



INNOVATIVE DESIGN. CLASSIC RESULTS.

**DRAINAGE LETTER
FOR
STERLING RANCH
SKETCH PLAN AMENDMENT**

Prepared for:
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(719) 785-0790

Job No. 1183.34

PCD Project No. SKP-235



DRAINAGE LETTER FOR STERLING RANCH SKETCH PLAN AMENDMENT

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

12/5/2023

Date

OWNER'S/DEVELOPER'S STATEMENT:

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

Business Name: CLASSIC SRJ LAND, LLC

By:  LOREN J. MORELAND

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.

Joshua Palmer, P.E.
County Engineer, / ECM Administrator

Date

Conditions:



DRAINAGE LETTER FOR STERLING RANCH SKETCH PLAN AMENDMENT

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DRAINAGE LETTER FOR STERLING RANCH SKETCH PLAN AMENDMENT

PURPOSE

The purpose of this Drainage Letter is to address all necessary MDDP level design accommodations based on the latest Sterling Ranch Sketch Plan Amendment related to on-site and off-site drainage patterns and drainage improvements required to minimize impacts to the adjacent properties.

GENERAL DESCRIPTION

The Sterling Ranch Sketch Plan totals 1,444 acres of Planned Unit Development to be built in multiple phases, located in Sections 27, 28, 33 and 34, Township 12 South and Section 4, Township 13 South, range 65 west of the sixth principal meridian. The site is bounded on the north and east by undeveloped land (existing residential properties), to the south by existing platted 5-ac. residential lots (Pawnee Rancheros) and Woodmen Heights developments and to the west by Vollmer Road. The site is in the upper portion of the Sand Creek Drainage Basin. **The proposed Sketch Plan Amendment only affects the residential land-use density of the extreme northeastern portion of the property covering about 217 acres. (See Appendix)**

The existing ground cover is sparse vegetation and open space, typical of Colorado rolling range land condition. In general, the site slopes from north to south within the existing natural drainageways at grades of 1%-4%. The average soil condition reflects Hydrologic Group "A" (Columbine gravelly sandy loam) and 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). Type A soils were used to determine the pre-development conditions however, Type B soils are utilized for developed site conditions as significant import is anticipated for this development.



FLOODPLAIN STATEMENT

No portion of the proposed Sketch Plan Amendment area is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C0535G with effective date of December 7, 2018 (See Appendix).

EXISTING DRAINAGE CONDITIONS

The existing conditions remain unchanged from what was described in the MDDP.

PROPOSED DRAINAGE CONDITIONS

The proposed basins remain unchanged from the MDDP, except for the following:

Basin SC3-25 is a 19-ac. basin with approximately 4.7 ac. lying within the Sterling Ranch property. This 4.7 ac. was originally planned for 5-ac. lot residential use. The Sketch Plan Amendment proposes 2.5-ac. lots in this area. However, the original MDDP used a CN number of 66 for this entire basin, which for the Type “B” soils accounts for 1.5 to 2-ac. residential lots. (Ref. Table 6-10 in DCM Vol. 1 update) Also, the Retreat at TimberRidge Filing No. 3 Final Drainage Report (Basin A) accounts for 2.5-ac. lots. Thus, this remains consistent with the proposed Sketch Plan Amendment.

Basin SC3-21 is a 23.3-ac. on-site basin that was also originally planned for 5-ac. residential lots. The Sketch Plan Amendment proposes both 2.5-ac. and 0.5-ac. lots in this area. However, the original MDDP used a CN number of 66 for this basin, which for the Type “B” soils accounts for 1.5 to 2-ac. residential lots. (Ref. Table 6-10 in DCM Vol. 1 update) The slight increase in developed flows within this basin above and beyond what was originally accounted for in the MDDP will be required to still be detained to the pre-development flows presented in the MDDP at FSD21. Thus, this will then remain consistent with the Final Drainage Reports

approved within the Retreat at TimberRidge Development accounting for pre-development release from this basin. (See Appendix for revised flow quantities and pond sizing)

Basin SC3-23 is a 14.5-ac. on-site basin that was originally planned for 2.5-ac. and 1-ac. residential lots. The Sketch Plan Amendment proposes 3-5 du/ac. residential use in this area. However, the original MDDP used a CN number of 67 for this basin, which for the Type “B” soils accounts for 1-ac. to 1.5-ac. residential lots. (Ref. Table 6-10 in DCM Vol. 1 update) The increase in developed flows within this basin above and beyond what was originally accounted for in the MDDP will be required to still be detained to the pre-development flows presented in the MDDP at FSD23. Thus, this will then remain consistent with the Final Drainage Reports approved within the Retreat at TimberRidge Development accounting for pre-development release from this basin. (See Appendix for revised flow quantities and pond sizing)

Basin SC3-16A is a 168.1-ac. on-site basin that was originally planned for 0.5-ac. and 3-5 du/ac. residential lots. The Sketch Plan Amendment proposes 3-5 du/ac residential use in this area. However, the original MDDP used a CN number of 74 for this basin, which for the Type “B” soils accounts for 1/3-ac. to 1/4-ac. residential lots. (Ref. Table 6-10 in DCM Vol. 1 update) Also, the recently approved MDDP/PDR for Sterling Ranch East Preliminary Plan No. 1 (Basins P1-A thru P1-F) account for medium density residential use within the SWMM Model for this same basin area. Thus, the proposed Sketch Plan Amendment within this basin will remain consistent with the most recently approved report for this area and the planned FSD-16 pond. (See Appendix for reference material)

Basin SCE-1 is a 64.4-ac. on-site basin that was originally planned for 5-ac., 2.5-ac. and 1-ac. residential lots. The Sketch Plan Amendment proposes 2.5-ac., 0.5-ac. and 3-5 du/ac. residential lots in this area. The original MDDP used a CN number of 65 for this basin, which for the Type “B” soils accounts for 2.0-ac. residential lots. (Ref. Table 6-10 in DCM Vol. 1 update) The increase in developed flows within this basin above and beyond what was originally



accounted for in the MDDP will be required to still be detained to the pre-development flows presented in the MDDP at FSDE1. (See Appendix for revised flow quantities and pond sizing)

Basin SCE-2 is a 15-ac. on-site basin that was originally planned for open space/buffer corridor adjacent to the 5-ac., 2.5-ac. and 1-ac. residential lots. The Sketch Plan Amendment continues to propose the same open space/buffer corridor adjacent to 2.5-ac. and 0.5-ac. residential lots. Thus, the proposed Sketch Plan Amendment continues to remain consistent with the original MDDP.

Unresolved:

Discuss impact to storm sewer system and trunk main in the basin from the increased density. State the change in peak flows at DP1E.

Basin SCE-3 is a 67.5-ac. on-site basin that was originally planned for open space/buffer corridor adjacent to the 0.5-ac. and 3-5 du/ac. residential lots. The Sketch Plan Amendment continues to propose the same open space/buffer corridor adjacent to 3-5 du/ac residential lots. The original MDDP used a CN number of 70 for this basin, which for the Type “B” soils accounts for 0.5-ac. residential lots. (Ref. Table 6-10 in DCM Vol. 1 update) The increase in developed flows within this basin above and beyond what was originally accounted for in the MDDP will also be required to still be detained to the pre-development flows presented in the MDDP at FSD-E2. (See Appendix for revised flow quantities and pond sizing)

DRAINAGE CONDITION COMPARISON

The following table represents a comparison between the previously planned conditions in the latest MDDP vs. the proposed conditions as presented on the Sketch Plan Amendment:

BASIN FLOW COMPARISON SUMMARY												
Basin	Existing MDDP flows (cfs)						Revised MDDP flows per Sketch Plan Amend. (cfs)					
	(HEC-HMS Methodology)						(Rational Method)					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SC3-21	7.0	10.8	16.3	23.7	30.4	37.5	4.7	10.3	17.5	26.4	33.5	42.2
SC3-23	5.5	8.3	12.4	18.0	23.0	28.4	10.2	15.6	21.2	27.8	33.9	40.7
SCE-1	23.3	35.9	53.8	79.1	102.4	127.4	22.5	40.6	61.9	87.6	109.3	134.9
SCE-3	30.6	45.2	65.9	93.3	118.0	143.9	40.1	61.5	83.5	109.4	133.3	159.8

Please note that the above table compares HEC-HMS methodology vs. Rational methodology. Thus, while there is a proposed increase in density, it may not always reflect an increase in flow, especially in the smaller storm events.



DRAINAGE DESIGN 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. Revised on-site developed basin design used for detention/SWQ basin sizing was calculated using the Rational Method. Runoff Coefficients are based on the imperviousness of the particular land use and the hydrologic soil type in accordance with Table 6-6 and 6-10. The average rainfall intensity, by recurrence interval found in the Intensity-Duration-Frequency (IDF) curves in Figure 6-5. Mile High Flood District (MHFD)-Detention spreadsheet Ver. 4.06 used for Preliminary Detention/SWQ design. (See Appendix)

SUMMARY

The proposed Sketch Plan Amendment remains consistent with the pre-development drainage conditions accounting for the increased density and revised developed flows contained within and the future construction of the required upsized FSD pond facilities. The developer for this area will be responsible for design and installation of all required full spectrum detention facilities and any downstream conveyance facilities. Any such facilities will be constructed as development occurs. 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 latest El Paso County Drainage Criteria requirements.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC



Marc A. Whorton, P.E.
Project Manager

Unresolved:
Include a section on the timing and responsibility for design and construction of detention facilities and downstream conveyance facilities.

maw/118334/SKPAmend Letter.doc



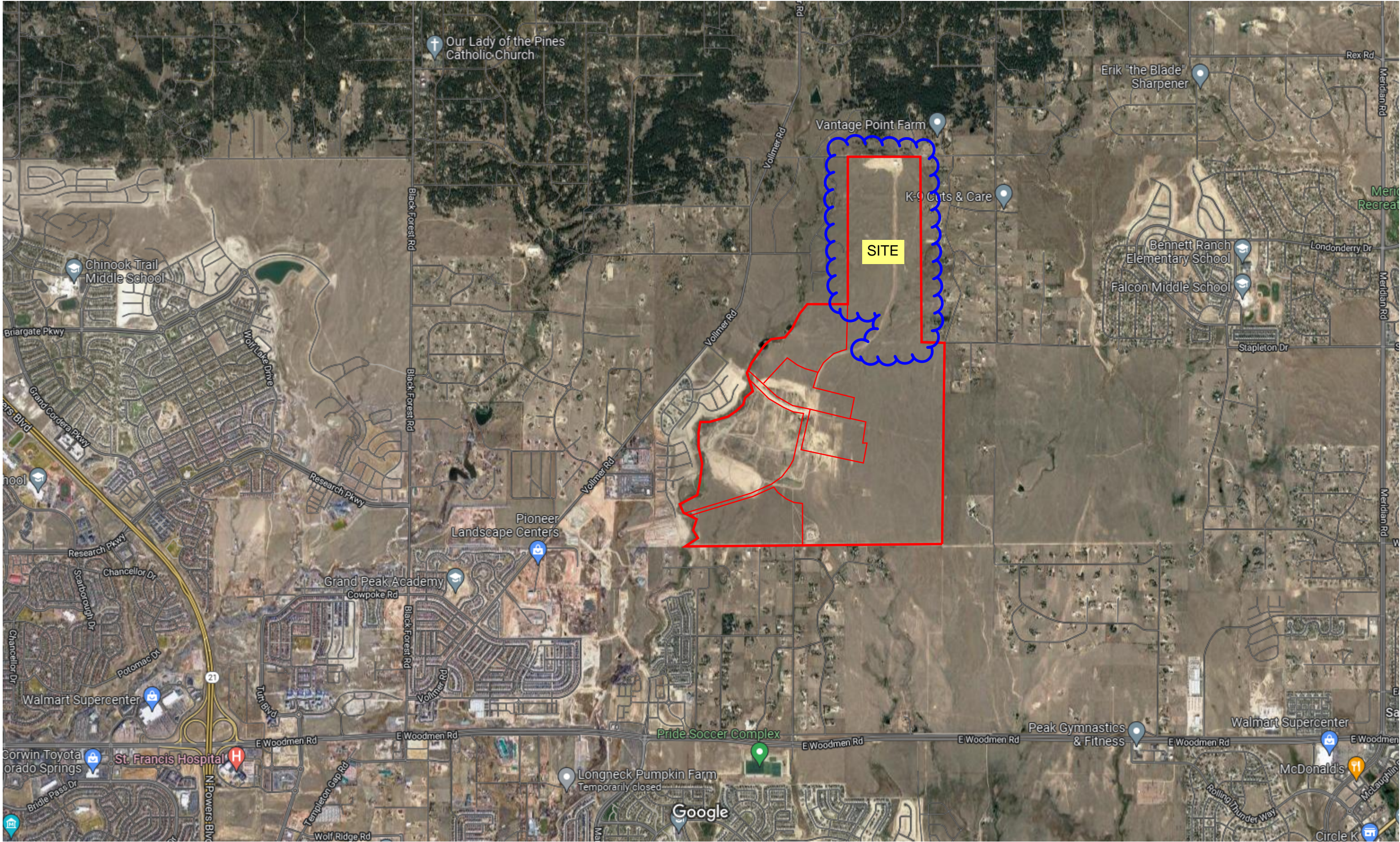
REFERENCES

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, approved September 2022
7. "Final Drainage Report for Retreat at TimberRidge Filing No. 3", Classic Consulting, dated December 2022
8. "Final Design Report for Sand Creek Restoration", JR Engineering, LLC, dated June 2023
9. "Drainage Letter for Sterling Ranch Road and Briargate Pkwy. Interim Plan", prepared by JR Engineering, LLC, dated June 2023
10. "Master Development Drainage Plan Amendment for Sterling Ranch", prepared by JR Engineering, LLC, dated July 2023
11. "Sterling Ranch MDDP Amendment No. 2 & Preliminary Drainage Report for Sterling Ranch East Preliminary Plan No. 1", prepared by Classic Consulting, approved January 2023



APPENDIX

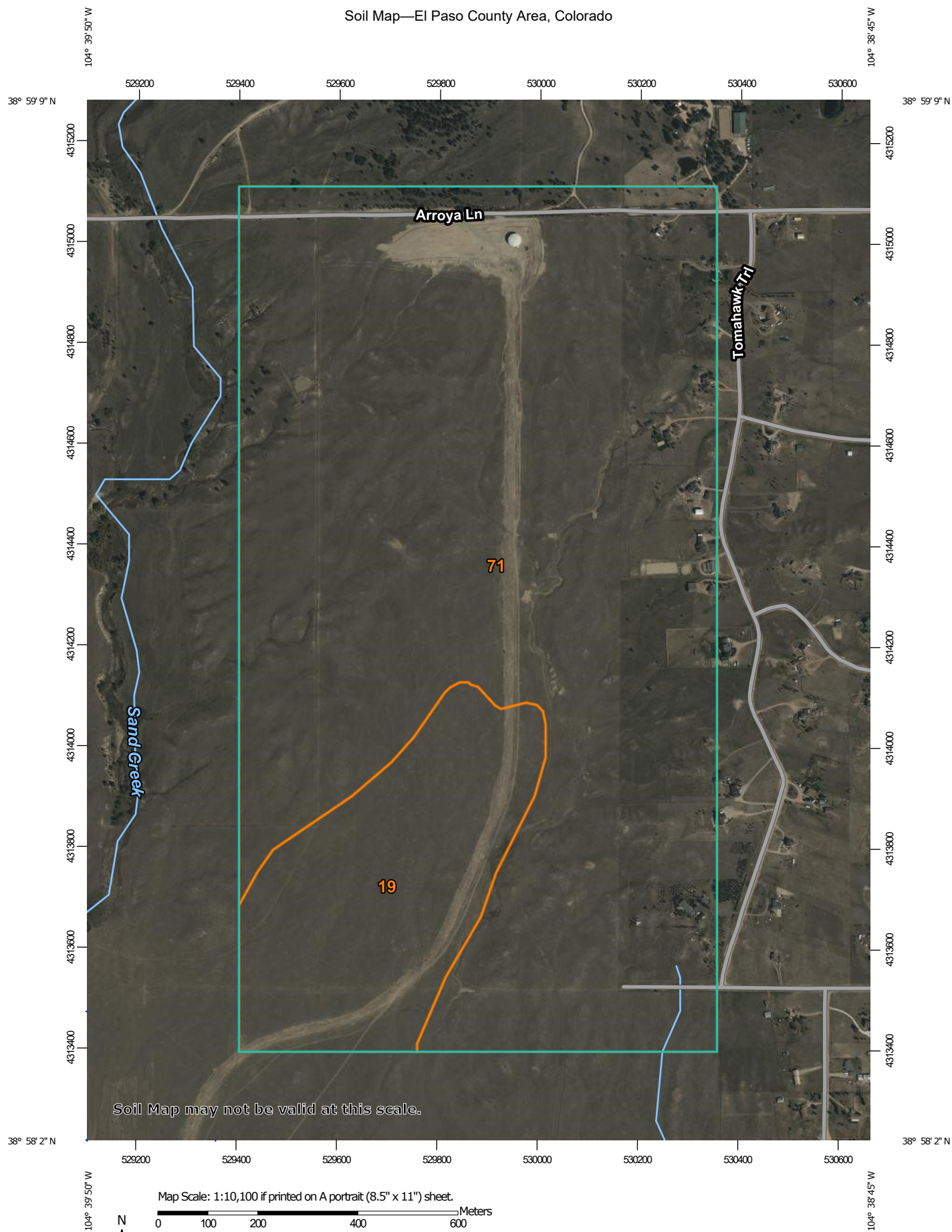
VICINITY MAP



VICINITY MAP

SOILS MAP (S.C.S SURVEY)

Soil Map—El Paso County Area, Colorado




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 20, Sep 2, 2022

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
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	67.7	16.7%
71	Pring coarse sandy loam, 3 to 8 percent slopes	337.9	83.3%
Totals for Area of Interest		405.7	100.0%

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: Fans, fan terraces, flood plains

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 20, Sep 2, 2022

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k

Elevation: 6,800 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pring

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam

C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High
(2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: R048AY222CO - Loamy Park

Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 20, Sep 2, 2022

F.E.M.A. MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSM-C-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov/>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

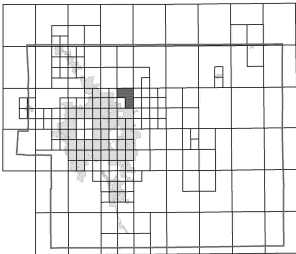
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.

LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY 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 dewatered. 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**
- 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.
- ZONE D** Areas determined to be outside the 0.2% annual chance floodplain. 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.
- 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)

- Cross section line
- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile

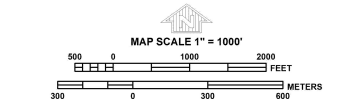
MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2016 - 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.



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:

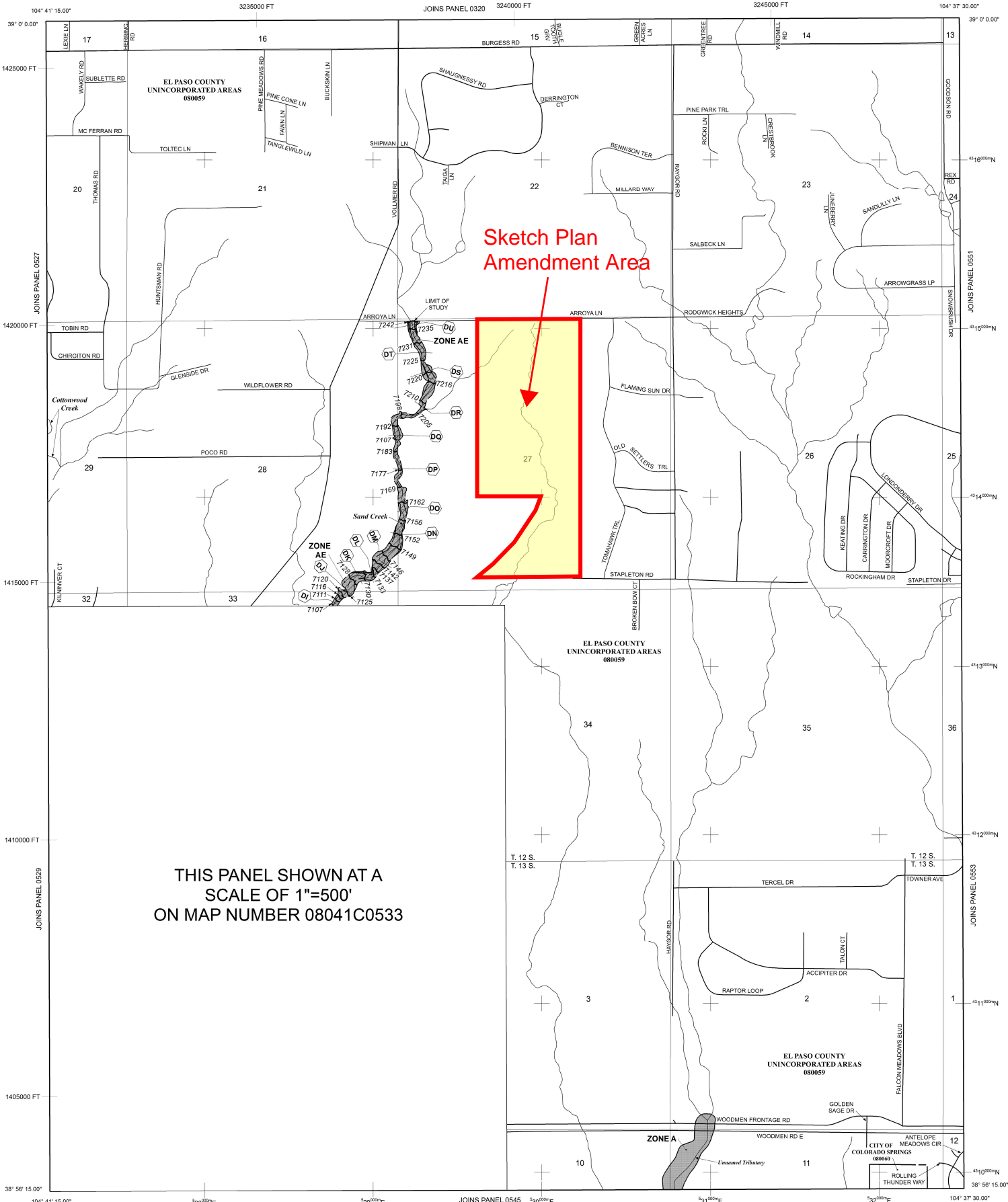
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	08060	0535	G
EL PASO COUNTY	08059	0535	G

Notice to User: The Map Number shown below should be used when playing map sections. 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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

SKETCH PLAN DOCUMENTS

LAND USE LEGEND:

44 AC. RESIDENTIAL: 0.2 DU/AC	9 D.U.
33 AC. RESIDENTIAL: 0.4 DU/AC	13 D.U.
35 AC. RESIDENTIAL: 1 DU/AC	35 D.U.
163 AC. RESIDENTIAL: 2 DU/AC	326 D.U.
790 AC. RESIDENTIAL: 3-5 DU/AC	3,642 D.U.
86 AC. RESIDENTIAL: 5-8 DU/AC	600 D.U.
47 AC. MIXED USE 8-25 DU/AC	600 D.U.
57 AC. ELEMENTARY / K-8 SCHOOL	
18 AC. NEIGHBORHOOD PARK	
25 AC. COMMUNITY PARK	
62 AC. OPEN SPACE / PARK / GREENWAY	
43 AC. OPEN SPACE / BUFFER	
9 AC. UTILITY PARCEL	
5 AC. INDUSTRIAL	

TOTAL: 1,444 AC TOTAL: 5,225 D.U. Max
 * COMMERCIAL / MULTIFAMILY UP TO 25 DU/AC

LEGAL DESCRIPTION:

THE WEST HALF OF THE WEST HALF OF THE EAST HALF AND EAST HALF OF THE WEST HALF AND THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 27; THE EAST HALF OF THE SOUTHEAST QUARTER AND THAT PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER LYING SOUTH AND EAST OF THE COUNTY ROAD KNOWN AS VOLLMER ROAD, OF SECTION 28; THE WEST HALF OF THE EAST HALF AND THE WEST HALF OF SECTION 34; THE EAST HALF AND THE EAST HALF OF THE SOUTHWEST QUARTER AND THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 33, AND ALL THAT PART OF THE NORTHWEST QUARTER OF SECTION 33 LYING SOUTH AND EAST OF THE COUNTY ROAD KNOWN AS VOLLMER ROAD, EXCEPT THAT PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SAID SECTION 33 LYING SOUTH AND EAST OF SAID COUNTY ROAD AS DEEDED TO COLORADO INTERSTATE GAS COMPANY BY WARRANTY DEED RECORDED IN BOOK 1173 AT PAGE 359; AND THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER AND THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER LYING SOUTHEAST OF THE COUNTY ROAD KNOWN AS VOLLMER ROAD, OF SECTION 32, EXCEPT THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 32 DEEDED TO J. MARCUS BROWN BY TRUSTEES' DEED RECORDED IN BOOK 3392 AT PAGE 168, ALL IN TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO. ALL THAT PORTION OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 28, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO LYING SOUTH AND EAST OF THE COUNTY ROAD (VOLLMER ROAD), ALSO: THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 4, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, LYING SOUTHERLY OF AN EXISTING EAST-WEST FENCE AS DESCRIBED IN SPECIAL WARRANTY DEED RECORDED DECEMBER 23, 2004 AT RECEPTION NO. 204209417, COUNTY OF EL PASO, STATE OF COLORADO, ALSO: THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 32, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., LYING SOUTHEASTLY OF THE PUBLIC ROAD KNOWN AS VOLLMER ROAD, EL PASO COUNTY, COLORADO, AND CONTAINING 1443.695 ACRES MORE OR LESS.

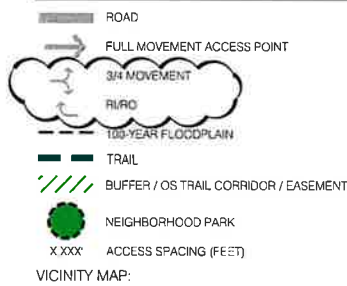
OWNERS:

SR LAND, LLC
 20 BOULDER CRESCENT STREET, SUITE 102
 COLORADO SPRINGS, CO 80903-3300

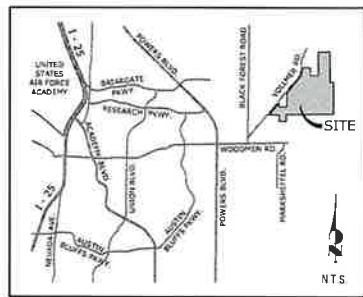
CLASSIC SRJ LAND, LLC
 2138 FLYING HORSE CLUB DRIVE
 COLORADO SPRINGS, CO 80921

CHALLENGER COMMUNITIES, LLC
 8605 EXPLORER DRIVE, SUITE 250
 COLORADO SPRINGS, CO 80920-1013

SYMBOL LEGEND:



VICINITY MAP:



Overall Development Dwelling Unit Table

	Homestead Filing #1 SF 04-029	Branding Iron Filing #1 SF-06-017	Homestead Filing #2 SF-19-004	Branding Iron Filing #2 SF-19-018	Sterling Ranch Filing #2 SF-20-015	Total Entitled Units	Remaining Developable Units	Maximum Dwelling Units
Dwelling Units	72	51	104	75	49	351	4874	5225

ROAD CLASSIFICATION TABLE

Roadway	Existing	2040 MTCP	2050 MTCP/CPP	Sterling Ranch Proposed
Vollmer Road	2 Lane Collector - 100'	4 Lane Minor - 100'	4 Lane Minor - 100'	4 Lane Minor - 100'
Briargate Parkway	4 Lane Principal - 130'	4 Lane Principal - 130'	4 Lane Principal - 130'	4 Lane Principal - 130'
Banning Lewis Ranch Parkway	4 Lane Principal - 130'	4 Lane Principal - 130'	4 Lane Principal - 130'	4 Lane Principal - 130'

STERLING RANCH SKETCH PLAN AMENDMENT

RR-5 VACANT

Land Planning
Landscape
Architecture
Urban Design

NES

N.E.S., Inc.
 619 N. Cascade Avenue, Suite 200
 Colorado Springs, CO 80903

Tel. 719.471.0073
 Fax 719.471.0267

www.nescolorado.com

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STERLING RANCH SKETCH PLAN AMENDMENT

MORLEY-BENTLEY INVESTMENTS, LLC.

DATE: OCTOBER 28, 2007
 PROJECT NO: 1 MAYNARD/2 BOWEN
 PREPARED BY: J. KUNDELIN SWIFT

AMENDMENT

DATE	BY	DESCRIPTION
05.22.2009	ALX	APPROVED SKETCH PLAN PER COUNTY - NOV. 2009
12.05.2016	BI	APPROVED SKETCH PLAN AMENDMENT - DEC. 2016
07.01.2022	BI	SKETCH PLAN AMENDMENT - DEC. 2022
08.30.2022	AL	SKETCH PLAN AMENDMENT - DEC. 2022

Conditions of Approval:

- Applicant has provided an updated traffic impact study which limits the maximum dwelling units to 5,000 with this 2022 amendment.
- The MDDP and Traffic Study shall be resubmitted for approval prior to the approval of a plat east of the Sand Creek Channel.

This sketch plan amendment (in part) for Sterling Ranch was approved for filing by the El Paso County Planning and Community Development Department Director on the day of the month of the year as indicated by the signature and date. All conditions of approval and limitations apply.

Planning and Community Development Director

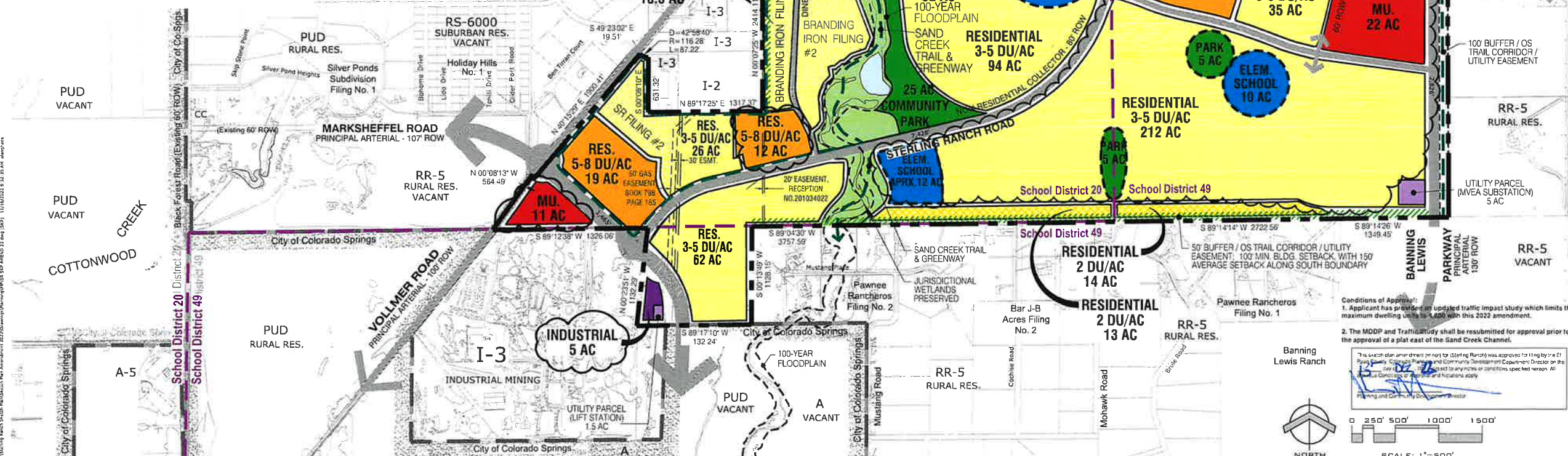
0 250' 500' 1000' 1500'

SCALE: 1"=500'

1

OF 1

SKP 22-004



LAND USE LEGEND:

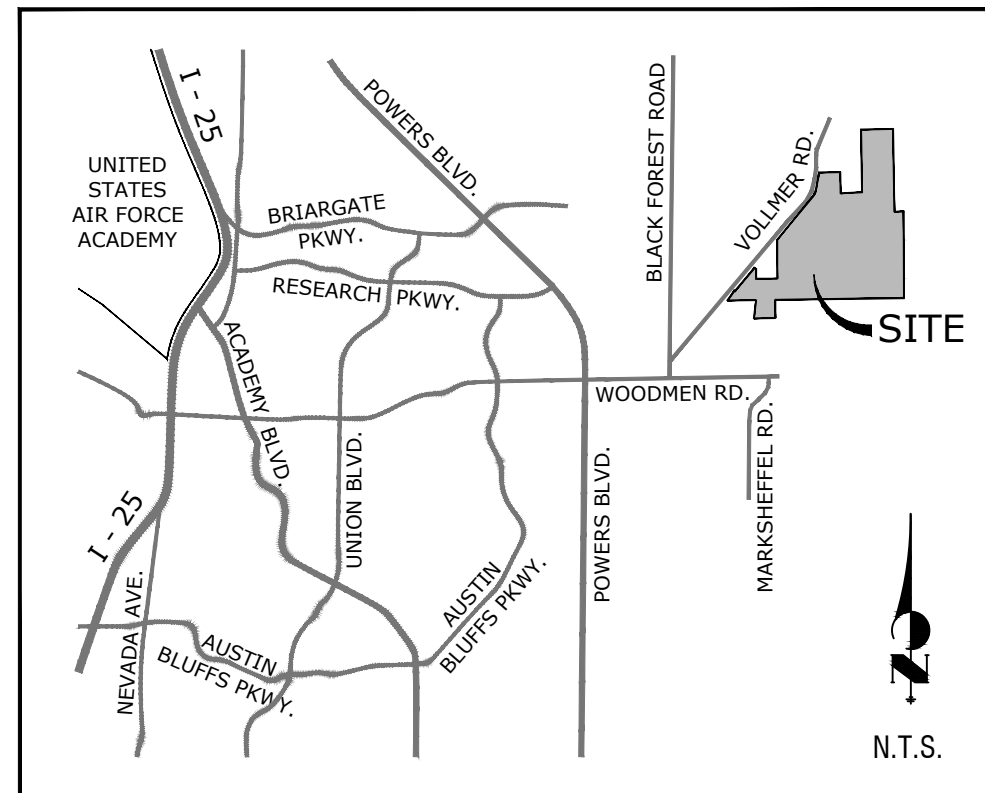
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43 AC. OPEN SPACE / BUFFER	
9 AC. UTILITY PARCEL	
5 AC. INDUSTRIAL	

TOTAL: 1,444 AC. TOTAL: 4,800 D.U. Max
* COMMERCIAL/ MULTIFAMILY UP TO 25 DU/AC

SYMBOL LEGEND:

ROAD
FULL MOVEMENT ACCESS POINT
3/4 MOVEMENT
RI/RO
100-YEAR FLOODPLAIN
TRAIL
BUFFER / OS TRAIL CORRIDOR / EASEMENT
NEIGHBORHOOD PARK
X,XXX' ACCESS SPACING (FEET)

VICINITY MAP:



LEGAL DESCRIPTION:

THE WEST HALF OF THE WEST HALF OF THE EAST HALF AND EAST HALF OF THE WEST HALF AND THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 27; THE EAST HALF OF THE SOUTHEAST QUARTER AND THAT PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER LYING SOUTH AND EAST OF THE COUNTY ROAD KNOWN AS VOLLMER ROAD, OF SECTION 28; THE WEST HALF OF THE EAST HALF AND THE WEST HALF OF SECTION 34; THE EAST HALF AND THE EAST HALF OF THE SOUTHWEST QUARTER AND THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 33, AND ALL THAT PART OF THE NORTHWEST QUARTER OF SECTION 33 LYING SOUTH AND EAST OF THE COUNTY ROAD KNOWN AS VOLLMER ROAD, EXCEPT THAT PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SAID SECTION 33 LYING SOUTH AND EAST OF SAID COUNTY ROAD AS DEEDED TO COLORADO INTERSTATE GAS COMPANY BY WARRANTY DEED RECORDED IN BOOK 1173 AT PAGE 359; AND THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER AND THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER LYING SOUTHEAST OF THE COUNTY ROAD KNOWN AS VOLLMER ROAD, OF SECTION 32, EXCEPT THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 32 DEEDED TO J. MARCUS BROWN BY TRUSTEE'S DEED RECORDED IN BOOK 3292 AT PAGE 168; ALL IN TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO, ALL THAT PORTION OF THE NORTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 28, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO LYING SOUTH AND EAST OF THE COUNTY ROAD (VOLLMER ROAD), ALSO: THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 4, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, LYING SOUTHERLY OF AN EXISTING EAST- WEST FENCE AS DESCRIBED IN SPECIAL WARRANTY DEED RECORDED DECEMBER 23, 2004 AT RECEPTION NO. 204209417, COUNTY OF EL PASO, STATE OF COLORADO, ALSO: THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 32, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M., LYING SOUTHEASTERLY OF THE PUBLIC ROAD KNOWN AS VOLLMER ROAD, EL PASO COUNTY, COLORADO, AND CONTAINING 1443.695 ACRES MORE OR LESS.

OWNERS:

SR LAND, LLC,
20 BOULDER CRESCENT STREET, SUITE 102
COLORADO SPRINGS, CO 80903-3300

CLASSIC SRJ LAND, LLC
2138 FLYING HORSE CLUB DRIVE
COLORADO SPRINGS, CO 80921

CHALLENGER COMMUNITIES, LLC,
8605 EXPLORER DRIVE, SUITE 250
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Overall Development Dwelling Unit Table

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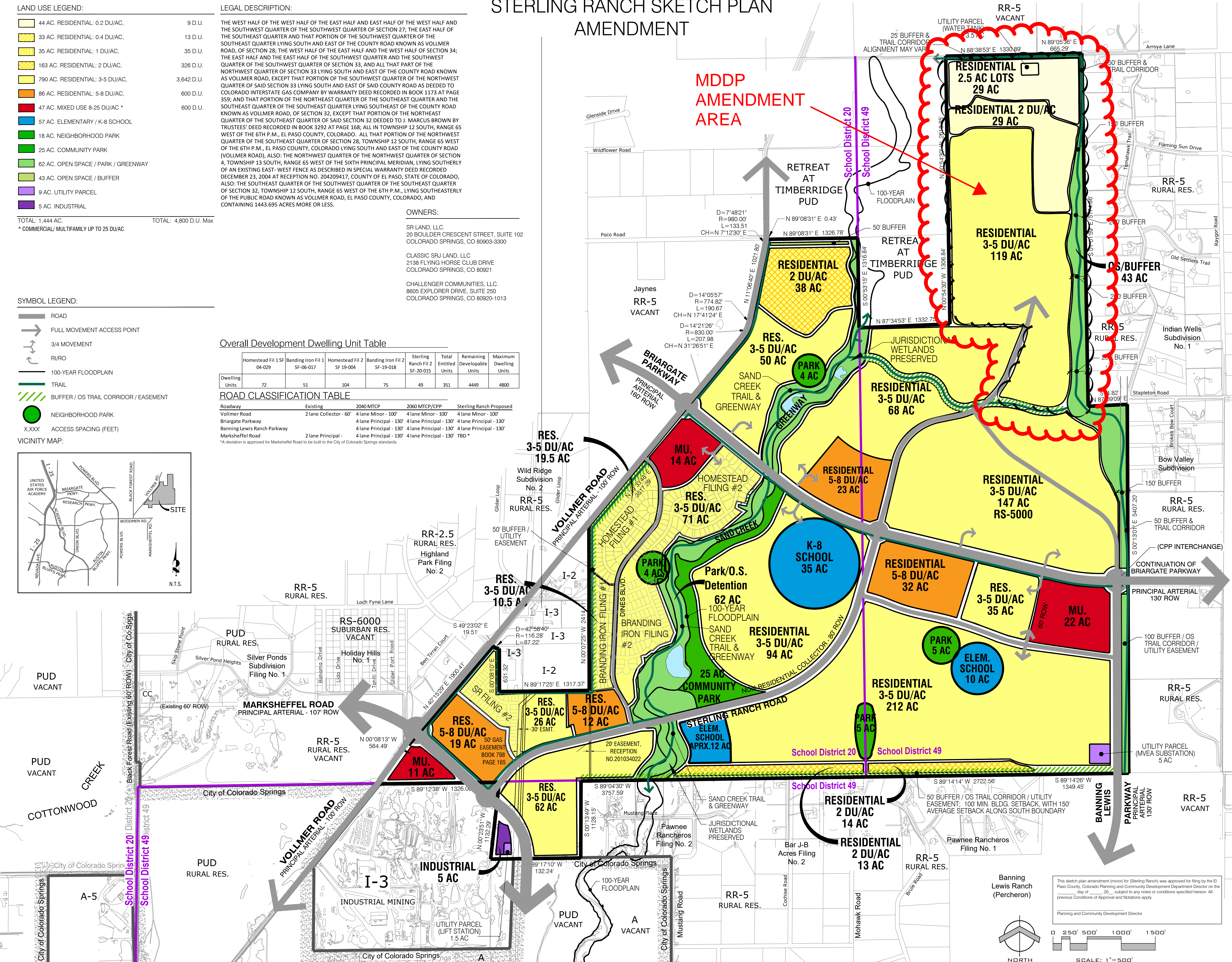
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Briargate Parkway	2 lane Principal - 130'	4 lane Principal - 130'	4 lane Principal - 130'	4 lane Principal - 130'
Banning Lewis Ranch Parkway	2 lane Principal - 130'	4 lane Principal - 130'	4 lane Principal - 130'	4 lane Principal - 130'
Marksheffel Road	2 lane Principal - 130'	4 lane Principal - 130'	4 lane Principal - 130'	TBD **

*A deviation is approved for Marksheffel Road to be built to the City of Colorado Springs standards.

STERLING RANCH SKETCH PLAN AMENDMENT

MDDP AMENDMENT AREA



Land Planning
Landscape Architecture
Urban Design

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STERLING RANCH

SKETCH PLAN AMENDMENT

MORLEY-BENTLEY INVESTMENTS, LLC.

AMENDMENT

DATE	BY	DESCRIPTION
05.22.2009	JLK	APPROVED SKETCH PLAN COUNTY - NOV. 21
12.05.2018	BI	APPROVED SKETCH PLAN AMENDMENT - DEC. 20
07.01.2022	BI	SKETCH PLAN AMENDMENT - DEC. 20
08.30.2022	AL	SKETCH PLAN AMENDMENT - DEC. 20
06.28.2023	JS	SKETCH PLAN AMENDMENT - DEC. 20

1
OF 1

HYDROLOGIC CALCULATIONS

JOB NAME:
JOB NUMBER:
DATE:
CALCULATED BY:

DRAINAGE LETTER FOR STERLING RANCH SKETCH PLAN AMENDMENT
T183.34
08/22/23
MAW

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	C VALUE DCM TABLE 6-6									C VALUE DCM TABLE 6-6								C VALUE DCM TABLE 6-6								WEIGHTED "C" VALUE							WEIGHTED CA						WEIGHTED IMP.	
		LAND USE	PERCENT IMP.	AREA (AC)	C(2)	C(5)	C(10)	C(25)	C(50)	C(100)	LAND USE	PERCENT IMP.	AREA (AC)	C(2)	C(5)	C(10)	C(25)	C(50)	C(100)	LAND USE	PERCENT IMP.	AREA (AC)	C(2)	C(5)	C(10)	C(25)	C(50)	C(100)	C(2)	C(5)	C(10)	C(25)	C(50)	C(100)	CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	CA(100)	PERCENT
SC3-21	23.3	0.5-AC. RURAL RES.	25.0%	10.00	0.15	0.22	0.30	0.37	0.41	0.46	2.5-AC. RURAL RES.	10.0%	13.30	0.06	0.14	0.22	0.31	0.36	0.40									0.10	0.17	0.25	0.34	0.38	0.43	2.30	4.06	5.93	7.82	8.82	9.92	16.4%	
SC3-23	14.5	5 DU/AC. RES.	46.3%	14.50	0.28	0.34	0.39	0.45	0.49	0.52																	0.28	0.34	0.39	0.45	0.49	0.52	3.99	4.89	5.69	6.53	7.07	7.58	46.3%		
SCE-1	64.4	0.5-AC. RURAL RES.	25.0%	20.00	0.15	0.22	0.30	0.37	0.41	0.46	2.5-AC. RURAL RES.	10.0%	22.40	0.06	0.14	0.22	0.31	0.36	0.40	5 DU/AC. RES.	46.3%	22.00	0.28	0.34	0.39	0.45	0.49	0.52	0.16	0.23	0.30	0.38	0.42	0.46	10.39	14.96	19.56	24.24	26.88	29.66	27.0%
SCE-3	67.5	5 DU/AC. RES.	46.3%	67.50	0.28	0.34	0.39	0.45	0.49	0.52																	0.28	0.34	0.39	0.45	0.49	0.52	18.56	22.78	26.49	30.38	32.91	35.27	46.3%		

JOB NAME: **DRAINAGE LETTER FOR STERLING RANCH SKETCH PLAN AMENDMENT**
 JOB NUMBER: **1183.34**
 DATE: **03/28/03**
 CALC'D BY: **MAW**

Return Period	1-Hour Depth
2	1.19
5	1.50
10	1.75
25	2.00
50	2.25
100	2.52

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S^{0.33}}$$

$$V = C_v S_w^{0.5} \quad T_c = L/V$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)* $t_c = \frac{L}{180} + 10$	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

*For buried riprap, select C_v value based on type of vegetative cover.

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED						OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY						TOTAL FLOWS					
	CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(2) (in/hr)	I(5) (in/hr)	I(10) (in/hr)	I(25) (in/hr)	I(50) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)	Q(10) (cfs)	Q(25) (cfs)	Q(50) (cfs)	Q(100) (cfs)
SC3-21	2.30	4.06	5.93	7.82	8.82	9.92	0.17	300	10	19.5	700	1.5%	1.2	9.5	29.0	2.03	2.53	2.96	3.38	3.80	4.25	4.7	10.3	17.5	26.4	33.5	42.2
SC3-23	3.99	4.89	5.69	6.53	7.07	7.58	0.34	100	2	11.0	1300	2.0%	2.8	7.7	18.6	2.56	3.20	3.73	4.26	4.80	5.37	10.2	15.6	21.2	27.8	33.9	40.7
SCE-1	10.39	14.96	19.56	24.24	26.88	29.66	0.23	300	14	16.3	800	2.0%	1.4	9.4	25.7	2.17	2.71	3.16	3.61	4.07	4.55	22.5	40.6	61.9	87.6	109.3	134.9
SCE-3	18.56	22.78	26.49	30.38	32.91	35.27	0.34	100	2	11.0	2200	1.5%	2.4	15.0	25.9	2.16	2.70	3.15	3.60	4.05	4.53	40.1	61.5	83.5	109.4	133.3	159.8

BASIN FLOW COMPARISON SUMMARY

	Existing MDDP flows (cfs)							Revised MDDP flows per Sketch Plan Amend. (cfs)					
	(HEC-HMS Methodology)							(Rational Method)					
Basin	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SC3-21	7.0	10.8	16.3	23.7	30.4	37.5		4.7	10.3	17.5	26.4	33.5	42.2
SC3-23	5.5	8.3	12.4	18.0	23.0	28.4		10.2	15.6	21.2	27.8	33.9	40.7
SCE-1	23.3	35.9	53.8	79.1	102.4	127.4		22.5	40.6	61.9	87.6	109.3	134.9
SCE-3	30.6	45.2	65.9	93.3	118.0	143.9		40.1	61.5	83.5	109.4	133.3	159.8

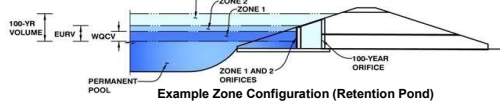
STORMWATER QUALITY / BMP CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD21**



Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	23.30	acres
Watershed Length =	1,200	ft
Watershed Length to Centroid =	600	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	16.40%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
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.

Water Quality Capture Volume (WQCV) =	0.194	acre-feet
Excess Urban Runoff Volume (EURV) =	0.374	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.434	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.836	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	1.224	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.876	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	2.335	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.980	acre-feet
500-yr Runoff Volume (P1 = 3.48 in.) =	4.849	acre-feet
Approximate 2-yr Detention Volume =	0.251	acre-feet
Approximate 5-yr Detention Volume =	0.378	acre-feet
Approximate 10-yr Detention Volume =	0.650	acre-feet
Approximate 25-yr Detention Volume =	0.833	acre-feet
Approximate 50-yr Detention Volume =	0.879	acre-feet
Approximate 100-yr Detention Volume =	1.098	acre-feet

Optional User Overrides

		acre-feet
		acre-feet
	1.19	inches
	1.50	inches
	1.75	inches
	2.00	inches
	2.25	inches
	2.52	inches
	3.48	inches

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.194	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.180	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.724	acre-feet
Total Detention Basin Volume =	1.098	acre-feet
Initial Surge Volume (ISV) =	100	ft ³
Initial Surge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H _{total}) =	5.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.010	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (L _{LW}) =	2	

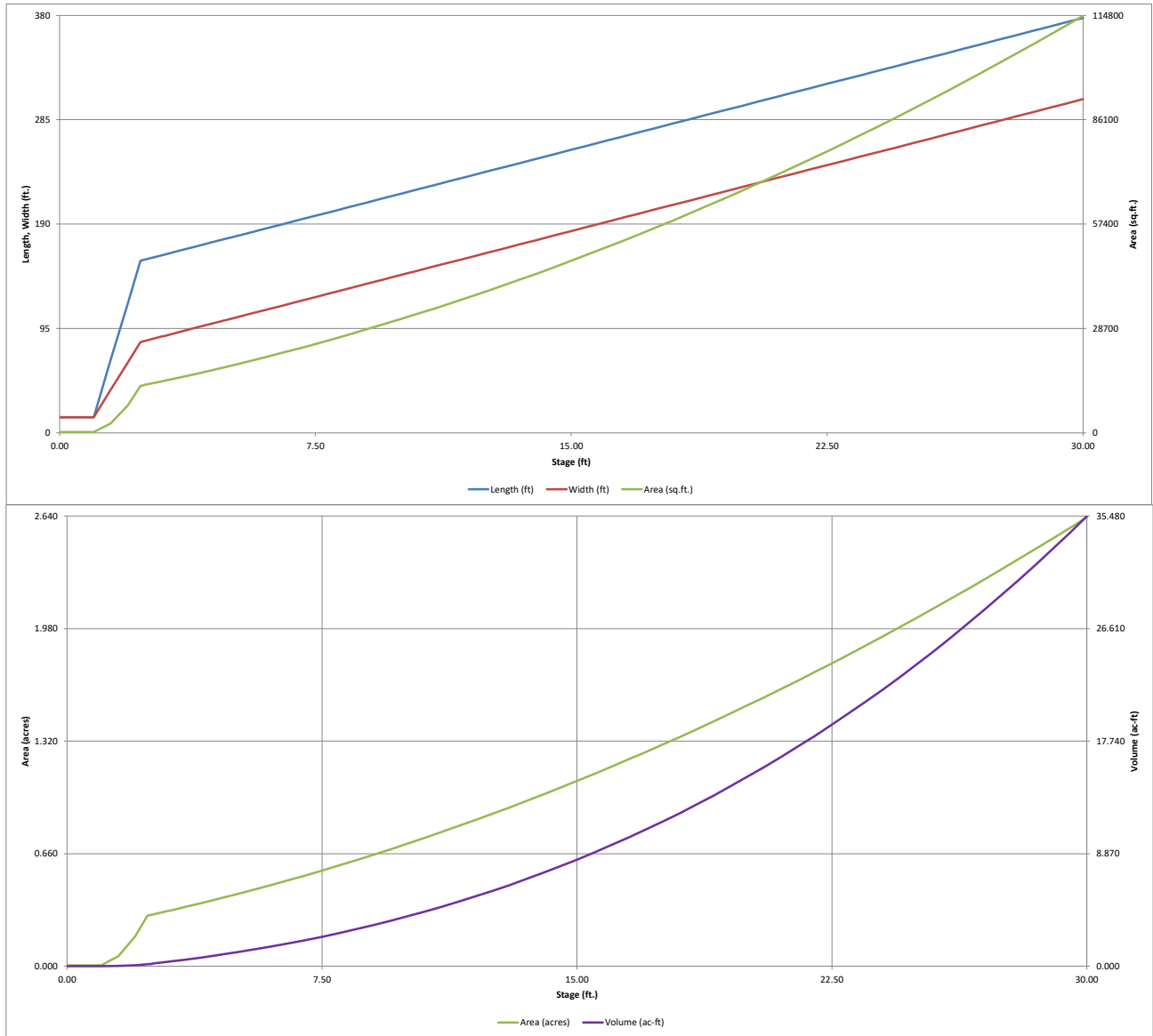
Initial Surge Area (A _{ISV}) =	200	ft ²
Surcharge Volume Length (L _{ISV}) =	14.1	ft
Surcharge Volume Width (W _{ISV}) =	14.1	ft
Depth of Basin Floor (H _{FLOOR}) =	1.37	ft
Length of Basin Floor (L _{FLOOR}) =	156.6	ft
Width of Basin Floor (W _{FLOOR}) =	82.6	ft
Area of Basin Floor (A _{FLOOR}) =	12,944	ft ²
Volume of Basin Floor (V _{FLOOR}) =	6,737	ft ³
Depth of Main Basin (H _{MAIN}) =	2.63	ft
Length of Main Basin (L _{MAIN}) =	177.7	ft
Width of Main Basin (W _{MAIN}) =	103.7	ft
Area of Main Basin (A _{MAIN}) =	18,420	ft ²
Volume of Main Basin (V _{MAIN}) =	41,032	ft ³
Calculated Total Basin Volume (V _{total}) =	1.101	acre-feet

Depth Increment = 0.50 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		14.1	14.1	200		0.005		
ISV	0.50		14.1	14.1	200		0.005	100	0.002
	1.00		14.1	14.1	200		0.005	200	0.005
	1.50		66.1	39.1	2,589		0.059	789	0.018
	2.00		118.1	64.1	7,578		0.174	3,222	0.074
Floor	2.37		156.6	82.6	12,944		0.297	6,975	0.160
Zone 1 (WQCV)	2.49		157.6	83.6	13,174		0.302	8,542	0.196
	2.50		157.7	83.7	13,194		0.303	8,674	0.199
	3.00		161.7	87.7	14,175		0.325	15,515	0.356
Zone 2 (EURV)	3.06		162.1	88.2	14,295		0.328	16,369	0.376
	3.50		165.7	91.7	15,188		0.349	22,854	0.525
	4.00		169.7	95.7	16,234		0.373	30,708	0.705
	4.50		173.7	99.7	17,311		0.397	39,093	0.897
Zone 3 (100-year)	4.99		177.6	103.6	18,398		0.422	47,840	1.098
	5.00		177.7	103.7	18,420		0.423	48,024	1.102
	5.50		181.7	107.7	19,562		0.449	57,519	1.320
	6.00		185.7	111.7	20,735		0.476	67,592	1.552
	6.50		189.7	115.7	21,941		0.504	78,259	1.797
	7.00		193.7	119.7	23,178		0.532	89,537	2.055
	7.50		197.7	123.7	24,447		0.561	101,442	2.329
	8.00		201.7	127.7	25,749		0.591	113,990	2.617
	8.50		205.7	131.7	27,082		0.622	127,196	2.920
	9.00		209.7	135.7	28,447		0.653	141,077	3.239
	9.50		213.7	139.7	29,845		0.685	155,649	3.573
	10.00		217.7	143.7	31,274		0.718	170,927	3.924
	10.50		221.7	147.7	32,736		0.752	186,929	4.291
	11.00		225.7	151.7	34,229		0.786	203,668	4.676
	11.50		229.7	155.7	35,754		0.821	221,163	5.077
	12.00		233.7	159.7	37,312		0.857	239,428	5.497
	12.50		237.7	163.7	38,901		0.893	258,480	5.934
	13.00		241.7	167.7	40,522		0.930	278,334	6.390
	13.50		245.7	171.7	42,176		0.968	299,008	6.864
	14.00		249.7	175.7	43,861		1.007	320,515	7.358
	14.50		253.7	179.7	45,579		1.046	342,874	7.871
	15.00		257.7	183.7	47,328		1.086	366,099	8.404
	15.50		261.7	187.7	49,109		1.127	390,207	8.958
	16.00		265.7	191.7	50,923		1.169	415,214	9.532
	16.50		269.7	195.7	52,768		1.211	441,135	10.127
	17.00		273.7	199.7	54,645		1.254	467,987	10.744
	17.50		277.7	203.7	56,555		1.298	495,786	11.382
	18.00		281.7	207.7	58,496		1.343	524,548	12.042
	18.50		285.7	211.7	60,470		1.388	554,288	12.725
	19.00		289.7	215.7	62,475		1.434	585,022	13.430
	19.50		293.7	219.7	64,512		1.481	616,768	14.159
	20.00		297.7	223.7	66,582		1.529	649,540	14.911
	20.50		301.7	227.7	68,683		1.577	683,355	15.688
	21.00		305.7	231.7	70,816		1.626	718,229	16.488
	21.50		309.7	235.7	72,982		1.675	754,177	17.314
	22.00		313.7	239.7	75,179		1.726	791,216	18.164
	22.50		317.7	243.7	77,409		1.777	829,361	19.040
	23.00		321.7	247.7	79,670		1.829	868,630	19.941
	23.50		325.7	251.7	81,963		1.882	909,037	20.869
	24.00		329.7	255.7	84,289		1.935	950,598	21.823
	24.50		333.7	259.7	86,646		1.989	993,331	22.804
	25.00		337.7	263.7	89,035		2.044	1,037,250	23.812
	25.50		341.7	267.7	91,457		2.100	1,082,371	24.848
	26.00		345.7	271.7	93,910		2.156	1,128,712	25.912
	26.50		349.7	275.7	96,396		2.213	1,176,287	27.004
	27.00		353.7	279.7	98,913		2.271	1,225,113	28.125
	27.50		357.7	283.7	101,462		2.329	1,275,205	29.275
	28.00		361.7	287.7	104,044		2.389	1,326,581	30.454
	28.50		365.7	291.7	106,657		2.449	1,379,254	31.663
	29.00		369.7	295.7	109,302		2.509	1,433,243	32.903
	29.50		373.7	299.7	111,980		2.571	1,488,562	34.173
	30.00		377.7	303.7	114,689		2.633	1,545,228	35.474

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

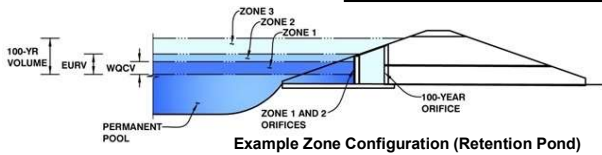


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD21**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.49	0.194	Orifice Plate
Zone 2 (EURV)	3.06	0.180	Orifice Plate
Zone 3 (100-year)	4.99	0.724	Weir&Pipe (Restrict)
Total (all zones)		1.098	

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 = ft²
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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.10	2.20					
Orifice Area (sq. inches)	0.70	0.73	0.73					

	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)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

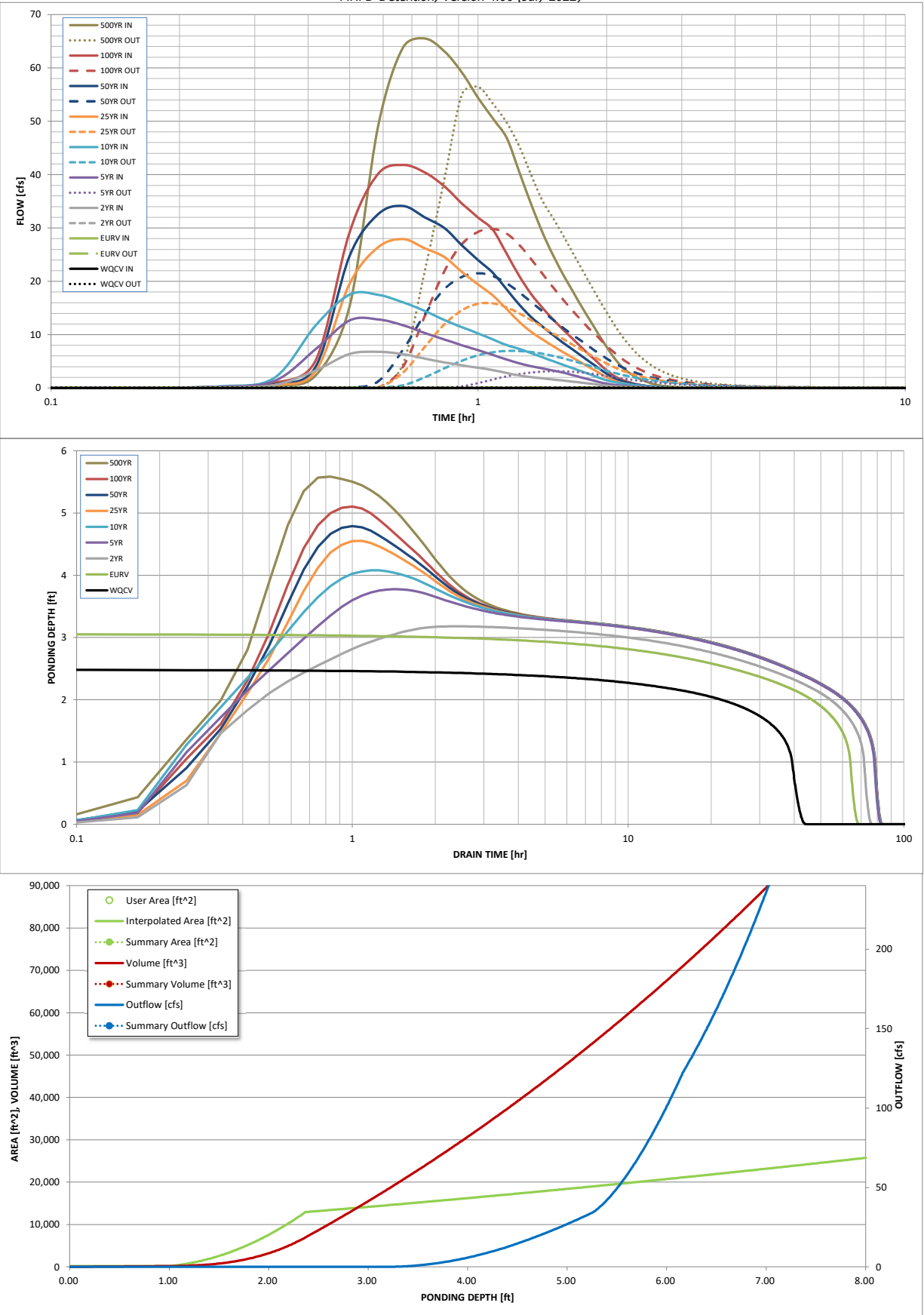
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
One-Hour Rainfall Depth (in) =	0.194	0.374	0.434	0.836	1.224	1.876	2.335	2.980	4.849
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.434	0.836	1.224	1.876	2.335	2.980	4.849
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.3	9.1	13.6	24.0	30.1	37.7	60.8
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.39	0.59	1.03	1.29	1.62	2.61
Peak Inflow Q (cfs) =	N/A	N/A	6.8	12.9	17.5	27.9	34.1	41.8	65.5
Peak Outflow Q (cfs) =	0.1	0.1	0.1	3.1	7.0	15.9	21.5	29.8	56.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.5	0.7	0.7	0.8	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.4	1.0	1.3	1.8	2.7
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	62	69	72	69	65	62	58	47
Time to Drain 99% of Inflow Volume (hours) =	41	65	72	77	76	74	73	71	67
Maximum Ponding Depth (ft) =	2.49	3.06	3.18	3.78	4.08	4.55	4.79	5.10	5.58
Area at Maximum Ponding Depth (acres) =	0.30	0.33	0.33	0.36	0.38	0.40	0.41	0.43	0.45
Maximum Volume Stored (acre-ft) =	0.196	0.376	0.415	0.621	0.731	0.917	1.015	1.145	1.357

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	0.02	0.00	0.09
	0:15:00	0.00	0.00	0.15	0.25	0.31	0.21	0.26	0.26	0.43
	0:20:00	0.00	0.00	0.56	1.31	1.91	0.55	0.69	0.95	2.35
	0:25:00	0.00	0.00	3.31	7.28	11.73	3.18	3.98	5.16	15.36
	0:30:00	0.00	0.00	6.40	12.66	17.50	19.55	24.78	29.18	49.07
	0:35:00	0.00	0.00	6.80	12.88	17.49	26.37	32.56	40.16	63.80
	0:40:00	0.00	0.00	6.35	11.77	16.06	27.90	34.11	41.81	65.52
	0:45:00	0.00	0.00	5.53	10.31	14.46	26.21	32.02	40.43	63.14
	0:50:00	0.00	0.00	4.83	9.12	12.76	24.57	30.01	37.82	59.16
	0:55:00	0.00	0.00	4.27	8.03	11.41	21.77	26.74	34.58	54.42
	1:00:00	0.00	0.00	3.81	7.10	10.24	19.42	24.01	31.97	50.49
	1:05:00	0.00	0.00	3.37	6.20	9.11	17.35	21.57	29.63	46.88
	1:10:00	0.00	0.00	2.82	5.34	8.04	14.79	18.49	25.18	40.35
	1:15:00	0.00	0.00	2.37	4.62	7.32	12.36	15.57	20.92	34.34
	1:20:00	0.00	0.00	2.06	4.09	6.54	10.51	13.28	17.58	29.06
	1:25:00	0.00	0.00	1.82	3.66	5.74	9.08	11.48	14.99	24.81
	1:30:00	0.00	0.00	1.60	3.26	5.01	7.82	9.90	12.82	21.23
	1:35:00	0.00	0.00	1.40	2.89	4.34	6.70	8.48	10.93	18.08
	1:40:00	0.00	0.00	1.20	2.42	3.71	5.68	7.19	9.19	15.22
	1:45:00	0.00	0.00	1.01	1.97	3.11	4.71	5.98	7.57	12.54
	1:50:00	0.00	0.00	0.82	1.54	2.53	3.78	4.81	6.05	10.03
	1:55:00	0.00	0.00	0.62	1.14	1.95	2.89	3.71	4.64	7.72
	2:00:00	0.00	0.00	0.45	0.83	1.47	2.06	2.67	3.32	5.68
	2:05:00	0.00	0.00	0.33	0.61	1.13	1.39	1.85	2.28	4.07
	2:10:00	0.00	0.00	0.25	0.48	0.90	0.97	1.32	1.61	2.96
	2:15:00	0.00	0.00	0.20	0.37	0.72	0.70	0.96	1.13	2.15
	2:20:00	0.00	0.00	0.16	0.30	0.57	0.50	0.70	0.79	1.54
	2:25:00	0.00	0.00	0.12	0.23	0.44	0.37	0.52	0.54	1.08
	2:30:00	0.00	0.00	0.10	0.18	0.34	0.27	0.38	0.35	0.74
	2:35:00	0.00	0.00	0.07	0.14	0.25	0.19	0.27	0.23	0.49
	2:40:00	0.00	0.00	0.06	0.10	0.19	0.14	0.20	0.16	0.35
	2:45:00	0.00	0.00	0.05	0.08	0.14	0.11	0.15	0.13	0.26
	2:50:00	0.00	0.00	0.04	0.06	0.10	0.08	0.11	0.10	0.20
	2:55:00	0.00	0.00	0.03	0.04	0.08	0.06	0.09	0.08	0.16
	3:00:00	0.00	0.00	0.02	0.03	0.06	0.05	0.07	0.06	0.12
	3:05:00	0.00	0.00	0.01	0.02	0.04	0.03	0.05	0.04	0.09
	3:10:00	0.00	0.00	0.01	0.01	0.03	0.02	0.03	0.03	0.06
	3:15:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.04
	3:20:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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.

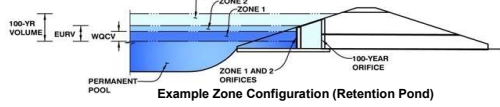
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD23**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB
Watershed Area =	14.50 acres
Watershed Length =	1,050 ft
Watershed Length to Centroid =	500 ft
Watershed Slope =	0.035 ft/ft
Watershed Imperviousness =	46.30% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input

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

Water Quality Capture Volume (WQCV) =	0.237 acre-feet
Excess Urban Runoff Volume (EURV) =	0.713 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.665 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.964 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	1.228 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.592 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	1.883 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.255 acre-feet
500-yr Runoff Volume (P1 = 3.48 in.) =	3.422 acre-feet
Approximate 2-yr Detention Volume =	0.534 acre-feet
Approximate 5-yr Detention Volume =	0.737 acre-feet
Approximate 10-yr Detention Volume =	0.988 acre-feet
Approximate 25-yr Detention Volume =	1.089 acre-feet
Approximate 50-yr Detention Volume =	1.139 acre-feet
Approximate 100-yr Detention Volume =	1.284 acre-feet

Optional User Overrides

	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.48	inches

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.237 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.476 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.570 acre-feet
Total Detention Basin Volume =	1.284 acre-feet
Initial Surge Volume (ISV) =	100 ft ³
Initial Surge Depth (ISD) =	0.50 ft
Total Available Detention Depth (H _{total}) =	5.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.010 ft/ft
Slopes of Main Basin Sides (S _{main}) =	4 H:V
Basin Length-to-Width Ratio (L _W) =	2

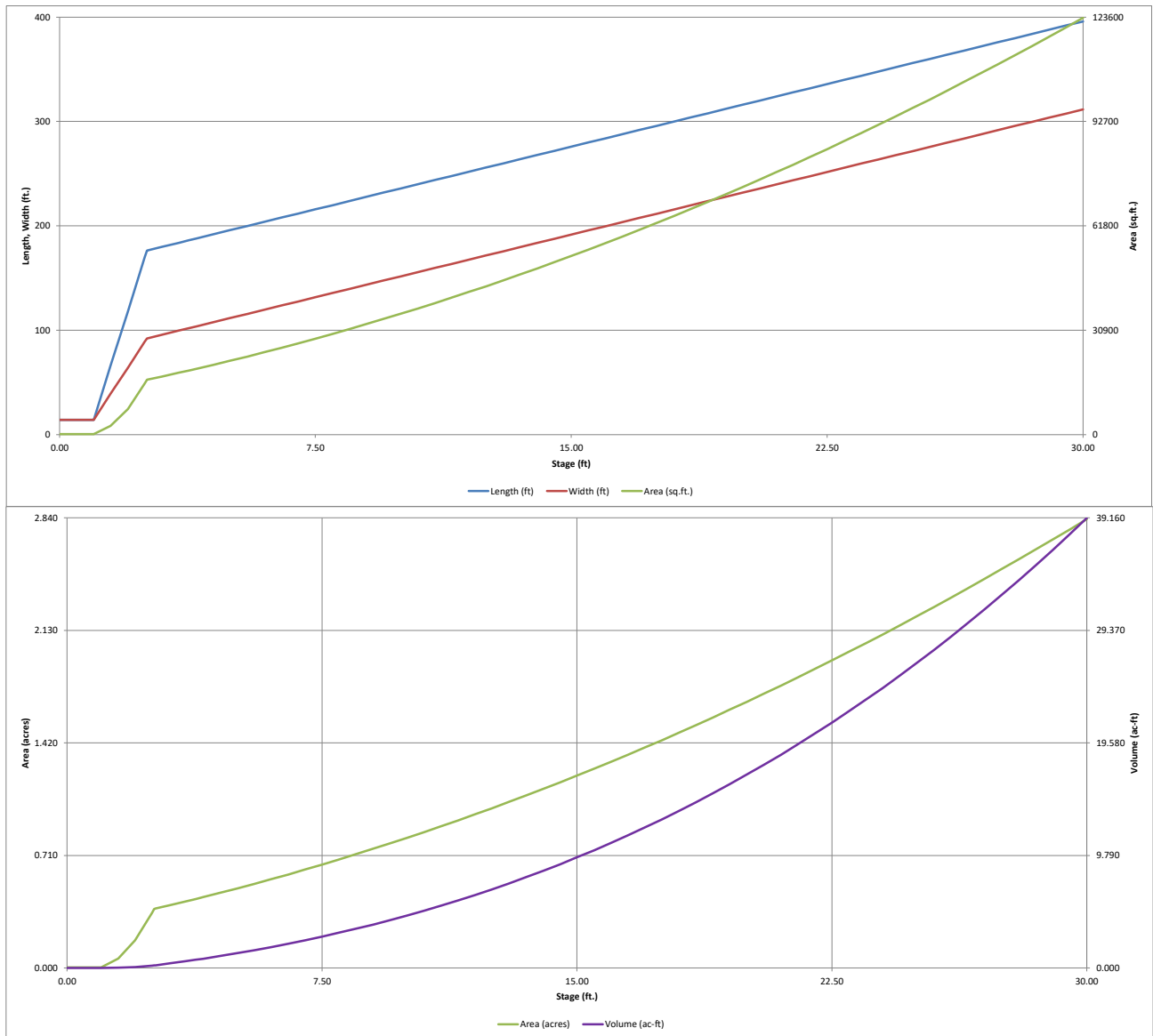
Initial Surge Area (A _{ISV}) =	200 ft ²
Surcharge Volume Length (L _{ISV}) =	14.1 ft
Surcharge Volume Width (W _{ISV}) =	14.1 ft
Depth of Basin Floor (H _{FLOOR}) =	1.56 ft
Length of Basin Floor (L _{FLOOR}) =	176.4 ft
Width of Basin Floor (W _{FLOOR}) =	92.1 ft
Area of Basin Floor (A _{FLOOR}) =	16,252 ft ²
Volume of Basin Floor (V _{FLOOR}) =	9,493 ft ³
Depth of Main Basin (H _{MAIN}) =	2.44 ft
Length of Main Basin (L _{MAIN}) =	195.9 ft
Width of Main Basin (W _{MAIN}) =	111.7 ft
Area of Main Basin (A _{MAIN}) =	21,875 ft ²
Volume of Main Basin (V _{MAIN}) =	46,346 ft ³
Calculated Total Basin Volume (V _{total}) =	1.286 acre-feet

Depth Increment = 0.50 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		14.1	14.1	200		0.005		
ISV	0.50		14.1	14.1	200		0.005	100	0.002
	1.00		14.1	14.1	200		0.005	200	0.005
	1.50		66.1	39.1	2,589		0.059	789	0.018
	2.00		118.1	64.1	7,578		0.174	3,222	0.074
	2.50		170.1	89.1	15,167		0.348	8,800	0.202
Floor	2.56		176.4	92.1	16,252		0.373	9,743	0.224
Zone 1 (WQCV)	2.60		176.7	92.5	16,338		0.375	10,394	0.239
	3.00		179.9	95.7	17,210		0.395	17,103	0.393
	3.50		183.9	99.7	18,328		0.421	25,986	0.597
Zone 2 (EURV)	3.78		186.1	101.9	18,968		0.435	31,208	0.716
	4.00		187.9	103.7	19,478		0.447	35,437	0.814
	4.50		191.9	107.7	20,661		0.474	45,470	1.044
Zone 3 (100-year)	5.00		195.9	111.7	21,875		0.502	56,103	1.288
	5.50		199.9	115.7	23,121		0.531	67,350	1.546
	6.00		203.9	119.7	24,399		0.560	79,229	1.819
	6.50		207.9	123.7	25,710		0.590	91,755	2.106
	7.00		211.9	127.7	27,052		0.621	104,944	2.409
	7.50		215.9	131.7	28,426		0.653	118,812	2.728
	8.00		219.9	135.7	29,832		0.685	133,375	3.062
	8.50		223.9	139.7	31,271		0.718	148,650	3.413
	9.00		227.9	143.7	32,741		0.752	164,651	3.780
	9.50		231.9	147.7	34,243		0.786	181,396	4.164
	10.00		235.9	151.7	35,777		0.821	198,900	4.566
	10.50		239.9	155.7	37,344		0.857	217,179	4.986
	11.00		243.9	159.7	38,942		0.894	236,249	5.424
	11.50		247.9	163.7	40,572		0.931	256,126	5.880
	12.00		251.9	167.7	42,234		0.970	276,826	6.355
	12.50		255.9	171.7	43,929		1.008	298,366	6.850
	13.00		259.9	175.7	45,655		1.048	320,761	7.364
	13.50		263.9	179.7	47,413		1.088	344,026	7.898
	14.00		267.9	183.7	49,203		1.130	368,179	8.452
	14.50		271.9	187.7	51,026		1.171	393,235	9.027
	15.00		275.9	191.7	52,880		1.214	419,210	9.624
	15.50		279.9	195.7	54,766		1.257	446,120	10.242
	16.00		283.9	199.7	56,685		1.301	473,982	10.881
	16.50		287.9	203.7	58,635		1.346	502,810	11.543
	17.00		291.9	207.7	60,617		1.392	532,622	12.227
	17.50		295.9	211.7	62,631		1.438	563,433	12.935
	18.00		299.9	215.7	64,678		1.485	595,258	13.665
	18.50		303.9	219.7	66,756		1.533	628,115	14.420
	19.00		307.9	223.7	68,866		1.581	662,020	15.198
	19.50		311.9	227.7	71,008		1.630	696,987	16.001
	20.00		315.9	231.7	73,183		1.680	733,033	16.828
	20.50		319.9	235.7	75,389		1.731	770,175	17.681
	21.00		323.9	239.7	77,627		1.782	808,427	18.559
	21.50		327.9	243.7	79,897		1.834	847,807	19.463
	22.00		331.9	247.7	82,200		1.887	888,330	20.393
	22.50		335.9	251.7	84,534		1.941	930,012	21.350
	23.00		339.9	255.7	86,900		1.995	972,869	22.334
	23.50		343.9	259.7	89,298		2.050	1,016,917	23.345
	24.00		347.9	263.7	91,729		2.106	1,062,173	24.384
	24.50		351.9	267.7	94,191		2.162	1,108,651	25.451
	25.00		355.9	271.7	96,685		2.220	1,156,369	26.547
	25.50		359.9	275.7	99,211		2.278	1,205,342	27.671
	26.00		363.9	279.7	101,770		2.336	1,255,586	28.824
	26.50		367.9	283.7	104,360		2.396	1,307,117	30.007
	27.00		371.9	287.7	106,982		2.456	1,359,951	31.220
	27.50		375.9	291.7	109,636		2.517	1,414,104	32.463
	28.00		379.9	295.7	112,323		2.579	1,469,593	33.737
	28.50		383.9	299.7	115,041		2.641	1,526,432	35.042
	29.00		387.9	303.7	117,791		2.704	1,584,639	36.378
	29.50		391.9	307.7	120,573		2.768	1,644,229	37.746
	30.00		395.9	311.7	123,388		2.833	1,705,218	39.146

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

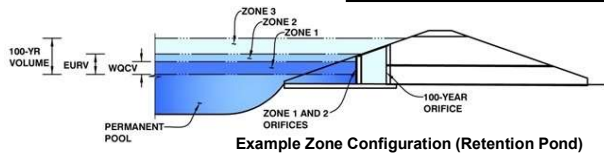


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD23**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.60	0.237	Orifice Plate
Zone 2 (EURV)	3.78	0.476	Orifice Plate
Zone 3 (100-year)	5.00	0.570	Weir&Pipe (Restrict)
Total (all zones)		1.284	

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 = ft²
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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.26	2.52					
Orifice Area (sq. inches)	0.60	1.40	3.00					

	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)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

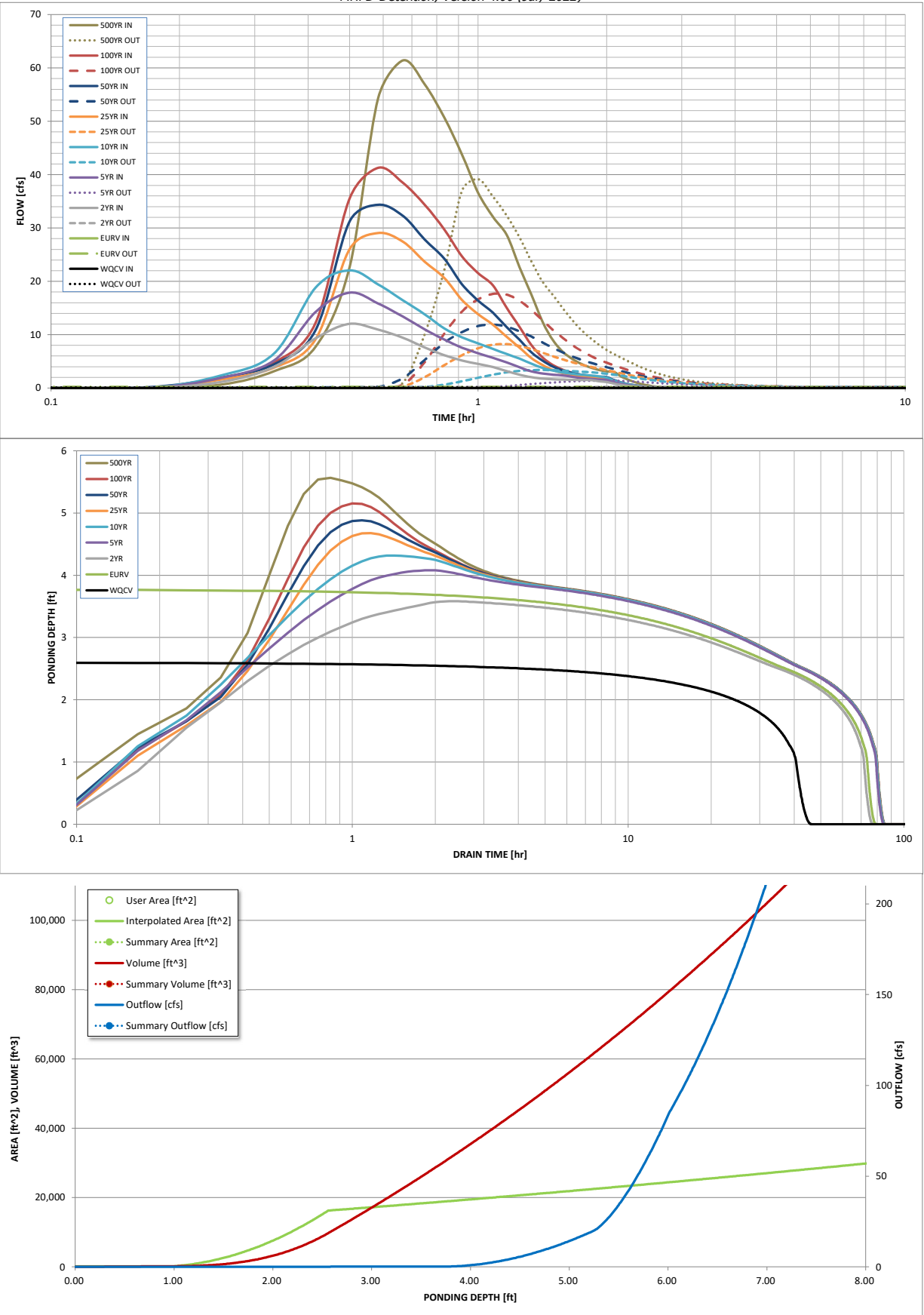
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
One-Hour Rainfall Depth (in) =	0.237	0.713	0.665	0.964	1.228	1.592	1.883	2.255	3.422
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.665	0.964	1.228	1.592	1.883	2.255	3.422
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.9	5.4	8.0	14.2	17.8	22.3	36.0
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.37	0.56	0.98	1.23	1.54	2.48
Peak Inflow Q (cfs) =	N/A	N/A	12.0	17.9	22.1	29.1	34.4	41.3	61.4
Peak Outflow Q (cfs) =	0.1	0.2	0.2	1.4	3.4	8.2	11.9	17.6	39.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.4	0.6	0.7	0.8	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.2	0.5	0.7	1.1	1.7
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	66	72	70	68	67	65	59
Time to Drain 99% of Inflow Volume (hours) =	42	72	71	77	76	75	75	74	71
Maximum Ponding Depth (ft) =	2.60	3.78	3.58	4.08	4.32	4.68	4.89	5.15	5.57
Area at Maximum Ponding Depth (acres) =	0.38	0.44	0.42	0.45	0.46	0.48	0.50	0.51	0.53
Maximum Volume Stored (acre-ft) =	0.239	0.716	0.630	0.849	0.955	1.125	1.228	1.364	1.578

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	0.13	0.01	0.65
	0:15:00	0.00	0.00	1.16	1.90	2.35	1.58	1.96	1.93	3.16
	0:20:00	0.00	0.00	4.00	5.23	6.53	3.86	4.48	4.82	7.72
	0:25:00	0.00	0.00	9.34	14.27	18.82	9.17	10.89	12.22	22.70
	0:30:00	0.00	0.00	12.02	17.89	22.05	26.03	31.23	35.52	54.28
	0:35:00	0.00	0.00	10.94	15.87	19.44	29.07	34.36	41.29	61.42
	0:40:00	0.00	0.00	9.44	13.38	16.45	27.44	32.27	38.46	56.91
	0:45:00	0.00	0.00	7.62	11.01	13.82	23.66	27.82	34.35	50.71
	0:50:00	0.00	0.00	6.18	9.09	11.18	20.66	24.26	29.73	43.79
	0:55:00	0.00	0.00	5.19	7.58	9.52	16.53	19.46	24.69	36.62
	1:00:00	0.00	0.00	4.51	6.54	8.38	13.86	16.40	21.54	32.08
	1:05:00	0.00	0.00	3.93	5.64	7.34	11.88	14.12	19.25	28.72
	1:10:00	0.00	0.00	3.17	4.81	6.37	9.58	11.42	15.02	22.65
	1:15:00	0.00	0.00	2.50	3.88	5.52	7.57	9.05	11.46	17.52
	1:20:00	0.00	0.00	2.03	3.12	4.56	5.62	6.70	8.06	12.37
	1:25:00	0.00	0.00	1.77	2.72	3.77	4.29	5.12	5.70	8.88
	1:30:00	0.00	0.00	1.65	2.51	3.27	3.35	3.99	4.28	6.73
	1:35:00	0.00	0.00	1.58	2.37	2.92	2.77	3.28	3.42	5.40
	1:40:00	0.00	0.00	1.54	2.09	2.67	2.39	2.80	2.83	4.47
	1:45:00	0.00	0.00	1.51	1.88	2.50	2.14	2.50	2.43	3.85
	1:50:00	0.00	0.00	1.49	1.73	2.38	1.98	2.29	2.15	3.41
	1:55:00	0.00	0.00	1.28	1.61	2.20	1.87	2.15	1.97	3.13
	2:00:00	0.00	0.00	1.13	1.48	1.95	1.80	2.06	1.90	3.00
	2:05:00	0.00	0.00	0.82	1.08	1.40	1.30	1.49	1.37	2.15
	2:10:00	0.00	0.00	0.59	0.76	0.99	0.92	1.05	0.98	1.53
	2:15:00	0.00	0.00	0.41	0.54	0.69	0.65	0.74	0.69	1.09
	2:20:00	0.00	0.00	0.29	0.36	0.48	0.45	0.51	0.48	0.75
	2:25:00	0.00	0.00	0.19	0.24	0.32	0.30	0.34	0.32	0.50
	2:30:00	0.00	0.00	0.13	0.16	0.22	0.21	0.24	0.22	0.34
	2:35:00	0.00	0.00	0.07	0.10	0.13	0.13	0.15	0.14	0.22
	2:40:00	0.00	0.00	0.04	0.06	0.07	0.07	0.08	0.08	0.12
	2:45:00	0.00	0.00	0.02	0.02	0.03	0.03	0.04	0.03	0.05
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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	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.

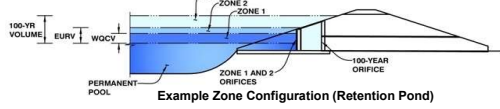
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD-E1**



Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	64.40	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	850	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	27.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

Water Quality Capture Volume (WQCV) =	0.761	acre-feet		
Excess Urban Runoff Volume (EURV) =	1.769	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	1.813	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.033	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.166	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.914	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	7.217	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	8.977	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	14.230	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	1.252	acre-feet		
Approximate 5-yr Detention Volume =	1.808	acre-feet		
Approximate 10-yr Detention Volume =	2.701	acre-feet		
Approximate 25-yr Detention Volume =	3.182	acre-feet		
Approximate 50-yr Detention Volume =	3.357	acre-feet		
Approximate 100-yr Detention Volume =	4.012	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.761	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.009	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.242	acre-feet
Total Detention Basin Volume =	4.012	acre-feet
Initial Surge Volume (ISV) =	100	ft ³
Initial Surge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H _{total}) =	5.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.008	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{LW}) =	2	

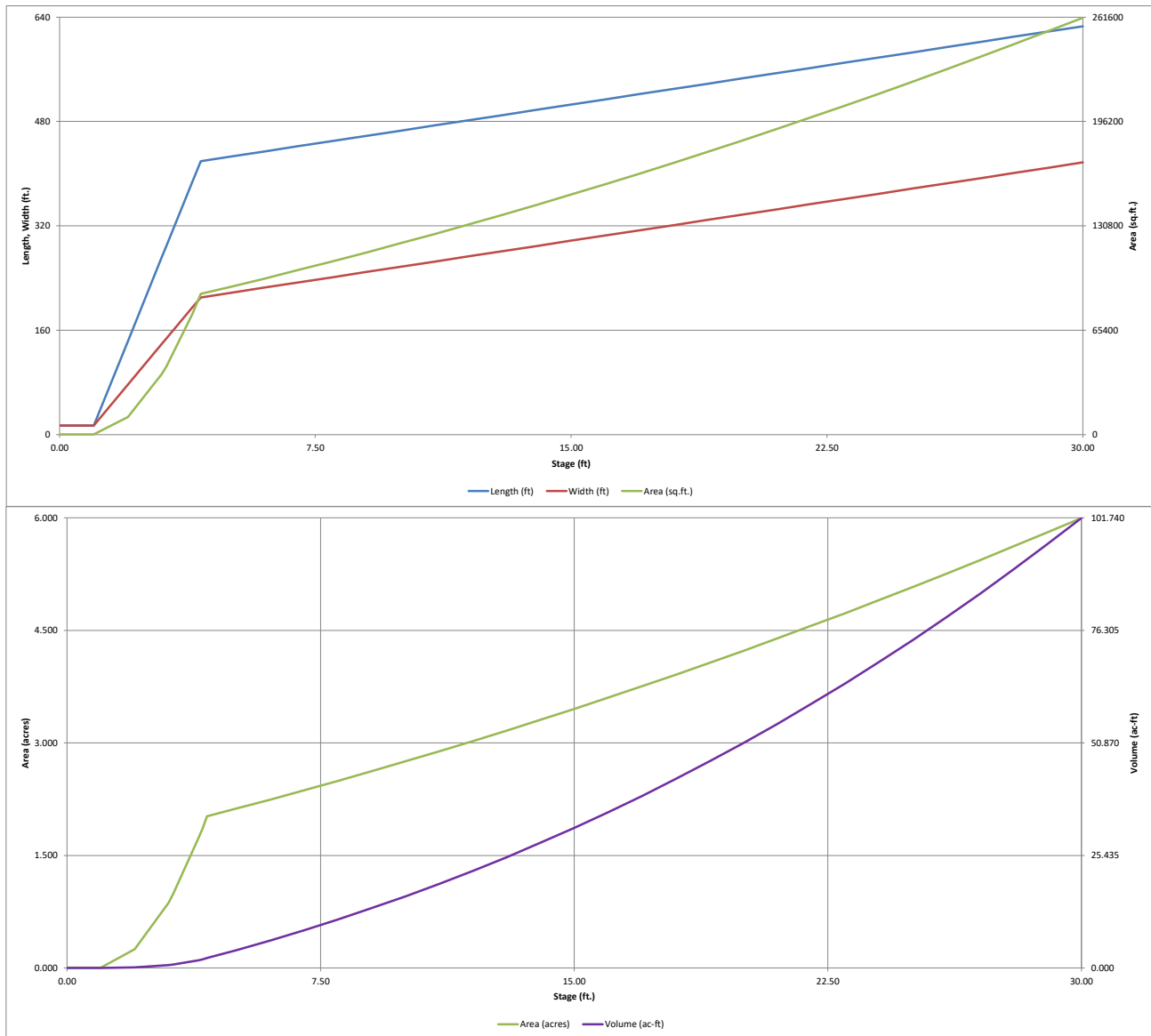
Initial Surge Area (A _{ISV}) =	200	ft ²
Surcharge Volume Length (L _{ISV}) =	14.1	ft
Surcharge Volume Width (W _{ISV}) =	14.1	ft
Depth of Basin Floor (H _{FLOOR}) =	3.14	ft
Length of Basin Floor (L _{FLOOR}) =	419.2	ft
Width of Basin Floor (W _{FLOOR}) =	210.4	ft
Area of Basin Floor (A _{FLOOR}) =	88,197	ft ²
Volume of Basin Floor (V _{FLOOR}) =	96,918	ft ³
Depth of Main Basin (H _{MAIN}) =	0.86	ft
Length of Main Basin (L _{MAIN}) =	426.1	ft
Width of Main Basin (W _{MAIN}) =	217.3	ft
Area of Main Basin (A _{MAIN}) =	92,576	ft ²
Volume of Main Basin (V _{MAIN}) =	77,725	ft ³
Calculated Total Basin Volume (V _{total}) =	4.014	acre-feet

Depth Increment = 1.00 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		14.1	14.1	200		0.005		
ISV	0.50		14.1	14.1	200		0.005	100	0.002
	1.00		14.1	14.1	200		0.005	200	0.005
	2.00		143.1	76.6	10,971		0.252	4,442	0.102
	3.00		272.1	139.1	37,866		0.869	27,516	0.632
Zone 1 (WQCV)	3.14		290.2	147.9	42,919		0.985	33,168	0.761
Zone 2 (EURV)	3.90		388.2	195.4	75,859		1.741	77,713	1.784
	4.00		401.1	201.6	80,887		1.857	85,549	1.964
Floor	4.14		419.2	210.4	88,197		2.025	97,382	2.236
Zone 3 (100-year)	5.00		426.1	217.3	92,576		2.125	175,107	4.020
	6.00		434.1	225.3	97,787		2.245	270,278	6.205
	7.00		442.1	233.3	103,125		2.367	370,723	8.511
	8.00		450.1	241.3	108,592		2.493	476,571	10.941
	9.00		458.1	249.3	114,187		2.621	587,950	13.497
	10.00		466.1	257.3	119,910		2.753	704,988	16.184
	11.00		474.1	265.3	125,761		2.887	827,813	19.004
	12.00		482.1	273.3	131,740		3.024	956,552	21.959
	13.00		490.1	281.3	137,846		3.165	1,091,335	25.054
	14.00		498.1	289.3	144,081		3.308	1,232,288	28.289
	15.00		506.1	297.3	150,444		3.454	1,379,540	31.670
	16.00		514.1	305.3	156,935		3.603	1,533,219	35.198
	17.00		522.1	313.3	163,554		3.755	1,693,452	38.876
	18.00		530.1	321.3	170,301		3.910	1,860,369	42.708
	19.00		538.1	329.3	177,175		4.067	2,034,096	46.696
	20.00		546.1	337.3	184,178		4.228	2,214,763	50.844
	21.00		554.1	345.3	191,309		4.392	2,402,496	55.154
	22.00		562.1	353.3	198,568		4.558	2,597,423	59.629
	23.00		570.1	361.3	205,955		4.728	2,799,674	64.272
	24.00		578.1	369.3	213,470		4.901	3,009,376	69.086
	25.00		586.1	377.3	221,112		5.076	3,226,656	74.074
	26.00		594.1	385.3	228,883		5.254	3,451,643	79.239
	27.00		602.1	393.3	236,782		5.436	3,684,465	84.584
	28.00		610.1	401.3	244,809		5.620	3,925,250	90.111
	29.00		618.1	409.3	252,964		5.807	4,174,126	95.825
	30.00		626.1	417.3	261,247		5.997	4,431,221	101.727

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

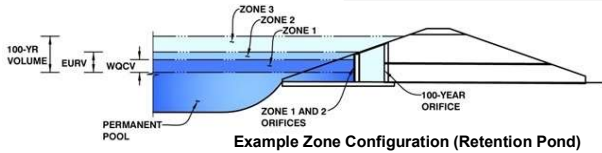


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD-E1**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.14	0.761	Orifice Plate
Zone 2 (EURV)	3.90	1.009	Orifice Plate
Zone 3 (100-year)	5.00	2.242	Weir&Pipe (Restrict)
Total (all zones)		4.012	

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 = ft²
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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.30	2.60					
Orifice Area (sq. inches)	2.00	2.41	4.50					

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

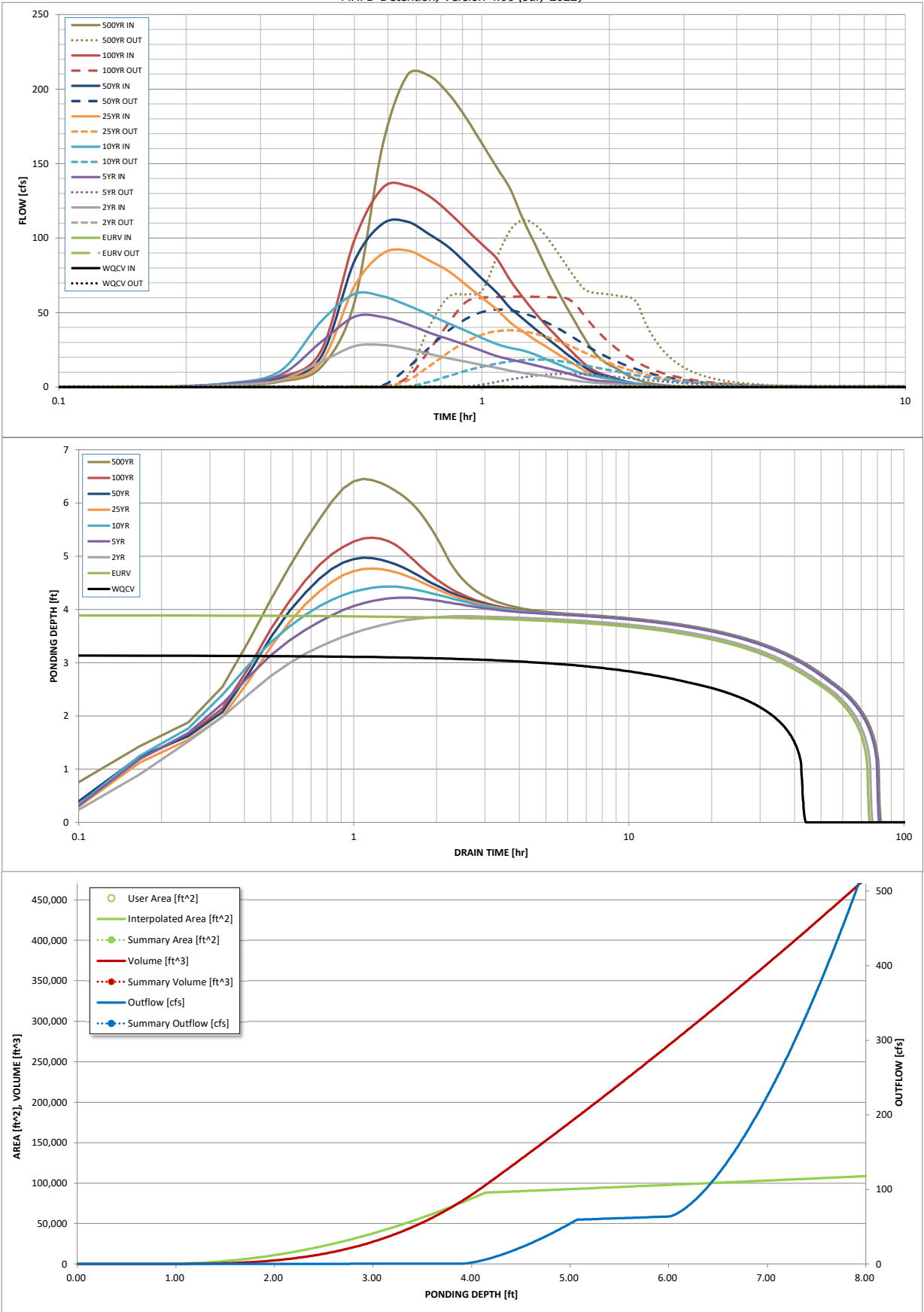
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
One-Hour Rainfall Depth (in) =	0.761	1.769	1.813	3.033	4.166	5.914	7.217	8.977	14.230
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.813	3.033	4.166	5.914	7.217	8.977	14.230
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	9.4	26.4	39.7	69.3	87.0	108.9	175.8
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.15	0.41	0.62	1.08	1.35	1.69	2.73
Peak Inflow Q (cfs) =	N/A	N/A	28.2	47.3	62.5	91.7	111.0	135.1	209.4
Peak Outflow Q (cfs) =	0.3	0.4	0.4	9.0	18.5	38.1	52.0	60.7	112.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.5	0.5	0.6	0.6	0.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.6	1.2	1.6	1.9	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) =	40	69	70	72	70	66	64	60	52
Time to Drain 99% of Inflow Volume (hours) =	42	72	74	77	76	75	74	73	69
Maximum Ponding Depth (ft) =	3.14	3.90	3.87	4.22	4.43	4.77	4.97	5.35	6.45
Area at Maximum Ponding Depth (acres) =	0.99	1.74	1.71	2.03	2.06	2.10	2.12	2.17	2.30
Maximum Volume Stored (acre-ft) =	0.761	1.784	1.732	2.398	2.828	3.513	3.956	4.771	7.227

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	0.15	0.01	0.73
	0:15:00	0.00	0.00	1.26	2.07	2.56	1.72	2.19	2.13	3.70
	0:20:00	0.00	0.00	4.64	8.02	10.74	4.60	5.48	6.64	13.34
	0:25:00	0.00	0.00	16.91	30.23	44.02	16.53	20.28	24.22	56.91
	0:30:00	0.00	0.00	27.51	47.26	62.51	67.69	84.55	98.52	162.70
	0:35:00	0.00	0.00	28.25	46.96	60.87	89.63	109.76	133.83	209.35
	0:40:00	0.00	0.00	25.90	42.14	54.91	91.70	110.99	135.10	208.92
	0:45:00	0.00	0.00	22.36	36.60	48.70	84.95	102.64	128.14	197.03
	0:50:00	0.00	0.00	19.39	32.27	42.81	77.89	94.04	117.49	180.92
	0:55:00	0.00	0.00	17.06	28.24	37.74	68.70	83.19	106.12	163.53
	1:00:00	0.00	0.00	14.90	24.37	33.05	59.96	72.79	95.82	147.53
	1:05:00	0.00	0.00	12.93	20.90	28.88	52.18	63.49	86.27	133.07
	1:10:00	0.00	0.00	11.01	18.54	26.31	43.45	53.22	71.69	112.66
	1:15:00	0.00	0.00	9.60	16.66	24.57	37.27	45.94	60.18	96.27
	1:20:00	0.00	0.00	8.42	14.74	21.92	31.88	39.25	50.28	80.38
	1:25:00	0.00	0.00	7.37	12.93	18.80	27.24	33.39	41.67	66.25
	1:30:00	0.00	0.00	6.35	11.21	15.87	22.72	27.75	34.23	54.02
	1:35:00	0.00	0.00	5.36	9.56	13.14	18.55	22.54	27.39	42.82
	1:40:00	0.00	0.00	4.41	7.56	10.64	14.65	17.69	21.08	32.61
	1:45:00	0.00	0.00	3.57	5.77	8.56	11.03	13.26	15.46	24.03
	1:50:00	0.00	0.00	3.08	4.66	7.37	8.11	9.94	11.40	18.42
	1:55:00	0.00	0.00	2.66	4.07	6.56	6.45	8.04	8.94	14.88
	2:00:00	0.00	0.00	2.33	3.62	5.69	5.43	6.86	7.32	12.46
	2:05:00	0.00	0.00	1.88	2.90	4.56	4.18	5.29	5.45	9.38
	2:10:00	0.00	0.00	1.48	2.26	3.58	3.13	3.97	3.92	6.80
	2:15:00	0.00	0.00	1.15	1.76	2.78	2.37	3.00	2.79	4.86
	2:20:00	0.00	0.00	0.89	1.36	2.12	1.78	2.23	1.97	3.45
	2:25:00	0.00	0.00	0.69	1.05	1.60	1.33	1.67	1.44	2.54
	2:30:00	0.00	0.00	0.54	0.79	1.18	1.00	1.25	1.09	1.88
	2:35:00	0.00	0.00	0.42	0.58	0.87	0.74	0.93	0.82	1.42
	2:40:00	0.00	0.00	0.32	0.43	0.66	0.56	0.70	0.63	1.08
	2:45:00	0.00	0.00	0.24	0.31	0.50	0.42	0.53	0.48	0.82
	2:50:00	0.00	0.00	0.17	0.22	0.36	0.32	0.39	0.35	0.59
	2:55:00	0.00	0.00	0.12	0.15	0.25	0.22	0.27	0.24	0.40
	3:00:00	0.00	0.00	0.07	0.10	0.15	0.15	0.18	0.16	0.25
	3:05:00	0.00	0.00	0.04	0.06	0.08	0.09	0.10	0.09	0.13
	3:10:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.04	0.05
	3:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	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.

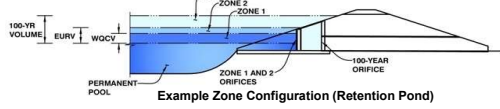
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD-E2**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	67.50	acres
Watershed Length =	2,700	ft
Watershed Length to Centroid =	1,300	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	46.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

Water Quality Capture Volume (WQCV) =	1.105	acre-feet		
Excess Urban Runoff Volume (EURV) =	3.321	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	3.193	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.632	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.907	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.661	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.062	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	10.856	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.48 in.) =	16.488	acre-feet	3.48	inches
Approximate 2-yr Detention Volume =	2.485	acre-feet		
Approximate 5-yr Detention Volume =	3.429	acre-feet		
Approximate 10-yr Detention Volume =	4.599	acre-feet		
Approximate 25-yr Detention Volume =	5.067	acre-feet		
Approximate 50-yr Detention Volume =	5.304	acre-feet		
Approximate 100-yr Detention Volume =	5.975	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.105	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.216	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.655	acre-feet
Total Detention Basin Volume =	5.975	acre-feet
Initial Surge Volume (ISV) =	100	ft ³
Initial Surge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H _{total}) =	5.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.006	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{LW}) =	2	

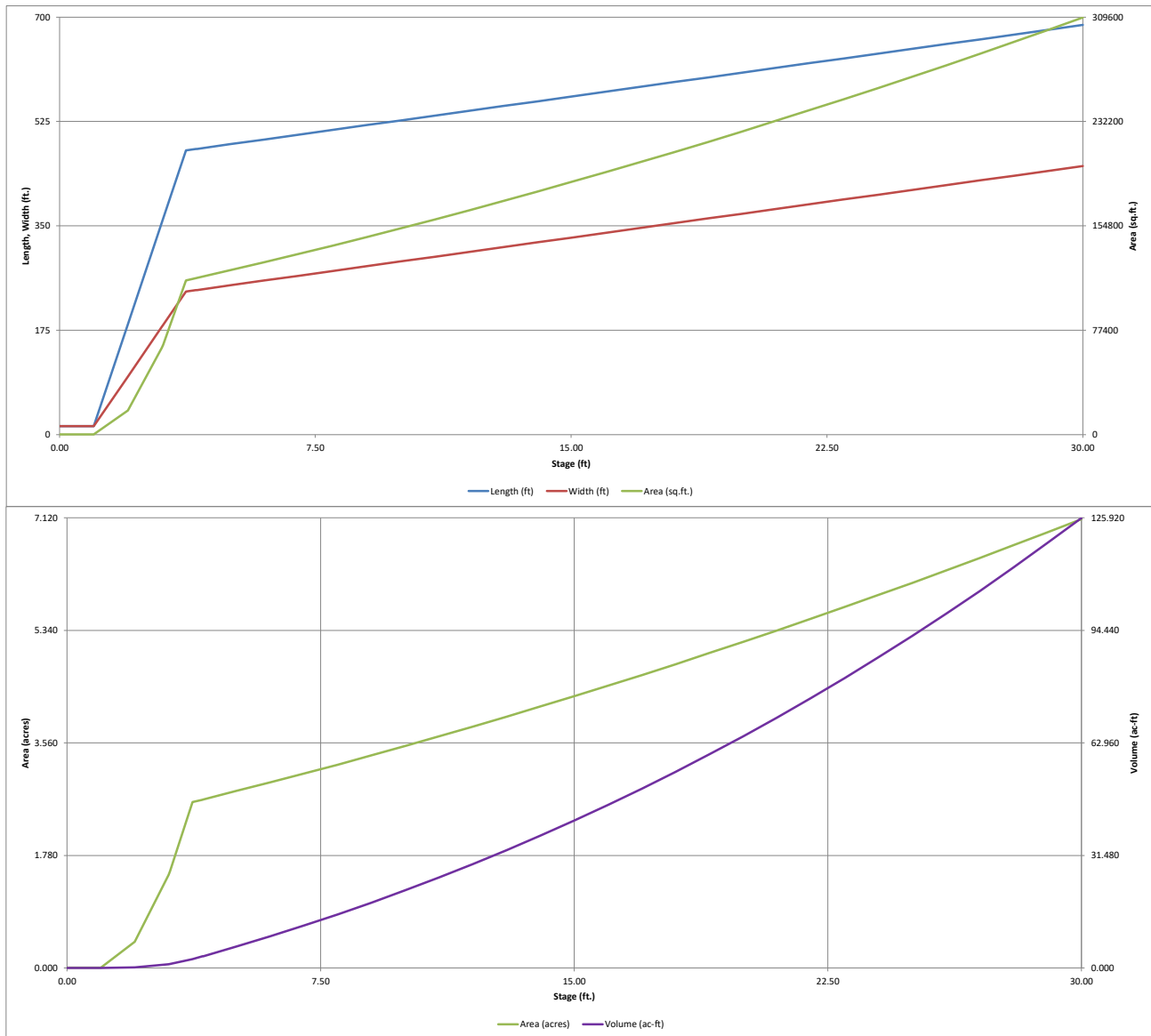
Initial Surge Area (A _{ISV}) =	200	ft ²
Surcharge Volume Length (L _{ISV}) =	14.1	ft
Surcharge Volume Width (W _{ISV}) =	14.1	ft
Depth of Basin Floor (H _{FLOOR}) =	2.71	ft
Length of Basin Floor (L _{FLOOR}) =	476.6	ft
Width of Basin Floor (W _{FLOOR}) =	240.0	ft
Area of Basin Floor (A _{FLOOR}) =	114,384	ft ²
Volume of Basin Floor (V _{FLOOR}) =	107,828	ft ³
Depth of Main Basin (H _{MAIN}) =	1.29	ft
Length of Main Basin (L _{MAIN}) =	487.0	ft
Width of Main Basin (W _{MAIN}) =	250.3	ft
Area of Main Basin (A _{MAIN}) =	121,886	ft ²
Volume of Main Basin (V _{MAIN}) =	152,369	ft ³
Calculated Total Basin Volume (V _{total}) =	5.978	acre-feet

Depth Increment = 1.00 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		14.1	14.1	200		0.005		
ISV	0.50		14.1	14.1	200		0.005	100	0.002
	1.00		14.1	14.1	200		0.005	200	0.005
	2.00		184.8	97.5	18,014		0.414	6,937	0.159
	3.00		355.5	180.8	64,273		1.476	45,710	1.049
Zone 1 (WQCV)	3.04		362.3	184.1	66,715		1.532	48,330	1.109
Floor	3.71		476.6	240.0	114,384		2.626	108,285	2.486
	4.00		479.0	242.3	116,052		2.664	141,698	3.253
Zone 2 (EURV)	4.03		479.2	242.5	116,225		2.668	145,182	3.333
Zone 3 (100-year)	5.00		487.0	250.3	121,886		2.798	260,656	5.984
	6.00		495.0	258.3	127,848		2.935	385,513	8.850
	7.00		503.0	266.3	133,938		3.075	516,395	11.855
	8.00		511.0	274.3	140,156		3.218	653,432	15.001
	9.00		519.0	282.3	146,503		3.363	796,751	18.291
	10.00		527.0	290.3	152,977		3.512	946,480	21.728
	11.00		535.0	298.3	159,579		3.663	1,102,747	25.316
	12.00		543.0	306.3	166,309		3.818	1,265,680	29.056
	13.00		551.0	314.3	173,167		3.975	1,435,407	32.952
	14.00		559.0	322.3	180,153		4.136	1,612,057	37.008
	15.00		567.0	330.3	187,267		4.299	1,795,756	41.225
	16.00		575.0	338.3	194,509		4.465	1,986,634	45.607
	17.00		583.0	346.3	201,879		4.635	2,184,818	50.157
	18.00		591.0	354.3	209,378		4.807	2,390,435	54.877
	19.00		599.0	362.3	217,004		4.982	2,603,615	59.771
	20.00		607.0	370.3	224,758		5.160	2,824,485	64.841
	21.00		615.0	378.3	232,640		5.341	3,053,174	70.091
	22.00		623.0	386.3	240,650		5.525	3,289,808	75.524
	23.00		631.0	394.3	248,788		5.711	3,534,516	81.141
	24.00		639.0	402.3	257,054		5.901	3,787,427	86.947
	25.00		647.0	410.3	265,448		6.094	4,048,668	92.945
	26.00		655.0	418.3	273,970		6.289	4,318,366	99.136
	27.00		663.0	426.3	282,621		6.488	4,596,651	105.525
	28.00		671.0	434.3	291,399		6.690	4,883,650	112.113
	29.00		679.0	442.3	300,305		6.894	5,179,491	118.905
	30.00		687.0	450.3	309,339		7.101	5,484,302	125.902

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

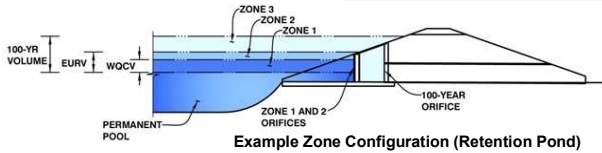


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **STERLING RANCH SKETCH PLAN AMENDMENT - DRAINAGE LETTER**

Basin ID: **POND FSD-E2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.04	1.105	Orifice Plate
Zone 2 (EURV)	4.03	2.216	Orifice Plate
Zone 3 (100-year)	5.00	2.655	Weir&Pipe (Restrict)
Total (all zones)		5.975	

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 = ft²
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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.34	2.69					
Orifice Area (sq. inches)	3.00	3.69	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)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

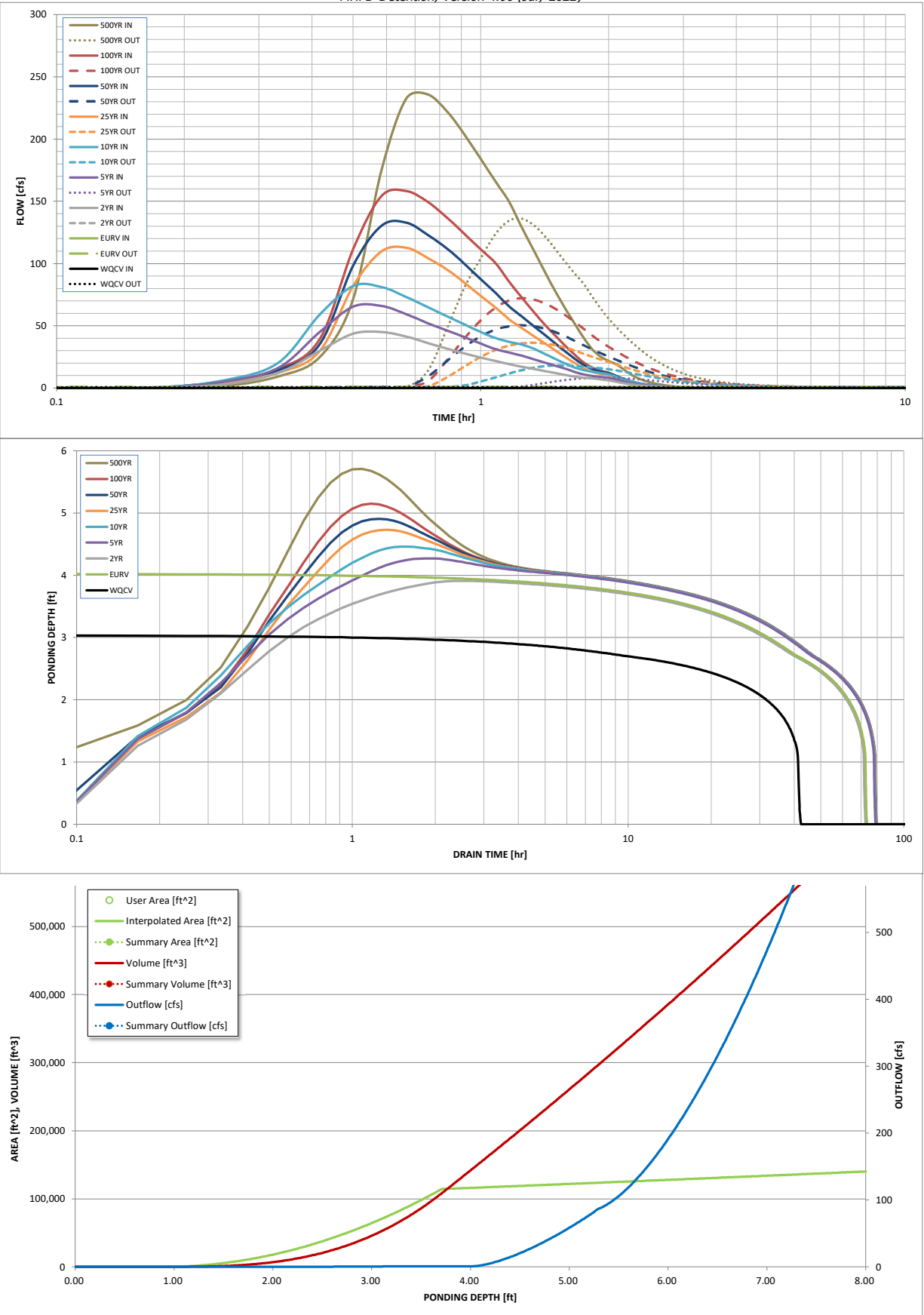
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.48
One-Hour Rainfall Depth (in) =	1.105	3.321	3.193	4.632	5.907	7.661	9.062	10.856	16.488
CUHP Runoff Volume (acre-ft) =	N/A	N/A	3.193	4.632	5.907	7.661	9.062	10.856	16.488
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	6.6	18.7	28.4	50.9	63.9	81.8	132.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.28	0.42	0.75	0.95	1.21	1.96
Peak Inflow Q (cfs) =	N/A	N/A	45.0	65.9	81.9	112.7	132.9	158.3	235.9
Peak Outflow Q (cfs) =	0.6	1.0	1.0	8.1	18.1	36.4	50.4	72.1	136.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.8	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.4	0.8	1.1	1.6	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	66	65	69	68	65	64	61	54
Time to Drain 99% of Inflow Volume (hours) =	41	70	69	75	74	73	73	72	69
Maximum Ponding Depth (ft) =	3.04	4.03	3.91	4.27	4.46	4.73	4.91	5.15	5.71
Area at Maximum Ponding Depth (acres) =	1.53	2.67	2.65	2.70	2.73	2.76	2.78	2.82	2.89
Maximum Volume Stored (acre-ft) =	1.109	3.333	3.014	3.977	4.493	5.233	5.705	6.377	8.005

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	0.36	0.04	1.78
	0:15:00	0.00	0.00	3.15	5.17	6.41	4.31	5.49	5.28	9.36
	0:20:00	0.00	0.00	12.13	16.30	20.34	12.25	14.40	15.28	24.68
	0:25:00	0.00	0.00	29.93	44.88	58.83	29.48	34.96	38.96	71.11
	0:30:00	0.00	0.00	43.61	65.28	81.93	81.87	98.15	111.39	174.99
	0:35:00	0.00	0.00	44.96	65.85	81.15	109.73	130.33	154.25	232.35
	0:40:00	0.00	0.00	41.35	59.40	73.20	112.71	132.92	158.32	235.88
	0:45:00	0.00	0.00	36.10	52.02	64.94	104.42	122.95	149.49	221.96
	0:50:00	0.00	0.00	31.52	46.23	57.54	95.10	111.93	136.71	203.27
	0:55:00	0.00	0.00	27.78	40.78	50.91	84.42	99.58	123.53	183.88
	1:00:00	0.00	0.00	24.43	35.59	44.93	73.81	87.26	111.30	165.73
	1:05:00	0.00	0.00	21.68	31.29	40.08	64.51	76.41	100.25	149.55
	1:10:00	0.00	0.00	19.15	28.44	37.08	55.16	65.54	85.36	128.67
	1:15:00	0.00	0.00	17.07	25.90	34.82	48.12	57.36	72.59	110.63
	1:20:00	0.00	0.00	15.26	23.12	31.55	41.65	49.64	61.07	93.24
	1:25:00	0.00	0.00	13.61	20.42	27.36	35.81	42.59	50.81	77.37
	1:30:00	0.00	0.00	12.01	17.85	23.25	30.08	35.67	41.89	63.62
	1:35:00	0.00	0.00	10.47	15.48	19.54	24.75	29.22	33.80	51.17
	1:40:00	0.00	0.00	9.11	12.88	16.38	19.89	23.36	26.49	40.00
	1:45:00	0.00	0.00	8.16	10.86	14.29	15.70	18.33	20.27	30.87
	1:50:00	0.00	0.00	7.68	9.67	13.09	13.02	15.20	16.35	25.26
	1:55:00	0.00	0.00	6.92	8.91	12.10	11.39	13.27	13.90	21.67
	2:00:00	0.00	0.00	6.17	8.23	11.01	10.36	12.03	12.21	19.16
	2:05:00	0.00	0.00	5.06	6.77	9.02	8.38	9.71	9.64	15.16
	2:10:00	0.00	0.00	3.97	5.28	7.04	6.44	7.45	7.18	11.30
	2:15:00	0.00	0.00	3.10	4.10	5.44	4.92	5.67	5.29	8.34
	2:20:00	0.00	0.00	2.41	3.17	4.16	3.74	4.29	3.90	6.14
	2:25:00	0.00	0.00	1.87	2.44	3.16	2.86	3.27	2.97	4.65
	2:30:00	0.00	0.00	1.43	1.84	2.36	2.15	2.45	2.24	3.49
	2:35:00	0.00	0.00	1.09	1.37	1.76	1.61	1.82	1.69	2.63
	2:40:00	0.00	0.00	0.82	1.02	1.33	1.20	1.36	1.28	1.99
	2:45:00	0.00	0.00	0.61	0.75	0.99	0.91	1.03	0.97	1.50
	2:50:00	0.00	0.00	0.43	0.53	0.71	0.66	0.75	0.70	1.08
	2:55:00	0.00	0.00	0.28	0.36	0.47	0.45	0.51	0.47	0.72
	3:00:00	0.00	0.00	0.16	0.22	0.28	0.28	0.31	0.29	0.44
	3:05:00	0.00	0.00	0.08	0.12	0.14	0.15	0.17	0.15	0.23
	3:10:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.08
	3:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	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.


[illegible]


REPORT REFERENCES

FINAL DRAINAGE REPORT - BASIN RUNOFF COEFFICIENT SUMMARY																		
		IMPERVIOUS AREA / STREETS					LANDSCAPE/DEVELOPED AREAS					WEIGHTED			WEIGHTED CA			
BASIN	TOTAL AREA (AC)	AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)	EFFECTIVE IMPERVIOUS (%)		
OS-1	24.1	0.00	0.89	0.90	0.95	24.1	0.03	0.09	0.36	0.03	0.09	0.36	0.07	2.17	8.68	2.0%		
OS-2	0.47	0.00	0.89	0.90	0.95	0.47	0.15	0.15	0.65	0.15	0.15	0.65	0.07	0.72	0.22	2.0%		
OS-3	4.2	0.00	0.89	0.90	0.95	4.2	0.18	0.25	0.47	0.18	0.25	0.47	0.76	1.05	1.97	39.0%		
OS-4	3.3	0.25	0.89	0.90	0.96	3.1	0.05	0.12	0.39	0.11	0.18	0.43	0.38	0.59	1.43	13.3%		
OS-5	45.8	0.00	0.89	0.90	0.95	45.8	0.03	0.09	0.36	0.03	0.09	0.36	1.37	4.12	16.49	2.0%		
OS-6	5.9	0.50	0.89	0.90	0.96	5.4	0.03	0.09	0.36	0.10	0.16	0.44	0.61	0.94	2.42	14.0%		
OS-7	1.4	0.80	0.89	0.90	0.96	0.6	0.06	0.14	0.40	0.42	0.47	0.64	0.59	0.65	0.90	55.7%		
A	14.2	0.50	0.89	0.90	0.95	13.70	0.05	0.12	0.39	0.08	0.15	0.41	1.13	2.09	5.82	10.1%		
B	8.8	0.00	0.89	0.90	0.95	8.80	0.12	0.20	0.44	0.12	0.20	0.44	0.86	1.78	3.87	20.0%		
C	1.4	0.20	0.89	0.90	0.95	1.20	0.18	0.20	0.44	0.28	0.34	0.50	0.30	0.48	0.78	40.0%		
D	2.3	0.00	0.89	0.90	0.96	2.30	0.20	0.23	0.30	0.50	0.23	0.30	0.50	0.05	0.06	0.10	40.0%	
E	0.3	0.00	0.89	0.90	0.95	0.30	0.15	0.22	0.46	0.15	0.22	0.46	0.35	0.51	0.95	25.0%		
F	0.8	0.20	0.89	0.90	0.96	0.60	0.18	0.25	0.47	0.36	0.41	0.59	0.29	0.33	0.47	45.0%		
G	2.2	0.00	0.89	0.90	0.95	2.20	0.19	0.28	0.49	0.18	0.28	0.49	0.45	0.65	1.09	40.0%		
H1	2.5	0.20	0.89	0.90	0.96	2.30	0.05	0.12	0.39	0.12	0.18	0.44	0.29	0.46	1.09	14.0%		
H2	3.1	0.30	0.89	0.90	0.96	2.80	0.07	0.16	0.41	0.15	0.23	0.46	0.46	0.72	1.44	15.5%		
I	2.6	0.00	0.89	0.90	0.95	2.60	0.05	0.12	0.39	0.05	0.12	0.39	0.13	0.31	1.01	7.0%		
J	2.4	0.25	0.89	0.90	0.96	2.14	0.05	0.15	0.39	0.14	0.25	0.49	0.32	0.49	1.08	15.0%		
K	3.30	0.55	0.89	0.90	0.96	2.75	0.05	0.12	0.39	0.10	0.25	0.49	0.63	0.83	1.60	24.2%		
L	3.90	0.20	0.89	0.90	0.95	3.70	0.06	0.14	0.40	0.19	0.18	0.43	0.40	0.70	1.67	15.1%		
M	0.54	0.58	0.89	0.90	0.96	0.16	0.05	0.12	0.39	0.64	0.67	0.79	0.34	0.36	0.43	65.1%		
N	0.55	0.30	0.89	0.90	0.95	0.25	0.05	0.12	0.39	0.51	0.55	0.70	0.28	0.30	0.39	52.7%		
O	0.61	0.00	0.89	0.90	0.96	0.61	0.05	0.12	0.39	0.05	0.12	0.39	0.03	0.07	0.24	7.0%		


FINAL DRAINAGE REPORT - PIPE ROUTING SUMMARY									
Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
1	DP-1	2.09	5.82	20.1	3.08	5.18	6	30	30" RCP
2	DP-2	0.48	0.76	16.9	3.34	5.61	2	4	18" RCP
3	DP-3	1.92	4.19	30.8	2.44	4.10	5	21	30" RCP
4	PR-1, PR-2 and PR-3	4.50	10.77	20.9	3.03	5.08	14	55	36" RCP
5	DP-7	0.59	1.43	25.8	2.71	4.54	2	6	18" RCP
6	DP-8	0.30	0.39	7.8	4.50	7.55	1	3	18" RCP
7	DP-9	0.36	0.43	7.8	4.50	7.55	2	3	18" RCP
8	PR-6 and PR-7	0.66	0.81	7.8	4.50	7.55	3	6	24" RCP
9	PR-5, PR-8	1.25	2.24	26.0	2.68	4.52	3	10	24" RCP

<u>DESCRIPTION</u>	<u>SYMBOL</u>
EXISTING GROUND CONTOUR	
PROPOSED FINISHED CONTOUR	
BASIN BOUNDARY	
DESIGN POINT	
PIPE RUN	
BASIN IDENTIFIER	
AREA IN ACRES	
EXISTING DIRECTION OF FLOW	
EXISTING/PROP. STORM SEWER	
WETLAND DELINEATION	





SCALE: 1" = 100'

	<p>RETREAT AT TIMBERRIDGE FILING NO. 3</p> <p>FINAL DRAINAGE REPORT</p> <p>DEVELOPED DRAINAGE MAP</p>															
<p>CONSULTING ENGINEERS & SURVEYORS</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">DESIGNED BY</td> <td style="width: 25%;">MAW</td> <td style="width: 25%;">SCALE</td> <td style="width: 25%;">DATE</td> <td>8/17/22</td> </tr> <tr> <td>DRAWN BY</td> <td>MAW</td> <td>(H) 1" = 100'</td> <td>SHEET</td> <td>2 OF 2</td> </tr> <tr> <td>CHECKED BY</td> <td>(V) 1" = N/A</td> <td>JOB NO.</td> <td colspan="2">1185.30</td> </tr> </table>	DESIGNED BY	MAW	SCALE	DATE	8/17/22	DRAWN BY	MAW	(H) 1" = 100'	SHEET	2 OF 2	CHECKED BY	(V) 1" = N/A	JOB NO.	1185.30	
DESIGNED BY	MAW	SCALE	DATE	8/17/22												
DRAWN BY	MAW	(H) 1" = 100'	SHEET	2 OF 2												
CHECKED BY	(V) 1" = N/A	JOB NO.	1185.30													

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

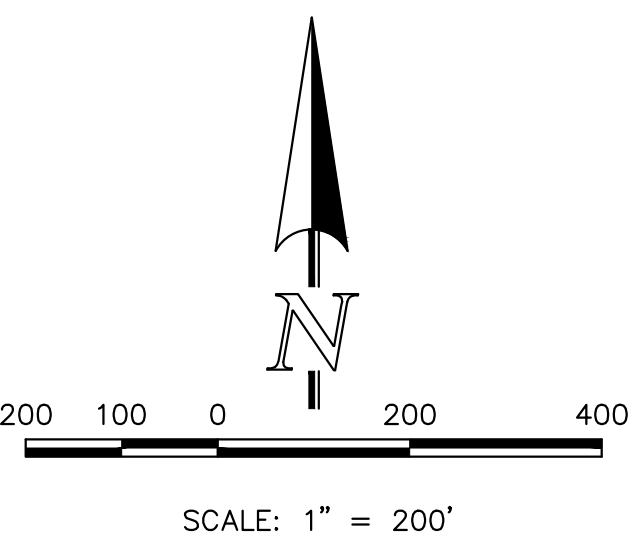
Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5yr. (CFS)	Peak Runoff 100 yr. (CFS)
EX-10	265.9	7%	105	222
EX10A	153.5	5%	46	103
EX-11 *	214.3	4%	54	129
EX-13 *	94.8	6%	36	85
EX-4A	44.2	8%	19	50
EX-5	26.2	8%	12	32
EX-7	152.8	5%	46	105
EX-7A	2.4	2%	1	5
EX-8	32.2	2%	5	23
EX-8A	6.6	2%	2	9
EX-9	139.3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

* Basins with no change upon developed condition

STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

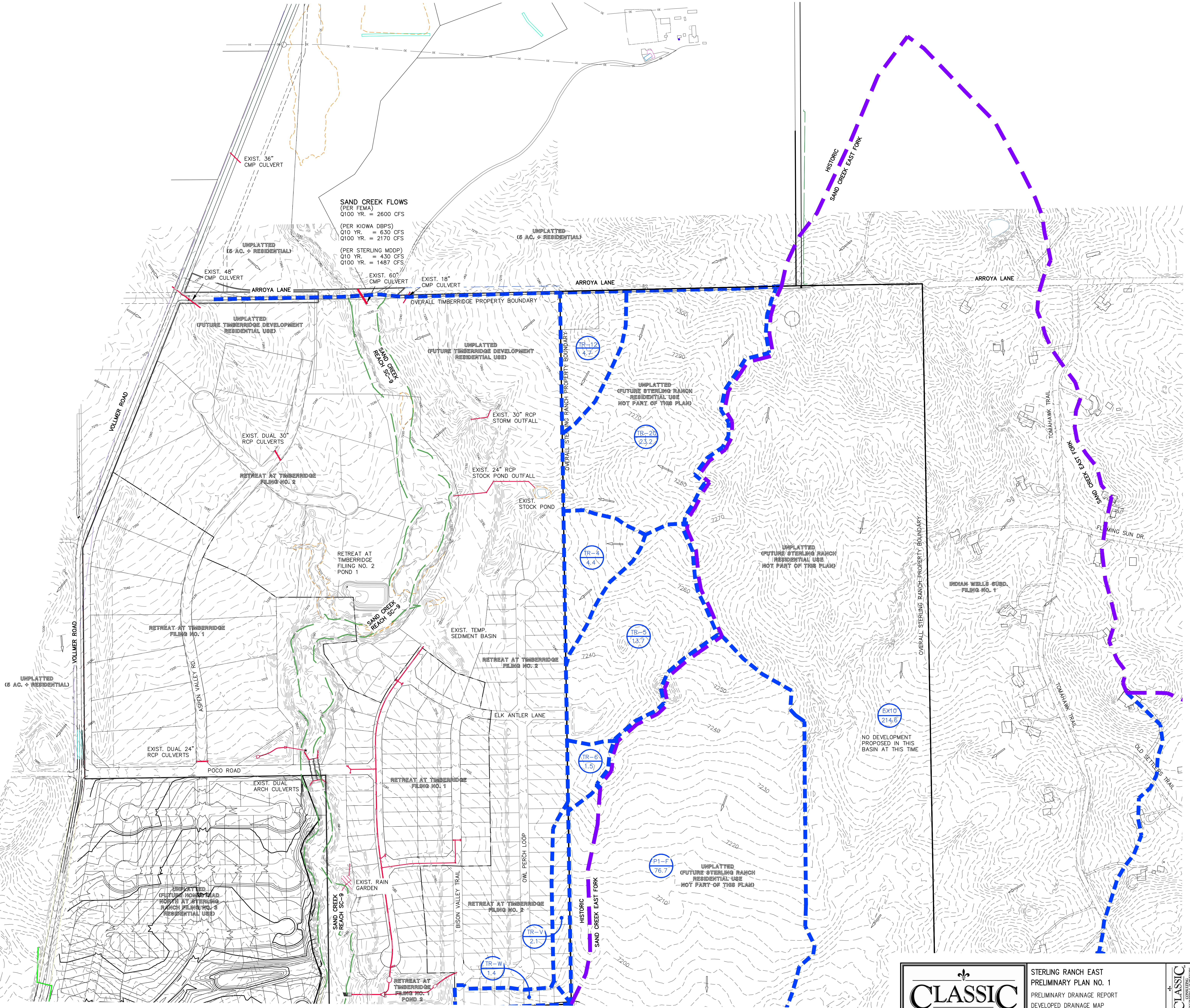
Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5 yr. (CFS)	Peak Runoff 100 yr. (CFS)
EF-A	8.2	15%	7	20
EX10A +	60.4	5%	18	50
EX-9 +	6.0	5%	2	8
EX-9A +	12.7	5%	4	16
P1-A	12.7	8%	6	19
P1-A1	5.0	45%	11	21
P1-A2	6.4	45%	12	23
P1-A3	1.8	50%	5	9
P1-A4	2.0	50%	5	10
P1-A5	5.7	45%	13	25
P1-A6	2.8	50%	7	14
P1-B (Dev.)	35.5	38%	55	108
P1-B (Un-dev.)	35.5	5%	10	23
P1-C	8.9	50%	23	46
P1-D	31.4	38%	53	102
P1-E1	30.4	35%	50	97
P1-E2	21.8	40%	41	80
P1-F (Dev.)	76.7	30%	111	215
P1-F (Un-dev.)	76.7	5%	22	59
P2-A	24.4	10%	15	43
P2-B	57.8	38%	88	173
P2-B1	2.5	50%	7	13
P2-B10	1.7	50%	5	10
P2-B2	1.9	50%	5	10
P2-B3	2.8	45%	7	13
P2-B4	1.6	50%	4	8
P2-B5	1.9	45%	5	9
P2-B6	1.1	50%	3	6
P2-B7	2.5	45%	6	12
P2-B8	1.2	50%	3	7
P2-B9	2.0	50%	5	11
P2-S1	35.6	40%	68	133
P3-A	52.6	40%	85	166
P3-C	1.7	13%	1	5
P3-S2	11.9	40%	25	50
P4-A	25.8	35%	41	80
P4-B	37.3	35%	63	123
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	19%	2	6
TR-W	1.4	38%	3	5

+ Basin not changed from pre-development conditions



LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	---
EAST FORK BASIN BOUNDARY	---
DESIGN POINT	15
BASIN IDENTIFIER	BB 10.0
AREA IN ACRES	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	---



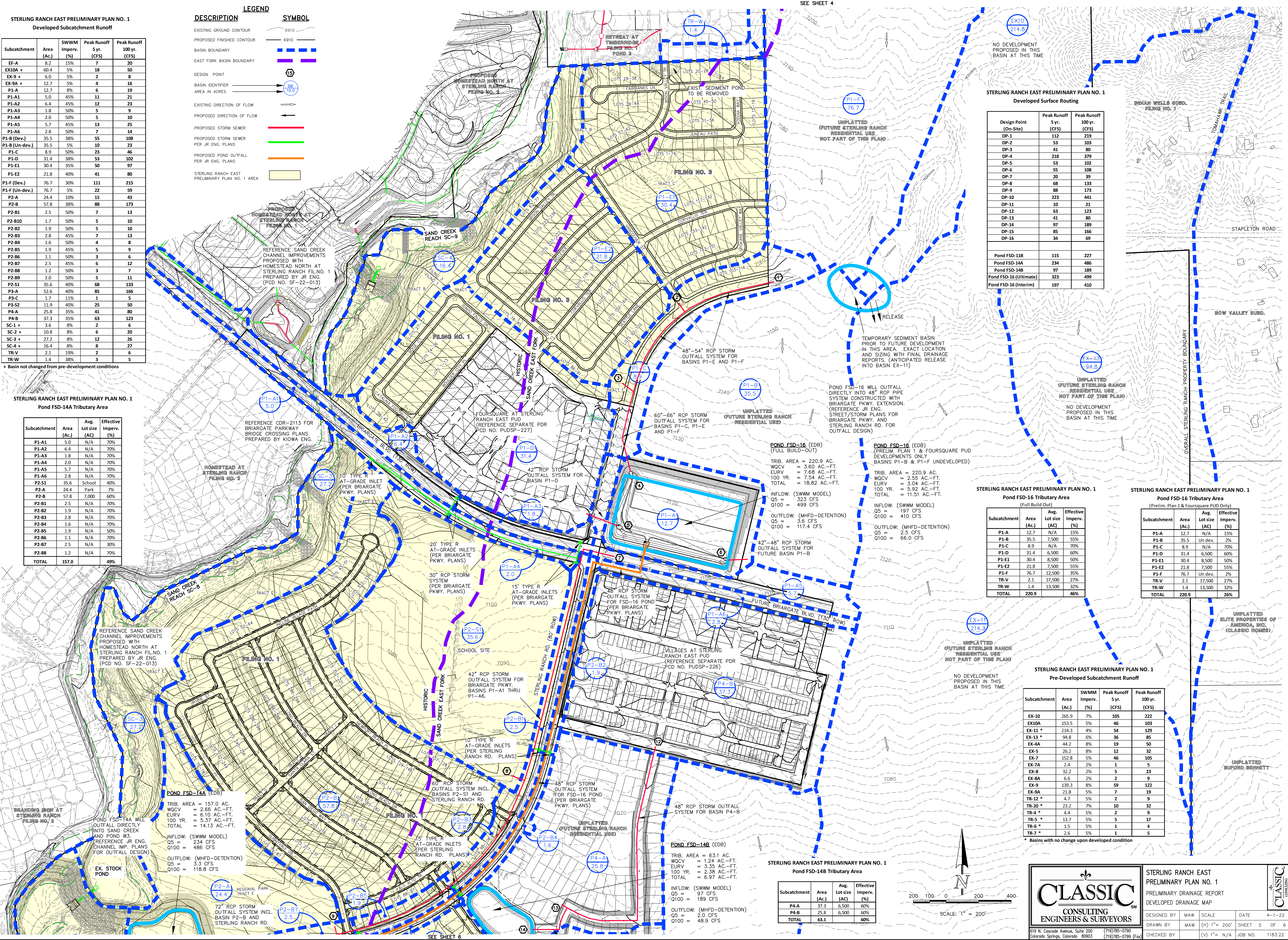
STERLING RANCH EAST
PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE	4-1-22
DRAWN BY	MAW	(H) 1" = 200'	SHEET	4 OF 6
CHECKED BY	(V) 1" = N/A	JOB NO.	1183.22	

619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903

(719) 785-0790
(719) 785-0799 (Fax)

CLASSIC CONSULTING ENGINEERS & SURVEYORS



STERLING RANCH EAST PRELIMINARY PLAN NO. 1
Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5yr (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	45%	11	21
P1-A2	6.4	45%	12	23
P1-A3	1.8	50%	5	9
P1-A4	2.0	50%	5	10
P1-A5	5.7	45%	13	25
P1-A6	2.8	50%	7	14
P1-B (Dev.)	35.5	38%	55	108
P1-B (Un-dev.)	35.5	5%	10	23
P1-C	8.9	50%	23	46
P1-D	31.4	38%	53	102
P1-E1	30.4	35%	50	97
P1-E2	21.8	40%	41	80
P1-F (Dev.)	76.7	30%	111	215
P1-F (Un-dev.)	76.7	5%	22	59
P2-A	24.4	10%	15	43
P2-B	57.8	38%	88	173
P2-B1	2.5	50%	7	13
P2-B10	1.7	50%	5	10
P2-B2	1.9	50%	5	10
P2-B3	2.8	45%	7	13
P2-B4	1.6	50%	4	8
P2-B5	1.9	45%	5	9
P2-B6	1.1	50%	3	6
P2-B7	2.5	45%	6	12
P2-B8	1.2	50%	3	7
P2-B9	2.0	50%	5	11
P2-S1	35.6	40%	68	133
P3-A	52.6	40%	85	166
P3-C	1.7	11%	1	5
P3-S2	11.9	40%	25	50
P4-A	25.8	35%	41	80
P4-B	37.3	35%	63	123
SC-1 +	3.6	8%	6	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	19%	2	6
TR-W	1.4	38%	3	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	40%
P2-A	24.4	Park	7%
P2-B	57.8	7,000	60%
P2-B1	2.5	N/A	70%
P2-B2	1.9	N/A	70%
P2-B3	2.8	N/A	70%
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	30%
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 5yr. (CFS)	Peak Runoff 100 yr. (CFS)
DP-1	112	219
DP-2	53	103
DP-3	41	80
DP-4	218	379
DP-5	53	102
DP-6	55	108
DP-7	29	39
DP-8	68	133
DP-9	88	173
DP-10	223	441
DP-11	10	21
DP-12	63	123
DP-13	41	80
DP-14	97	189
DP-15	85	166
DP-16	34	69

Pond FSD-11B	115	227
Pond FSD-14A	234	486
Pond FSD-14B	97	189
Pond FSD-16 (Ultimate)	323	499
Pond FSD-16 (Interim)	197	410

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	15%
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	15%
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
Pre-Developed Subcatchment Runoff

Subcatchment	Area (Ac.)	SWMM Imperv. (%)	Peak Runoff 5yr. (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

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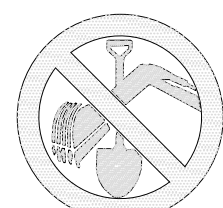
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(719) 785-0799 (Fax)

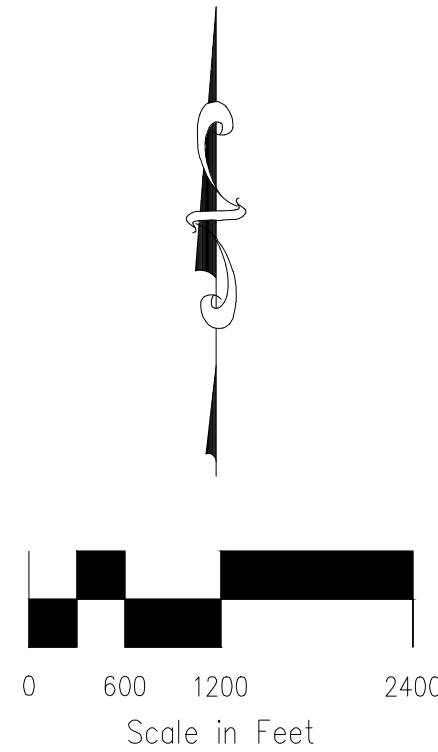
STERLING RANCH EAST PRELIMINARY PLAN NO. 1
PRELIMINARY DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE
DRAWN BY	MAW	(H) 1" = 200'	SHEET 5 OF 6
CHECKED BY	(V) 1" = N/A	JOB NO.	1163.22

N:\118322\REPORTS\PRELIM DRAINAGE REPORT\118322PREL.DWG, 12/20/2022, 1:18:46 PM, L1



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LEGEND

BASIN ID - SC3-77

DESIGN POINT - 87

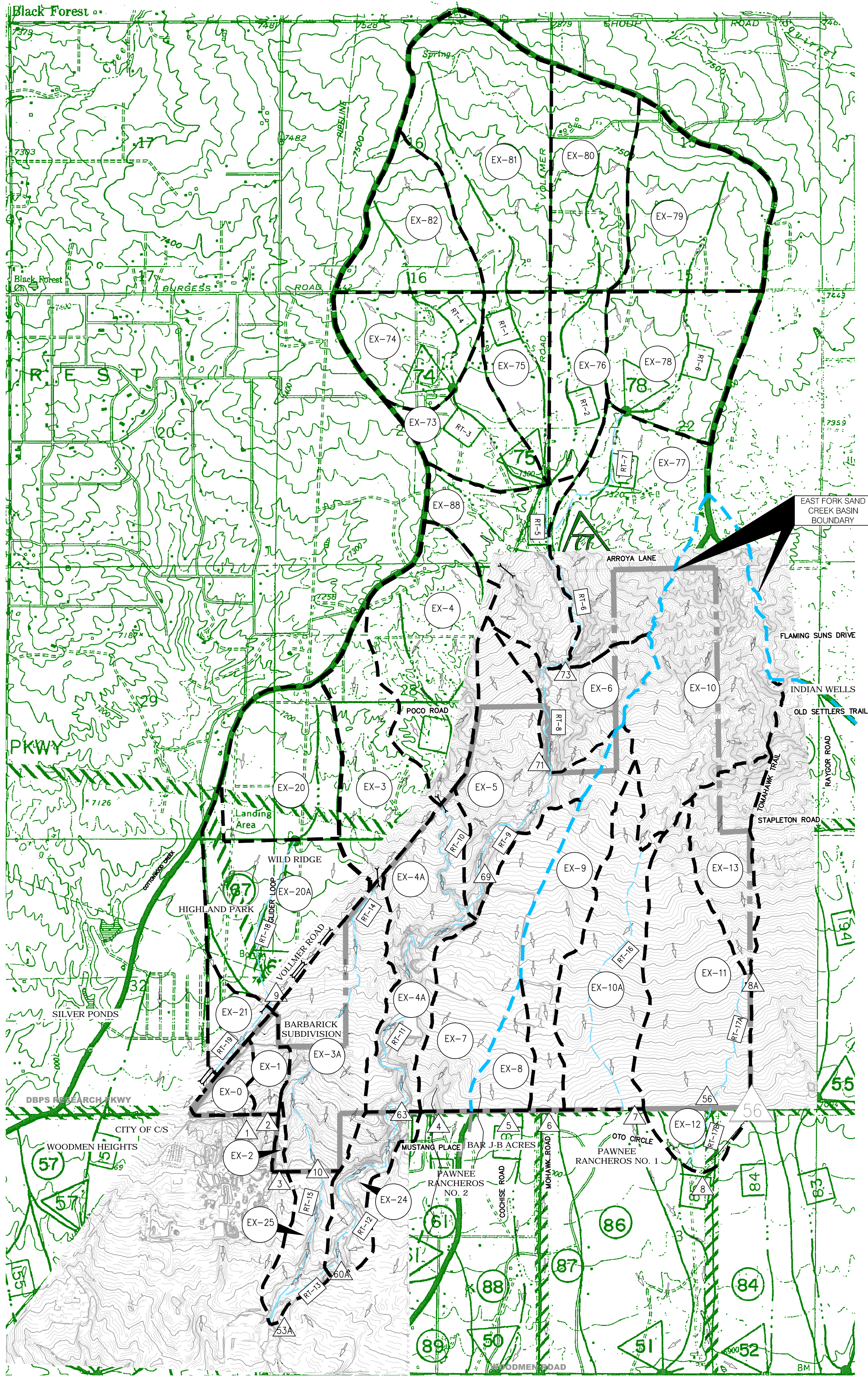
REACH IDENTIFIER - RT-17A

BASIN BOUNDARY - - - - -

EAST FORK SAND CREEK - - - - -

BASIN BOUNDARY - - - - -

FLOW DIRECTION - - - - -



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)
EX-0	62	23.8	0.037	5.0	8.2	13.0	19.6	25.7	32.2
EX-1	62	25.7	0.040	4.8	7.9	12.4	18.7	24.5	30.9
EX-2	62	5.5	0.009	1.1	1.8	2.8	4.3	5.6	7.1
EX-3	62	136.8	0.214	22.0	36.4	57.6	86.9	114.0	143.1
EX-3A	61	188.1	0.294	28.3	47.4	75.7	115.1	152.2	192.6
EX-4	62	192.0	0.300	30.1	49.9	79.1	119.5	157.0	197.3
EX-4A	62	151.5	0.237	24.7	40.8	64.4	97.0	127.2	160.1
EX-5	62	153.9	0.240	24.2	40.0	63.4	95.9	125.9	158.2
EX-6	62	90.2	0.141	15.3	25.5	40.1	60.7	79.9	100.5
EX-7	56	165.0	0.258	11.6	21.5	37.5	60.9	83.1	107.4
EX-8	45	42.0	0.066	0.5	1.7	4.5	9.4	14.5	20.5
EX-9	54	131.9	0.206	12.2	23.9	43.1	70.9	97.0	125.2
EX-10	60	270.7	0.423	32.7	56.0	91.1	140.1	185.9	236.1
EX-10A	41	179.3	0.280	0.6	2.2	7.3	17.4	29.1	43.1
EX-11	43	209.3	0.327	18.0	29.8	47.7	73.4	98.3	126.1
EX-12	51	39.5	0.062	2.2	5.1	10.1	17.7	25.1	33.3
EX-13	55	89.3	0.139	7.7	15.2	27.1	44.2	60.5	78.4
EX-20	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
EX-20A	64	179.7	0.281	32.2	51.9	80.5	119.8	155.9	194.6
EX-21	65	33.3	0.052	8.6	13.5	20.7	30.5	39.4	49.0
EX-24	59	63.1	0.099	9.5	16.6	27.5	42.9	57.4	73.0
EX-25	43	54.4	0.085	0.3	1.5	4.8	10.7	17.2	25.1
EX-73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
EX-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
EX-75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
EX-76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
EX-77	62	230.6	0.360	34.7	58.9	90.6	137.5	180.9	227.7
EX-78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
EX-79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
EX-80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
EX-81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
EX-82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3
EX-88	62	139.2	0.217	22.2	36.7	58.0	87.6	115.0	144.4

DESIGN POINT SUMMARY (PEAK FLOW)

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-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP-73	2.528	225.9	380.7	618.0	957.0	1260.4	1582.3	
DP-71	2.669	229.3	388.9	629.7	978.8	1277.3	1637.9	STERLING RANCH NORTHERN BNDRY
DP-69	3.209	253.0	434.8	707.7	1100.0	1453.3	1870.4	
DP-63	3.446	251.4	430.7	713.1	1113.2	1496.2	1911.5	STERLING RANCH SOUTHERN BNDRY
DP-10	0.508	36.5	58.0	106.4	162.9	220.6	287.2	COLORADO SPRINGS/EL PASO BNDRY
DP-9A	0.557	55.3	94.3	150.3	227.7	299.5	380.5	VOLLMER/TAHITI DRIVE
DP-9	0.505	52.8	88.8	142.1	214.2	281.0	351.4	VOLLMER/LOCHWINNOCH LN
DP-8A	0.139	7.7	15.2	27.1	44.2	60.5	78.4	D/S STERLING RANCH EASTERN BNDRY
DP-8	0.528	24.2	45.1	77.8	124.4	169.5	220.9	D/S STERLING RANCH SOUTHERN BNDRY
DP-7	0.703	32.4	57.1	97.3	156.1	213.8	277.9	STERLING RANCH SOUTHERN BNDRY
DP-6	0.206	12.2	23.9	43.1	70.9	97.0	125.2	STERLING RANCH SOUTHERN BNDRY
DP-5	0.066	0.5	1.7	4.5	9.4	14.5	20.5	STERLING RANCH SOUTHERN BNDRY
DP-4	0.258	11.6	21.5	37.5	60.9	83.1	107.4	STERLING RANCH SOUTHERN BNDRY
DP-3	0.009	1.1	1.8	2.8	4.3	5.6	7.1	STERLING RANCH SOUTHERN BNDRY
DP-2	0.040	4.8	7.9	12.4	18.7	24.5	30.9	STERLING RANCH SOUTHERN BNDRY
DP-1	0.037	5.0	8.2	13.0	19.6	25.7	32.2	STERLING RANCH SOUTHERN BNDRY
DP-60A	3.545	247.7	430.2	707.1	1113.0	1496.6	1913.5	FUTURE MARKSHEFFEL X-ING
DP-56	0.466	23.2	42.5	71.9	115.6	157.4	202.9	STERLING RANCH SOUTHERN BNDRY
DP-53A	4.138	262.1	454.0	763.2	1196.5	1609.8	2061.5	SAND CREEK AND POND 3

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-78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP-73	2.528	40.4	61.5	92.1	134.3	173.1	214.9	
DP-71	2.669	42.5	64.9	97.1	141.6	182.5	226.6	STERLING RANCH NORTHERN BNDRY
DP-69	3.209	50.7	77.4	116.1	169.4	218.6	271.4	
DP-63	3.446	54.1	82.5	123.8	180.8	233.3	289.9	STERLING RANCH SOUTHERN BNDRY
DP-10	0.508	7.6	11.7	17.6	25.8	33.4	41.6	COLORADO SPRINGS/EL PASO BNDRY
DP-9A	0.557	9.3	14.1	21.1	30.7	39.4	48.8	VOLLMER/TAHITI DRIVE
DP-9	0.505	8.4	12.7	19.0	27.6	35.5	44.0	VOLLMER/LOCHWINNOCH LN
DP-8A	0.139	1.3	2.1	3.4	5.2	7.0	8.9	D/S STERLING RANCH EASTERN BNDRY
DP-8	0.528	4.4	7.0	11.1	16.8	22.3	28.4	D/S STERLING RANCH SOUTHERN BNDRY
DP-7	0.703	6.1	10.0	15.9	24.3	32.4	41.3	STERLING RANCH SOUTHERN BNDRY
DP-6	0.206	2.4	4.0	6.3	9.6	12.7	16.0	STERLING RANCH SOUTHERN BNDRY
DP-5	0.066	0.2	0.4	0.8	1.4	1.9	2.6	STERLING RANCH SOUTHERN BNDRY
DP-4	0.258	2.6	4.2	6.7	10.2	13.5	17.2	STERLING RANCH SOUTHERN BNDRY
DP-3	0.009	0.1	0.2	0.3	0.5	0.6	0.8	STERLING RANCH SOUTHERN BNDRY
DP-2	0.040	0.6	0.9	1.4	2.1	2.7	3.4	STERLING RANCH SOUTHERN BNDRY
DP-1	0.037	0.6	0.9	1.3	1.9	2.5	3.1	STERLING RANCH SOUTHERN BNDRY
DP-60A	3.545	55.3	84.4	126.4	184.8	238.5	296.6	FUTURE MARKSHEFFEL X-ING
DP-56	0.466	4.0	6.3	9.9	14.9	19.8	25.1	SAND CREEK AND POND 3
DP-53A	4.138	63.0	96.4	144.7	211.8	273.9	340.9	SAND CREEK AND POND 3

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (SQ MI)	Q ₂ (CFS)	Q ₁₀₀ (CFS)
DP-50	0.32	47.0	195.7
DP-51 (BASIN 86)	0.33	17.7	74.1
DP-52	1.67	80.5	456.5
DP-56	0.79	63.6	265.0

Values reported from SCDBPS
(DP 50, 51, 52 Not analyzed as a part of this study)
DBPS Reach 85(Basin#1)=Q10=28.8cfs Q100=115.2cfs



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

2018 STERLING RANCH MDDP

EXISTING HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09-002 FILE: \dwg\Eng Exhibits\2018-MDDP-ExistCondWSWMap.dwg

DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS

SCALE
HORIZ: NTS
VERT: NTS

DATE: 08-22-18

DM1

DESIGN POINT SUMMARY (VOLUME)							
DESIGN POINT	AREA (sq ft)	V ₁ (cu ft)	V ₂ (cu ft)	V ₃ (cu ft)	V ₄ (cu ft)	V ₅ (cu ft)	LOCATION
DP-74	0.371	5.9	9.0	13.6	19.8	25.5	ARROYA LANE X-ING
DP-75	1.413	22.7	34.5	51.7	75.4	97.1	
DP-77	2.343	37.7	57.4	85.9	125.1	161.1	
DP-78	0.538	8.9	13.5	20.1	29.3	37.7	
DP-73	2.471	40.0	60.8	91.0	132.5	170.7	POCO ROAD X-ING
DP-72	2.543	41.3	62.9	94.0	136.8	176.2	
DP-71	2.657	46.3	70.0	104.3	151.3	194.5	
DP-70	2.867	49.5	74.5	110.6	160.1	205.4	
DP-69	3.328	57.5	86.1	127.4	183.8	235.3	STERLING RANCH NORTHERN BNDRY
DP-87	3.594	66.5	98.9	145.6	209.1	267.1	
DP-68	4.312	81.8	123.7	183.9	264.9	338.0	
DP-64	0.119	7.0	9.1	11.8	15.2	18.1	
DP-63	4.449	85.6	129.5	192.3	276.7	352.8	UPSTREAM OF POND W3
DP-61	5.565	103.7	157.8	235.1	338.4	431.3	
DP-60A	5.617	110.1	168.6	250.4	359.5	457.7	
DP-53A	5.661	112.0	170.0	252.6	362.6	461.7	
DP-51A	0.247	3.1	5.2	8.4	12.7	16.6	STERLING RANCH SOUTHERN BNDRY
DP-25	0.480	6.1	10.4	16.9	25.7	33.7	
DP-35	0.620	7.0	13.7	23.4	36.1	47.4	
DP-45	0.736	7.6	15.6	27.2	43.0	57.2	
DP-56	1.017	7.7	16.1	28.6	51.3	71.7	NEAR SE PROP CORNER BELOW SE PROP CORNER
DP-8	1.079	8.0	16.7	26.6	53.0	74.0	
DP-21	0.396	6.3	11.3	18.3	27.5	35.6	
DP-22	0.736	6.3	10.7	16.7	24.6	31.5	
DP-25	1.017	1.3	1.9	1.2	4.1	5.2	SAND CREEK AND POND 3
DP-26	1.079	0.7	0.9	2.8	1.5	1.8	

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)						
DBPS DESIGN POINT	AREA (sq mi)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	PEAK FLOW (cfs)	Q ₁₀ (mgd)	Q ₁₀₀ (mgd)
DP-50	0.02	4.70	195.7	0.32	146.7	570.3
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 SCDGPS. DP-51, 52 Not analyzed as a part of this study)
 DBPS Reach 85(Basin91)=Q10=28.6cfs, Q100=115.2cfs, Q10=345.7cfs, Q100=588.9cfs
 DBPS Reach 86(Basin86)=Q10=17.7cfs, Q100=74.1cfs, Q10=110.0cfs, Q100=233.5cfs

2018 STERLING RANCH MDDP

20 BOULDER CRESCENT, SUITE 11
COLORADO SPRINGS, CO 8090
PHONE: 719.955.5485

DRAINAGE MAP

REVISED DETENTION/SWQ PER SKETCH PLAN AMENDMENT						
POND FSD21						
PEAK INFLOW (CFS)	Q2	Q3	Q10	Q25	Q50	Q100
	4.7	10.3	17.5	26.4	33.5	42.2
ALLOWABLE RELEASE (CFS)	0.3	4.0	8.0	18.3	23.7	30.3
MODELED RELEASE (CFS)	0.1	3.1	7.0	15.9	21.5	29.8
STORED VOLUME (AC.-FT)	0.415	0.621	0.731	0.917	1.015	1.145
POND FSD23						
PEAK INFLOW (CFS)	Q2	Q3	Q10	Q25	Q50	Q100
	10.2	15.6	21.2	27.8	33.9	40.7
ALLOWABLE RELEASE (CFS)	0.2	2.4	4.9	11.2	14.5	18.6
MODELED RELEASE (CFS)	0.2	1.4	3.4	8.2	11.9	17.6
STORED VOLUME (AC.-FT)	0.630	0.849	0.955	1.125	1.228	1.364

REVISED DETENTION/SWQ PER SKETCH PLAN AMENDMENT						
POND FSD-E1						
PEAK INFLOW (CFS)	Q2	Q5	Q10	Q25	Q50	Q100
	22.5	40.6	61.9	87.6	109.33	134.9
ALLOWABLE RELEASE (CFS)	0.7	11.0	22.1	50.9	65.7	84.1
MODELED RELEASE (CFS)	0.4	9.0	18.5	38.1	52.0	60.7
STORED VOLUME (AC.-FT)	1.732	2.398	2.828	3.513	3.956	4.771
POND FSD-E2						
PEAK INFLOW (CFS)	Q2	Q5	Q10	Q25	Q50	Q100
	40.15	61.5	109.4	133.3	159.8	186
ALLOWABLE RELEASE (CFS)	0.6	9.5	19.2	45.5	59.8	77.6
MODELED RELEASE (CFS)	0.6	8.1	18.1	36.4	50.4	72.1
STORED VOLUME (AC.-FT)	3.014	3.977	4.493	5.233	5.705	6.377

REVISÉ BASIN
FLOWS PER
SKETCH PLAN
AMENDMENT
SEE TABLE ABOVE

DESIGN POINT SUMMARY (VOLUME)							
DESIGN POINT	AREA (SQ. FT.)	V ₂ (MG/IT)	V ₃ (MG/IT)	V ₄ (MG/IT)	V _{5a} (MG/IT)	V _{5b} (MG/IT)	LOCATION
DP--74	0.371	5.9	9.0	13.6	19.8	25.6	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
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
DP--71	2.757	46.3	70.0	104.3	151.3	194.5	240.8
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
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
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
DP--61	5.356	103.7	157.8	235.1	338.4	431.3	529.8
DP--60A	5.517	110.1	168.6	255.4	359.5	457.7	556.5
DP--52A	5.661	112.0	170.2	252.6	362.6	461.7	566.5
DP--1E	0.247	3.1	5.2	8.4	12.7	16.8	20.9
DP--2E	0.480	6.1	10.4	16.9	25.7	33.5	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--5E	1.017	7.7	16.1	28.6	51.3	71.7	92.9
DP--8	1.079	8.0	16.7	26.6	53.0	74.0	95.9
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

SAND CREEK FLOW COMPARISON CHART			
DESIGN POINT	AREA (SQ MI)	Q ₁₀₀ (CFS)	DESCRIPTION
DP-77	2.34,3	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
	4.3,3	2630	SAND CREEK DBPS
		2600	FEMA
DP-60A	5.661	1662	PROPOSED CONDITION
	5.36	3295	SAND CREEK DBPS

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)						
DBPS DESIGN POINT	AREA (sq ft)	Q _{avg} (cfs)	Q _{avg} (cfs/sq ft)	AREA (sq ft)	Q _{avg} (cfs)	Q _{avg} (cfs/sq ft)
DP-50	0.32	47.0	195.7	0.32	146.7	370.3
DP-51 (BASIN #6)	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 SCDDBPS (DP 50, 51, 52 Not Analyzed as part of this study)
 DBPS Reach #5(Basin#1)-Q10=20.8 cfs Q10=115.2 cfs Q1=354.8 cfs
 DBPS Reach #6(Basin#1)-Q10=20.8 cfs Q10=115.2 cfs Q1=354.8 cfs

[EXISTING]	[PROPOSED]
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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 REVISED FSD DESIGN PER SKETCH PLAN AMENDMENT - SEE TABLE LEFT							
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 REVISED FSD DESIGN PER SKETCH PLAN AMENDMENT - SEE TABLE LEFT							
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	42.7	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 REVISED FSD DESIGN PER SKETCH PLAN AMENDMENT - SEE TABLE LEFT							
STORM EVENT (YR)	2	5	10	25	50	100	
PEAK INFLOW (CFS)	23.3	35.9	53.8	79.1	102.4	122.4	
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 REVISED FSD DESIGN PER SKETCH PLAN AMENDMENT - SEE TABLE LEFT							
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	2.3	2.4	2.8	3.3	3.8	
FSD-E3							
STORM EVENT (YR)	2	5	10	25	50	100	
PEAK INFLOW (CFS)	100.4	130.6	169.6	217.4	257.8	298.4	
ALLOWABLE RELEASE (CFS)	0.9	13.2	26.5	61.6	79.8	102.6	
MODELED RELEASE (CFS)	1.0	6.8	25.7	56.0	79.8	101.3	
STORED VOLUME (AC-FT)	7.0	7.2	7.7	8.9	10.1	11.4	
FSD-E4							
STORM EVENT (YR)	2	5	10	25	50	100	
PEAK INFLOW (CFS)	58.9	75.5	96.6	122.2	143.7	165.2	
ALLOWABLE RELEASE (CFS)	0.3	4.4	8.8	23.0	32.2	43.7	
MODELED RELEASE (CFS)	0.9	2.8	8.7	21.9	32.2	43.6	
STORED VOLUME (AC-FT)	4.2	4.3	4.7	5.4	6.2	6.9	
FSD-E5							
STORM EVENT (YR)	2	5	10	25	50	100	
PEAK INFLOW (CFS)	38.6	48.4	60.7	75.4	87.7	99.9	
ALLOWABLE RELEASE (CFS)	0.0	0.2	0.4	4.2	8.7	14.3	
MODELED RELEASE (CFS)	0.0	0.2	0.5	2.2	5.1	10.0	
STORED VOLUME (AC-FT)	3.0	3.7	4.4	4.8	5.0	5.3	
FSD-E6							
STORM EVENT (YR)	2	5	10	25	50	100	
PEAK INFLOW (CFS)	141.6	189.4	252.5	331.4	398.9	467.5	
ALLOWABLE RELEASE (CFS)	0.2	1.9	3.2	37.4	77.3	125.6	
MODELED RELEASE (CFS)	0.2	0.9	3.2	18.3	64.1	123.3	
STORED VOLUME (AC-FT)	13.0	17.0	21.9	22.2	22.6	23.7	
PND-E7							
STORM EVENT (YR)	2	5	10	25	50	100	
PEAK INFLOW (CFS)	46.5	75.4	121.2	285.2	402.4	548.0	
MODELED RELEASE (CFS)	23.1	35.3	71.5	108.3	152.1	196.4	
STORED VOLUME (AC-FT)	1.0	1.8	4.6	10.5	17.9	28.0	

Text Box (2)

Assigned: Include a section on the siting and responsibility for design and construction of detention facilities and downstream conveyance facilities.

Unresolved:
Include a section on the timing and responsibility for design and construction of detention facilities and downstream conveyance facilities.

Run01 0.2 to 0.5 m on site basin that was originally prepared for space squabbles on the 0.2 m to 0.5 m and 1.5 m recirculation. The Blank-Pan Amendment continues to prepare the same space squabbles for carrier adjacent to 0.3 m, 0.5 m, and 1.5 m recirculation. In this, the proposed Blank-Pan Amendment continues to remain consistent with the original [WSPR](#) [Amendment](#).

Run02 0.5 to 0.9 m on site basin that was originally prepared for space squabbles on the 0.5 m and 1.5 m recirculation. The Blank-Pan Amendment continues to prepare the same space squabbles for carrier adjacent to 0.5 m, 1.5 m, and 3.5 m recirculation. The original WSPR call number of 7019 for this basin, which for the Type "W" means adjacent to 0.5 m recirculation (i.e., Table 3 in 0.5 m, 1.5 m, 3.5 m). The increase in divergent flows inside this basin above and beyond what was originally assumed for the WSPR will be required to still be obtained in the pre-development. Gens presented in the

Unresolved:
Discuss impact to storm sewer system and trunk main in the basin from the increased density. State the change in peak flows at DP1E.