	0.617	0.849	0.000
DP-2	JUNCTION	133.03	133.03	0	00:45	1.55	1.55	-0.000
DP-3	JUNCTION	101.88	101.88	0	00:45	1.14	1.14	0.000
DP-4	JUNCTION	0.00	375.93	0	00:51	0	6.04	0.000
DP-5	JUNCTION	142.47	142.47	0	00:45	1.7	1.7	-0.000
DP-6	JUNCTION	140.22	140.22	0	00:45	1.78	1.78	-0.000
DP-7	JUNCTION	53.26	53.26	0	00:45	0.525	0.525	0.000
DP-8	JUNCTION	158.17	283.32	0	00:46	1.78	3.44	0.000
DP-9	JUNCTION	228.89	228.89	0	00:45	2.96	2.96	0.000

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

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
DPBGP	OUTFALL	27.41	27.41	0	00:45	0.501	0.501	0.000
EF-A-Outfall	OUTFALL	19.75	19.75	0	00:45	0.288	0.288	0.000
EX.STKPND	OUTFALL	26.44	26.44	0	00:45	0.566	0.566	0.000
EX-DP4	OUTFALL	4.80	4.80	0	00:45	0.0611	0.0611	0.000
EX-DP6	OUTFALL	7.84	7.84	0	00:50	0.168	0.168	0.000
EX-DP6A	OUTFALL	15.97	15.97	0	00:45	0.351	0.351	0.000
EX-DP7	OUTFALL	50.17	50.17	0	00:45	1.32	1.32	0.000
FSD-11B	OUTFALL	0.00	236.32	0	00:46	0	3.45	0.000
FSD-14A	OUTFALL	36.58	488.03	0	00:46	0.716	7.46	0.000
FSD-14B	OUTFALL	0.00	192.60	0	00:46	0	3.13	0.000
FSD-16	OUTFALL	18.97	495.50	0	00:53	0.37	9.38	0.000
J16	JUNCTION	0.00	338.87	0	00:47	0	4.63	0.000
JOS-TR	JUNCTION	7.17	7.17	0	00:45	0.0866	0.0866	-0.000
JP1-3	JUNCTION	59.20	487.28	0	00:46	0.553	6.32	0.000
JP1-A12	JUNCTION	61.27	61.27	0	00:45	0.689	0.689	0.000
JP1-A56	JUNCTION	24.86	132.74	0	00:46	0.236	1.45	0.000
JP2-B12	JUNCTION	26.16	145.73	0	00:48	0.25	1.69	0.000

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

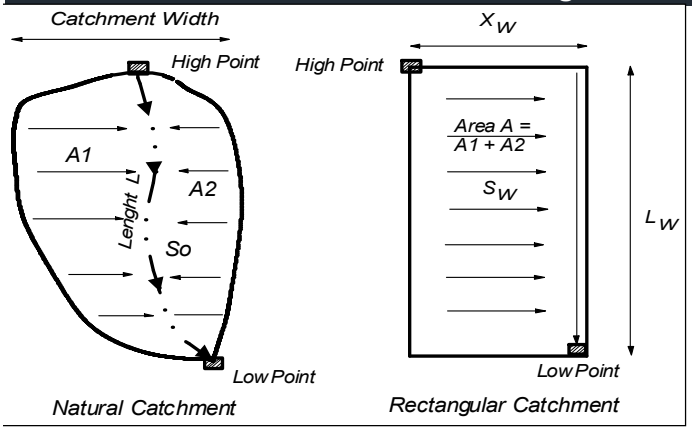
Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
JP2-B34	JUNCTION	25.20	304.20	0	00:46	0.246	3.68	0.000
JP2-B56	JUNCTION	18.05	493.95	0	00:47	0.17	6.73	0.000
PNDW3	OUTFALL	20.21	20.21	0	00:45	0.343	0.343	0.000
SC-Outfall	OUTFALL	5.65	5.65	0	00:45	0.107	0.107	0.000

STERLING RANCH EAST PRELIMINARY PLAN NO. 1 (100-yr. Developed Condition)

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
DPBGP	46.53	6.66	27.41	0.501
EF-A-Outfall	50.56	3.52	19.75	0.288
EX.STKPND	70.14	4.99	26.44	0.566
EX-DP4	37.36	1.01	4.80	0.061
EX-DP6	41.53	2.51	7.84	0.168
EX-DP6A	42.92	5.07	15.97	0.351
EX-DP7	58.75	13.86	50.17	1.316
FSD-11B	98.33	21.73	236.32	3.452
FSD-14A	98.47	46.92	488.03	7.465
FSD-14B	97.92	19.79	192.60	3.130
FSD-16	98.47	58.99	495.50	9.384
PNDW3	42.92	4.95	20.21	0.343
SC-Outfall	41.53	1.60	5.65	0.107

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	X=A/L²	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
EF-A	8.20	4.10	4.10	260	7050.0	7028.0	0.50	5.28	4.09	1,064	336	8.46	5.38	1.57
P3-C	1.70	0.50	1.20	260	7027.0	7019.0	0.71	1.10	1.72	446	166	3.08	2.35	1.31
P1-A	12.70	7.00	5.70	850	7,124	7,102	0.55	0.77	1.50	1,276	433	2.59	2.01	1.29
P1-B	35.50	10.00	25.50	3,100	7,160	7,124	0.72	0.16	0.28	873	1,770	1.16	0.85	1.36
P1-C	8.90	4.50	4.40	1,700	7,158	7,122	0.51	0.13	0.30	510	761	2.12	0.75	2.83
P1-D	31.40	14.00	17.40	2,800	7,136	7,106	0.55	0.17	0.37	1,033	1,324	1.07	0.84	1.27
P1-E1	30.40	16.00	14.40	2,500	7,188	7,152	0.53	0.21	0.46	1,148	1,154	1.44	0.92	1.56
P1-E2	21.80	11.00	10.80	2,000	7,158	7,134	0.50	0.24	0.52	1,048	906	1.20	0.98	1.23
P1-F	76.70	35.00	41.70	3,000	7,240	7,158	0.54	0.37	0.77	2,322	1,439	2.73	1.25	2.18
TR-W	1.40	0.70	0.70	90	7,192	7,182	0.50	7.53	1.00	90	678	11.11	8.53	1.30
TR-V	2.10	1.50	0.60	1,000	7,220	7,190	0.71	0.09	0.16	162	563	3.00	0.73	4.13
P1-A1	5.00	3.10	1.90	2,400	7,134	7,112	0.62	0.04	0.08	182	1,199	0.92	0.58	1.59
P1-A2	6.40	3.20	3.20	2,400	7,134	7,110	0.50	0.05	0.11	264	1,056	1.00	0.55	1.82
P1-A3	1.80	0.70	1.10	800	7,110	7,103	0.61	0.12	0.25	196	400	0.88	0.74	1.17
P1-A4	2.00	1.30	0.70	800	7,112	7,105	0.65	0.14	0.26	208	419	0.88	0.78	1.12
P1-A5	5.70	3.00	2.70	1,300	7,114	7,100	0.53	0.15	0.32	417	595	1.08	0.78	1.38
P1-A6	2.80	1.30	1.50	1,300	7,114	7,100	0.54	0.07	0.16	205	595	1.08	0.62	1.75
P2-A	24.40	13.20	11.20	900	7,056	7,000	0.54	1.31	2.40	2,164	491	6.22	2.95	2.11
P2-B	57.80	18.50	39.30	3,800	7,106	7,052	0.68	0.17	0.32	1,215	2,072	1.42	0.87	1.64
P2-S1	35.60	18.00	17.60	1,900	7,110	7,072	0.51	0.43	0.92	1,756	883	2.00	1.39	1.44
P2-B1	2.50	1.50	1.00	1,100	7,102	7,077	0.60	0.09	0.18	201	541	2.27	0.67	3.37
P2-B2	1.90	1.20	0.70	1,100	7,102	7,077	0.63	0.07	0.13	148	559	2.27	0.64	3.54
P2-B3	2.80	1.70	1.10	1,000	7,077	7,061	0.61	0.12	0.25	245	498	1.60	0.74	2.15
P2-B4	1.60	1.00	0.60	1,000	7,077	7,061	0.63	0.07	0.14	138	504	1.60	0.64	2.49
P2-B5	1.90	1.20	0.70	700	7,061	7,050	0.63	0.17	0.33	230	360	1.57	0.84	1.86
P2-B6	1.10	0.65	0.45	700	7,061	7,050	0.59	0.10	0.20	141	341	1.57	0.69	2.28
P2-B7	2.50	1.60	0.90	770	7,050	7,038	0.64	0.18	0.35	272	401	1.56	0.87	1.78
P2-B8	1.20	0.70	0.50	770	7,050	7,038	0.58	0.09	0.18	141	372	1.56	0.67	2.34
P2-B9	2.00	1.00	1.00	870	7,038	7,018	0.50	0.12	0.26	226	386	2.30	0.70	3.27
P2-B10	1.70	0.90	0.80	870	7,038	7,018	0.53	0.10	0.21	187	397	2.30	0.67	3.43
P3-A	1.70	0.90	0.80	870	7,038	7,018	0.53	0.10	0.21	187	397	2.30	0.67	3.43
P3-S2	11.90	6.00	5.90	1,000	7,036	7,016	0.50	0.52	1.10	1,103	470	2.00	1.57	1.27
P4-A	25.80	20.00	5.80	1,950	7,078	7,052	0.78	0.30	0.47	920	1,222	1.33	1.10	1.21
P4-B	37.30	25.00	12.30	1,600	7,116	7,080	0.67	0.63	1.11	1,773	916	2.25	1.68	1.34
SC-1	3.60	1.80	1.80	150	7,014	6,996	0.50	6.97	2.04	306	512	12.00	5.46	2.20
SC-2	10.80	5.00	5.80	770	7040.0	7001.0	0.54	0.79	1.57	1,211	388	5.06	2.08	2.44
SC-3	27.20	14.00	13.20	4,300	7100.0	7032.0	0.51	0.06	0.14	616	1,925	1.58	0.59	2.68
SC-4	16.40	8.20	8.20	420	7,136	7,102	0.50	4.05	4.57	1,918	372	8.10	5.45	1.48
EX-9	6.00	3.00	3.00	1,000	7,050	7,030	0.50	0.26	0.58	578	452	2.00	1.03	1.94
EX-9A	12.70	6.30	6.40	1,100	7,049	7,022	0.50	0.46	0.98	1,080	512	2.45	1.45	1.70

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	*SWMM Width (Lw) (ft.)	*SWMM Slope (Sw) (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	1064	1.57%	7	20
EX10A ++	60.4	5%	2452	1.79%	18	50
EX-9 ++	6.0	5%	578	1.70%	2	8
EX-9A ++	12.7	5%	1080	1.94%	4	16
P1-A	12.7	8%	1276	1.29%	6	19
P1-A1	5.0	70%	258	1.66%	15	29
P1-A2	6.4	70%	258	0.77%	16	32
P1-A3	1.8	70%	196	1.17%	6	12
P1-A4	2.0	70%	208	1.12%	7	13
P1-A5	5.7	70%	417	1.38%	18	35
P1-A6	2.8	70%	205	1.75%	9	18
P1-B (Dev.)	35.5	55%	873	1.36%	71	140
P1-B (Un-dev.)	35.5	5%	873	1.36%	10	23
P1-C	8.9	70%	581	3.69%	31	59
P1-D	31.4	60%	1033	1.27%	72	142
P1-E1	30.4	50%	1148	1.56%	66	128
P1-E2	21.8	55%	1048	1.23%	53	102
P1-F (Dev.)	76.7	35%	2322	2.18%	125	243
P1-F (Un-dev.)	76.7	5%	2322	2.18%	22	59
P2-A	24.4	7%	2164	2.11%	11	37
P2-B	57.8	57%	1215	1.64%	114	229
P2-B1	2.5	50%	201	3.37%	7	13
P2-B10	1.7	70%	187	3.43%	6	12
P2-B2	1.9	70%	148	3.54%	7	13
P2-B3	2.8	50%	245	2.15%	7	14
P2-B4	1.6	70%	138	2.49%	6	11
P2-B5	1.9	50%	230	1.86%	5	10
P2-B6	1.1	70%	141	2.28%	4	8
P2-B7	2.5	25%	272	1.78%	3	8
P2-B8	1.2	70%	141	2.34%	4	8
P2-B9	2.0	70%	226	3.27%	7	14
P2-S1	35.6	50%	1756	1.44%	82	158
P3-A	52.6	57%	1290	1.37%	107	213
P3-C	1.7	11%	446	1.31%	1	5
P3-S2	11.9	50%	1103	1.27%	30	59
P4-A	25.8	57%	920	1.21%	59	115
P4-B	37.3	60%	1773	1.34%	97	188
SC-1 +	3.6	8%	306	2.20%	2	6
SC-2 +	10.8	8%	1211	2.44%	6	20
SC-3 +	27.2	8%	616	2.68%	12	26
SC-4 +	16.4	8%	1918	1.48%	8	27
TR-V	2.1	27%	162	4.13%	3	7
TR-W	1.4	32%	90	1.30%	2	5

*** Reference SWMM Catchment Shape Parameter Finder for calculations**

+ Basin not changed from pre-development conditions

++ Remaining undeveloped portion of the pre-development Basin

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point (On-Site)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	127	248
DP-2	69	133
DP-3	53	102
DP-4	167	376
DP-5	72	142
DP-6	71	140
DP-7	28	53
DP-8	82	158
DP-9	114	229
DP-10	282	456
DP-11	14	26
DP-12	97	188
DP-13	59	115
DP-14	101	193
DP-15	107	213
DP-16	43	84
Pond FSD-11B	144	236
Pond FSD-14A	290	488
Pond FSD-14B	101	193
Pond FSD-16 (Ultimate)	307	496
Pond FSD-16 (Interim)	197	410
Design Point (South Bndy.)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
4	0.5	2.5
4A	0.5	2.5
5	5	13
5A	2	7
6	2.0	48.1
6A	4	16
7	18	50

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Pond FSD-16 Tributary Area

(Full Build Out)

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	8%
P1-B	35.5	7,500	55%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	12,500	35%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	**220.9**		**46%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Pond FSD-16 Tributary Area

(Prelim. Plan 1 & Foursquare PUD Only)

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	8%
P1-B	35.5	Un dev.	2%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	Un dev.	2%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	**220.9**		**26%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Pond FSD-14A Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A1	5.0	N/A	70%
P1-A2	6.4	N/A	70%
P1-A3	1.8	N/A	70%
P1-A4	2.0	N/A	70%
P1-A5	5.7	N/A	70%
P1-A6	2.8	N/A	70%
P2-S1	35.6	School	50%
P2-A	24.4	Park	7%
P2-B	57.8	7,000	57%
P2-B1	2.5	N/A	50%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	50%
P2-B4	1.6	N/A	70%
P2-B5	1.9	N/A	50%
P2-B6	1.1	N/A	70%
P2-B7	2.5	N/A	25%
P2-B8	1.2	N/A	70%
TOTAL	**157.0**		**49%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Pond FSD-14B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P4-A	25.8	7,000	57%
P4-B	37.3	6,500	60%
TOTAL	**63.1**		**59%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Pond FSD-11B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P2-B9	2.0	N/A	70%
P2-B10	1.7	N/A	70%
P3-S2	11.9	School	50%
P3-A	52.6	7,000	57%
TOTAL	**68.2**		**56%**

STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Flow Comparison along South Boundary

	This Report (SWMM 5.1) Pre-Dev. Conditions		This Report (SWMM 5.1) Developed Conditions		2018 SR MDDP (HEC-HMS) Pre-Dev. Conditions	
Design Point (South Bndy.)	**Peak Runoff 5 yr. (CFS)**	**Peak Runoff 100 yr. (CFS)**	**Peak Runoff 5 yr. (CFS)**	**Peak Runoff 100 yr. (CFS)**	**Peak Runoff 5 yr. (CFS)**	**Peak Runoff 100 yr. (CFS)**
4	**46**	**105**	**0.5**	**2.5**	**21.5**	**107.4**
4A	**1**	**5**	**0.5**	**2.5**		
5	**5**	**23**	**5**	**13**	**1.7**	**20.5**
5A	**2**	**9**	**2**	**7**		
6	**59**	**122**	**2.0**	**48.1**	**23.9**	**125.2**
6A	**7**	**19**	**4**	**16**		
7	**110**	**249**	**18**	**50**	**57.1**	**277.9**
56	**60**	**160**	**60**	**160**	**42.5**	**202.9**

STORMWATER QUALITY CALCULATIONS

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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: March 8, 2023
Project: Foursquare at Sterling Ranch Preliminary Plan/PUD
Location: FSD-16 (Interim Condition)

1. Basin Storage Volume		
A) Effective Imperviousness of Tributary Area, I_a	I_a = 26.0	%
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.260	
C) Contributing Watershed Area	Area = 220.900	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 ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= 2.488	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 = 100	%
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 0	%
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 0	%
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: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 5.514	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} = 0.075	ac-ft
B) Actual Forebay Volume	V_F = 0.075	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} = 410.00	cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 8.20	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 = 13.5	in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: March 8, 2023
Project: Foursquare at Sterling Ranch Preliminary Plan/PUD
Location: FSD-16 (Interim Condition)

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)	$D_{orifice}$ = 3.25 inches
E) Total Outlet Area	A_{ot} = 73.14 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} = 325 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 = 2,068 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 2" 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} = 2913 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 10 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 148 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 19.7 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: March 8, 2023
Project: Foursquare at Sterling Ranch Preliminary Plan/PUD
Location: FSD-16 (Interim Condition)

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:

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

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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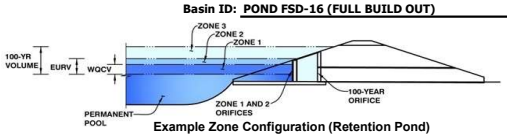
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-16 (FULL BUILD OUT)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	220.90	acres
Watershed Length =	4,000	ft
Watershed Length to Centroid =	1,975	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	46.00%	percent
Percentage Hydrologic Soil Group A =	75.0%	percent
Percentage Hydrologic Soil Group B =	25.0%	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) =	3.600	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	11.282	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	8.943	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	11.875	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	14.782	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	19.914	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	23.966	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	29.512	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	47.014	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	7.518	acre-feet		
Approximate 5-yr Detention Volume =	10.041	acre-feet		
Approximate 10-yr Detention Volume =	12.630	acre-feet		
Approximate 25-yr Detention Volume =	15.056	acre-feet		
Approximate 50-yr Detention Volume =	16.576	acre-feet		
Approximate 100-yr Detention Volume =	18.826	acre-feet		

Define Zones and Basin Geometry

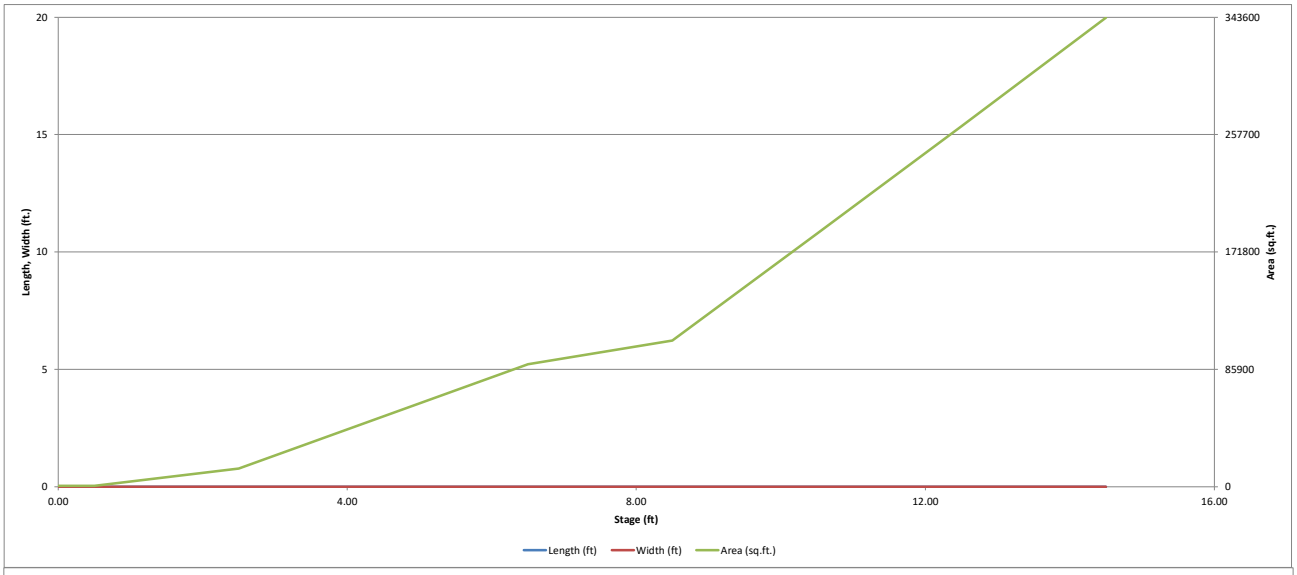
Zone 1 Volume (WQCV) =	3.600	acre-feet
Zone 2 Volume (EURV - Zone 1) =	7.682	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	7.544	acre-feet
Total Detention Basin Volume =	18.826	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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

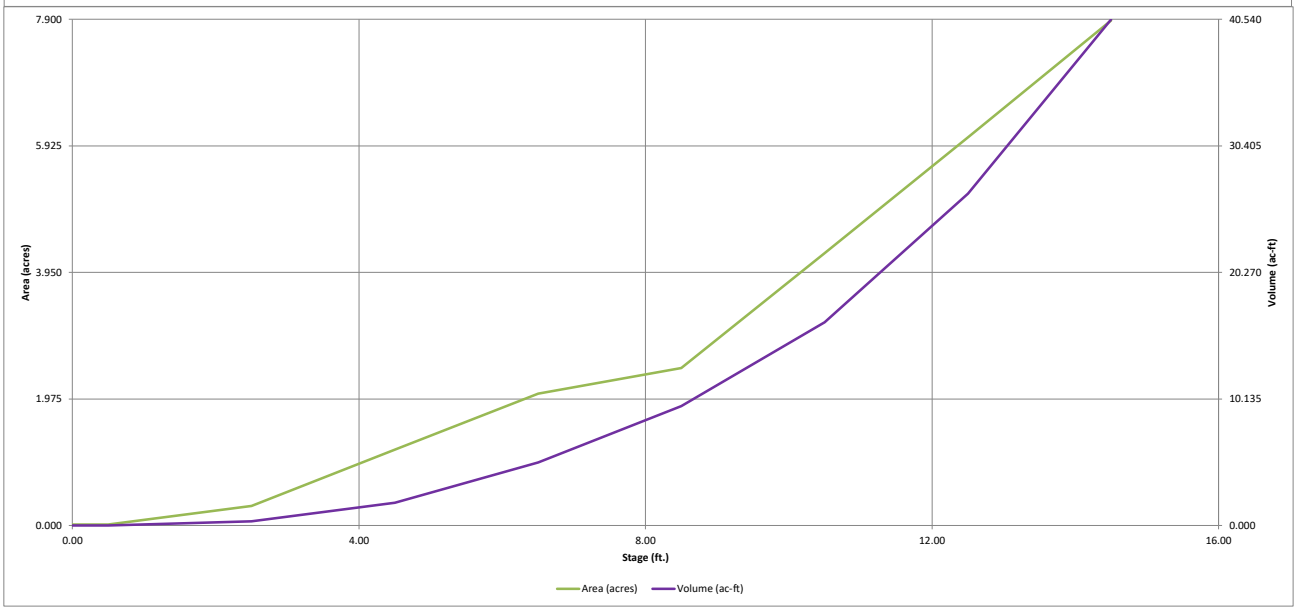
Depth Increment = 2.00 ft

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	--	--	--	650	0.015		
7092	--	0.50	--	--	--	650	0.015	325	0.007
7094	--	2.50	--	--	--	13,311	0.306	14,286	0.328
7096	--	4.50	--	--	--	51,595	1.184	79,192	1.818
7098	--	6.50	--	--	--	89,663	2.058	220,450	5.061
7100	--	8.50	--	--	--	107,054	2.458	417,167	9.577
7102	--	10.50	--	--	--	185,183	4.251	709,404	16.286
7104	--	12.50	--	--	--	263,928	6.059	1,158,515	26.596
7106	--	14.50	--	--	--	343,298	7.881	1,765,741	40.536

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



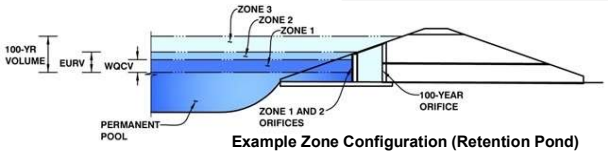


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-16 (FULL BUILD OUT)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	5.73	3.600	Orifice Plate
Zone 2 (EURV)	9.13	7.682	Orifice Plate
Zone 3 (100-year)	11.07	7.544	Weir&Pipe (Restrict)
Total (all zones)		18.826	

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

Underdrain Orifice Invert Depth = [ ] ft (distance below the filtration media surface)

Underdrain Orifice Diameter = [ ] inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = [ ] ft^2

Underdrain Orifice Centroid = [ ] feet

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

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 10.00 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = 30.00 inches

Orifice Plate: Orifice Area per Row = N/A sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.50	5.00	7.50				
Orifice Area (sq. inches)	10.00	10.00	16.00	16.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	10.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	20.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	10.00	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.17	N/A	
Overflow Grate Open Area w/o Debris =	55.68	N/A	ft^2
Overflow Grate Open Area w/ Debris =	27.84	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	28.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	6.81	N/A	ft^2
Outlet Orifice Centroid =	1.31	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 12.00 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 165.00 feet

Spillway End Slopes = 6.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.91 feet

Stage at Top of Freeboard = 13.91 feet

Basin Area at Top of Freeboard = 7.34 acres

Basin Volume at Top of Freeboard = 36.04 acre-ft

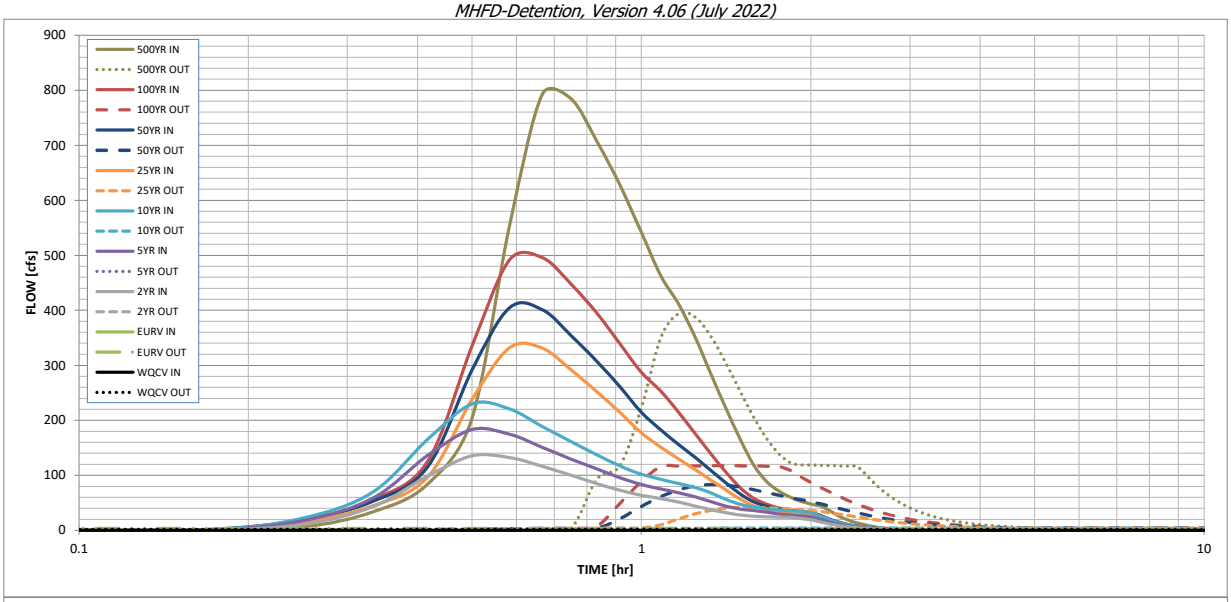
Routed Hydrograph Results

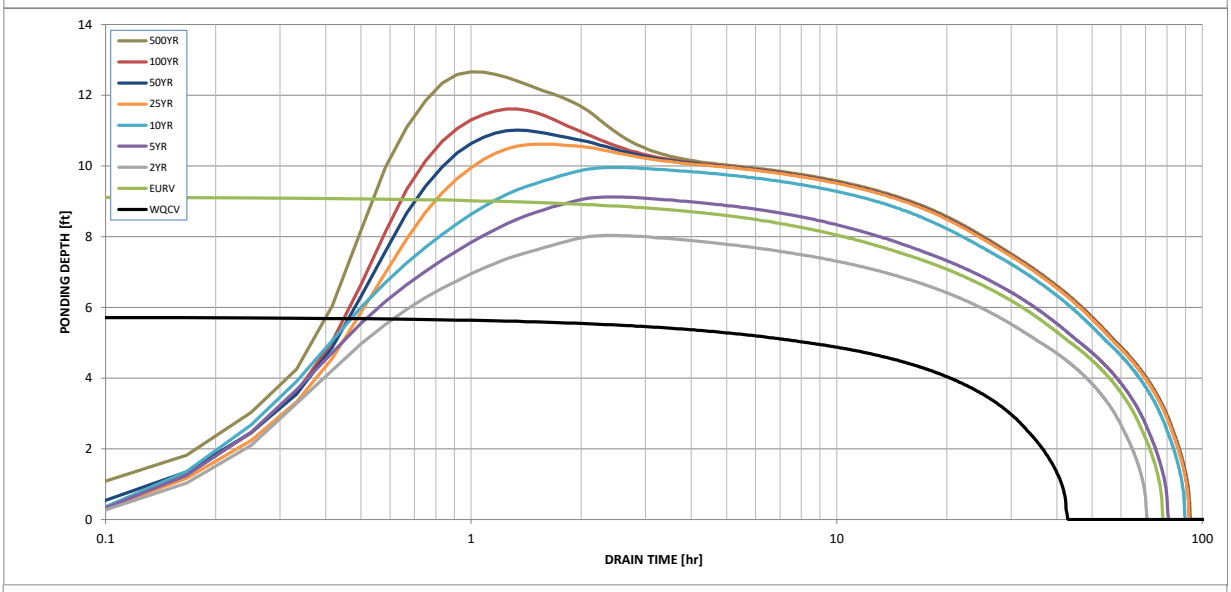
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

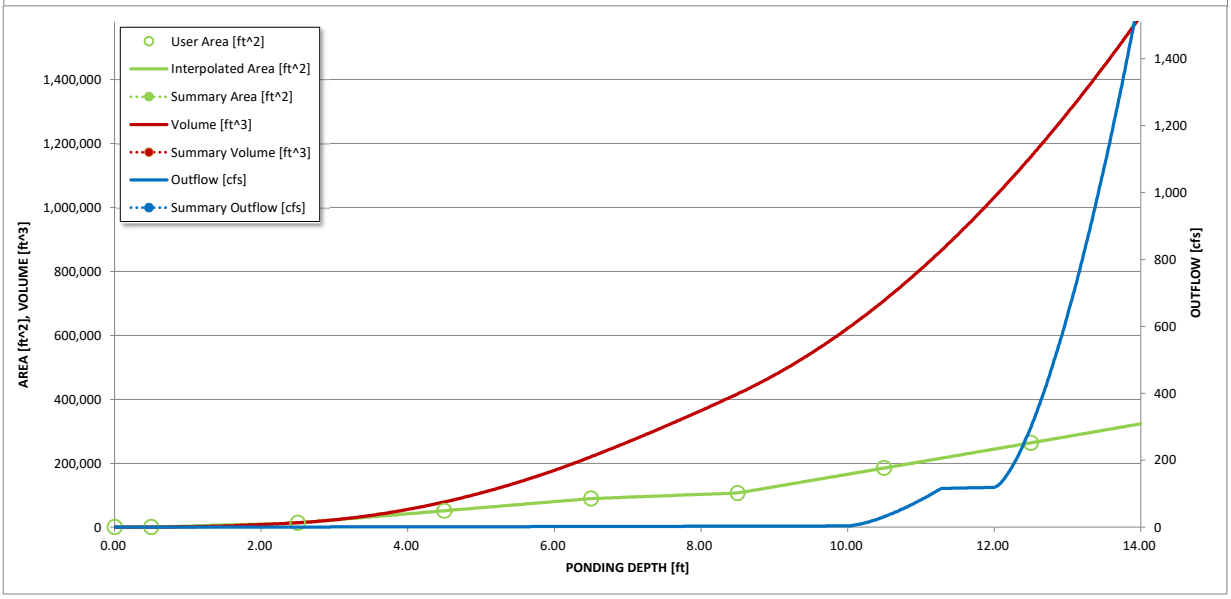
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	3.600	11.282	8.943	11.875	14.782	19.914	23.966	29.512	47.014
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	8.943	11.875	14.782	19.914	23.966	29.512	47.014
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.7	4.5	23.5	96.1	141.4	205.1	403.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.11	0.44	0.64	0.93	1.83
Peak Inflow Q (cfs) =	N/A	N/A	135.3	183.1	229.9	331.9	404.9	495.7	793.1
Peak Outflow Q (cfs) =	1.9	3.6	3.1	3.6	4.0	41.8	83.3	117.4	394.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.2	0.4	0.6	0.6	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.7	1.4	2.0	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	68	63	71	78	78	77	75	69
Time to Drain 99% of Inflow Volume (hours) =	**41**	74	67	77	85	86	85	84	81
Maximum Ponding Depth (ft) =	5.73	9.13	8.04	9.12	9.96	10.62	11.01	11.62	12.66
Area at Maximum Ponding Depth (acres) =	1.72	3.02	2.36	3.01	3.76	4.35	4.71	5.25	6.20
Maximum Volume Stored (acre-ft) =	3.605	11.303	8.444	11.273	14.083	16.759	18.571	21.561	27.577

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 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	1.24	0.12	6.15
	0:15:00	0.00	0.00	10.70	17.61	21.94	14.79	19.10	18.19	33.44
	0:20:00	0.00	0.00	43.18	58.87	70.08	44.77	52.76	55.91	83.77
	0:25:00	0.00	0.00	98.69	135.84	165.22	96.55	115.12	125.16	203.80
	0:30:00	0.00	0.00	135.32	183.13	229.89	237.80	291.54	335.10	555.86
	0:35:00	0.00	0.00	132.22	174.59	220.39	331.92	404.94	492.08	793.05
	0:40:00	0.00	0.00	116.21	150.70	188.33	330.99	401.00	495.71	784.49
	0:45:00	0.00	0.00	99.80	129.34	161.18	291.52	353.54	447.43	707.22
	0:50:00	0.00	0.00	84.77	111.60	137.41	252.07	307.20	394.76	626.90
	0:55:00	0.00	0.00	72.60	95.57	116.64	213.86	260.45	338.62	541.01
	1:00:00	0.00	0.00	63.64	83.27	102.06	176.80	214.16	287.00	461.86
	1:05:00	0.00	0.00	57.61	75.01	92.63	150.83	182.13	252.27	410.20
	1:10:00	0.00	0.00	50.94	68.11	84.84	129.15	155.43	213.77	347.73
	1:15:00	0.00	0.00	43.79	60.25	77.13	109.49	131.27	173.68	280.81
	1:20:00	0.00	0.00	37.31	51.49	67.23	90.44	107.69	137.32	219.70
	1:25:00	0.00	0.00	31.69	43.81	55.80	72.75	85.74	104.63	164.49
	1:30:00	0.00	0.00	27.65	38.59	47.09	56.54	65.82	77.04	118.65
	1:35:00	0.00	0.00	25.55	35.97	42.24	44.76	51.77	58.27	89.11
	1:40:00	0.00	0.00	24.59	32.99	39.31	38.14	43.84	47.63	72.05
	1:45:00	0.00	0.00	24.02	29.92	37.20	34.25	39.09	40.97	60.80
	1:50:00	0.00	0.00	23.65	27.71	35.72	31.73	36.00	36.52	53.11
	1:55:00	0.00	0.00	21.57	26.05	34.13	30.04	33.97	33.48	47.73
	2:00:00	0.00	0.00	18.92	24.32	31.48	28.91	32.62	31.34	43.91
	2:05:00	0.00	0.00	15.18	19.76	25.31	23.79	26.78	25.27	34.99
	2:10:00	0.00	0.00	11.30	14.58	18.56	17.41	19.55	18.33	25.24
	2:15:00	0.00	0.00	8.41	10.77	13.60	12.78	14.32	13.46	18.42
	2:20:00	0.00	0.00	6.19	7.89	9.92	9.37	10.48	9.91	13.53
	2:25:00	0.00	0.00	4.50	5.65	7.16	6.75	7.54	7.17	9.75
	2:30:00	0.00	0.00	3.21	3.95	5.09	4.78	5.32	5.07	6.87
	2:35:00	0.00	0.00	2.23	2.75	3.59	3.40	3.79	3.61	4.88
	2:40:00	0.00	0.00	1.49	1.88	2.43	2.35	2.61	2.48	3.32
	2:45:00	0.00	0.00	0.90	1.20	1.51	1.49	1.65	1.55	2.06
	2:50:00	0.00	0.00	0.47	0.67	0.81	0.83	0.91	0.85	1.10
	2:55:00	0.00	0.00	0.19	0.30	0.33	0.36	0.38	0.35	0.43
	3:00:00	0.00	0.00	0.06	0.08	0.08	0.08	0.08	0.07	0.07
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 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.

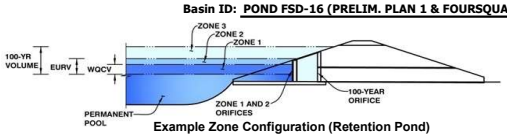
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: STERLING RANCH EAST PRELIMINARY PLAN NO. 1

Basin ID: POND FSD-16 (PRELIM. PLAN 1 & FOURSQUARE PUD ONLY)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	220.90	acres
Watershed Length =	4,000	ft
Watershed Length to Centroid =	2,000	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	26.00%	percent
Percentage Hydrologic Soil Group A =	75.0%	percent
Percentage Hydrologic Soil Group B =	25.0%	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) =	2.547	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	5.592	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.110	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	5.787	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.129	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	13.122	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	16.794	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	22.358	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	39.476	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	3.611	acre-feet		
Approximate 5-yr Detention Volume =	4.947	acre-feet		
Approximate 10-yr Detention Volume =	6.597	acre-feet		
Approximate 25-yr Detention Volume =	8.208	acre-feet		
Approximate 50-yr Detention Volume =	9.303	acre-feet		
Approximate 100-yr Detention Volume =	11.510	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	2.547	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.046	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.917	acre-feet
Total Detention Basin Volume =	11.510	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	

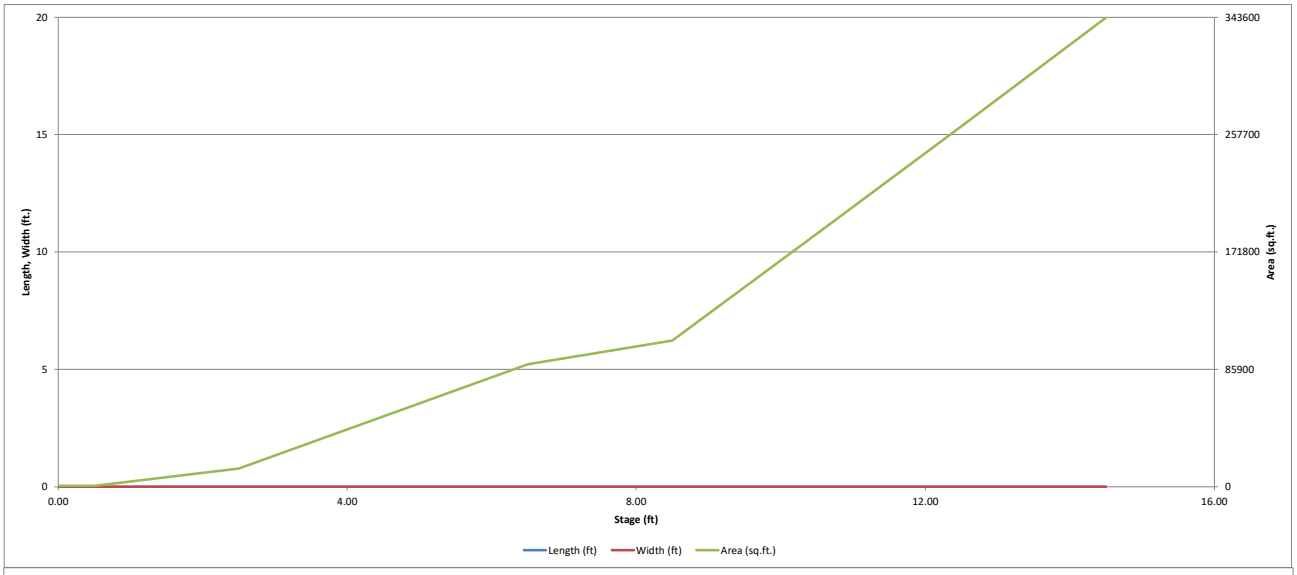
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	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

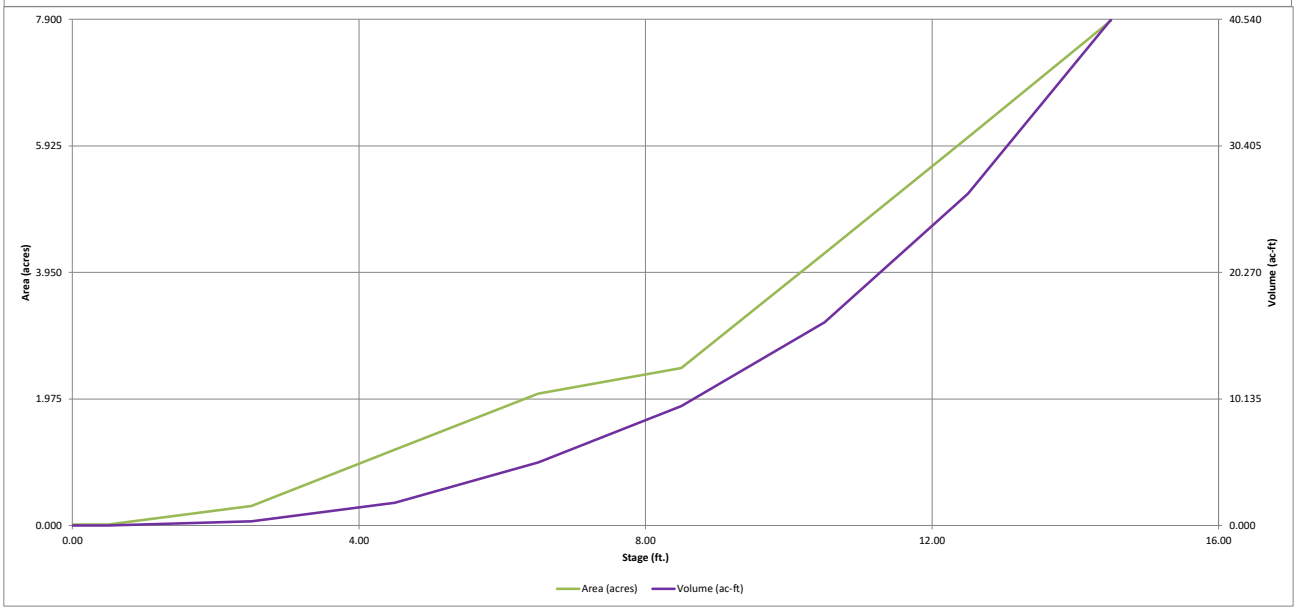
Depth Increment = 2.00 ft

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	--	--	--	650	0.015		
7092	--	0.50	--	--	--	650	0.015	325	0.007
7094	--	2.50	--	--	--	13,311	0.306	14,286	0.328
7096	--	4.50	--	--	--	51,595	1.184	79,192	1.818
7098	--	6.50	--	--	--	89,663	2.058	220,450	5.061
7100	--	8.50	--	--	--	107,054	2.458	417,167	9.577
7102	--	10.50	--	--	--	185,183	4.251	709,404	16.286
7104	--	12.50	--	--	--	263,928	6.059	1,158,515	26.596
7106	--	14.50	--	--	--	343,298	7.881	1,765,741	40.536

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



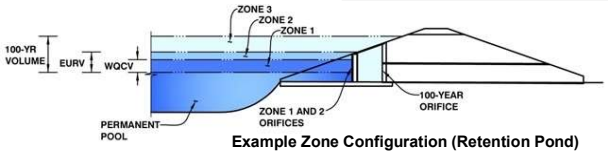


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH EAST PRELIMINARY PLAN NO. 1**

Basin ID: **POND FSD-16 (PRELIM. PLAN 1 & FOURSQUARE PUD ONLY)**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	5.06	2.547	Orifice Plate
Zone 2 (EURV)	6.76	3.046	Orifice Plate
Zone 3 (100-year)	9.20	5.917	Weir&Pipe (Restrict)
Total (all zones)		11.510	

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

Underdrain Orifice Invert Depth = [ ] ft (distance below the filtration media surface)

Underdrain Orifice Diameter = [ ] inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = [ ] ft^2

Underdrain Orifice Centroid = [ ] feet

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

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 10.00 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = 30.00 inches

Orifice Plate: Orifice Area per Row = N/A sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.50	5.00	7.50				
Orifice Area (sq. inches)	8.30	8.30	28.27	28.27				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	10.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	20.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	10.00	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.17	N/A	
Overflow Grate Open Area w/o Debris =	55.68	N/A	ft^2
Overflow Grate Open Area w/ Debris =	27.84	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	28.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	6.81	N/A	ft^2
Outlet Orifice Centroid =	1.31	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 12.00 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 165.00 feet

Spillway End Slopes = 6.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.91 feet

Stage at Top of Freeboard = 13.91 feet

Basin Area at Top of Freeboard = 7.34 acres

Basin Volume at Top of Freeboard = 36.04 acre-ft

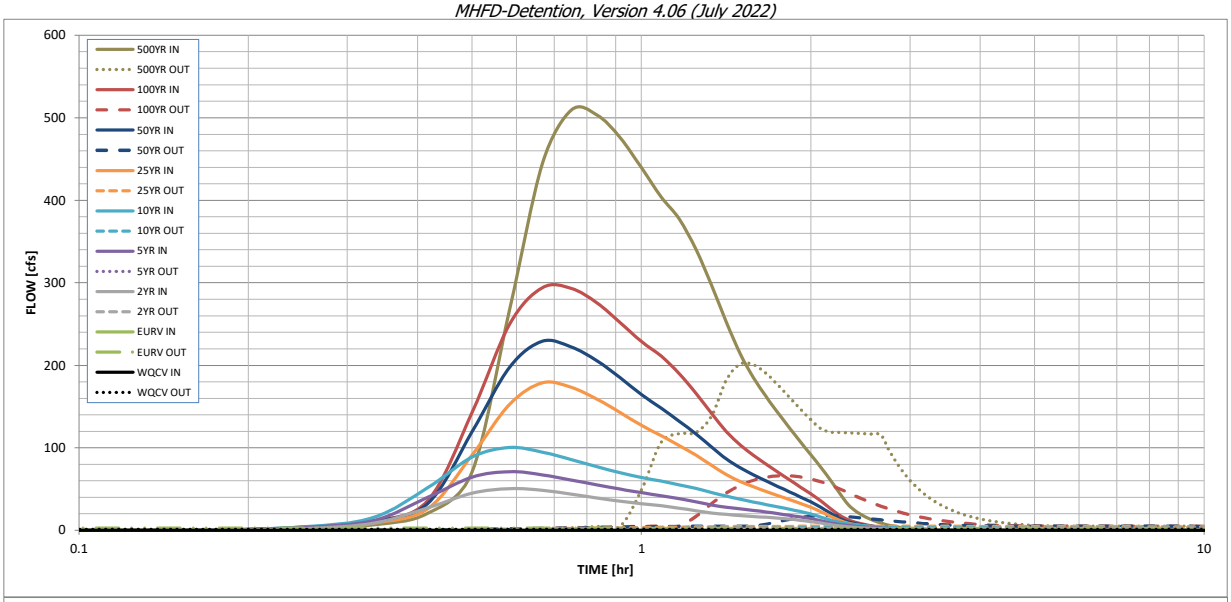
Routed Hydrograph Results

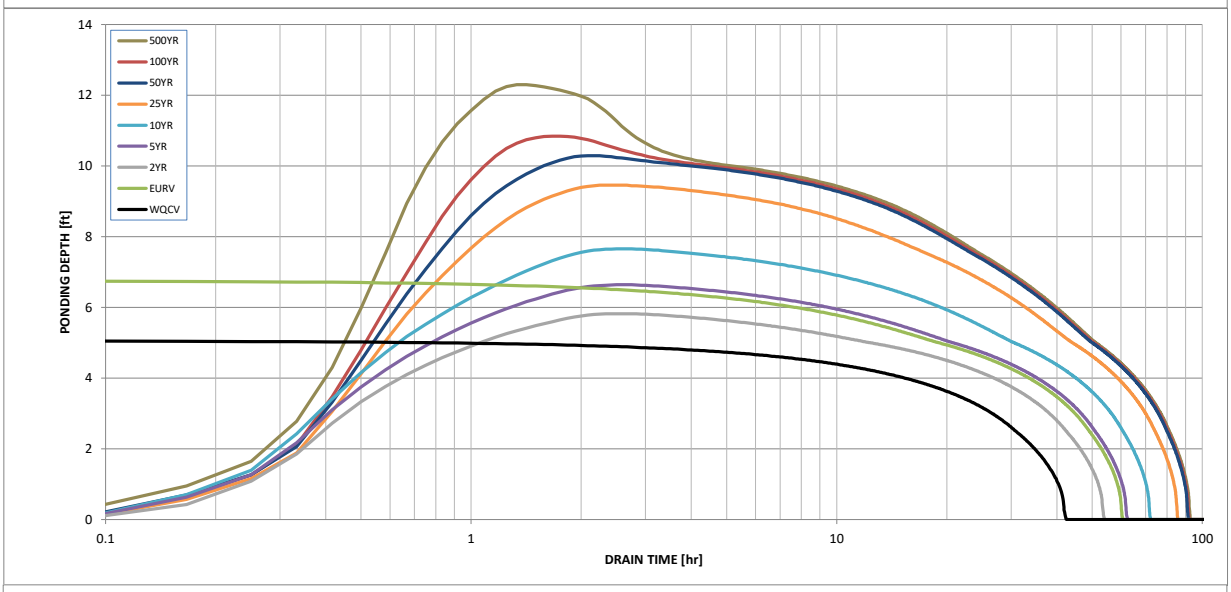
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

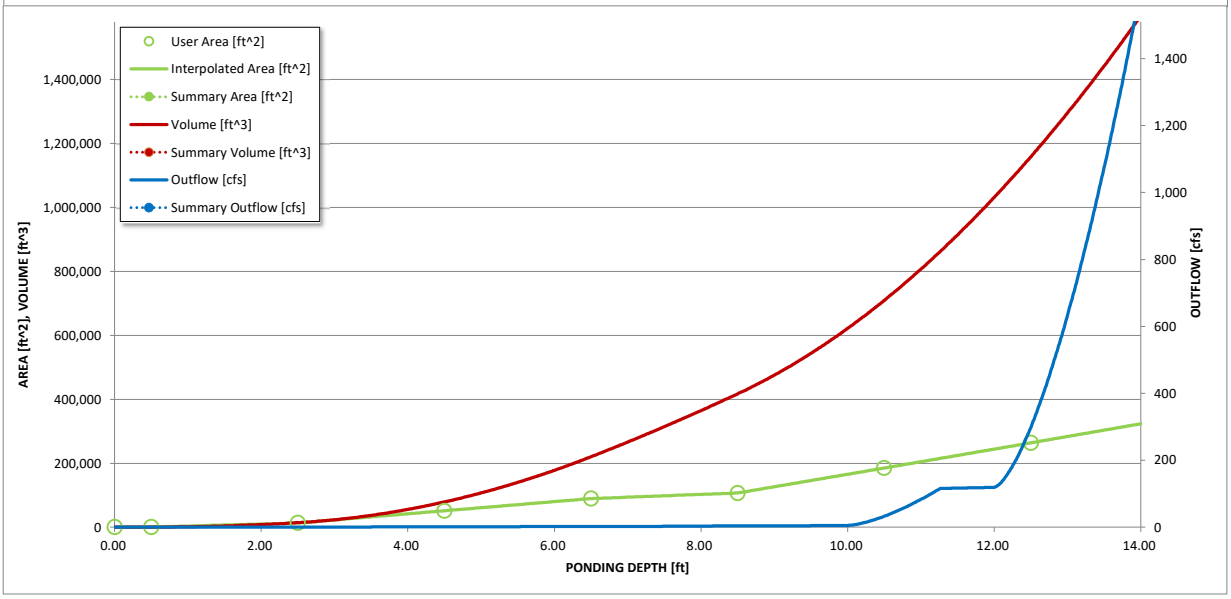
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
CUHP Runoff Volume (acre-ft) =	2.547	5.592	4.110	5.787	8.129	13.122	16.794	22.358	39.476
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.110	5.787	8.129	13.122	16.794	22.358	39.476
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.7	4.5	23.4	95.7	140.7	204.0	401.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.11	0.43	0.64	0.92	1.82
Peak Inflow Q (cfs) =	N/A	N/A	50.6	71.1	100.3	178.7	229.1	294.1	509.2
Peak Outflow Q (cfs) =	1.3	2.5	2.0	2.5	3.3	4.9	17.8	66.0	201.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.1	0.1	0.1	0.3	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.2	1.1	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) =	39	54	49	55	63	73	76	74	67
Time to Drain 99% of Inflow Volume (hours) =	**41**	58	52	59	68	80	85	84	80
Maximum Ponding Depth (ft) =	5.06	6.76	5.82	6.64	7.66	9.46	10.30	10.85	12.30
Area at Maximum Ponding Depth (acres) =	1.43	2.11	1.76	2.08	2.29	3.31	4.06	4.56	5.87
Maximum Volume Stored (acre-ft) =	2.550	5.603	3.762	5.330	7.560	12.316	15.413	17.783	25.343

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 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	0.24	0.02	1.18
	0:15:00	0.00	0.00	2.03	3.34	4.17	2.82	3.68	3.47	6.61
	0:20:00	0.00	0.00	8.59	11.82	15.31	9.04	10.77	11.30	20.43
	0:25:00	0.00	0.00	27.16	39.83	51.41	26.13	32.34	35.79	70.62
	0:30:00	0.00	0.00	44.93	64.44	88.85	91.14	119.27	142.88	268.21
	0:35:00	0.00	0.00	50.55	71.08	100.35	152.92	197.95	250.14	444.67
	0:40:00	0.00	0.00	48.41	67.27	94.81	178.70	229.13	294.14	509.21
	0:45:00	0.00	0.00	43.75	60.84	85.71	173.31	222.22	293.11	503.55
	0:50:00	0.00	0.00	39.15	55.15	77.15	159.03	205.45	275.77	476.05
	0:55:00	0.00	0.00	35.24	49.86	69.74	142.72	184.91	251.80	439.26
	1:00:00	0.00	0.00	32.24	45.61	64.15	127.18	164.52	228.67	404.19
	1:05:00	0.00	0.00	29.69	41.92	59.56	114.79	148.04	211.24	377.59
	1:10:00	0.00	0.00	26.81	38.40	55.04	102.87	132.34	190.08	340.58
	1:15:00	0.00	0.00	23.82	34.57	50.68	91.03	116.89	166.02	296.73
	1:20:00	0.00	0.00	21.07	30.64	45.81	78.75	100.91	141.51	252.08
	1:25:00	0.00	0.00	19.20	27.98	41.40	67.41	86.34	119.49	213.16
	1:30:00	0.00	0.00	17.91	26.00	37.70	59.10	75.65	103.29	184.49
	1:35:00	0.00	0.00	16.77	24.22	34.30	52.60	67.07	90.75	161.64
	1:40:00	0.00	0.00	15.71	22.25	31.20	47.10	59.73	80.01	141.90
	1:45:00	0.00	0.00	14.66	20.16	28.30	41.94	52.93	70.29	123.97
	1:50:00	0.00	0.00	13.60	18.12	25.52	37.13	46.62	61.21	107.29
	1:55:00	0.00	0.00	12.21	16.16	22.72	32.43	40.46	52.51	91.47
	2:00:00	0.00	0.00	10.62	14.16	19.71	27.86	34.48	44.22	76.59
	2:05:00	0.00	0.00	8.74	11.67	16.08	22.62	27.77	35.48	61.02
	2:10:00	0.00	0.00	6.83	9.07	12.40	17.10	20.76	26.48	45.13
	2:15:00	0.00	0.00	5.27	7.03	9.62	12.05	14.38	18.17	30.96
	2:20:00	0.00	0.00	4.22	5.67	7.80	8.61	10.26	12.72	22.24
	2:25:00	0.00	0.00	3.48	4.65	6.43	6.48	7.68	9.29	16.39
	2:30:00	0.00	0.00	2.87	3.83	5.28	5.07	5.95	6.86	12.05
	2:35:00	0.00	0.00	2.37	3.15	4.31	3.99	4.62	5.09	8.80
	2:40:00	0.00	0.00	1.93	2.56	3.47	3.14	3.62	3.76	6.34
	2:45:00	0.00	0.00	1.57	2.06	2.75	2.45	2.81	2.72	4.46
	2:50:00	0.00	0.00	1.28	1.64	2.15	1.90	2.17	1.98	3.18
	2:55:00	0.00	0.00	1.04	1.30	1.68	1.49	1.69	1.54	2.50
	3:00:00	0.00	0.00	0.84	1.04	1.32	1.19	1.34	1.23	2.00
	3:05:00	0.00	0.00	0.67	0.82	1.03	0.94	1.05	0.99	1.60
	3:10:00	0.00	0.00	0.52	0.63	0.80	0.73	0.81	0.77	1.24
	3:15:00	0.00	0.00	0.38	0.47	0.60	0.55	0.61	0.58	0.93
	3:20:00	0.00	0.00	0.27	0.33	0.43	0.40	0.44	0.42	0.67
	3:25:00	0.00	0.00	0.18	0.22	0.29	0.27	0.30	0.28	0.44
	3:30:00	0.00	0.00	0.11	0.14	0.17	0.17	0.18	0.17	0.26
	3:35:00	0.00	0.00	0.05	0.08	0.09	0.09	0.10	0.09	0.13
	3:40:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.03	0.04
	3:45:00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 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.

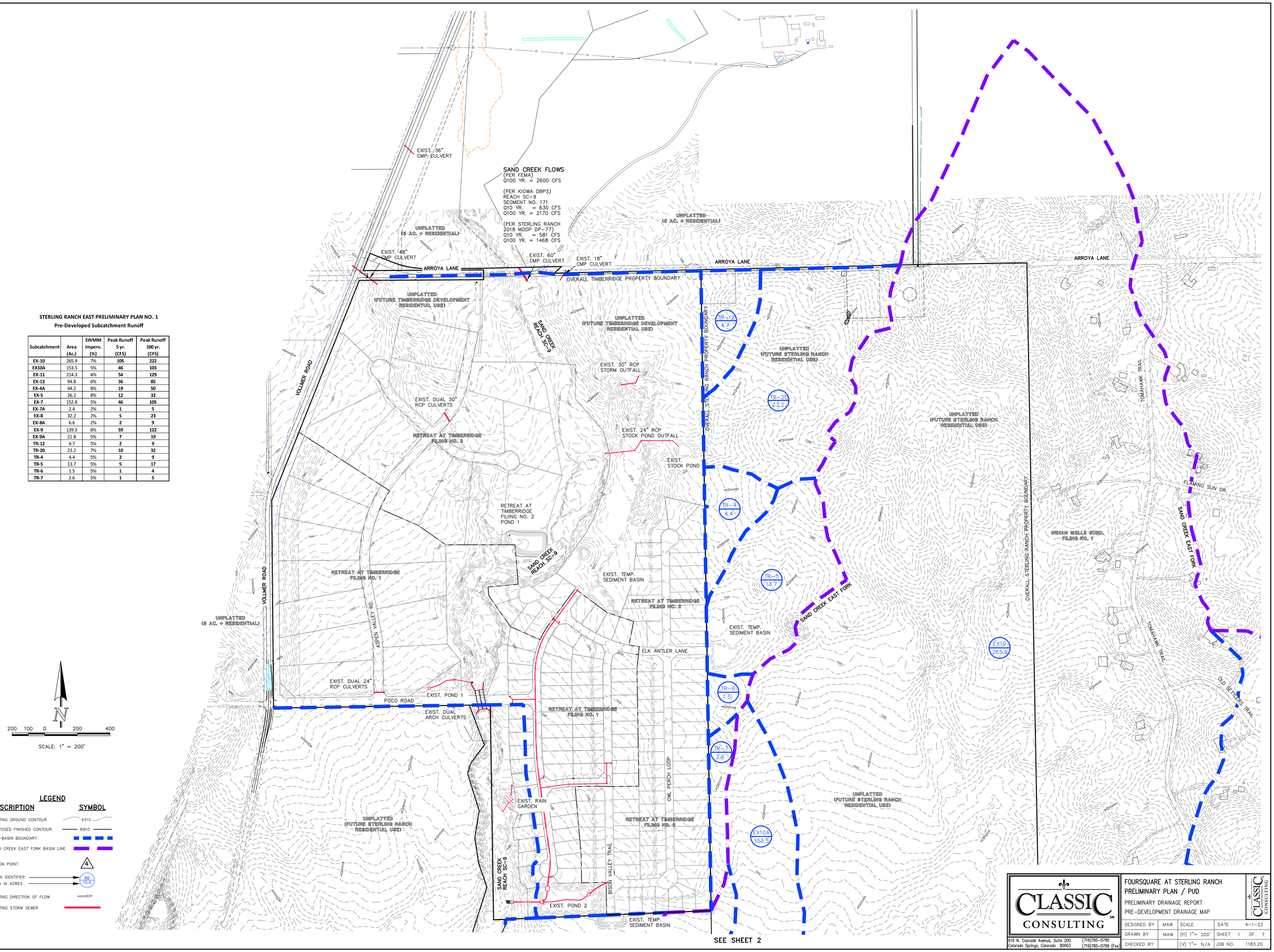
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

DRAINAGE MAPS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5



N

200 100 0 200 400

SCALE: 1" = 200'

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
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FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	1 OF 7
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

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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	

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

SAND CREEK REACH SC-
BISON VALLE
EXIST. POND 2
EXIST. TEMP. SEDIMENT BASIN
EX10 265.9
INDIAN WELLS SUBD. FILING NO. 1
TOMAHAWK TRAIL
STAPLETON ROAD
BOW VALLEY SUBD.
EX-13 94.8
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
OVERALL STERLING RANCH PROPERTY BOUNDARY
UNPLATTED ELITE PROPERTIES OF AMERICA, INC. (CLASSIC HOMES)
UNPLATTED BUFORD/BENNETT
VOLLMER ROAD
(HOMESTEAD NORTH AT STERLING RANCH RESIDENTIAL USE)
CLASSIC OWNERSHIP BOUNDARY
HOMESTEAD NORTH PLATTED BOUNDARY
SAND CREEK REACH SC-9
EX-5 26.2
REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG. (PCD NO. SF-22-013)
BRIARGATE BLVD. (130' ROW)
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
SAND CREEK EAST FORK
EX-9 139.3
EX-7 152.8
EX10A 153.5
EX-11 214.3
EX-4A 44.2
HOMESTEAD AT STERLING RANCH FILING NO. 2
HOMESTEAD AT STERLING RANCH FILING NO. 1
STERLING RANCH RD. (80' ROW)
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
SAND CREEK REACH SC-8
REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG. (PCD NO. SF-22-013)
CLASSIC OWNERSHIP BOUNDARY
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
BRANDING IRON AT STERLING RANCH FILING NO. 2

SEE SHEET 3

N

200 100 0 200 400

SCALE: 1" = 200'

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

FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	2 OF 7
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

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SEE SHEET 2

BRANDING IRON AT STERLING RANCH FILING NO. 2

EXIST. STOCK POND

CLASSIC OWNERSHIP BOUNDARY

SAND CREEK REACH SC-8

STERLING RANCH RD. (80' ROW)

EX-4A 44.2

EX-7 152.8

EX-8 32.2

EX-9 139.3

EX-9A 21.8

EX10A 153.5

EX-11 214.3

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

UNPLATTED BUFORD BENNETT

UNPLATTED THOMAS KENDALL

SAND CREEK EAST FORK

EX-7A 2.4

EX-8A 6.6

Q5 YR. = 46 CFS
Q100 YR. = 105 CFS

(PER STERLING RANCH 2018 MDDP DP-4)
Q5 YR. = 21.5 CFS
Q100 YR. = 107.4 CFS

Q5 YR. = 1 CFS
Q100 YR. = 5 CFS

Q5 YR. = 2 CFS
Q100 YR. = 9 CFS

Q5 YR. = 5 CFS
Q100 YR. = 23 CFS

(PER STERLING RANCH 2018 MDDP DP-5)
Q5 YR. = 1.7 CFS
Q100 YR. = 20.5 CFS

Q5 YR. = 59 CFS
Q100 YR. = 122 CFS

(PER STERLING RANCH 2018 MDDP DP-6)
Q5 YR. = 23.9 CFS
Q100 YR. = 125.2 CFS

Q5 YR. = 7 CFS
Q100 YR. = 19 CFS

OVERALL STERLING RANCH PROPERTY BOUNDARY

Q5 YR. = 110 CFS
Q100 YR. = 249 CFS

(PER 2018 MDDP)
Q5 YR. = 57.1 CFS
Q100 YR. = 277.9 CFS

Q5 YR. = 60 CFS
Q100 YR. = 160 CFS

(PER 2018 MDDP)
Q5 YR. = 42.5 CFS
Q100 YR. = 202.9 CFS

SAND CREEK FLOWS
(PER FEMA)
Q100 YR. = 2600 CFS

(PER KIOWA DBPS)
REACH SC-8
SEGMENT NO. 163
Q10 YR. = 770 CFS
Q100 YR. = 2630 CFS

(PER STERLING RANCH 2018 MDDP DP-63)
Q10 YR. = 713 CFS
Q100 YR. = 1912 CFS

4 | 4A | 5 | 5A | 6 | 6A | 7 | 56

PAWNEE RANCHEROS FILING NO. 2

MUSTANG PLACE

MUSTANG ROAD

COCHISE ROAD

BAR J-3 ACRES FILING NO. 2

MOHAWK ROAD

PAWNEE RANCHEROS FILING NO. 1

BRULE ROAD

OTO CIRCLE

UNPLATTED SLN NO. 1 LLC (BANNING LEWIS RANCH)

MUSTANG ROAD

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP4	46	105
DP4A	1	5
DP5	5	23
DP5A	2	9
DP6	59	122
DP6A	7	19
DP7	110	249
DP56	60	160
DPEX-4A	19	50
DPEX-5	12	32

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'

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

FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	3 OF 7
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

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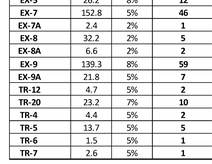
STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

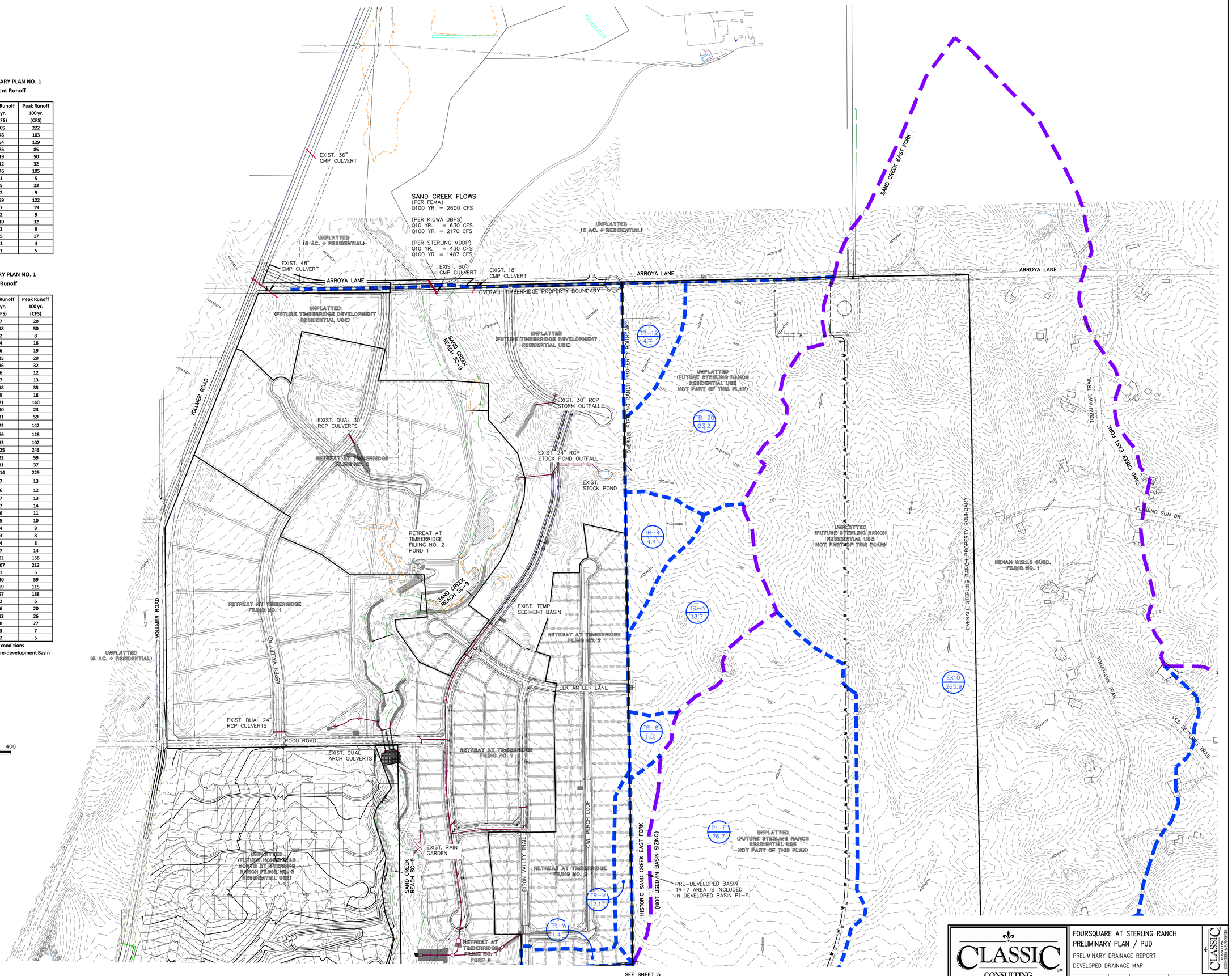
Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A ++	60.4	5%	18	50
EX-9 ++	6.0	5%	2	8
EX-9A ++	12.7	5%	4	16
P1-A	12.7	8%	6	19
P1-A1	5.0	70%	15	29
P1-A2	6.4	70%	16	32
P1-A3	1.8	70%	6	12
P1-A4	2.0	70%	7	13
P1-A5	5.7	70%	18	35
P1-A6	2.8	70%	9	18
P1-B (Dev.)	35.5	55%	71	140
P1-B (Un-dev.)	35.5	5%	10	23
P1-C	8.9	70%	31	59
P1-D	31.4	60%	72	142
P1-E1	30.4	50%	66	128
P1-E2	21.8	55%	53	102
P1-F (Dev.)	76.7	35%	125	243
P1-F (Un-dev.)	76.7	5%	22	59
P2-A	24.4	7%	11	37
P2-B	57.8	57%	114	229
P2-B1	2.5	50%	7	13
P2-B10	1.7	70%	6	12
P2-B2	1.9	70%	7	13
P2-B3	2.8	50%	7	14
P2-B4	1.6	70%	6	11
P2-B5	1.9	50%	5	10
P2-B6	1.1	70%	4	8
P2-B7	2.5	25%	3	8
P2-B8	1.2	70%	4	8
P2-B9	2.0	70%	7	14
P2-S1	35.6	50%	82	158
P3-A	52.6	57%	107	213
P3-C	1.7	11%	1	5
P3-S2	11.9	50%	30	59
P4-A	25.8	57%	59	115
P4-B	37.3	60%	97	188
SC-1 +	3.6	8%	2	6
SC-2 +	10.8	8%	6	20
SC-3 +	27.2	8%	12	26
SC-4 +	16.4	8%	8	27
TR-V	2.1	27%	3	7
TR-W	1.4	32%	2	5

+ Basin not changed from pre-development conditions
++ Remaining undeveloped portion of the pre-development Basin



LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
HISTORIC EAST FORK BASIN BOUNDARY (NOT USED IN BASIN SIZING)	
DESIGN POINT	15
BASIN IDENTIFIER / AREA IN ACRES	99 / 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	



SEE SHEET 5

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

FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	4 OF 7
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

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LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
HISTORIC EAST FORK BASIN BOUNDARY (NOT USED IN BASIN SIZING)	
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	

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A ++	60.4	5%	18	50
EX-9 ++	6.0	5%	2	8
EX-9A ++	12.7	5%	4	16
P1-A	12.7	8%	6	19
P1-A1	5.0	70%	15	29
P1-A2	6.4	70%	16	32
P1-A3	1.8	70%	6	12
P1-A4	2.0	70%	7	13
P1-A5	5.7	70%	18	35
P1-A6	2.8	70%	9	18
P1-B (Dev.)	35.5	55%	71	140
P1-B (Un-dev.)	35.5	5%	10	23
P1-C	8.9	70%	31	59
P1-D	31.4	60%	72	142
P1-E1	30.4	50%	66	128
P1-E2	21.8	55%	53	102
P1-F (Dev.)	76.7	35%	125	243
P1-F (Un-dev.)	76.7	5%	22	59
P2-A	24.4	7%	11	37
P2-B	57.8	57%	114	229
P2-B1	2.5	50%	7	13
P2-B10	1.7	70%	6	12
P2-B2	1.9	70%	7	13
P2-B3	2.8	50%	7	14
P2-B4	1.6	70%	6	11
P2-B5	1.9	50%	5	10
P2-B6	1.1	70%	4	8
P2-B7	2.5	25%	3	8
P2-B8	1.2	70%	4	8
P2-B9	2.0	70%	7	14
P2-S1	35.6	50%	82	158
P3-A	52.6	57%	107	213
P3-C	1.7	11%	1	5
P3-S2	11.9	50%	30	59
P4-A	25.8	57%	59	115
P4-B	37.3	60%	97	188
SC-1 +	3.6	8%	2	6
SC-2 +	10.8	8%	6	20
SC-3 +	27.2	8%	12	26
SC-4 +	16.4	8%	8	27
TR-V	2.1	27%	3	7
TR-W	1.4	32%	2	5

\+ Basin not changed from pre-development conditions
++ Remaining undeveloped portion of the pre-development Basin

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14A Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A1	5.0	N/A	70%
P1-A2	6.4	N/A	70%
P1-A3	1.8	N/A	70%
P1-A4	2.0	N/A	70%
P1-A5	5.7	N/A	70%
P1-A6	2.8	N/A	70%
P2-S1	35.6	School	50%
P2-A	24.4	Park	7%
P2-B	57.8	7,000	57%
P2-B1	2.5	N/A	50%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	50%
P2-B4	1.6	N/A	70%
P2-B5	1.9	N/A	50%
P2-B6	1.1	N/A	70%
P2-B7	2.5	N/A	25%
P2-B8	1.2	N/A	70%
TOTAL	157.0		49%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point (On-Site)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	127	248
DP-2	69	133
DP-3	53	102
DP-4	167	376
DP-5	72	142
DP-6	71	140
DP-7	28	53
DP-8	82	158
DP-9	114	229
DP-10	282	456
DP-11	14	26
DP-12	97	188
DP-13	59	115
DP-14	101	193
DP-15	107	213
DP-16	43	84

SEE SHEET 4

RETREAT AT TIMBERRIDGE FILING NO. 1 POND 2

PROPOSED HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

TR-W 1.4

PRE-DEVELOPED BASIN TR-7 AREA IS INCLUDED IN DEVELOPED BASIN P1-F.

EXIST. SEDIMENT POND TO BE REMOVED WITH DEVELOPMENT OF THIS AREA

P1-F 76.7

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE NOT PART OF THIS PLAN)

INDIAN WELLS SUBD. FILING NO. 1

TOMAHAWK TRAIL

STAPLETON ROAD

NATURAL SWALE

NATURAL SWALE

FUTURE STERLING RANCH EAST PRELIMINARY PLAN NO. 1- FILING 3 (PCD NO. SF22-0041)

P1-E1 30.4

HISTORIC SAND CREEK EAST FORK (NOT USED IN BASIN SIZING)

SAND CREEK REACH SC-9

SC-4 16.4

REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG. (PCD NO. SF-22-013)

P1-E2 21.8

FUTURE STERLING RANCH EAST PRELIMINARY PLAN NO. 1- FILING 3 (PCD NO. SF22-0041)

TEMPORARY SEDIMENT BASIN PRIOR TO FUTURE DEVELOPMENT IN THIS AREA. EXACT LOCATION AND SIZING WITH FINAL DRAINAGE REPORTS.

FUTURE STERLING RANCH EAST PRELIMINARY PLAN NO. 1 - FILING 1 (PCD NO. SF22-004)

PROP. PUBLIC TYPE R INLETS (TYP.)

P1-C 8.9

FUTURE 48"-54" RCP STORM OUTFALL SYSTEM FOR BASINS P1-E AND P1-F

RELEASE

TEMPORARY SEDIMENT BASIN PRIOR TO FUTURE DEVELOPMENT IN THIS AREA. EXACT LOCATION AND SIZING WITH FINAL DRAINAGE REPORTS.

P1-B 35.5

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)

FUTURE 60"-66" RCP STORM OUTFALL SYSTEM FOR BASINS P1-C, P1-E AND P1-F

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)

EX-12 94.8

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE NOT PART OF THIS PLAN)

NO DEVELOPMENT PROPOSED IN THIS BASIN AT THIS TIME

BOW VALLEY SUBD.

OVERALL STERLING RANCH PROPERTY BOUNDARY

P1-A1 5.0

REFERENCE CDR-2113 FOR BRIARGATE PARKWAY BRIDGE CROSSING PLANS PREPARED BY KIOWA ENG.

BRIARGATE BLVD. (130' ROW)

P1-A2 6.4

HOMESTEAD AT STERLING RANCH FILING NO. 2

SC-3 27.2

10' TYPE R AT-GRADE INLET (PER BRIARGATE PKWY. PLANS)

P1-A3 1.8

P1-D 31.4

48"-54" RCP STORM OUTFALL SYSTEM FOR BASINS P1-C, P1-D AND BRIARGATE SYSTEM

SEE SHEET 7 FOR SITE SPECIFIC DRAINAGE MAP

P1-A 12.7

POND FSD-16 (EDB) (FULL BUILD-OUT)

TRIB. AREA = 220.9 AC.
WQCV = 3.60 AC.-FT.
EURV = 7.70 AC.-FT.
100 YR. = 10.26 AC.-FT.
TOTAL = 21.56 AC.-FT.

INFLOW: (SWMM MODEL)
Q5 = 307 CFS
Q100 = 496 CFS

OUTFLOW: (MHFD-DETENTION)
Q5 = 3.6 CFS
Q100 = 117.4 CFS

POND FSD-16 (EDB) (PRELIM. PLAN 1 & FOURSQUARE PUD)

TRIB. AREA = 220.9 AC.
WQCV = 2.55 AC.-FT.
EURV = 3.04 AC.-FT.
100 YR. = 5.92 AC.-FT.
TOTAL = 11.51 AC.-FT.

INFLOW: (SWMM MODEL)
Q5 = 197 CFS
Q100 = 410 CFS

OUTFLOW: (MHFD-DETENTION)
Q5 = 2.5 CFS
Q100 = 66.0 CFS

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area
(Full Build Out)

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	8%
P1-B	35.5	7,500	55%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	12,500	35%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	220.9		46%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area
(Prelim. Plan 1 & Foursquare PUD Only)

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	8%
P1-B	35.5	Un dev.	2%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	Un dev.	2%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	220.9		26%

UNPLATTED ELITE PROPERTIES OF AMERICA, INC. (CLASSIC HOMES)

UNPLATTED BUFORD BERRETT

P1-A4 2.0

20' TYPE R AT-GRADE INLET (PER BRIARGATE PKWY. PLANS)

30" RCP STORM SYSTEM (PER BRIARGATE PKWY. PLANS)

15' TYPE R AT-GRADE INLETS (PER BRIARGATE PKWY. PLANS)

48" RCP STORM OUTFALL SYSTEM FOR FSD-16 POND (PER BRIARGATE PKWY. PLANS)

P1-A5 5.7

FUTURE BRIARGATE BLVD. (130' ROW)

P1-A6 2.8

EX-11 214.3

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE NOT PART OF THIS PLAN)

NO DEVELOPMENT PROPOSED IN THIS BASIN AT THIS TIME

SAND CREEK REACH SC-8

REFERENCE SAND CREEK CHANNEL IMPROVEMENTS PROPOSED WITH HOMESTEAD NORTH AT STERLING RANCH FIL.NO. 1 PREPARED BY JR ENG. (PCD NO. SF-22-013)

P2-S1 35.6

SCHOOL SITE

HISTORIC SAND CREEK EAST FORK (NOT USED IN BASIN SIZING)

STERLING RANCH RD. (80' ROW)

42" RCP STORM OUTFALL SYSTEM FOR BRIARGATE PKWY. BASINS P1-A1 THRU P1-A6.

FUTURE VILLAGE AT STERLING RANCH PRELIMINARY PLAN / PUD (HSD NO. PUDSR 2287)

P2-B2 1.9

P4-B 37.3

FUTURE STERLING RANCH EAST PRELIMINARY PLAN NO. 1 - FILING 1 (PCD NO. SF22-004)

SC-1 27.2

P2-B1 2.5

10' TYPE R AT-GRADE INLETS (PER STERLING RANCH RD. PLANS)

60" RCP STORM OUTFALL SYSTEM INCL. BASINS P2-S1 AND STERLING RANCH RD.

48" RCP STORM OUTFALL SYSTEM FOR FSD-16 POND (PER BRIARGATE PKWY. PLANS)

FUTURE 48" RCP STORM OUTFALL SYSTEM FOR BASIN P4-B

BRANDING IRON AT STERLING RANCH FILING NO. 2

POND FSD-14A (EDB)

TRIB. AREA = 157.0 AC.
WQCV = 2.67 AC.-FT.
EURV = 6.10 AC.-FT.
100 YR. = 5.59 AC.-FT.
TOTAL = 14.36 AC.-FT.

INFLOW: (SWMM MODEL)
Q5 = 290 CFS
Q100 = 488 CFS

OUTFLOW: (MHFD-DETENTION)
Q5 = 3.3 CFS
Q100 = 119.0 CFS

POND FSD-14A WILL OUTFALL DIRECTLY INTO SAND CREEK AND POND W3. (REFERENCE JR ENG. CHANNEL IMP. PLANS FOR OUTFALL DESIGN)

EX. STOCK POND

P2-B8 57.8

FUTURE STERLING RANCH EAST PRELIMINARY PLAN NO. 1 - FILING 4 (PCD NO. SF22-004)

P2-B3 2.8

15' TYPE R AT-GRADE INLETS (PER STERLING RANCH RD. PLANS)

P2-B4 1.6

P4-A 25.8

UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE NOT PART OF THIS PLAN)

FUTURE POND FSD-14B (EDB)

TRIB. AREA = 63.1 AC.
WQCV = 1.23 AC.-FT.
EURV = 3.27 AC.-FT.
100 YR. = 1.93 AC.-FT.
TOTAL = 6.43 AC.-FT.

INFLOW: (SWMM MODEL)
Q5 = 101 CFS
Q100 = 193 CFS

OUTFLOW: (MHFD-DETENTION)
Q5 = 2.0 CFS
Q100 = 48.1 CFS

P2-A 22.2

72" RCP STORM OUTFALL SYSTEM INCL. BASIN P2-B AND STERLING RANCH RD.

P2-B7 2.5

P2-B5 1.9

SEE SHEET 6

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P4-A	25.8	7,000	57%
P4-B	37.3	6,500	60%
TOTAL	63.1		59%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

N

200 100 0 200 400

SCALE: 1" = 200'

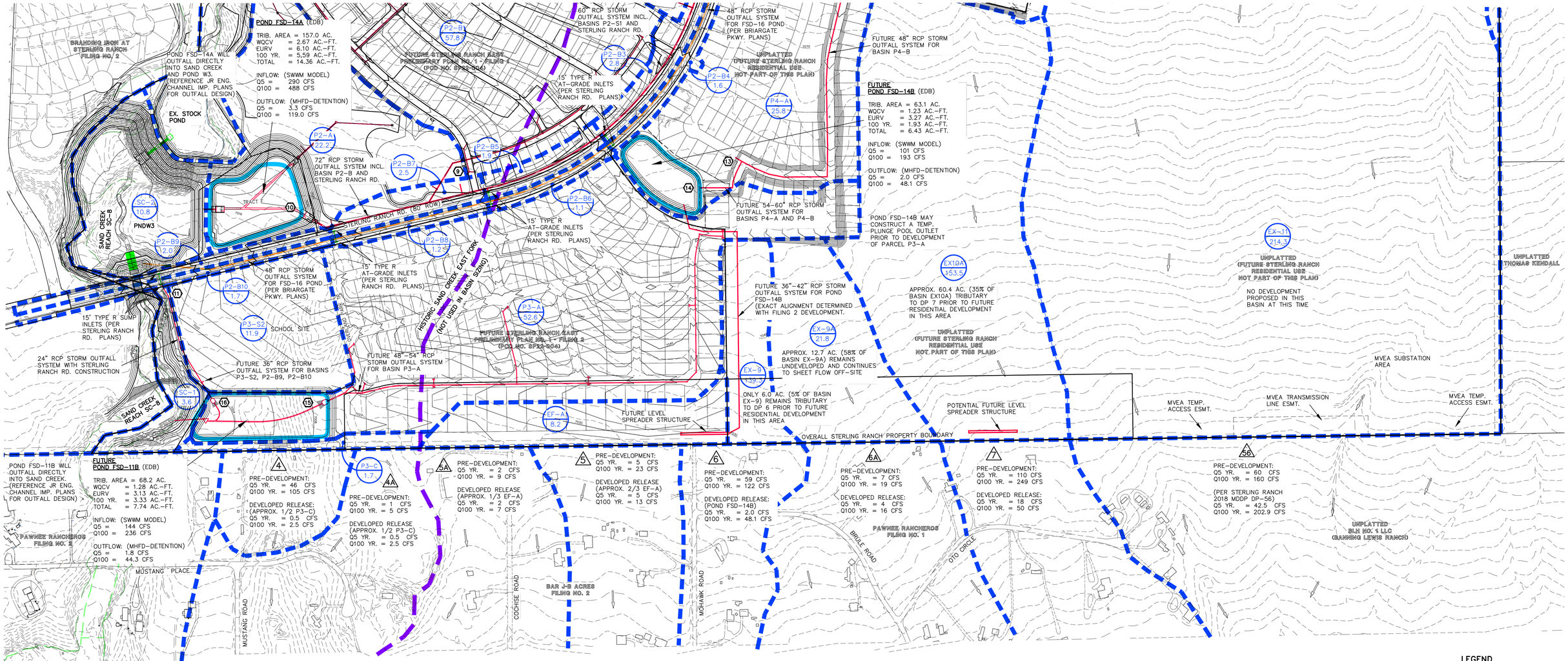
CLASSIC CONSULTING ENGINEERS & SURVEYORS SM
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799 (Fax)

FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'	SHEET	5 OF 7
CHECKED BY		(V) 1"= N/A	JOB NO.	1183.20

N:\1183\PLREPORTS\PRELIMINARY DRAINAGE REPORT\1183D PRR DM rev.dwg, 3/6/2023 4:08:46 PM, 1:1

SEE SHEET 5



STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14A Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A1	5.0	N/A	70%
P1-A2	6.4	N/A	70%
P1-A3	1.8	N/A	70%
P1-A4	2.0	N/A	70%
P1-A5	5.7	N/A	70%
P1-A6	2.8	N/A	70%
P2-S1	35.6	School	50%
P2-A	24.4	Park	7%
P2-B	57.8	7,000	57%
P2-B1	2.5	N/A	50%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	50%
P2-B4	1.6	N/A	70%
P2-B5	1.9	N/A	50%
P2-B6	1.1	N/A	70%
P2-B7	2.5	N/A	25%
P2-B8	1.2	N/A	70%
TOTAL	157.0		49%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-14B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P4-A	25.8	7,000	57%
P4-B	37.3	6,500	60%
TOTAL	63.1		59%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-11B Tributary Area

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P2-B9	2.0	N/A	70%
P2-B10	1.7	N/A	70%
P3-S2	11.9	School	50%
P3-A	52.6	7,000	57%
TOTAL	68.2		56%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A ++	60.4	5%	18	50
EX-9 ++	6.0	5%	2	8
EX-9A ++	12.7	5%	4	16
P1-A	12.7	8%	6	19
P1-A1	5.0	70%	15	29
P1-A2	6.4	70%	16	32
P1-A3	1.8	70%	6	12
P1-A4	2.0	70%	7	13
P1-A5	5.7	70%	18	35
P1-A6	2.8	70%	9	18
P1-B (Dev.)	35.5	55%	71	140
P1-B (Un-dev.)	35.5	5%	10	23
P1-C	8.9	70%	31	59
P1-D	31.4	60%	72	142
P1-E1	30.4	50%	66	128
P1-E2	21.8	55%	53	102
P1-F (Dev.)	76.7	35%	125	243
P1-F (Un-dev.)	76.7	5%	22	59
P2-A	24.4	7%	11	37
P2-B	57.8	57%	114	229
P2-B1	2.5	50%	7	13
P2-B10	1.7	70%	6	12
P2-B2	1.9	70%	7	13
P2-B3	2.8	50%	7	14
P2-B4	1.6	70%	6	11
P2-B5	1.9	50%	5	10
P2-B6	1.1	70%	4	8
P2-B7	2.5	25%	3	8
P2-B8	1.2	70%	4	8
P2-B9	2.0	70%	7	14
P2-S1	35.6	50%	82	158
P3-A	52.6	57%	107	213
P3-C	1.7	11%	1	5
P3-S2	11.9	50%	30	59
P4-A	25.8	57%	59	115
P4-B	37.3	60%	97	188
SC-1 +	3.6	8%	2	6
SC-2 +	10.8	8%	6	20
SC-3 +	27.2	8%	12	26
SC-4 +	16.4	8%	8	27
TR-V	2.1	27%	3	7
TR-W	1.4	32%	2	5

+ Basin not changed from pre-development conditions
++ Remaining undeveloped portion of the pre-development Basin

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point (On-Site)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	127	248
DP-2	69	133
DP-3	53	102
DP-4	167	376
DP-5	72	142
DP-6	71	140
DP-7	28	53
DP-8	82	158
DP-9	114	229
DP-10	282	456
DP-11	14	26
DP-12	97	188
DP-13	59	115
DP-14	101	193
DP-15	107	213
DP-16	43	84

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Surface Routing

Design Point	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP4	46	105
DP4A	1	5
DP5	5	23
DP5A	2	9
DP6	59	122
DP6A	7	19
DP7	110	249
DP56	60	160
DPEX-4A	19	50
DPEX-5	12	32

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
HISTORIC EAST FORK BASIN BOUNDARY (NOT USED IN BASIN SIZING)	
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'

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

FOURSQUARE AT STERLING RANCH
PRELIMINARY PLAN / PUD
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	4-1-22
DRAWN BY	MAW	(H) 1"= 200'		SHEET	6 OF 7
CHECKED BY		(V) 1"= N/A		JOB NO.	1183.20

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SEE SHEET 4

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWWM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A ++	60.4	5%	18	50
EX-9 ++	6.0	5%	2	8
EX-9A ++	12.7	5%	4	16
P1-A	12.7	8%	6	19
P1-A1	5.0	70%	15	29
P1-A2	6.4	70%	16	32
P1-A3	1.8	70%	6	12
P1-A4	2.0	70%	7	13
P1-A5	5.7	70%	18	35
P1-A6	2.8	70%	9	18
P1-B (Dev.)	35.5	55%	71	140
P1-B (Un-dev.)	35.5	5%	10	23
P1-C	8.9	70%	31	59
P1-D	31.4	60%	72	142
P1-E1	30.4	50%	66	128
P1-E2	21.8	55%	53	102
P1-F (Dev.)	76.7	35%	125	243
P1-F (Un-dev.)	76.7	5%	22	59
P2-A	24.4	7%	11	37
P2-B	57.8	57%	114	229
P2-B1	2.5	50%	7	13
P2-B10	1.7	70%	6	12
P2-B2	1.9	70%	7	13
P2-B3	2.8	50%	7	14
P2-B4	1.6	70%	6	11
P2-B5	1.9	50%	5	10
P2-B6	1.1	70%	4	8
P2-B7	2.5	25%	3	8
P2-B8	1.2	70%	4	8
P2-B9	2.0	70%	7	14
P2-S1	35.6	50%	82	158
P3-A	52.6	57%	107	213
P3-C	1.7	11%	1	5
P3-S2	11.9	50%	30	59
P4-A	25.8	57%	59	115
P4-B	37.3	60%	97	188
SC-1 +	3.6	8%	2	6
SC-2 +	10.8	8%	6	20
SC-3 +	27.2	8%	12	26
SC-4 +	16.4	8%	8	27
TR-V	2.1	27%	3	7
TR-W	1.4	32%	2	5

+ Basin not changed from pre-development conditions
++ Remaining undeveloped portion of the pre-development Basin

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Surface Routing

Design Point (On-Site)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	127	248
DP-2	69	133
DP-3	53	102
DP-4	167	376
DP-5	72	142
DP-6	71	140
DP-7	28	53
DP-8	82	158
DP-9	114	229
DP-10	282	456
DP-11	14	26
DP-12	97	188
DP-13	59	115
DP-14	101	193
DP-15	107	213
DP-16	43	84

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11	214.3	4%	54	129
EX-13	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3	8%	59	122
EX-9A	21.8	5%	7	19
TR-12	4.7	5%	2	9
TR-20	23.2	7%	10	32
TR-4	4.4	5%	2	9
TR-5	13.7	5%	5	17
TR-6	1.5	5%	1	4
TR-7	2.6	5%	1	5

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area
(Prelim. Plan 1 & Foursquare PUD Only)

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	8%
P1-B	35.5	Un dev.	2%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	Un dev.	2%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	220.9		26%

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Pond FSD-16 Tributary Area
(Full Build Out)

Subcatchment	Area (Ac.)	Avg. Lot size (AC)	Effective Imperv. (%)
P1-A	12.7	N/A	8%
P1-B	35.5	7,500	55%
P1-C	8.9	N/A	70%
P1-D	31.4	6,500	60%
P1-E1	30.4	8,500	50%
P1-E2	21.8	7,500	55%
P1-F	76.7	12,500	35%
TR-V	2.1	17,500	27%
TR-W	1.4	13,500	32%
TOTAL	220.9		46%

POND FSD-16 (EDB)
(FULL BUILD-OUT)

TRIB. AREA = 220.9 AC.
WQCV = 3.60 AC.-FT.
EURV = 7.70 AC.-FT.
100 YR. = 10.26 AC.-FT.
TOTAL = 21.56 AC.-FT.

INFLOW: (SWWM MODEL)
Q5 = 307 CFS
Q100 = 496 CFS

OUTFLOW: (MHFD-DETENTION)
Q5 = 3.6 CFS
Q100 = 117.4 CFS

POND FSD-16 (EDB)
(PRELIM. PLAN 1 & FOURSQUARE PUD)

TRIB. AREA = 220.9 AC.
WQCV = 2.55 AC.-FT.
EURV = 3.04 AC.-FT.
100 YR. = 5.92 AC.-FT.
TOTAL = 11.51 AC.-FT.

INFLOW: (SWWM MODEL)
Q5 = 197 CFS
Q100 = 410 CFS

OUTFLOW: (MHFD-DETENTION)
Q5 = 2.5 CFS
Q100 = 66.0 CFS

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
HISTORIC EAST FORK BASIN BOUNDARY (NOT USED IN BASIN SIZING)	
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

100 50 0 100 200

SCALE: 1" = 100'

SEE SHEET 6

CLASSIC CONSULTING ENGINEERS & SURVEYORS	FOURSQUARE AT STERLING RANCH PRELIMINARY PLAN / PUD		
	PRELIMINARY DRAINAGE REPORT		
	DEVELOPED DRAINAGE MAP		
	DESIGNED BY: MAW	SCALE	DATE: 9-30-22
	DRAWN BY: MAW	(H) 1"= 100'	SHEET 7 OF 7
	CHECKED BY:	(V) 1"= N/A	JOB NO. 1183.20

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

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