FINAL DRAINAGE REPORT

for

SUNDANCE WEST SUBDIVISION

Prepared for:

Mr. Matt Dunston
1230 Scarsbrook Court
Monument, CO 80132

July 21, 2025
Revised October 13, 2026

Prepared by:

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JPS Project No. 022501
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FINAL DRAINAGE REPORT
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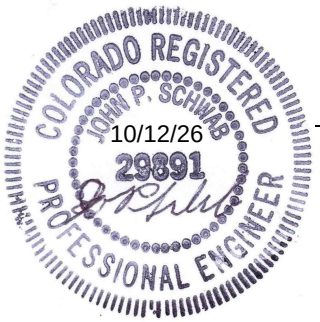
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DRAINAGE STATEMENT

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 master plan of the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.



John P. Schwab, P.E. #29891

Developer's Statement:

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

By: Matthew Dunston 10/13/26

Printed Name: Matt Dunston Date
1230 Scarsbrook Court, Monument, CO 80132

El Paso County's Statement

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

Add "J."

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

Conditions:

I. GENERAL LOCATION AND DESCRIPTION

A. Background

Sundance West Subdivision is a proposed 7-lot rural residential subdivision located in northern El Paso County, Colorado. The existing 19.5-acre parcel (El Paso County Assessor's Number 61250-01-003) is addressed as 5525 Hodgen Road, located at the southeast corner of Hodgen Road and Farrar Road. The property is currently platted as Lot 1, Thal Subdivision. The proposed subdivision will consist of a replat of Lot 1, Thal Subdivision, creating seven rural residential lots.

The property is developed with an existing barn / garage with gravel parking and storage areas in the northeast corner of the site. The existing barn / residence / garage will be platted as the new 4.5-acre Lot 5, and six new 2.5-acre lots will be created to the west and south of Lot 5. Lot 5 will continue to utilize the existing access drive connection to Hodgen Road at the northeast corner of the property.

No access to Hodgen Road will be allowed. Existing access will be closed per Plat note. Please revise statement

A previously disturbed area of approximately 5 acres along the west and south sides of the existing barn will be restored to historic / undeveloped conditions in preparing this property for subdivision.

Farrar Road does not meet minimum County roadway standards and therefore improvements are required to meet criteria of approval for suitable access. Please revise.

The new lots will all have driveway access to Farrar Road along the west boundary of the subdivision. There are no public roadway improvements proposed, and common infrastructure improvements will be limited to the shared access driveway serving Lots 3,4, and 7 at the south end of the property.

B. Scope

This report will provide a summary of site drainage issues impacting the proposed residential subdivision. The report will analyze upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the El Paso County Drainage Criteria Manual, and the report is intended to fulfill the requirements for a "Final Drainage Report" in support of the Final Plat process for this property.

C. Site Location and Description

Sundance West Subdivision is located in the Northeast Quarter of the Northeast Quarter Section 25, Township 11 South, Range 66 West of the 6th Principal Meridian. The 19.5-acre parcel is currently partially developed with a residence / garage at the north end of the site, and the balance of the site vegetated with native meadow grasses. The property is zoned RR5 (rural residential; 5-acre minimum lot sizes), and the project will include re-zoning to RR2.5 (rural residential; 2.5-acre minimum lot sizes).

The site is bordered by rural residential properties on all sides (Zoned RR5). Hodgen Road is a paved collector public street adjoining the north boundary of the site, and Hodgen Road is projected to be a minor arterial in 2045 by the County Major Transportation Corridors Plan (MTCP).

The existing Longview Estates Subdivision (Zoned RR5) is located on the north side of Hodgen Road.

Farrar Road is an existing gravel local road along the west boundary of the site. The Providence Point Estates Subdivision, consisting of existing 5-acre rural residential properties, adjoins the west side of Farrar Road along most of the west frontage of this site.

(not county maintained)

The south end of the west boundary of the site adjoins a vacant, unplatted 40-acre property (zoned RR5). Farrar Road is a public road along the frontage of the Providence Point Estates Subdivision, and Farrar Road then transitions to a private road extending to the south of the Providence Point Estates boundary.

The south boundary of the site adjoins a vacant, unplatted 40-acre property (zoned RR5).

The east boundary of the site adjoins an existing 19.5-acre rural residential property platted as Lot 2, Thal Subdivision.

Ground elevations within the site range from approximately 7,508 to 7,556 feet above mean sea level.

The site is located in the East Cherry Creek Drainage Basin, and the existing drainage swales downstream of the site flow northeasterly towards East Cherry Creek. The terrain is rolling with average grades ranging from 2 to 8 percent. The site is vegetated with native grasses along with clusters of native shrubbery.

D. General Soil Conditions

According to the Custom Soil Resource Report for this site (see details in Appendix A) provided by the Natural Resources Conservation Service (NRCS), on-site soils are comprised of "Type 67: Peyton sandy loam" and "Type 68: Peyton-Pring complex." These soils are classified as hydrologic soils group "B" (moderate infiltration rate).

E. References

El Paso County "Engineering Criteria Manual," revised December 13, 2016.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C0310G, December 7, 2018.

City of Colorado Springs & El Paso County "Drainage Criteria Manual," revised October 31, 2018.

City of Colorado Springs "Drainage Criteria Manual, Volume 1," revised January, 2021.

City of Colorado Springs "Drainage Criteria Manual, Volume 2," revised December, 2020.

Classic Consulting Engineers & Surveyors, "Preliminary and Final Drainage Report for High Forest Ranch Filing No. 2 and Filing No. 3," May, 2001.

El Paso County "Engineering Criteria Manual," revised July 18, 2023.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C0305G, December 7, 2018.

Legacy Engineering, Inc., "Final Drainage Study for Providence Point," October 16, 2015 (approved by County 11/4/15).

Mile High Flood District, "Urban Storm Drainage Criteria Manual, Volume 1," revised August, 2018.

Mile High Flood District, "Urban Storm Drainage Criteria Manual, Volume 2," revised September, 2017.

Mile High Flood District, "Urban Storm Drainage Criteria Manual, Volume 3," revised January, 2021.

M.V.E., Inc., "Longview Estates Final Drainage Report," October 30, 2002 (approved by County 11/19/02).

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The proposed development lies completely within the East Cherry Creek Drainage Basin as classified by El Paso County. Stormwater runoff from the property generally drains easterly to existing natural swales flowing to the East Cherry Creek channel, which ultimately flows to a downstream confluence with the South Platte River.

B. Floodplain Impacts

The project site is located beyond the limits of any 100-year floodplain delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Panel Number 08041C0305G dated December 7, 2018 (see Firmette Exhibit in Appendix D).

All drainage from this site ultimately flows to the delineated FEMA floodplain of East Cherry Creek downstream of the site to the northeast.

C. Sub-Basin Description

The existing drainage basins lying in and around the proposed development are depicted on Figure EX1 and EX2 (Appendix F). The property has been delineated as three on-site drainage basins (Basins A1, A2.1, and A2.2).

Include the size of the culvert under Farrar and analyze whether or not it is adequate to convey these flows (are flows contained in the pipe, does the road overtop in the 100 year, etc.) If it is not adequate please, provide recommendation of what the minimum culvert size should be based on analysis.

In aerial imagery, I'm only able to see the western end of the culvert. Please verify that the eastern end, please verify that the eastern end daylights as well. Providence Point FDR mentioned an existing culvert here.

Developed runoff in this subdivision will continue to follow historic paths.

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

No Drainage Basin Planning Study (DBPS) has been completed for the East Cherry Creek Drainage Basin.

Legacy Engineering, Inc. prepared a drainage report for the adjoining rural residential subdivision to the west entitled "Final Drainage Study for Providence Point," dated October 16, 2015 (see excerpts in Appendix A; PCD File Number SF164). According to the rational method hydrologic calculations in the Legacy report, the off-site area to the west comprises a total basin area of 196.3 acres, with a total calculated developed flow of Q_{100} = 205.4 cfs crossing Farrar Road at the west boundary of the Sundance West Subdivision property.

B. Hydrologic Criteria

Rational Method Hydrology procedures were utilized for calculation of peak flows. Rational Method hydrologic calculations were based on the following assumptions:

- Design storm (minor) — 5-year
- Design storm (major) — 100-year
- Rainfall Intensities — El Paso County I-D-F Curve
- Hydrologic soil type — B

	C5	C100
• Runoff Coefficients - undeveloped:		
Existing meadow / forest areas	0.08	0.35
• Runoff Coefficients - developed:		
Proposed lot areas (2.5-acre lots)	0.170	0.417
Proposed lot areas (5-acre lots)	0.137	0.393

Hydrologic calculations are enclosed in Appendix C, and peak design flows are identified on the drainage basin drawings.

IV. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

A2.1 and A2.2 should be considered a major drainageway. Please revise.

As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project:

Step 1: Employ Runoff Reduction Practices

- Minimize Impacts: The proposed rural residential subdivision is an inherently low impact development. The proposed 2.5-acre minimum lot sizes will minimize drainage impacts in comparison to higher density development alternatives.

Step 2: Stabilize Drainageways

- There are no major drainageways within the site. Vegetated buffer strips will be maintained between developed areas of the site and downstream drainage swales.

Step 3: Provide Water Quality Capture Volume (WQCV)

- Water quality detention is not required based on the low density of the rural residential development proposed (minimum lot size of 2.5-acres). According to ECM Appendix I Section I.7.1.B.5, a single-family residential lot greater than or equal to 2.5 acres in size per dwelling and having a total lot impervious area of less than 10 percent is excluded from permanent WQ control measures. The proposed impervious area for the new rural residential lots is planned to remain at a maximum of 10 percent per lot in conformance with "10 percent" threshold for exclusion from water quality requirements.
- The previously disturbed area at the north end of the property will need to be stabilized with vegetation so that the lots remain under 10 percent impervious in order to utilize the referenced water quality exclusion.

Step 4: Consider Need for Industrial and Commercial BMPs

- No industrial or commercial land uses are proposed as part of this development.

V. GENERAL DRAINAGE RECOMMENDATIONS

The developed drainage plan for the site is to provide and maintain positive drainage away from structures and conform to the established drainage patterns for the overall site. JPS Engineering recommends that positive drainage be established and maintained away from all structures within the site in conformance with applicable building codes and geotechnical engineering recommendations.

Individual lot grading is the sole responsibility of the individual builders and property owners. Final grading of each home site should establish proper protective slopes and positive drainage in accordance with applicable housing industry standards, HUD guidelines, and building codes. In general, main floor elevations for each home should be established a minimum of 2 feet above the adjoining street.

In general, we recommend a minimum of 6 inches clearance from the top of concrete foundation walls to adjacent finished site grades. Positive drainage slopes should be maintained away from all structures, with a minimum recommended slope of 5 percent for the first 10 feet away from buildings in landscaped areas, a minimum recommended slope of 2 percent for the first 10 feet away from buildings in paved areas, and a minimum slope of 1 percent for paved areas beyond buildings.

Both of these are not correct. Common subdivision infrastructure improvements are shown on the GEC and Farrar Road does not meet minimum county standards for a roadway.

VI. DRAINAGE FACILITY DESIGN

A. General Concept

Development of the proposed minor subdivision will not require any public improvements or common subdivision infrastructure improvements. The general concept for management of developed storm runoff is for the individual home site grading to provide positive drainage away from the building pads and divert runoff to stable drainage swales following historic drainage patterns.

B. Specific Details

1. Existing Drainage Conditions

Historic drainage conditions are depicted on Figures EX1 and EX2 (Appendix F). The northeast part of the property has been developed with an existing residence / garage with gravel parking and storage areas. The balance of the property is a historically vacant meadow area. There are no existing drainage facilities within the property. There are no existing irrigation facilities, major utilities, or significant encumbrances impacting the site.

There is an 80' wide no-build drainage easement crossing the site.

Basin A1

Basin A1 (9.2-acres) comprises the north side of the property, which sheet flows southeasterly towards an existing drainage swale along the east boundary of the site. Existing peak flows from Basin A1 are calculated as Q_5 = 4.7 cfs and Q_{100} = 22.7 cfs. Off-site Basin OA1 (45.8-acres) comprises a large upstream area to the northwest (part of the Longview Estates Subdivision on the north side of Hodgen Road), which flows southeasterly into Basin A1 through an existing 42" RCP culvert crossing Hodgen Road near the northeast corner of the property. Runoff from Basins OA1 and A1 combines at Design Point #A1, with existing peak flows calculated as Q_5 = 16.0 cfs and Q_{100} = 77.1 cfs. Drainage from Design Point #1 flows southeasterly to an existing stable vegetated drainage swale downstream.

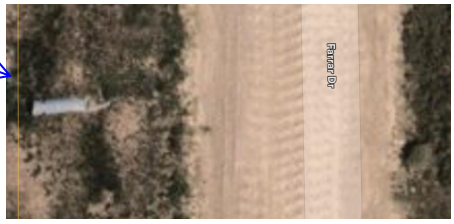
Basins A2.1-A2.2

Basin A2.1 (7.3-acres) comprises the southwest area of the property, which flows easterly through a grass-lined swale to an existing stock pond ("Pond A2") at the east edge of Basin A2. The existing stock pond has a depth of 10 feet and there is an existing valve and drain pipe with an invert elevation several feet above the bottom of the pond.

This pond does not appear to be a wet pond or a stock pond. If this is detaining flows and releasing them it should be referred to as a detention pond or a dam.

Update to match maps/calcs.

Please see comment on PDF page 6 and revise as needed.



Existing peak flows from Basin A2.1 are calculated as Q_5 = 1.8 cfs and Q_{100} = 13.4 cfs.

Off-site Basin OA2 (164.7-acres) comprises a large upstream area to the northwest (including parts of Providence Point Estates Subdivision and High Forest Ranch to the west). Off-site Basin OA2 flows southeasterly into Basin A2.1, crossing a low point in Farrar Road (existing gravel road) at the west boundary of the property. Based on field survey and site observation, no existing culvert has been found at the low point in Farrar Road, so off-site flows from the west would be expected to overtop the gravel road and flow easterly across Basin A2.1.

Existing Basins OA2 and A2.1 flow easterly to Pond A2 (Design Point #A2.1). Existing peak flows at Design Point #A2.1 are calculated as Q_5 = 41.2 cfs and Q_{100} = 197.4 cfs.

Pond A2 has a grass-lined overflow spillway around the south edge of the pond embankment. Based on the existing vertical height from pond bottom to spillway being 10 feet or less, the existing pond would be classified as a non-jurisdictional embankment. We are not aware of any legal documentation regarding water storage rights for the existing stock pond.

Existing hydrologic conditions for Pond A2 have been modeled using "MHFD-Detention-v4.07," resulting in the following pond operating parameters (see Appendix D1):

Bottom Elevation	7510
Spillway	7520
5-Year WSL	7518.33
100-Year WSL	7521.01

Proof of submittal of a non-jurisdictional impoundment form is required.

Basin A2.2 (4.8-acres) comprises the southeast area of the property, downstream of Pond A2, which flows easterly through a grass-lined swale to an existing grass-lined swale at the east boundary of the property. Existing peak flows from Basin A2.2 are calculated as Q_5 = 1.5 cfs and Q_{100} = 11.0 cfs.

Existing flows from Basins OA1-OA2 and A1-A2.1-A2.2 combine at Design Point #1 at the east boundary of the site, with total existing peak flows calculated as Q_5 = 24.3 cfs and Q_{100} = 241.1 cfs. Drainage from Design Point #1 flows easterly to an existing stable vegetated drainage swale downstream.

2. Developed Drainage Conditions

The developed drainage basins and projected flows are shown on the Developed Drainage Plan (Figure D1, Appendix F).

Basin A1

Developed flows from Basin A1 will continue to flow southeasterly to the existing drainage swale at the east boundary of the site (Design Point #1), with developed peak flows calculated as Q_5 = 5.9 cfs and Q_{100} = 24.4 cfs.

This is being used as a detention pond and not functioning as a stock pond. Please update terminology accordingly throughout. If this is not holding water then legal documentation is not needed for a stock pond. Please update narrative as needed.

See comment on drainage map regarding basin A1 and revise section as needed

Developed flows from Basins OA1 and A1 will continue to flow southeasterly to Design Point #A1 along the east boundary of the proposed Lot 5.

Based on the proposed typical rural residential development, peak flows at Design Point #A1 are calculated as Q_5 = 16.7 cfs and Q_{100} = 77.9 cfs (minimal 100-year flow increase of 0.8 cfs, or 1.0 percent, compared to existing conditions).

As previously noted, the existing disturbed area of approximately 5 acres at the north end of the site will be re-vegetated and restored to undeveloped conditions in preparation for the proposed residential subdivision. The anticipated rural residential development is assumed to have a maximum impervious area of 10 percent per lot.

Basins A2.1-A2.2

Developed flows from Basins A2.1-A2.2 will continue to flow easterly across the property to the existing drainage swale at the east boundary of the site. Developed peak flows from Basin A2.1 (7.3-acres) are calculated as Q_5 = 4.0 cfs and Q_{100} = 16.5 cfs. Developed flows from Basins OA2 and A2.1 will continue to flow easterly to Pond A2 (Design Point #A2.1). Developed peak flows at Design Point #A2.1 are calculated as Q_5 = 41.2 cfs and Q_{100} = 197.4 cfs.

Subdivision development will include construction of the proposed shared driveway extending easterly from Farrar Road to serve Lots 3, 4 and 7 at the south end of the site. The proposed grading plan for the shared driveway has been designed to raise the driveway above the adjoining drainage swale flowing easterly across Lot 4. Proposed Channel A2.1A consists of the broad, grass-lined channel along the south side of the new driveway, flowing easterly into Pond A2 (see hydraulic calculations in Appendix E).

Proposed private driveway Culvert A2.1 (18" HDPE) will convey the flow from Basin A2.1 across the new driveway, flowing into Pond A2 on the south side of the shared driveway (see hydraulic calculation in Appendix E). A riprap outlet apron will be provided for erosion protection at the culvert outlet.

Is erosion protection needed at the inlet? Please address.

A riprap rundown will be provided for erosion protection along the channel transition segment draining southeasterly into Pond A2 (Channel A2.1B per Appendix E).

The existing Stock Pond A2 will be preserved and upgraded, allowing the pond embankment to serve as the driveway to Lot 7 at the southeast corner of the subdivision. The existing pond drain pipe and valve will be abandoned and replaced with a new 12-inch HDPE Culvert A2.1 (sized to maintain the pond outflow consistent with historic conditions). A riprap outlet apron will be provided for erosion protection at the culvert outlet.

Proposed hydrologic conditions for Pond A2 have been modeled using "MHFD-Detention-v4.07," resulting in the following pond operating parameters (see Appendix D2):

see comments regarding spillway on the drainage map and address as needed in narrative.

Please identify the ownership/maintenance responsibility of the drainage facilities on the site.

If retaining the stock pond, please detail the improvements in the narrative for the pond itself as well as any erosion control mesures.

Bottom Elevation	7512
Spillway	7520
5-Year WSL	7520.23
100-Year WSL	7522.98

see comments on drainage map and address in narrative as needed.

Basin A2.2 (4.8-acres) comprises the southeast area of the property, downstream of Pond A2, which flows easterly through a grass-lined swale (Channel A2.2) to the existing grass-lined swale at the east boundary of the property. Developed peak flows from Basin A2.2 are calculated as Q_5 = 3.3 cfs and Q_{100} = 13.5 cfs.

Combined Flows and Developed Drainage Impact

Developed flows from Basins OA1-OA2 and A1-A2.1-A2.2 will continue to flow easterly to Design Point #1 at the east boundary of the site, with total developed peak flows at Design Point #1 calculated as Q_5 = 30.5 cfs and Q_{100} = 228.8 cfs (decrease in 100-year flow compared to existing conditions). With appropriate measures to minimize impacts of concentrated flows from individual home sites, the drainage impact at the east boundary of the site will be minimal.

Include how much increase/decrease for 5 and 100 year.

The site outfall points are existing grass-lined swales at the east boundary of the property, which drain into a broad, grass-lined drainage swale flowing easterly across the adjoining property to the east. The existing grass-lined drainage swales provide a suitable outfall for drainage from this property.

As detailed in Appendix E, the hydraulic capacity of the existing drainage swales within the property has been evaluated, and the existing grass-lined swales (designated as Channels A1, A2.1, and A2.2 on Sh. D1) are adequate to convey the developed flows.

Proposed drainage easements have been delineated on the subdivision plat to prohibit building within the existing drainage swale areas.

Recognizing the minimal increase in developed flows calculated for the proposed rural residential subdivision, no on-site stormwater detention is proposed. As previously noted, we recommend implementation of appropriate drainage control measures during construction of individual home sites to minimize future impacts of concentrated drainage.

Based on the rural residential nature of the proposed subdivision (2.5-acre minimum lot sizes), the minor increase in developed flows will have no ~~significant~~ drainage impact in the East Cherry Creek Drainage Basin. Future construction of the rural residential home sites should implement appropriate drainage and erosion control measures and maximize preservation of vegetated buffer strips along the downstream sides of the property.

This needs to be a definitive statement, "no adverse drainage impact" otherwise please address what the impact will be to the downstream.

C. On-Site Drainage Facility Design

Developed drainage basins and drainage patterns are depicted on the enclosed Developed Drainage Plan (Sheet D1, Appendix F). No public drainage improvements are required for this subdivision. Based on the rural residential nature of this subdivision and the large lot sizes proposed, there will be no significant increase in developed flows, and there is no need for on-site flood control detention.

D. Analysis of Existing and Proposed Downstream Facilities

The proposed subdivision area will drain to existing natural drainage swales flowing to the East Cherry Creek Drainage Basin. Development of this property as a rural residential subdivision will have no ~~significant~~ impact on downstream drainage facilities.

E. Anticipated Drainage Problems and Solutions

The drainage plan for this minor subdivision consists of maintaining positive drainage away from home sites and conveying surface drainage through the site in general conformance with historic drainage patterns. The primary drainage problems anticipated within this type of development consist of maintenance of proper drainage patterns and erosion control.

Care will need to be taken to implement proper erosion control measures associated with the proposed driveways, home sites, and drainage swales. Vegetated buffer strips should be maintained along downstream property boundaries to the greatest extent possible. Drainage facilities outside the public right-of-way will be owned and maintained by the individual lot owners unless otherwise noted.

VII. EROSION CONTROL / SEDIMENT CONTROL

Contractors and Owners will need to implement and maintain proper Construction Control Measures (CCM's) for erosion and sediment control during and after construction. Erosion control measures should include installation of silt fence along the downstream edge of disturbed areas, sediment control logs protecting drainage ditches, vehicle tracking control pads at access points, riprap protection at culvert outlets, and revegetation of disturbed areas. Cut slopes will need to be stabilized during excavation as necessary and vegetation will need to be re-established as soon as possible for stabilization of graded areas.

VIII. STORMWATER DETENTION AND WATER QUALITY

As previously stated, the proposed development will result in a minimal increase in developed flows based on the rural residential development plan. There is no need for on-site stormwater detention based on the minimal developed drainage impact.

Unresolved - Currently Lot 5 appears to have approximately 17% impervious cover. Per ECM Section I.6.1.B.5, large lots utilizing the large lot exclusion must be less than 10% impervious OR:

A total lot imperviousness greater than 10 percent is allowed when a study specific to the watershed and/or MS4 shows that expected soil and vegetation conditions are suitable for infiltration/filtration of the WQCV for a typical site, and the permittee accepts such study as applicable within its MS4 boundaries. The maximum total lot impervious covered under this exclusion shall be 20 percent.

Water quality facilities are not required as this site meets exclusions listed in the revised El Paso County Engineering Criteria Manual (ECM). Section I.7.1.B.5 of the ECM identifies "Large Lot Single Family Sites" as excluded sites under the following definition: "A single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling and having a total lot impervious area of less than 10 percent." The proposed subdivision replat will create new rural residential lots with a minimum lot size of 2.5 acres. As detailed in Appendix C, the proposed impervious area for the new rural residential lots is planned to remain at a maximum of 10 percent per lot in conformance with "10 percent" threshold. A previously disturbed area of approximately 5 acres at the north end of the property will be re-vegetated and restored to undeveloped conditions in preparation for the proposed subdivision.

As noted on the enclosed "Developed Drainage Plan," builders and property owners shall implement and maintain appropriate drainage control measures to minimize impacts of concentrated drainage from individual home sites through use of level spreaders and similar techniques along the downstream edges of the disturbed home site areas.

This is more than what was mentioned on the previous pages regarding erosion. If the homeowners will need to install this level of drainage control measures address further in the report.

IX. DRAINAGE FEES

The developer will be responsible for all construction costs associated with subdivision infrastructure improvements. There are no public drainage improvements required for this subdivision.

This parcel is located in the East Cherry Creek Drainage Basin. No drainage and bridge fees will be due at the time of recordation of the final plat as the subject site is not located in a fee basin.

X. SUMMARY

Sundance West Subdivision is a proposed rural residential subdivision consisting of 7 lots on a 19.5-acre site. Development of the proposed subdivision is anticipated to result in a minimal increase in developed runoff from the site, and proper erosion and sediment control measures will be implemented by the individual owners and builders to mitigate developed drainage impacts. The proposed drainage patterns will remain consistent with historic conditions. Implementation and maintenance of proper erosion control measures will ensure that this minor subdivision has no ~~significant~~ adverse drainage impact on downstream properties or drainage facilities.

APPENDIX A

EXCERPTS FROM ADJOINING SUBDIVISION DRAINAGE REPORT

NEW DOC

RECEIVED
OCT 22 2015
BY: CY 930
Version 4

FINAL DRAINAGE STUDY

FOR

PROVIDENCE POINT

El Paso County, Colorado

Friday, October 16, 2015

PREPARED FOR
Marc and Cheryl Haes
16450 Farrar Drive
Colorado Springs, CO 80908
(719) 232-5605

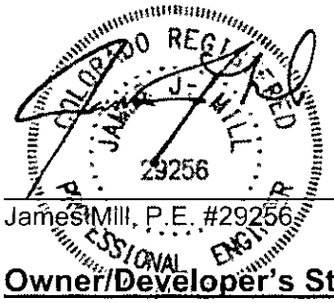
PREPARED BY

Legacy Engineering, Inc.
1626 Thatch Circle
El Paso County, Colorado 80109
(720) 200-4577

RECEIVED VERSION
FEB 08 2016 1

Design 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.



James Hill, P.E. #29256 — 10/16/15
Date

Owner/Developer's Statement:

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

Marc Haes, Owner — 11-2-15
Date
16450 Farrar Drive
Colorado Springs, CO 80908

El Paso County:

Filed in accordance with the requirements of the Drainage Criteria Manual, El Paso County Engineering Criteria Manual, and Land Development Code as amended.

Andre P. Brackin, P.E., — 11-4-15
Date
County Engineer / ECM Administrator

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I. GENERAL LOCATION AND DESCRIPTION

This Final Drainage Study for PROVIDENCE POINT has been prepared to address onsite and offsite drainage concepts in accordance with requirements of El Paso County, Colorado. The Appendix to this report includes minimum criteria, design computations and reference information to be used in subsequent phases of analysis and design. The attached Final Drainage Plan summarizes the drainage concepts and conclusions of this study.

A. LOCATION

PROVIDENCE POINT, containing a total of 35.34 acres, located in El Paso County as depicted on Figure 1 in the Appendix. The site is located in the northeast quarter of Section 25, Township 11 South, Range 66 West of the 6th P.M., El Paso County. The site is bounded by High Forest Ranch Filing 2 on the west, Hodgen Road ROW on the north, Thal Sudvision on the east, and Tract 7 of Eagle Crest Estates on the south.

B. DESCRIPTION OF PROPERTY

The site is to consist of 35.34 acres to be platted for 6 single family home sites. Existing vegetation covers the site, which is not irrigated, consisting mainly of native grasses on rolling topography ranging from 0% to 15%. The site drains to the east-southeast within existing arroyos and swales.

All drainage facilities per this drainage report are private and will not be maintained by El Paso County.

C. IRRIGATION FACILITIES

There are no active irrigation facilities on the site.

D. LAND USE

The development will NOT BE overlot graded for residential development. Providence Point is zoned for 5 acre min parcels.

II. DRAINAGE BASINS AND SUB-BASINS

A. HISTORIC PATTERNS

Historically, this site has drained to the east-southeast in exiting arroyos and swales. This pattern will not change with this subdivision and the addition of 5 additional home sites to this 35 acres will not increase or change the historic storm flows in a measurable way.

B. MAJOR BASIN DESCRIPTION

The drainage area which encompasses PROVIDENCE POINT drains entirely to an unnamed tributary arroyo of E Cherry Creek; the confluence of which is approx. 2 miles to the northeast at

Franktown-Parker FPE-3 Reservoir. According to the FIRM dated March 17, 1997, Map Number 08041CO325 F (reference 3; Figure 2a), there are no mapped A or AE flood zones on this property.

A significant amount of off-site drainage enters the property. The existing drainage patterns will remain exactly the same as a consequence of envisioned grading activities.

The predominant soil types for the site include Peyton Sandy Loams and Peyton Pring Complex (see Fig. 2 and Ref. 4). Peyton Sandy Loams is a well-drained soil group and have medium runoff with moderate erosion potential and are in the "B" hydrologic soils group classification and represents 79% of the project. **Peyton-Pring complex** is a well-drained soil group with low runoff with slight to moderate erosion potential and is classified as soil group "B" and represents 21% of the project.

C. SUB-BASIN DESCRIPTION

Sub-basins for this site have been divided as follows: A through D.

Basin "A" drains to the southeast toward the eastern property line and the existing culvert under Farrar Drive. The total area of Basin A is 55.6 acres including offsite area to the northwest. The total runoff from Basin A in the minor and major event are shown in the table below. Flows from will continue in their historic manner only to be interrupted by a culvert for the proposed Haes Haven View private Road. This culvert is calculated to be a 30" CMP (See appendix for Calculations).

Basin "B" drains to the southeast towards the southern property line. The total area of Basin B is 6.6 acres comprised only of onsite flows. The total runoff from Basin B in the minor and major event are shown in the table below. Flows from Basin B enter an existing offsite swale in Tract 7 that flows east towards an existing culvert under Farrar Drive.

Basin "C" drains to the southeast towards the southeastern property line. The total area of Basin C is 32.8 acres including offsite area to the west. The total runoff from Basin C in the minor and major event are shown in the table below. Flows from Basin C enter an existing offsite swale in Tract 7 that flows east towards an existing culvert under Farrar Drive.

Basin "D" drains to the east towards the southeastern property line. The total area of Basin D is 20.4 acres including offsite area to the west. The total runoff from Basin D in the minor and major event are shown in the table below. Flows from Basin D enter an existing offsite swale in Tract 7 that flows east towards an existing culvert under Farrar Drive.

Providence Point - Runoff Summary

Basin ID	Design Point	Area	10 year Runoff	100 year Runoff	Remarks
Basin OA + A(Hist)	1	55.6 ac	42.7 cfs	96.5 cfs	Total Hist flow to Culvert at HHV & Farrar
Basin OA +A	1	55.6 ac	44.2 cfs	97.9 cfs	Total Dev flow @ Culvert at HHV & Farrar
Basin B (Historic)	2	6.6 ac	4.7 cfs	14.7 cfs	Historic Sheet Flow offsite
Basin B	2	6.6 ac	6.8 cfs	15.1 cfs	Developed Sheet Flow offsite
Basin OC + C(Hist)	3	32.8 ac	7.8 cfs	55.9 cfs	Total Hist flow to S Arroyo
Basin OC + C	3	32.8 ac	8.2 cfs	56.5 cfs	Total Developed flow to S Arroyo
Basin OD + D(Hist)	4	20.5 ac	15.6 cfs	35.3 cfs	Total Hist flow to S Swale
Basin OD + D	4	20.5 ac	16.9 cfs	35.9 cfs	Total Developed flow to S Swale

III. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

Storm drainage analysis and design criteria are to be taken from the "City of Colorado Springs/El Paso County Drainage Criteria Manual (1994 Revisions), Reference 1

B. DEVELOPMENT CRITERIA REFERENCE AND CONSTRAINTS

Development criteria shall be in accordance with El Paso County Public Works Department.

C. HYDROLOGICAL CRITERIA

The Rational Method was utilized to analyze and quantify runoff from the developed basins. Design points were used to determine total flows at key points of interest. The 5-year storm event was used for the initial storm analysis within residential areas and the 100-year storm frequency was analyzed for the major storm.

D. HYDRAULIC CRITERIA

Sizing calculations for Haes Haven View Culvert were completed using Hydraflow Express Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. (See Appendix C).

E. SEDIMENT AND EROSION CONTROL

Site soils are typical of the area and will require careful erosion and sediment control methods. Construction sedimentation will be controlled, to meet El Paso County Performance Standards. Specifics of this erosion control plan will be demonstrated in the Grading, Erosion, and Sedimentation Control Plan that will be included in the construction plan set at time of Final Plat.

No unsuitability of the site soils with regard to construction of this development have been identified thus far.

IV. DRAINAGE FACILITY DESIGN

A. GENERAL CONCEPT

The general concept is to convey storm water via natural drainage-ways, culverts, to the unnamed E Cherry Creek tributary at the eastern boundary of PROVIDENCE POINT. Basins consist of rural lots, 1 private roadway, natural drainage-ways and open space.

Figure 1 is a vicinity map showing approximately where the PROVIDENCE POINT development is located. Figure 2 presents the soil classifications found within the site. Figure 2a presents a "firmette" for Map Number 08041CO325 F. Figure 3 is the IDF Curve for El Paso County. Figure 4 contains the time-intensity-frequency curves for El Paso County. Figure 5 shows calculations for a composite "I" value. Figure 6 presents average flow velocities for use with the rational method. Figure 7 contains time of concentration calculations and peak storm flows using rational method calculation sheets for the 5 and 100 year storm events, respectively for each basin. Figures in Appendix C contain culvert design calculations. An overall drainage map is provided at the end of this report.

Historic Basins: All existing basins and proposed basins shown in this development are exactly the same.

V. CONCLUSIONS

A. COMPLIANCE WITH STANDARDS

This Final Drainage Study for PROVIDENCE POINT was prepared in compliance with the El Paso County Public Works Regulations. In addition, no amendment to the Flood Hazard Area Delineation for this area is required for this development. There are no impacts to any threatened or endangered species that we are aware of. All Federal and State environmental permitting requirements, should they be necessary, will be complied with – this includes a State of Colorado Storm Water Discharge Permit.

B. DRAINAGE CONCEPT

The drainage designs and facilities presented in this report adequately convey developed runoff through the site and into existing drainage ways without increasing the existing discharge.

C. SUMMARY

The report provides sufficient information to accommodate the planning process. Information herein supports the viability of this proposed project.

East Cherry Creek is an unstudied basin therefore there are no Drainage or Bridge Fees to be collected for this Site.

VI. References

1) City of Colorado Springs/El Paso County Drainage Criteria Manual (1994 Revisions)

2) Flood Insurance Rate Map, Douglas County, Colorado, Map Number 08041CO325 March 17th, 1997, prepared by FEMA.

3) Soil Survey of El Paso County Area, Colorado, U.S. Department of Agriculture, Soil Conservation Service, issued November, 1974.

4) El Paso County Engineering Manual.

5) Software used - AutoDesk Civil 3D 2015; Microsoft Excel 2013; Microsoft Word 2013; UDFCD Excel Spreadsheets;

Providence Point			Phase III drainage study	
Basin A (Historic)	*COMPOSITE "I"*		*Total clustered lot area*	*38.6 acres*
Area Description	*Area*	*"I"*	*Imperv Area*	*Notes*
footprints in Lots	*0.0 acres*	*100%*	*0.0 acres*	
Roadways	*1.7 acres*	*100%*	*1.7 acres*	
Undisturbed	*16.4 acres*	*2%*	*0.3 acres*	
total	***18.1 acres***		*2.0 acres*	
CALCULATED BASIN "I" VALUE =			***11.0%***	
Basin A	COMPOSITE "I"		Total clustered lot area	*38.6 acres*
Area Description	Area	"I"	Imperv Area	*Notes*
footprints in Lots	0.7 acres	100%	0.7 acres	*6 home sites*
Roadways	1.7 acres	100%	1.7 acres	
Undisturbed	15.8 acres	2%	0.3 acres	
total	**18.1 acres**		2.7 acres	
CALCULATED BASIN "I" VALUE =			**14.6%**	
Basin B (Historic)				
footprints in Lots	*0.1 acres*	*100%*	*0.1 acres*	*1 exist home site*
Roadways	*0.0 acres*	*100%*	*0.0 acres*	
Undisturbed	*6.5 acres*	*2%*	*0.1 acres*	
total	***6.6 acres***		*0.2 acres*	
CALCULATED BASIN "I" VALUE =			***3.7%***	*Hist = Dev*
Basin B				
footprints in Lots	0.1 acres	100%	0.1 acres	*1 exist home site*
Roadways	0.0 acres	100%	0.0 acres	
Undisturbed	6.5 acres	2%	0.1 acres	
total	**6.6 acres**		0.2 acres	
CALCULATED BASIN "I" VALUE =			**3.7%**	*Hist = Dev*
Basin C (Historic)				
footprints in Lots	*0.0 acres*	*100%*	*0.0 acres*	
Roadways	*0.0 acres*	*100%*	*0.0 acres*	
Undisturbed	*5.3 acres*	*2%*	*0.1 acres*	
total	***5.3 acres***		*0.1 acres*	
CALCULATED BASIN "I" VALUE =			***2.0%***	
Basin C				
footprints in Lots	*0.2 acres*	100%	0.2 acres	*3 home sites*
Roadways	0.0 acres	100%	0.0 acres	
Undisturbed	5.1 acres	2%	0.1 acres	
total	**5.3 acres**		0.3 acres	
CALCULATED BASIN "I" VALUE =			**6.2%**	
Basin D (Historic)				
footprints in Lots	*0.0 acres*	*100%*	*0.0 acres*	
Roadways	*0.0 acres*	*100%*	*0.0 acres*	
Undisturbed	*4.6 acres*	*2%*	*0.1 acres*	
total	***4.6 acres***		*0.1 acres*	
CALCULATED BASIN "I" VALUE =			***2.0%***	*Hist = Dev*
Basin D				
footprints in Lots	0.2 acres	100%	0.2 acres	*2 home sites*
Roadways	*0.0 acres*	100%	0.0 acres	
Undisturbed	4.4 acres	2%	0.1 acres	
total	**4.6 acres**		0.3 acres	
CALCULATED BASIN "I" VALUE =			**6.9%**	*Hist = Dev*

Project Providence Point

Basin A (Historic) *Phase III Drainage Study*

	Runoff Coefficients (by soil group)	*Percentage Imperviousness*		*10/16/2015 10:01*		EP Cty Min		C Value to use	
		I	*i*	**10-Year**	**100-Year**	10-Year	100-Year	**10-Year**	**100-Year**
Basin OA						0.25	0.35	**0.25**	**0.35**
Basin A (Historic)	C_{CD}	*11.0%*	*0.110*	0.31	0.53				
	C_A	*11.0%*	*0.110*	0.14	0.28				
	C_B	*11.0%*	*0.110*	0.22	0.41				
% B type?	*100.00%*			**0.22**	**0.41**	0.15	0.30	**0.22**	**0.41**
Basin A	C_{CD}	*14.6%*	*0.146*	0.32	0.54				
	C_A	*14.6%*	*0.146*	0.17	0.30				
	C_B	*14.6%*	*0.146*	0.25	0.42				
% B type?	*100.00%*			**0.25**	**0.42**	0.25	0.35	**0.25**	**0.42**
Basin B (Historic)	C_{CD}	*3.7%*	*0.037*	0.27	0.51				
	C_A	*3.7%*	*0.037*	0.08	0.23				
	C_B	*3.7%*	*0.037*	0.18	0.37				
% B type?	*100.00%*			**0.18**	**0.37**	0.15	0.30	**0.18**	**0.37**
Basin B	C_{CD}	*3.7%*	*0.037*	0.27	0.51				
	C_A	*3.7%*	*0.037*	0.08	0.23				
	C_B	*3.7%*	*0.037*	0.18	0.37				
% B type?	100.00%			**0.18**	**0.37**	0.25	0.35	**0.25**	**0.37**
Basin OC						0.25	0.35	**0.25**	**0.35**
Basin C (Historic)	C_{CD}	*2.0%*	*0.020*	0.26	0.51				
	C_A	*2.0%*	*0.020*	0.07	0.22				
	C_B	*2.0%*	*0.020*	0.17	0.36				
% B type?	100.00%			**0.17**	**0.36**	0.15	0.30	**0.17**	**0.36**
Basin C	C_{CD}	*6.2%*	*0.062*	0.28	0.52				
	C_A	*6.2%*	*0.062*	0.11	0.25				
	C_B	*6.2%*	*0.062*	0.20	0.39				
% B type?	100.00%			**0.20**	**0.39**	0.25	0.35	**0.25**	**0.39**
Basin OD						0.25	0.35	**0.25**	**0.35**
Basin D (Historic)	C_{CD}	*2.0%*	*0.020*	0.26	0.51				
	C_A	*2.0%*	*0.020*	0.07	0.22				
	C_B	*2.0%*	*0.020*	0.17	0.36				
% B type?	100.00%			**0.17**	**0.36**	0.15	0.30	**0.17**	**0.36**
Basin D	C_{CD}	*6.9%*	*0.069*	0.29	0.52				
	C_A	*6.9%*	*0.069*	0.11	0.25				
	C_B	*6.9%*	*0.069*	0.20	0.39				
% B type?	*100.00%*			**0.20**	**0.39**	0.25	0.35	**0.25**	**0.39**

Proposed Drainage Basins
Standard Form SF-2
Storm Drainage System Design

	Providence Point																		
	JJM																		
Revised by:	10/16/2015													**Date:**	10/16/2015				
				Ti	*Ti*			*Tt*	*Tt*	*Tt*	*Tt*		*Ti+Tt*					EP Cty Tt Equation @ Pg 5-13	
	AREA	C(10)	C(100)	LNG	SLP	*Ti*		LNG	SLP	SWL	V	*Tt*	COMP	TOT	Urbanized?	Urbanized Check	FINAL				equiv swale
Basin	Ac			Ft	%	Min	*L-total*	Ft	%*	CODE*	FPS	Min	Tc	LENGTH			Tc	n	r	V	code
Basin OA	37.5	0.25	0.35	150	6.7%	10.3	*1152*	1002	6.7%	15.0	3.9	4.3	14.6	1152	n	16.4	14.6	0.063	0.5	3.8	15
Basin A (Historic)	18.1	0.22	0.41				*1477*	1477	3.1%	15.0	2.6	9.3	9.3	1477	n	18.2	9.3	0.063	0.5	2.6	15
Basin A	18.1	0.25	0.42				*1477*	1477	3.1%	15.0	2.6	9.3	9.3	1477	n	18.2	9.3	0.063	0.5	2.6	15
Basin OA + A(Hist)	55.6																**24.0**				
Basin OA +A	55.6																**24.0**				
Basin B (Historic)	6.6	0.18	0.37	150	5.6%	11.9	*907*	757	6.7%	15.0	3.9	3.2	15.2	907	n	15.0	**15.2**	0.063	0.5	3.9	15
Basin B	6.6	0.25	0.37	150	5.6%	11.0	*907*	757	6.7%	15.0	3.9	3.2	14.2	907	n	15.0	**14.2**	0.063	0.5	3.9	15
Basin OC	27.5	0.25	0.35	150	5.6%	11.0	*1630*	1480	5.8%	15.0	3.6	6.8	17.8	1630	n	19.1	17.8	0.063	0.5	3.6	15
Basin C (Historic)	5.3	0.17	0.36				*669*	669	3.6%	15.0	2.8	3.9	3.9	669	n	13.7	5.0	0.063	0.5	2.8	15
Basin C	5.3	0.25	0.39				*669*	669	3.6%	15.0	2.8	3.9	3.9	669	n	13.7	5.0	0.063	0.5	2.8	15
Basin OC + C(Hist)	32.8																**22.8**				
Basin OC + C	32.8																**22.8**				
Basin OD	15.9	0.25	0.35	150	3.0%	11.0	*1295*	1145	3.8%	15.0	2.9	6.5	17.5	1295	n	17.2	17.5	0.063	0.5	2.9	15
Basin D (Historic)	4.6	0.17	0.36				*761*	761	3.9%	15.0	3.0	4.3	4.3	761	n	14.2	5.0	0.063	0.5	3.0	15
Basin D	4.6	0.25	0.39				*761*	761	3.9%	15.0	3.0	4.3	4.3	761	n	14.2	5.0	0.063	0.5	3.0	15
Basin OD + D(Hist)	20.5																**22.5**				
Basin OD + D	20.5																**22.5**				

*SWALE CODES ARE:

MEADOW AND FORREST	2.50
TILLAGE	5.00
LAWN	7.00
BARE GROUND	10.00
GRASSED WATERWAY	15.00
PAVED WATERWAY	20.00

Regional Time of Concentration

$$T_i = 1.87\left[\frac{(1.1-C_{10})\sqrt{L}}{\sqrt[3]{S}}\right]$$

Urbanized Time of Concentration

$$T_c = \frac{L}{180} + 10$$

Tt Formulas

<based on Manning's Formula>

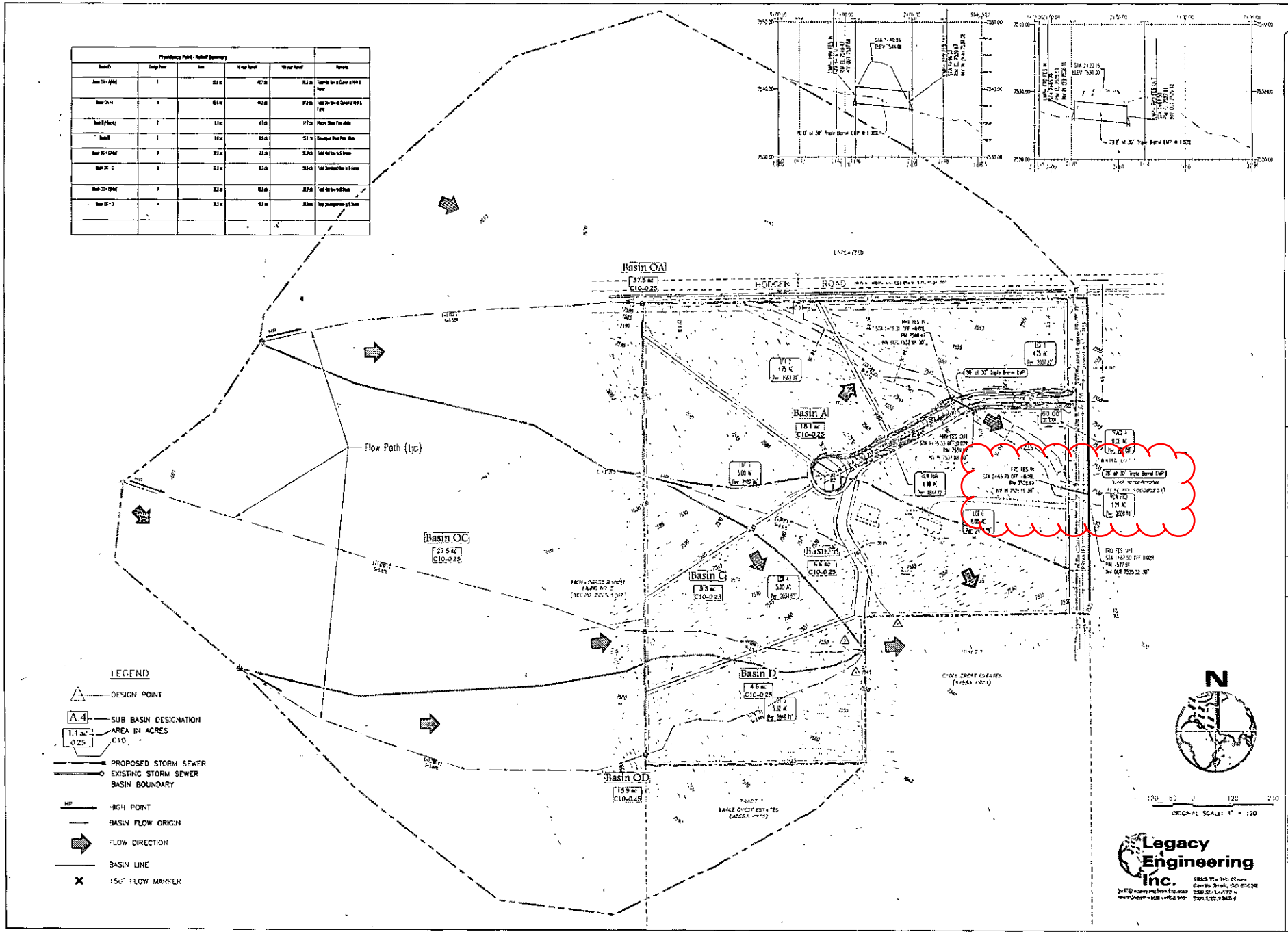
$$V = SwaleCode\sqrt{S}$$

$$SwaleCode = \frac{1.49}{n} r^{2/3}$$ <where r=0.5>

Figure 7.0

Providence Point - Runoff Summary

Basin ID	Design Point	Area	10 year Runoff	100 year Runoff	Remarks
Basin OA + A(Hist)	1	55.6 ac	42.7 cfs	96.5 cfs	Total Hist flow to Culvert at HHV & Farrar
Basin OA +A	1	55.6 ac	44.2 cfs	97.9 cfs	Total Dev flow @ Culvert at HHV & Farrar
Basin B (Historic)	2	6.6 ac	4.7 cfs	14.7 cfs	Historic Sheet Flow offsite
Basin B	2	6.6 ac	6.8 cfs	15.1 cfs	Developed Sheet Flow offsite
Basin OC + C(Hist)	3	32.8 ac	7.8 cfs	55.9 cfs	Total Hist flow to S Arroyo
Basin OC + C	3	32.8 ac	8.2 cfs	56.5 cfs	Total Developed flow to S Arroyo
Basin OD + D(Hist)	4	20.5 ac	15.6 cfs	35.3 cfs	Total Hist flow to S Swale
Basin OD + D	4	20.5 ac	16.9 cfs	35.9 cfs	Total Developed flow to S Swale



Providence Point - Runoff Summary					
Basin ID	Design Point	Area	10-year Runoff	100-year Runoff	Remarks
Basin OA + Offsite	1	55.6 ac	42.1 cfs	93.3 cfs	Total flow from Basin OA and offsite
Basin OA-A	1	55.6 ac	44.2 cfs	97.2 cfs	Total flow from Basin OA and offsite
Basin B (Interim)	2	6.5 ac	6.1 cfs	14.7 cfs	Interim Street Flow Only
Basin B	2	6.5 ac	6.5 cfs	15.1 cfs	Developed Street Flow Only
Basin OC + Offsite	3	33.8 ac	22 cfs	55.2 cfs	Total flow from 3 Basins
Basin OC-C	3	33.8 ac	8.5 cfs	19.6 cfs	Total Developed flow in 3 Basins
Basin OD + Offsite	4	20.5 ac	15.6 cfs	32.7 cfs	Total flow from 4 Basins
Basin OD-D	4	20.5 ac	9.5 cfs	19.6 cfs	Total Developed flow in 4 Basins

APPENDIX B

SOILS INFORMATION

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



March 6, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,490 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Jul 23, 2024—Aug 4, 2024

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
67	Peyton sandy loam, 5 to 9 percent slopes	10.2	47.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	11.2	52.4%
Totals for Area of Interest		**21.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

67—Peyton sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369d
Elevation: 6,800 to 7,600 feet
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

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 and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 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: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 5 percent
Landform: Depressions

Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

68—Peyton-Pring complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369f
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

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 and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 5 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): Moderately high (0.20 to 0.60 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: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B

Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

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: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

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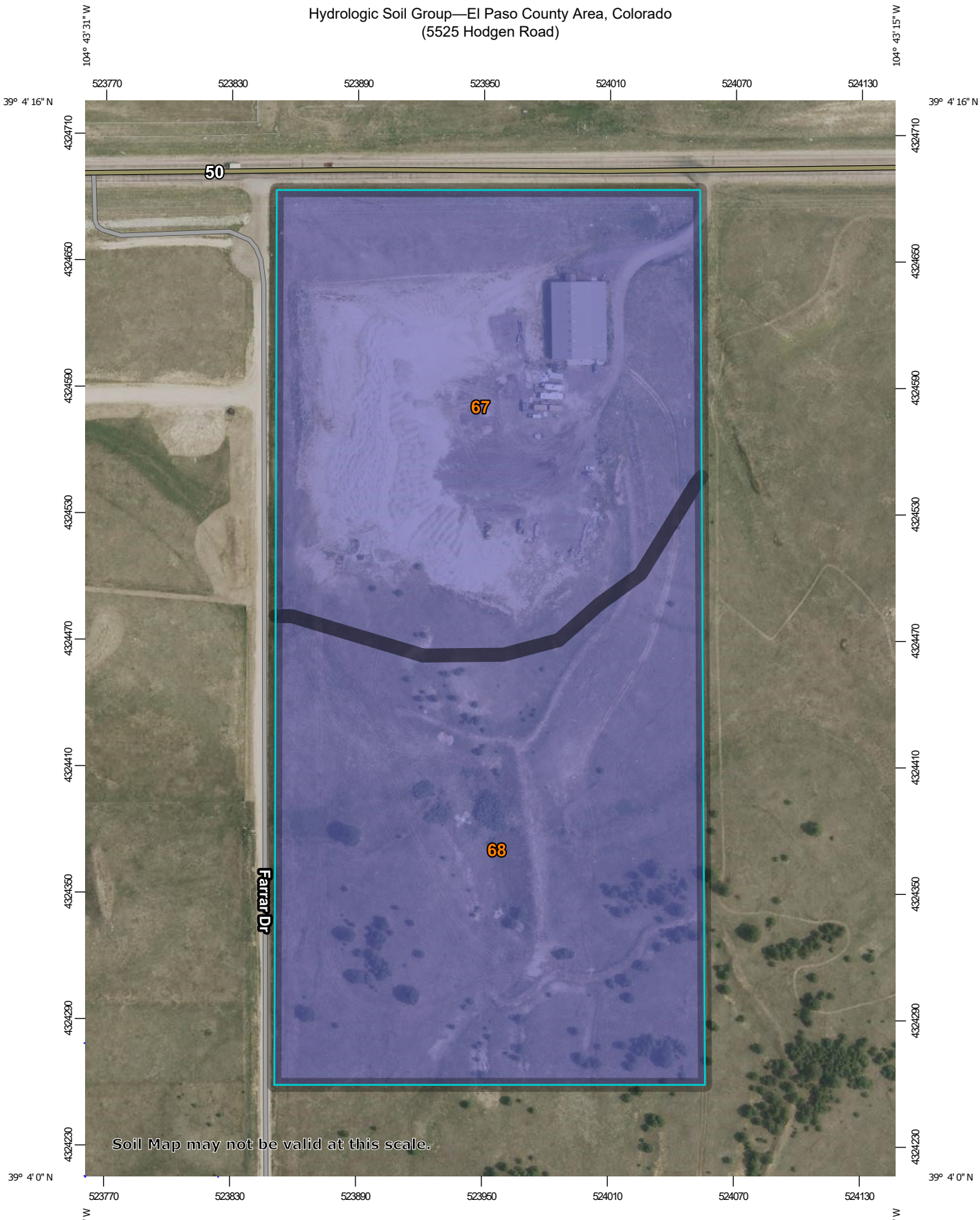
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Hydrologic Soil Group—El Paso County Area, Colorado
(5525 Hodgen Road)



Map Scale: 1:2,490 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Jul 23, 2024—Aug 4, 2024

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
67	Peyton sandy loam, 5 to 9 percent slopes	B	10.2	47.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	11.2	52.4%
Totals for Area of Interest			**21.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX C

HYDROLOGIC CALCULATIONS

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	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.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

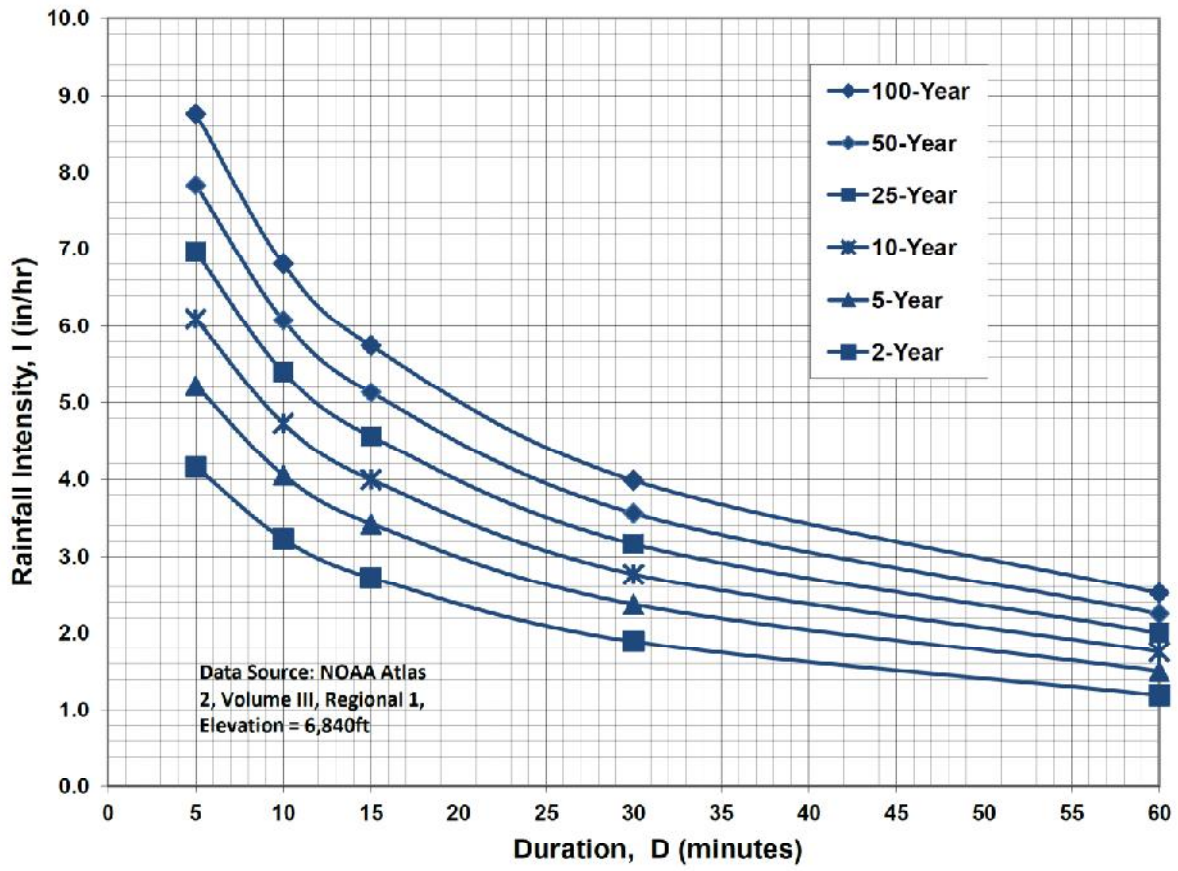
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

SUNDANCE WEST SUBDIVISION
IMPERVIOUS AREA CALCULATIONS

IMPERVIOUS AREAS - TYPICAL RURAL RESIDENTIAL LOTS - FOR REFERENCE ONLY

BASIN	TOTAL AREA (AC)	AREA PER LOT (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA PER LOT (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
5-ACRE LOTS	5.00	**0.35**	BUILDING / PAVEMENT	100.00	4.65	MEADOW/FOREST	0				7.000
2.5-ACRE LOTS	2.50	**0.275**	BUILDING / PAVEMENT	100.00	2.23	MEADOW/FOREST	0				11.000

* PRESUMPTIVE IMPERVIOUS VALUE FOR 5-ACRE LOTS IS 7.0% PER EL PASO COUNTY DRAINAGE BASIN FEE ADDENDUM DATED 6/21/01
* PRESUMPTIVE IMPERVIOUS VALUE FOR 2.5-ACRE LOTS IS 11.0% PER EL PASO COUNTY DRAINAGE BASIN FEE ADDENDUM DATED 6/21/01

IMPERVIOUS AREAS - SUNDANCE WEST SUBDIVISION (ASSUMING MAX. BLDG / PAVEMENT AREA OF 0.275-ACRES PER LOT)

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
Lot 5	**4.5**	**0.450**	**BUILDING / PAVEMENT**	**100.00**	**4.05**	**MEADOW / LS**	**0**				**10.000**
(4.5-Acre Lot)											
Lots 1-4, 6-7	**15.0**	**1.500**	**BUILDING / PAVEMENT**	**100.00**	**13.50**	**MEADOW / LS**	**0**				**10.000**
(2.5-Acre Lots w/ max. building / pavement area of 0.25-Acres per Lot)											
TOTAL SUBDIVISION *	**19.5**	**1.950**	**BUILDING / PAVEMENT**	**100.00**	**17.55**	**MEADOW / LS**	**0**				**10.000**

* Note: Previously disturbed area of approximately 5 acres to be re-vegetated and restored to undeveloped conditions in preparation for subdivision

calculations should match the drainage maps. The maps don't show re vegetating until the developed condition. Please be consistent.

Unresolved Review 1 comment:
Account for any additional imperviousness from all the existing disturbance on the site.

SUNDANCE WEST SUBDIVISION
IMPERVIOUS AREA CALCULATIONS

IMPERVIOUS AREAS - EXISTING CONDITIONS

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
OA1	45.8	45.8	RURAL RESIDENTIAL-RR5	7.000							7.000
A1	9.2	9.2	RURAL RESIDENTIAL-RR5	7.000							7.000
OA1,A1	55.0										7.000
OA2	164.7	164.7	RURAL RESIDENTIAL-RR5	7.000							7.000
A2.1	7.3	7.3	MEADOW	0.000							0.000
OA2,A2.1	172.0										6.703
A2.2	4.8	4.8	MEADOW	0.000							0.000
OA2,A2.1,A2.2	176.8										6.521
OA1-OA2,A1-A2.2	231.8										6.635

IMPERVIOUS AREAS - DEVELOPED CONDITIONS

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
OA1	45.8	45.8	RURAL RESIDENTIAL-RR5	7.000							7.000
A1	9.2	9.2	RURAL RESIDENTIAL-RR2.5	11.000							11.000
OA1,A1	55.0										7.669
OA2	164.7	164.7	RURAL RESIDENTIAL-RR5	7.000							7.000
A2.1	7.3	7.3	RURAL RESIDENTIAL-RR2.5	11.000							11.000
OA2,A2.1	172.0										7.170
A2.2	4.8	4.8	RURAL RESIDENTIAL-RR2.5	11.000							11.000
OA2,A2.1,A2.2	176.8										7.274
OA1-OA2,A1-A2.2	231.8										7.368

SUNDANCE WEST SUBDIVISION

COMPOSITE RUNOFF COEFFICIENTS - TYPICAL 2.5-ACRE TO 5-ACRE DEVELOPED RURAL RESIDENTIAL AREAS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
2.5-ACRE LOTS	2.50	B	11.00	BLDG/DRIVEWAY	0.9	89.00	LAWN/MEADOW	0.08				0.170
5-ACRE LOTS	5.00	B	7.00	BLDG/DRIVEWAY	0.9	93.00	LAWN/MEADOW	0.08				0.137

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
2.5-ACRE LOTS	2.50	B	11.00	BLDG/DRIVEWAY	0.96	89.00	LAWN/MEADOW	0.35				0.417
5-ACRE LOTS	5.00	B	7.00	BLDG/DRIVEWAY	0.96	93.00	LAWN/MEADOW	0.35				0.393

SUNDANCE WEST SUBDIVISION
COMPOSITE RUNOFF COEFFICIENTS

EXISTING CONDITIONS

5-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
OA1	45.8	45.8	RURAL RESIDENTIAL-RR5	0.137							0.137
A1 *	9.2	9.2	RURAL RESIDENTIAL-RR5	0.137							0.137
OA1,A1	55.0										0.137
OA2	164.7	164.7	RURAL RESIDENTIAL-RR5	0.137							0.137
A2.1	7.3	7.3	MEADOW	0.080							0.080
OA2,A2.1	172.0										0.135
A2.2	4.8	4.8	MEADOW	0.080							0.080
OA2,A2.1-A2.2	176.8										0.133
OA1-OA2,A1-A2.2	231.8										0.134

100-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
OA1	45.8	45.8	RURAL RESIDENTIAL-RR5	0.393							0.393
A1 *	9.2	9.2	RURAL RESIDENTIAL-RR5	0.393							0.393
OA1,A1	55.0										0.393
OA2	164.7	164.7	RURAL RESIDENTIAL-RR5	0.393							0.393
A2.1	7.3	7.3	MEADOW	0.350							0.350
OA2,A2.1	172.0										0.391
A2.2	4.8	4.8	MEADOW	0.350							0.350
OA2,A2.1-A2.2	176.8										0.390
OA1-OA2,A1-A2.2	231.8										0.391

* Note: Previously disturbed area of approximately 5 acres to be re-vegetated and restored to undeveloped conditions in preparation for subdivision

SUNDANCE WEST SUBDIVISION
RATIONAL METHOD

EXISTING CONDITIONS FLOWS

					Overland Flow			Channel flow										
BASIN	**DESIGN POINT**	**AREA (AC)**	**C** 5-YEAR	**C** 100-YEAR	**LENGTH (FT)**	**SLOPE (FT/FT)**	**Tco [1] (MIN)**	**CHANNEL LENGTH (FT)**	**CONVEYANCE COEFFICIENT C**	**SLOPE (FT/FT)**	**SCS [2] VELOCITY (FT/S)**	**Tt [3] (MIN)**	**TOTAL Tc [4] (MIN)**	**TOTAL Tc [4] (MIN)**	**INTENSITY [5] 5-YR (IN/HR)**	**INTENSITY [5] 100-YR (IN/HR)**	**PEAK FLOW Q5 [6] (CFS)**	**PEAK FLOW Q100 [6] (CFS)**
OA1		45.8	0.137	0.393	100	0.026	12.8	3295	15	0.026	2.42	22.7	35.5	35.5	2.23	3.74	13.98	67.28
Tt OA1 to DP1								310	15	0.019	2.07	2.5						
A1		9.2	0.137	0.393	100	0.050	10.3	605	15	0.065	3.82	2.6	13.0	13.0	3.74	6.28	4.72	22.71
OA1,A1	A1	55.0	0.137	0.393									38.0	38.0	2.13	3.57	16.02	77.09
OA2		164.7	0.137	0.393	100	0.027	12.7	5100	15	0.027	2.46	34.5	47.2	47.2	1.80	3.02	40.68	195.77
CHANNEL A2.1								380	15	0.039	2.96	2.1						
A2.1		7.3	0.080	0.350	100	0.020	14.8	900	15	0.043	3.11	4.8	19.6	19.6	3.12	5.23	1.82	13.36
OA2,A2.1	A2.1	172.0	0.135	0.391									49.3	49.3	1.74	2.91	40.32	195.89
POND A2 OUTFLOW																	6.8	153.0
A2.2		4.8	0.080	0.350	100	0.070	9.8	360	15	0.042	3.07	2.0	11.7	11.7	3.89	6.53	1.49	10.97
CHANNEL A2.2								380	15	0.017	1.96	3.2						
OA2,A2.1-A2.2	A2.2	176.8	0.133	0.390									52.5	52.5	1.64	2.75	38.59	189.79
OA1-OA1,A1-A2	**1 ***	**231.8**											52.5	52.5	1.64	2.75	**24.31**	**241.06**

* DP1 FLOW CALCULATED AS: DP1 = (DP-A1) + (POND A2 OUTFLOW) + (BASIN-A2.2)

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333)
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
   C = 2.5 FOR HEAVY MEADOW
   C = 5 FOR TILLAGE/FIELD
   C = 7 FOR SHORT PASTURE AND LAWNS
   C = 10 FOR NEARLY BARE GROUND
   C = 15 FOR GRASSED WATERWAY
   C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
   $I_5 = -1.5 * \ln(Tc) + 7.583$
   $I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA

SUNDANCE WEST SUBDIVISION
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
OA1	45.8	45.8	RURAL RESIDENTIAL-RR5	0.137							0.137
A1	9.2	9.2	RURAL RESIDENTIAL-RR2.5	0.170							0.170
OA1,A1	55.0										0.143
OA2	164.7	164.7	RURAL RESIDENTIAL-RR5	0.137							0.137
A2.1	7.3	7.3	RURAL RESIDENTIAL-RR2.5	0.170							0.170
OA2,A2.1	172.0										0.138
A2.2	4.8	4.8	RURAL RESIDENTIAL-RR2.5	0.170							0.170
OA2,A2.1-A2.2	176.8										0.139
OA1-OA2,A1-A2.2	231.8										0.140

100-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
OA1	45.8	45.8	RURAL RESIDENTIAL-RR5	0.393							0.393
A1	9.2	9.2	RURAL RESIDENTIAL-RR2.5	0.417							0.417
OA1,A1	55.0										0.397
OA2	164.7	164.7	RURAL RESIDENTIAL-RR5	0.393							0.393
A2.1	7.3	7.3	RURAL RESIDENTIAL-RR2.5	0.417							0.417
OA2,A2.1	172.0										0.394
A2.2	4.8	4.8	RURAL RESIDENTIAL-RR2.5	0.417							0.417
OA2,A2.1-A2.2	176.8										0.395
OA1-OA2,A1-A2.2	231.8										0.395

SUNDANCE WEST SUBDIVISION
RATIONAL METHOD

DEVELOPED FLOWS

					Overland Flow			Channel flow										
BASIN	**DESIGN POINT**	**AREA (AC)**	**C**		**LENGTH (FT)**	**SLOPE (FT/FT)**	**Tco [1] (MIN)**	**CHANNEL LENGTH (FT)**	**CONVEYANCE COEFFICIENT C**	**SLOPE (FT/FT)**	**SCS [2] VELOCITY (FT/S)**	**Tt [3] (MIN)**	**TOTAL Tc [4] (MIN)**	**TOTAL Tc [4] (MIN)**	**INTENSITY [5]**		**PEAK FLOW**	
			5-YEAR	**100-YEAR**											**5-YR (IN/HR)**	**100-YR (IN/HR)**	**Q5 [6] (CFS)**	**Q100 [6] (CFS)**
OA1		45.8	0.137	0.393	100	0.026	12.8	3295	15	0.026	2.42	22.7	35.5	35.5	2.23	3.74	13.98	67.28
Tt OA1 to DP1								310	15	0.019	2.07	2.5						
A1		9.2	0.170	0.417	100	0.050	10.0	605	15	0.065	3.82	2.6	12.6	12.6	3.78	6.35	5.92	24.36
OA1,A1	A1	55.0	0.143	0.397									38.0	38.0	2.13	3.57	16.72	77.87
OA2		164.7	0.137	0.393	100	0.027	12.7	5100	15	0.027	2.46	34.5	47.2	47.2	1.80	3.02	40.68	195.77
CHANNEL A2.1								380	15	0.039	2.96	2.1						
A2.1		7.3	0.170	0.417	100	0.020	13.5	900	15	0.043	3.11	4.8	18.3	18.3	3.22	5.40	4.00	16.45
OA2,A2.1	A2.1	172.0	0.138	0.394									49.3	49.3	1.74	2.91	41.22	197.40
POND A2 OUTFLOW																	10.5	137.5
A2.2		4.8	0.170	0.417	100	0.070	8.9	360	15	0.042	3.07	2.0	10.9	10.9	4.01	6.73	3.27	13.46
CHANNEL A2.2								380	15	0.017	1.96	3.2						
OA2,A2.1-A2.2	A2.2	176.8	0.139	0.395									52.5	52.5	1.64	2.75	40.33	192.22
OA1-OA1,A1-A2	**1 ***	**231.8**											52.5	52.5	1.64	2.75	**30.49**	**228.83**

* DP1 FLOW CALCULATED AS: DP1 = (DP-A1) + (POND A2 OUTFLOW) + (BASIN-A2.2)

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333)
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
$I_5 = -1.5 * \ln(Tc) + 7.583$
$I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA

APPENDIX D1

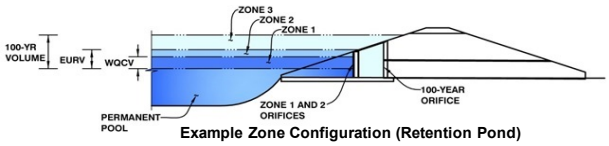
POND A2 CALCULATIONS – EXISTING CONDITIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

Project: **Sundance West Subdivision**

Basin ID: **Existing Stock Pond A2**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected SCM Type =	**EDB**	
Watershed Area =	172.00	acres
Watershed Length =	5,580	ft
Watershed Length to Centroid =	2,790	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	6.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.676 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.049 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.877 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.532 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.240 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	12.251 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	15.583 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	20.466 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	29.247 acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	0.642 acre-feet		
Approximate 5-yr Detention Volume =	1.042 acre-feet		
Approximate 10-yr Detention Volume =	2.628 acre-feet		
Approximate 25-yr Detention Volume =	3.888 acre-feet		
Approximate 50-yr Detention Volume =	4.009 acre-feet		
Approximate 100-yr Detention Volume =	5.291 acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (100-year) =	5.291 acre-feet	~~**WQCV not provided!**~~
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	5.291	acre-feet

Depth Increment = ft

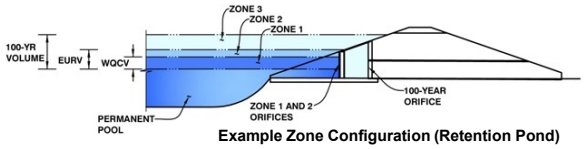
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
Bot EL=7510	--	0.10	--	--	--	631	0.014	31	0.001
	--	2.00	--	--	--	8,656	0.199	8,854	0.203
	--	4.00	--	--	--	16,444	0.378	33,954	0.779
	--	6.00	--	--	--	23,316	0.535	73,714	1.692
	--	8.00	--	--	--	35,716	0.820	132,746	3.047
Spillway=7520	--	10.00	--	--	--	61,152	1.404	229,614	5.271
	--	12.00	--	--	--	90,000	2.066	380,766	8.741
Top Berm=7524	--	14.00	--	--	--	128,200	2.943	598,966	13.750
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DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: Sundance West Subdivision

Basin ID: Existing Stock Pond A2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (100-year)	10.02	5.291	Circular Orifice
Zone 2			
Zone 3			
Total (all zones)		5.291	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

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

Calculated Parameters for Plate

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 1 Circular	Not Selected			Zone 1 Circular	Not Selected	
Invert of Vertical Orifice =	4.56		ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.79		ft^2
Depth at top of Zone using Vertical Orifice =	10.02		ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.50		feet
Vertical Orifice Diameter =	12.00		inches				

Calculated Parameters for Vertical Orifice

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	10.00		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	N/A		feet
Overflow Weir Front Edge Length =	24.00		feet	Overflow Weir Slope Length =	N/A		feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =	N/A		
Horiz. Length of Weir Sides =	N/A		feet	Overflow Grate Open Area w/o Debris =	N/A		ft^2
Overflow Grate Type =	N/A			Overflow Grate Open Area w/ Debris =	N/A		ft^2
Debris Clogging % =	N/A		%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	N/A		ft^2
Circular Orifice Diameter =	N/A		inches	Outlet Orifice Centroid =	N/A		feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.10	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.61	feet
Spillway Crest Length =	24.00	feet	Stage at Top of Freeboard =	12.71	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.84	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	8.51	acre-ft

Calculated Parameters for Spillway

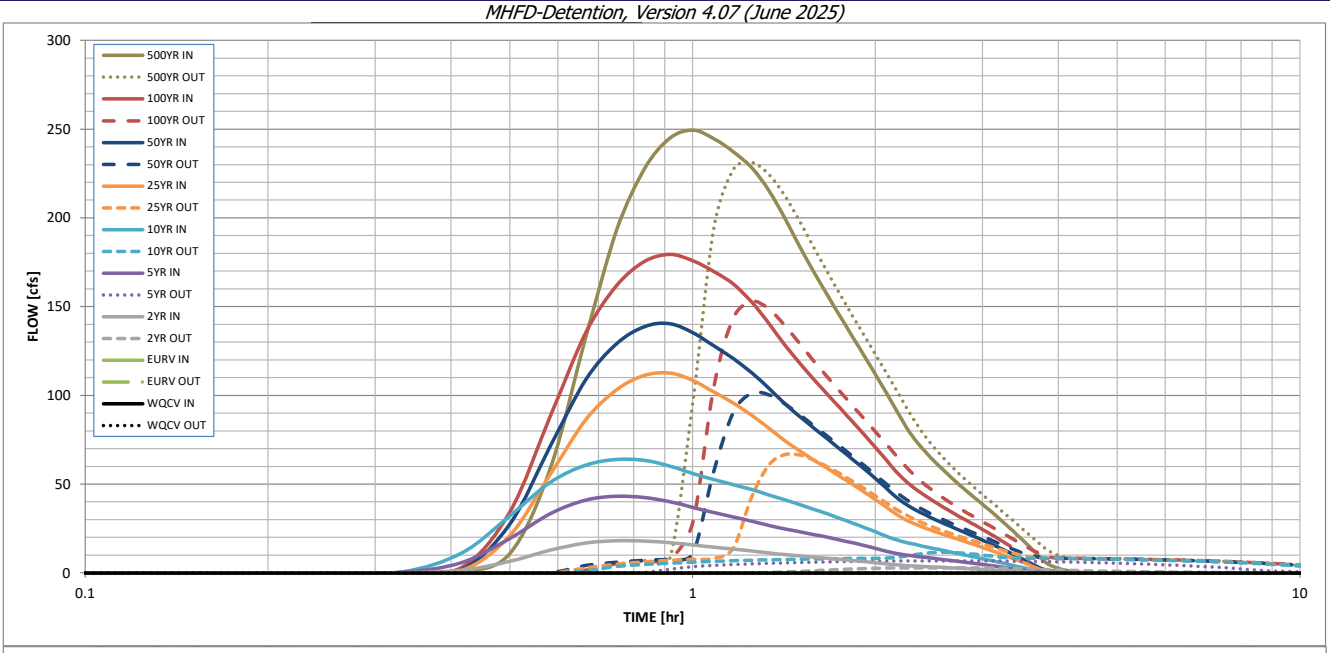
Routed Hydrograph Results

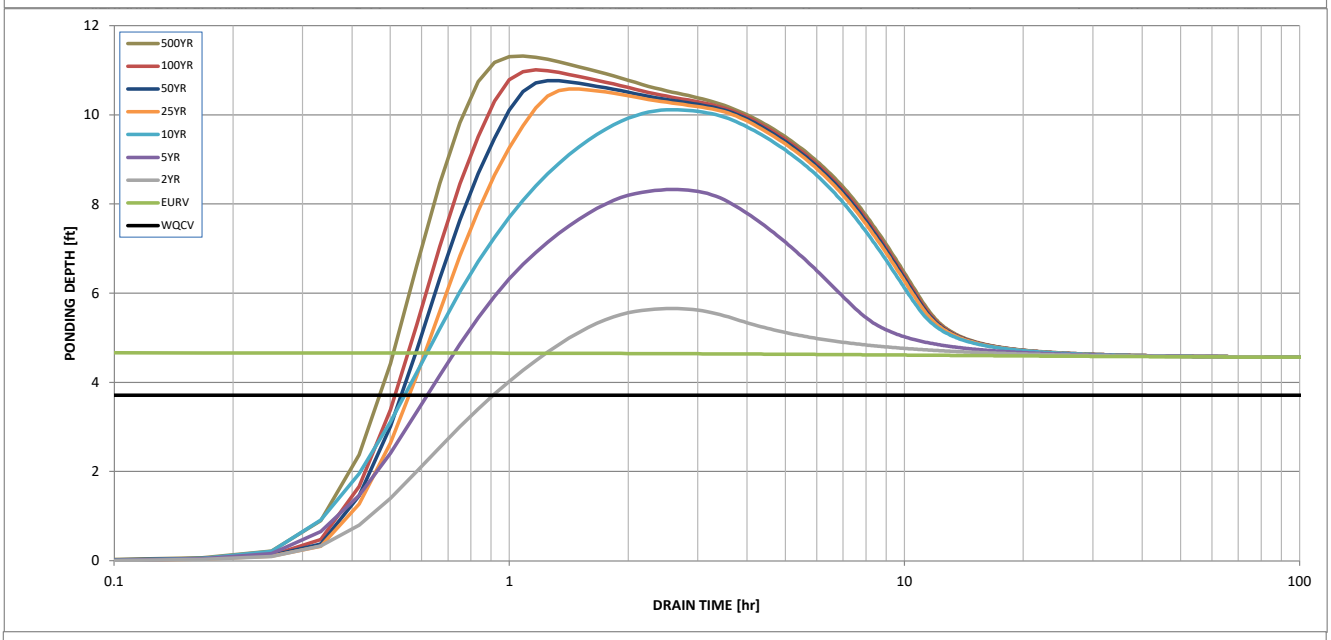
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

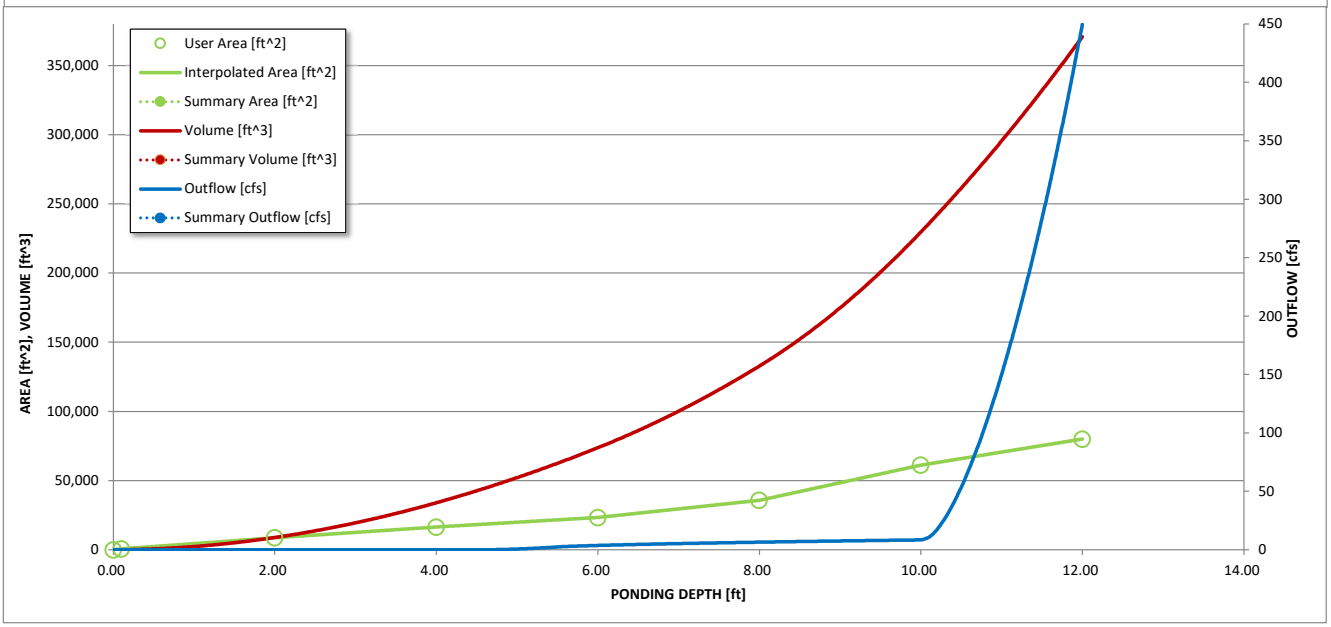
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.676	1.049	1.877	4.532	7.240	12.251	15.583	20.466	29.247
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.877	4.532	7.240	12.251	15.583	20.466	29.247
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	16.4	41.2	61.8	110.8	138.6	177.4	247.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.24	0.36	0.64	0.81	1.03	1.44
Peak Inflow Q (cfs) =	N/A	N/A	18.2	43.2	64.0	112.7	140.5	179.5	249.5
Peak Outflow Q (cfs) =		0.0	2.9	6.8	11.7	66.7	101.3	153.0	231.3
Ratio Peak Outflow to Predevelopment Q =		N/A	N/A	0.2	0.2	0.6	0.7	0.9	0.9
Structure Controlling Flow =		Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =		>120	>120	>120	>120	>120	>120	>120	>120
Time to Drain 99% of Inflow Volume (hours) =		>120	>120	>120	>120	>120	>120	>120	>120
Maximum Ponding Depth (ft) =		4.67	5.66	8.33	10.12	10.58	10.77	11.01	11.32
Area at Maximum Ponding Depth (acres) =		0.43	0.51	0.92	1.43	1.53	1.57	1.62	1.69
Maximum Volume Stored (acre-ft) =		1.050	1.510	3.334	5.427	6.122	6.416	6.799	7.296

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)







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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:15:00	0	0.00	0.03	0.05	0.06	0.04	0.05	0.05	0.08
	0:20:00	0	0.00	0.14	0.43	0.76	0.16	0.19	0.22	0.75
	0:25:00	0	0.00	1.59	5.93	11.29	1.53	2.01	3.30	11.02
	0:30:00	0	0.00	6.62	19.49	32.30	21.12	27.61	34.45	59.26
	0:35:00	0	0.00	12.90	33.48	51.17	55.86	71.68	88.68	132.89
	0:40:00	0	0.00	16.91	41.12	60.80	86.26	108.94	135.30	193.34
	0:45:00	0	0.00	18.22	43.21	63.96	103.33	129.26	162.05	227.81
	0:50:00	0	0.00	18.08	42.56	63.48	111.34	138.81	175.51	244.96
	0:55:00	0	0.00	17.14	40.18	60.26	112.71	140.49	179.45	249.51
	1:00:00	0	0.00	15.78	36.92	56.08	108.42	135.42	175.87	244.70
	1:05:00	0	0.00	14.49	33.98	52.66	101.95	127.95	169.87	237.30
	1:10:00	0	0.00	13.44	31.58	49.78	95.66	120.78	162.75	228.38
	1:15:00	0	0.00	12.39	29.23	47.00	88.87	112.84	152.67	215.65
	1:20:00	0	0.00	11.33	26.87	44.03	81.68	104.18	140.69	200.04
	1:25:00	0	0.00	10.36	24.83	41.25	74.61	95.43	128.59	183.89
	1:30:00	0	0.00	9.63	23.21	38.58	68.84	88.20	118.28	169.55
	1:35:00	0	0.00	8.95	21.69	35.91	63.64	81.59	109.02	156.43
	1:40:00	0	0.00	8.31	20.16	33.27	58.84	75.46	100.58	144.34
	1:45:00	0	0.00	7.68	18.59	30.68	54.28	69.62	92.73	133.03
	1:50:00	0	0.00	7.05	17.01	28.14	49.90	64.03	85.17	122.18
	1:55:00	0	0.00	6.42	15.42	25.65	45.58	58.54	77.81	111.67
	2:00:00	0	0.00	5.79	13.85	23.13	41.32	53.14	70.65	101.43
	2:05:00	0	0.00	5.15	12.29	20.62	37.11	47.79	63.63	91.40
	2:10:00	0	0.00	4.58	11.00	18.63	32.95	42.49	56.73	81.83
	2:15:00	0	0.00	4.19	10.12	17.18	29.76	38.47	51.34	74.29
	2:20:00	0	0.00	3.90	9.43	15.95	27.32	35.34	47.10	68.21
	2:25:00	0	0.00	3.64	8.80	14.82	25.28	32.69	43.45	62.90
	2:30:00	0	0.00	3.40	8.20	13.75	23.46	30.30	40.18	58.11
	2:35:00	0	0.00	3.16	7.61	12.73	21.80	28.12	37.18	53.72
	2:40:00	0	0.00	2.93	7.04	11.73	20.23	26.06	34.39	49.61
	2:45:00	0	0.00	2.70	6.48	10.77	18.71	24.08	31.77	45.76
	2:50:00	0	0.00	2.47	5.92	9.83	17.25	22.19	29.33	42.18
	2:55:00	0	0.00	2.25	5.38	8.93	15.81	20.33	26.94	38.70
	3:00:00	0	0.00	2.03	4.84	8.06	14.38	18.50	24.56	35.27
	3:05:00	0	0.00	1.81	4.31	7.21	12.96	16.68	22.19	31.86
	3:10:00	0	0.00	1.59	3.77	6.35	11.54	14.87	19.82	28.45
	3:15:00	0	0.00	1.37	3.25	5.50	10.12	13.06	17.45	25.05
	3:20:00	0	0.00	1.15	2.72	4.66	8.71	11.25	15.08	21.66
	3:25:00	0	0.00	0.94	2.20	3.81	7.29	9.45	12.72	18.26
	3:30:00	0	0.00	0.72	1.68	2.98	5.88	7.64	10.36	14.88
	3:35:00	0	0.00	0.51	1.16	2.15	4.47	5.85	8.00	11.51
	3:40:00	0	0.00	0.30	0.67	1.39	3.07	4.07	5.67	8.22
	3:45:00	0	0.00	0.14	0.37	0.95	1.81	2.47	3.58	5.44
	3:50:00	0	0.00	0.09	0.26	0.73	1.11	1.61	2.36	3.73
	3:55:00	0	0.00	0.07	0.20	0.57	0.70	1.07	1.57	2.59
	4:00:00	0	0.00	0.05	0.16	0.44	0.44	0.72	1.02	1.76
	4:05:00	0	0.00	0.04	0.12	0.35	0.27	0.47	0.63	1.15
	4:10:00	0	0.00	0.03	0.09	0.26	0.18	0.32	0.36	0.72
	4:15:00	0	0.00	0.02	0.07	0.19	0.11	0.20	0.18	0.41
	4:20:00	0	0.00	0.02	0.05	0.13	0.07	0.13	0.08	0.23
	4:25:00	0	0.00	0.01	0.04	0.09	0.05	0.09	0.06	0.16
	4:30:00	0	0.00	0.01	0.03	0.06	0.03	0.07	0.05	0.12
	4:35:00	0	0.00	0.01	0.02	0.04	0.02	0.05	0.04	0.09
	4:40:00	0	0.00	0.01	0.01	0.03	0.02	0.04	0.03	0.07
	4:45:00	0	0.00	0.01	0.01	0.02	0.01	0.03	0.02	0.05
	4:50:00	0	0.00	0.00	0.00	0.02	0.01	0.02	0.02	0.04
	4:55:00	0	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX D2

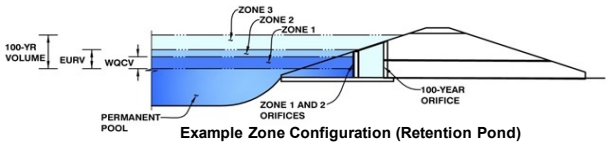
POND A2 CALCULATIONS – PROPOSED CONDITIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

Project: **Sundance West Subdivision**

Basin ID: **Stock Pond A2 - Proposed Conditions**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected SCM Type =	**EDB**	
Watershed Area =	172.00	acres
Watershed Length =	5,580	ft
Watershed Length to Centroid =	2,790	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	7.17%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.719	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.129	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.936	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.609	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.326	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	12.327	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	15.665	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	20.543	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	29.334	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	0.696	acre-feet		
Approximate 5-yr Detention Volume =	1.123	acre-feet		
Approximate 10-yr Detention Volume =	2.732	acre-feet		
Approximate 25-yr Detention Volume =	4.007	acre-feet		
Approximate 50-yr Detention Volume =	4.144	acre-feet		
Approximate 100-yr Detention Volume =	5.452	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (100-year) =	5.452	acre-feet	**WQCV not provided!**
Select Zone 2 Storage Volume (Optional) =		acre-feet	
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	5.452	acre-feet	

Depth Increment = ft

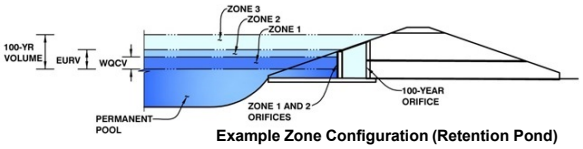
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
Bot EL=7512.0	--	0.10	--	--	--	254	0.006	13	0.000
	--	2.00	--	--	--	3,937	0.090	3,994	0.092
	--	4.00	--	--	--	7,611	0.175	15,542	0.357
	--	6.00	--	--	--	12,822	0.294	35,975	0.826
Spillway=7520.0	--	8.00	--	--	--	50,600	1.162	99,397	2.282
	--	10.00	--	--	--	90,000	2.066	239,997	5.510
Top Berm=7524	--	12.00	--	--	--	128,200	2.943	458,197	10.519
	--		--	--	--				
	--		--	--	--				
	--		--	--	--			

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: Sundance West Subdivision

Basin ID: Stock Pond A2 - Proposed Conditions



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (100-year)	9.98	5.452	Circular Orifice
Zone 2			
Zone 3			
Total (all zones)		5.452	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

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

Calculated Parameters for Plate

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 1 Circular	Not Selected			Zone 1 Circular	Not Selected	
Invert of Vertical Orifice =	0.00		ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.79		ft^2
Depth at top of Zone using Vertical Orifice =	9.98		ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.50		feet
Vertical Orifice Diameter =	12.00		inches				

Calculated Parameters for Vertical Orifice

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	10.00		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	N/A		feet
Overflow Weir Front Edge Length =	24.00		feet	Overflow Weir Slope Length =	N/A		feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =	N/A		
Horiz. Length of Weir Sides =	N/A		feet	Overflow Grate Open Area w/o Debris =	N/A		ft^2
Overflow Grate Type =	N/A			Overflow Grate Open Area w/ Debris =	N/A		ft^2
Debris Clogging % =	N/A		%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	N/A		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	N/A		ft^2
Circular Orifice Diameter =	N/A		inches	Outlet Orifice Centroid =	N/A		feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.61	feet
Spillway Crest Length =	24.00	feet	Stage at Top of Freeboard =	12.61	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.94	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	10.52	acre-ft

Calculated Parameters for Spillway

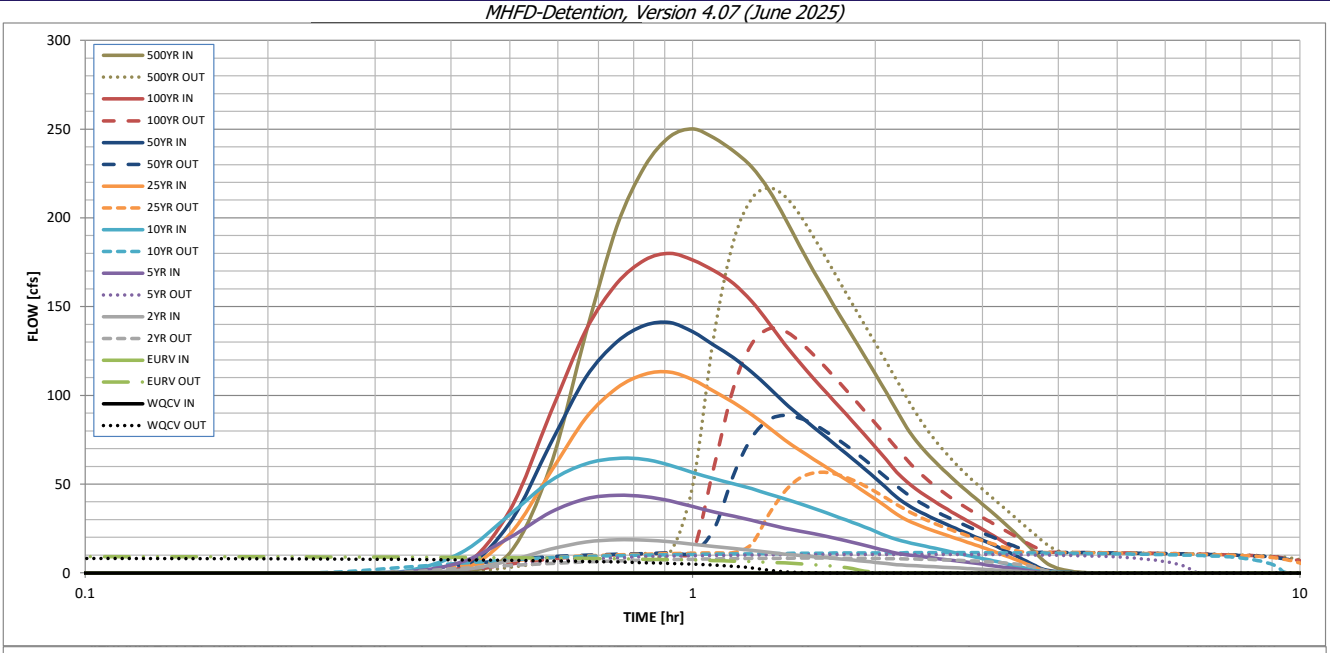
Routed Hydrograph Results

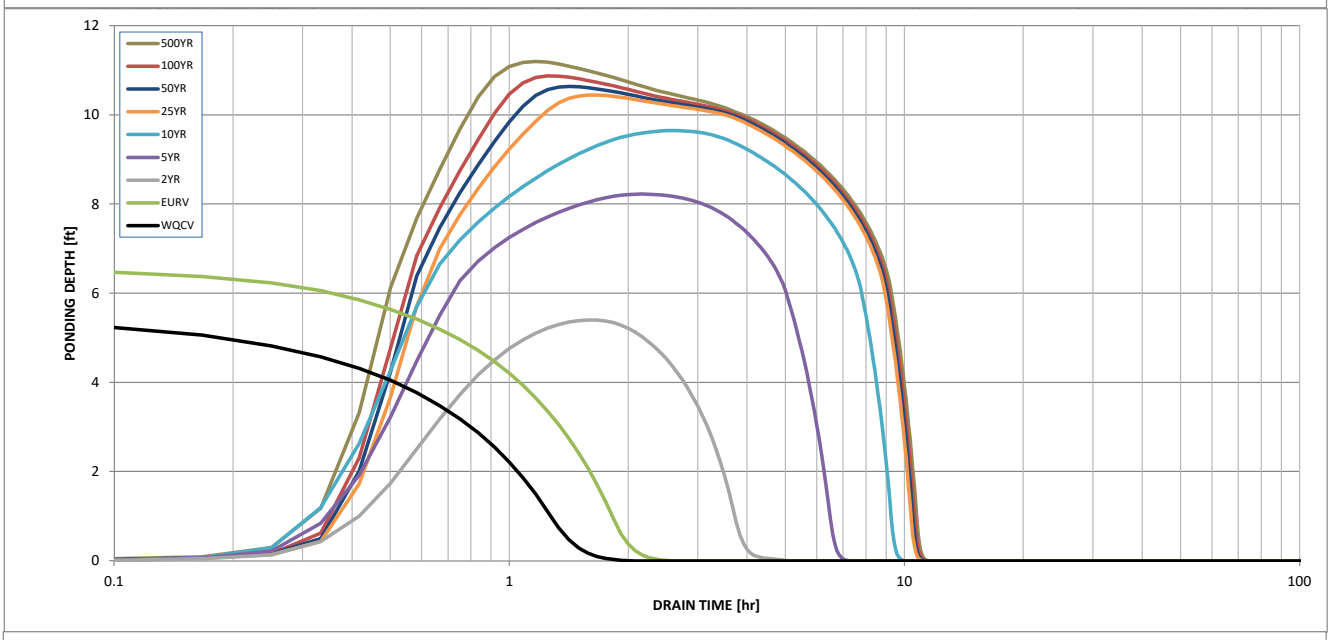
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

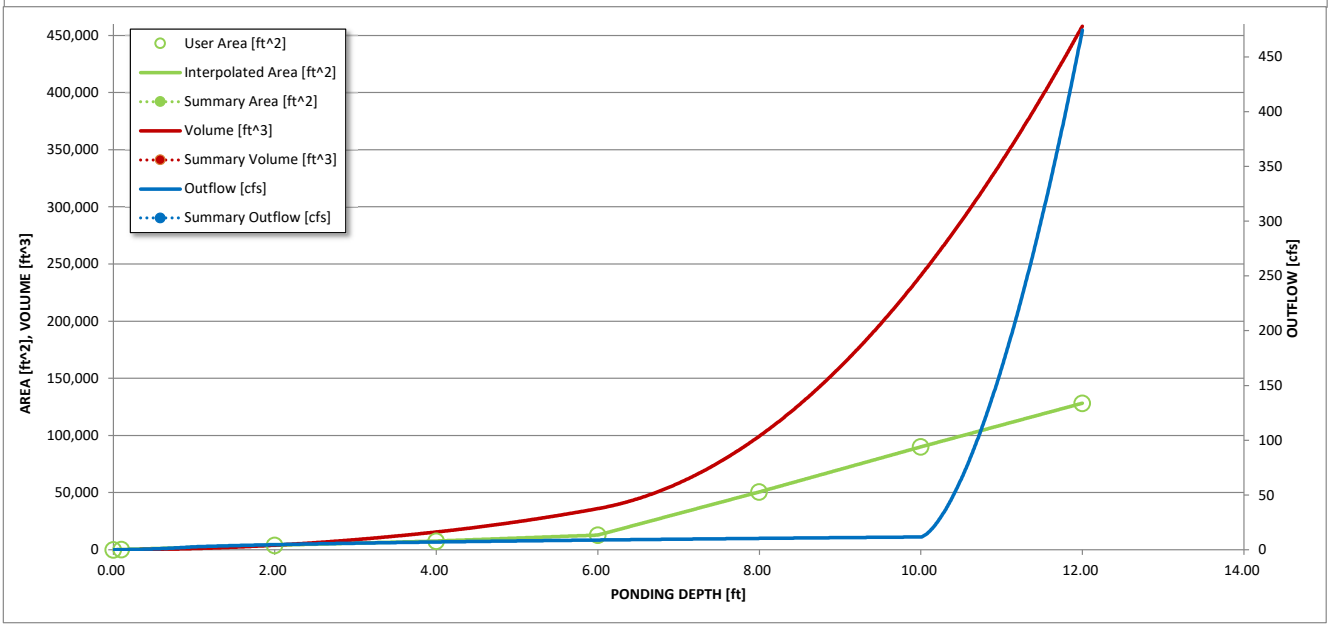
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.719	1.129	1.936	4.609	7.326	12.327	15.665	20.543	29.334
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.936	4.609	7.326	12.327	15.665	20.543	29.334
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	16.4	41.2	61.8	110.8	138.6	177.4	247.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.24	0.36	0.64	0.81	1.03	1.44
Peak Inflow Q (cfs) =	N/A	N/A	18.7	43.8	64.6	113.2	141.0	180.0	250.1
Peak Outflow Q (cfs) =	8.5	9.4	8.4	10.5	11.4	56.6	88.8	137.5	216.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.2	0.5	0.6	0.8	0.9
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	1	2	4	6	9	10	10	10	9
Time to Drain 99% of Inflow Volume (hours) =	1	2	4	6	9	10	10	10	10
Maximum Ponding Depth (ft) =	5.63	6.69	5.40	8.23	9.65	10.45	10.64	10.88	11.20
Area at Maximum Ponding Depth (acres) =	0.27	0.59	0.26	1.26	1.91	2.26	2.34	2.45	2.59
Maximum Volume Stored (acre-ft) =	0.721	1.132	0.660	2.548	4.814	6.461	6.898	7.473	8.305

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)







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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:15:00	0	0.00	0.03	0.05	0.07	0.05	0.06	0.06	0.10
	0:20:00	0	0.00	0.17	0.47	0.84	0.18	0.22	0.25	0.82
	0:25:00	0	0.00	1.74	6.19	11.67	1.68	2.20	3.51	11.41
	0:30:00	0	0.00	6.98	20.05	33.00	21.71	28.35	35.29	60.44
	0:35:00	0	0.00	13.40	34.16	51.97	56.82	72.85	90.04	134.64
	0:40:00	0	0.00	17.44	41.77	61.49	87.25	110.08	136.61	194.95
	0:45:00	0	0.00	18.73	43.79	64.57	104.13	130.14	163.06	229.00
	0:50:00	0	0.00	18.56	43.09	64.02	112.01	139.52	176.30	245.85
	0:55:00	0	0.00	17.58	40.66	60.74	113.24	141.04	180.04	250.12
	1:00:00	0	0.00	16.19	37.39	56.56	108.83	135.82	176.29	245.12
	1:05:00	0	0.00	14.89	34.46	53.16	102.38	128.38	170.33	237.77
	1:10:00	0	0.00	13.82	32.05	50.27	96.09	121.21	163.19	228.82
	1:15:00	0	0.00	12.74	29.69	47.48	89.28	113.24	153.04	216.00
	1:20:00	0	0.00	11.66	27.31	44.52	82.07	104.56	141.02	200.34
	1:25:00	0	0.00	10.68	25.26	41.73	75.02	95.83	128.94	184.21
	1:30:00	0	0.00	9.92	23.63	39.04	69.24	88.60	118.61	169.86
	1:35:00	0	0.00	9.23	22.08	36.34	64.01	81.97	109.33	156.73
	1:40:00	0	0.00	8.57	20.53	33.67	59.19	75.81	100.87	144.62
	1:45:00	0	0.00	7.92	18.93	31.05	54.59	69.95	92.99	133.29
	1:50:00	0	0.00	7.28	17.32	28.50	50.18	64.32	85.40	122.41
	1:55:00	0	0.00	6.63	15.71	25.97	45.82	58.80	78.01	111.87
	2:00:00	0	0.00	5.97	14.10	23.43	41.54	53.37	70.82	101.60
	2:05:00	0	0.00	5.32	12.51	20.89	37.30	47.98	63.76	91.53
	2:10:00	0	0.00	4.73	11.21	18.89	33.11	42.66	56.83	81.94
	2:15:00	0	0.00	4.34	10.33	17.43	29.94	38.66	51.48	74.45
	2:20:00	0	0.00	4.04	9.62	16.18	27.49	35.53	47.24	68.38
	2:25:00	0	0.00	3.77	8.98	15.03	25.44	32.87	43.58	63.06
	2:30:00	0	0.00	3.52	8.36	13.95	23.60	30.46	40.30	58.25
	2:35:00	0	0.00	3.27	7.76	12.90	21.94	28.27	37.29	53.84
	2:40:00	0	0.00	3.02	7.17	11.89	20.35	26.19	34.49	49.71
	2:45:00	0	0.00	2.79	6.60	10.91	18.82	24.19	31.86	45.85
	2:50:00	0	0.00	2.55	6.03	9.96	17.34	22.28	29.40	42.26
	2:55:00	0	0.00	2.32	5.47	9.04	15.89	20.41	27.00	38.75
	3:00:00	0	0.00	2.10	4.92	8.16	14.45	18.57	24.60	35.31
	3:05:00	0	0.00	1.87	4.38	7.29	13.01	16.73	22.21	31.87
	3:10:00	0	0.00	1.64	3.84	6.42	11.58	14.90	19.83	28.45
	3:15:00	0	0.00	1.41	3.30	5.56	10.15	13.08	17.44	25.02
	3:20:00	0	0.00	1.19	2.77	4.70	8.72	11.26	15.06	21.61
	3:25:00	0	0.00	0.96	2.23	3.85	7.29	9.44	12.68	18.20
	3:30:00	0	0.00	0.74	1.70	3.00	5.87	7.63	10.31	14.80
	3:35:00	0	0.00	0.52	1.17	2.16	4.45	5.82	7.93	11.41
	3:40:00	0	0.00	0.31	0.69	1.40	3.04	4.03	5.59	8.12
	3:45:00	0	0.00	0.15	0.39	0.97	1.80	2.47	3.55	5.39
	3:50:00	0	0.00	0.10	0.28	0.75	1.11	1.61	2.34	3.71
	3:55:00	0	0.00	0.07	0.21	0.59	0.70	1.07	1.56	2.58
	4:00:00	0	0.00	0.06	0.17	0.46	0.45	0.72	1.01	1.75
	4:05:00	0	0.00	0.05	0.13	0.36	0.28	0.48	0.63	1.15
	4:10:00	0	0.00	0.03	0.10	0.27	0.18	0.32	0.36	0.72
	4:15:00	0	0.00	0.03	0.08	0.20	0.11	0.21	0.18	0.42
	4:20:00	0	0.00	0.02	0.06	0.14	0.07	0.14	0.09	0.24
	4:25:00	0	0.00	0.02	0.04	0.09	0.05	0.10	0.07	0.17
	4:30:00	0	0.00	0.01	0.03	0.06	0.04	0.07	0.05	0.12
	4:35:00	0	0.00	0.01	0.02	0.05	0.03	0.05	0.04	0.10
	4:40:00	0	0.00	0.01	0.01	0.04	0.02	0.04	0.03	0.08
	4:45:00	0	0.00	0.01	0.01	0.03	0.01	0.03	0.02	0.06
	4:50:00	0	0.00	0.00	0.00	0.02	0.01	0.02	0.02	0.04
	4:55:00	0	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.03
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX E

HYDRAULIC CALCULATIONS

SUNDANCE WEST SUBDIVISION
CHANNEL CALCULATIONS

CHANNELS - DEVELOPED FLOWS

CHANNEL	DESIGN POINT	SLOPE (FT/FT)	BOTTOM WIDTH (B, FT)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	DP/ BASIN	Q100 FLOW (CFS)	CHANNEL FLOW % OF BASIN	CHANNEL FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	TOP WIDTH (FT)	EASEMENT WIDTH (FT)	CHANNEL LINING
CHANNEL A1	A1	0.019	20	4:1	2.0	0.030	A1	77.9	100	77.9	0.7	4.9	25.5	50	GRASS
CHANNEL A2.1A	A2.1	0.019	60	4:1	2.0	0.030	A2.1	197.4	100	197.4	0.6	4.9	65.1	80	GRASS
CHANNEL A2.1B	A2.1	0.082	4	3:1	2.0	0.040	A2.1	197.4	100	197.4	1.8	11.4	14.9	80	RIPRAP
CHANNEL A2.2	A2	0.017	60	4:1	2.0	0.030	A2.1	197.4	100	197.4	0.7	4.8	65.3	80	GRASS

1) Channel flow calculations based on Manning's Equation
2) n = 0.03 for grass-lined non-irrigated channels (minimum)
3) Vmax = 5.0 fps for 100-year flows w/ grass-lined channels
4) Vmax = 8.0 fps for 100-year flows w/ Erosion Control Blankets / Turf Reinforcement Mats (Eronet SC150 or equal)

TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH VARIED GRASS LININGS AND SLOPES

Channel Slope	Lining	Permissible Mean Channel Velocity * (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3

* For highly erodible soils, decrease permissible velocities by 25%.

* Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.

Hydraulic Analysis Report

Project Data

Project Title: Project - Sundance West Subdivision - Channels

Designer: JPS

Project Date: Saturday, March 8, 2025

Project Units: U.S. Customary Units

Notes

Channel Analysis: Channel Analysis - A1

Notes:

Input Parameters

Channel Type: : Trapezoidal

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Channel Width: 20.00 ft

Longitudinal Slope: 0.0190 ft/ft

Manning's n: : 0.0300

Flow: 77.9000 cfs

Result Parameters

Depth: 0.6934 ft

Area of Flow: 15.7918 ft^2

Wetted Perimeter: 25.7181 ft

Hydraulic Radius: 0.6140 ft

Average Velocity: 4.9329 ft/s

Top Width: 25.5474 ft

Froude Number: : 1.1057

Critical Depth: 0.7391 ft

Critical Velocity: 4.5913 ft/s

Critical Slope: 0.0153 ft/ft

Critical Top Width: 25.91 ft

Calculated Max Shear Stress: 0.8221 lb/ft^2

Calculated Avg Shear Stress: 0.7280 lb/ft^2

Channel Analysis: Channel Analysis - A2.1A

Notes:

Input Parameters

Channel Type: : Trapezoidal

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Channel Width: 60.00 ft

Longitudinal Slope: 0.0190 ft/ft

Manning's n: : 0.0300

Flow: 197.4000 cfs

Result Parameters

Depth: 0.6401 ft

Area of Flow: 40.0480 ft^2

Wetted Perimeter: 65.2788 ft

Hydraulic Radius: 0.6135 ft

Average Velocity: 4.9291 ft/s

Top Width: 65.1212 ft

Froude Number: : 1.1077

Critical Depth: 0.6846 ft

Critical Velocity: 4.5958 ft/s

Critical Slope: 0.0152 ft/ft

Critical Top Width: 65.48 ft

Calculated Max Shear Stress: 0.7590 lb/ft^2

Calculated Avg Shear Stress: 0.7274 lb/ft^2

Channel Analysis: Channel Analysis - A2.1B

Notes:

Input Parameters

Channel Type: : Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 4.00 ft

Longitudinal Slope: 0.0820 ft/ft

Manning's n: : 0.0400

Flow: 197.4000 cfs

Result Parameters

Depth: 1.8245 ft

Area of Flow: 17.2847 ft^2

Wetted Perimeter: 15.5393 ft

Hydraulic Radius: 1.1123 ft

Average Velocity: 11.4205 ft/s

Top Width: 14.9471 ft

Froude Number: : 1.8716

Critical Depth: 2.4804 ft

Critical Velocity: 6.9561 ft/s

Critical Slope: 0.0215 ft/ft

Critical Top Width: 18.88 ft

Calculated Max Shear Stress: 9.3357 lb/ft^2

Calculated Avg Shear Stress: 5.6915 lb/ft^2

Channel Analysis: Channel Analysis - A2.2

Notes:

Input Parameters

Channel Type: : Trapezoidal

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Channel Width: 60.00 ft

Longitudinal Slope: 0.0170 ft/ft

Manning's n: : 0.0300

Flow: 197.4000 cfs

Result Parameters

Depth: 0.6617 ft

Area of Flow: 41.4537 ft^2

Wetted Perimeter: 65.4566 ft

Hydraulic Radius: 0.6333 ft

Average Velocity: 4.7619 ft/s

Top Width: 65.2936 ft

Froude Number: : 1.0532

Critical Depth: 0.6846 ft

Critical Velocity: 4.5958 ft/s

Critical Slope: 0.0152 ft/ft

Critical Top Width: 65.48 ft

Calculated Max Shear Stress: 0.7019 lb/ft^2

Calculated Avg Shear Stress: 0.6718 lb/ft^2

SUNDANCE WEST SUBDIVISION
DRIVEWAY CULVERT SIZING SUMMARY

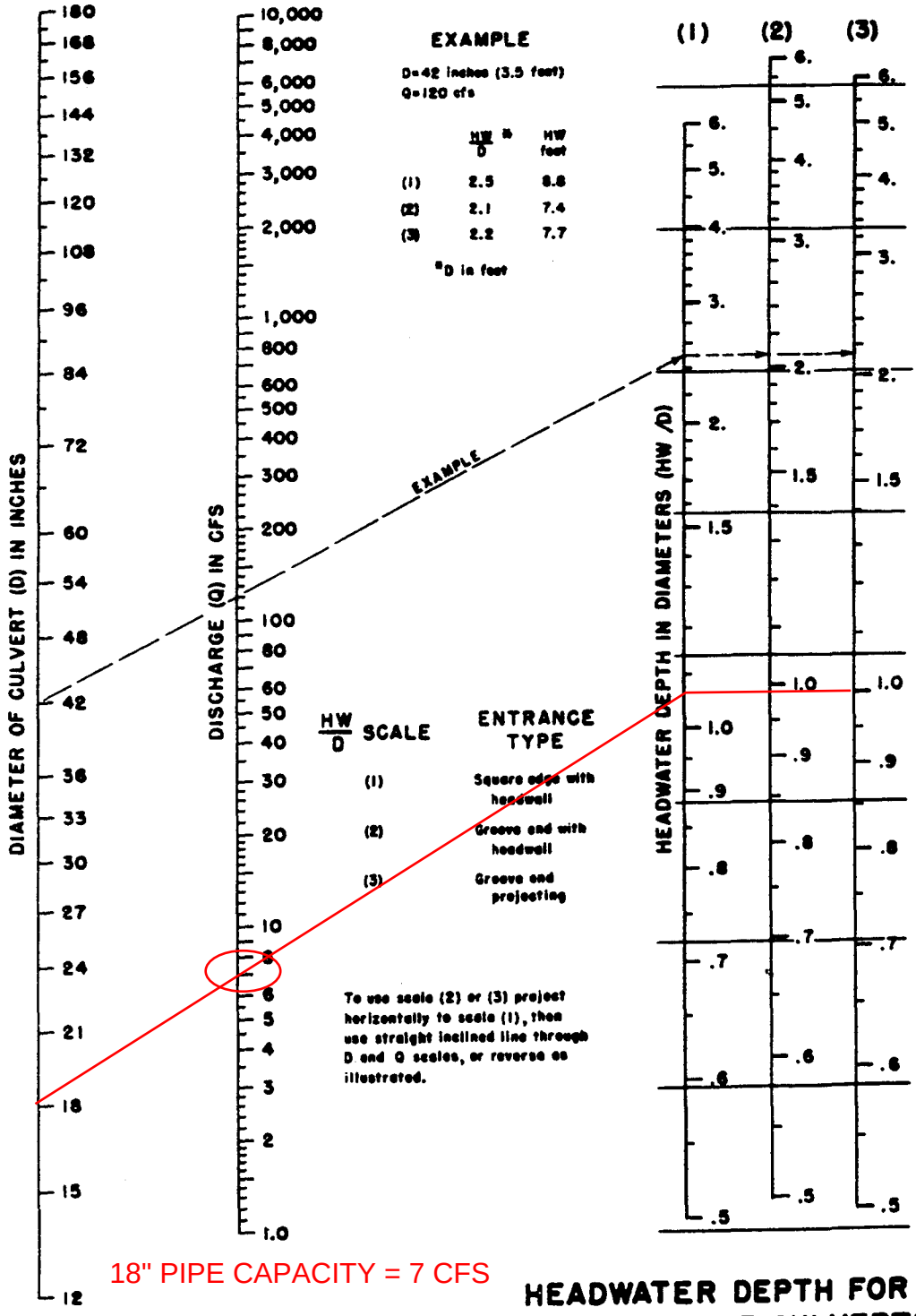
PRIVATE CULVERT	BASIN	Q5 FLOW (CFS)	FLOW % AT DVWY CULVERT	CULVERT FLOW (Q5, CFS)		CULVERT SIZE (IN)
A2.1A	A2.1	4.0	100	4.0		18

* CULVERT SIZING BASED ON EPC DCM, FIGURE 9-34; ASSUMING MAX. HW/D = 1.0 FOR Q5

Please include design of 42" culvert back in that was provided with review 1.

Include design calculations for riprap aprons for culverts

PRIVATE DRIVEWAY CULVERT A2.1A



18" PIPE CAPACITY = 7 CFS

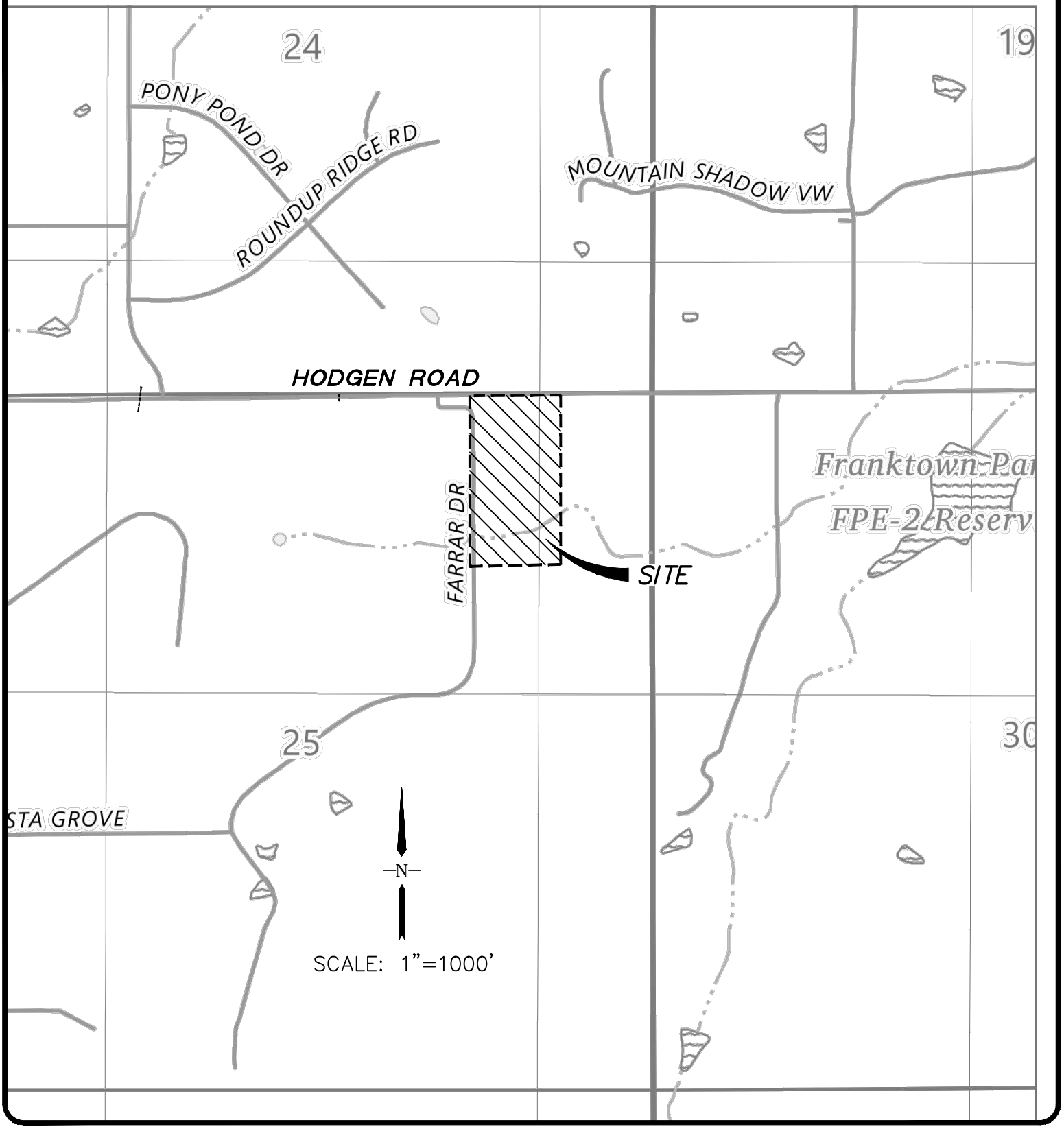
HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

APPENDIX F

FIGURES



VICINITY MAP

JPS ENGINEERING

SUNDANCE WEST SUBDIVISION

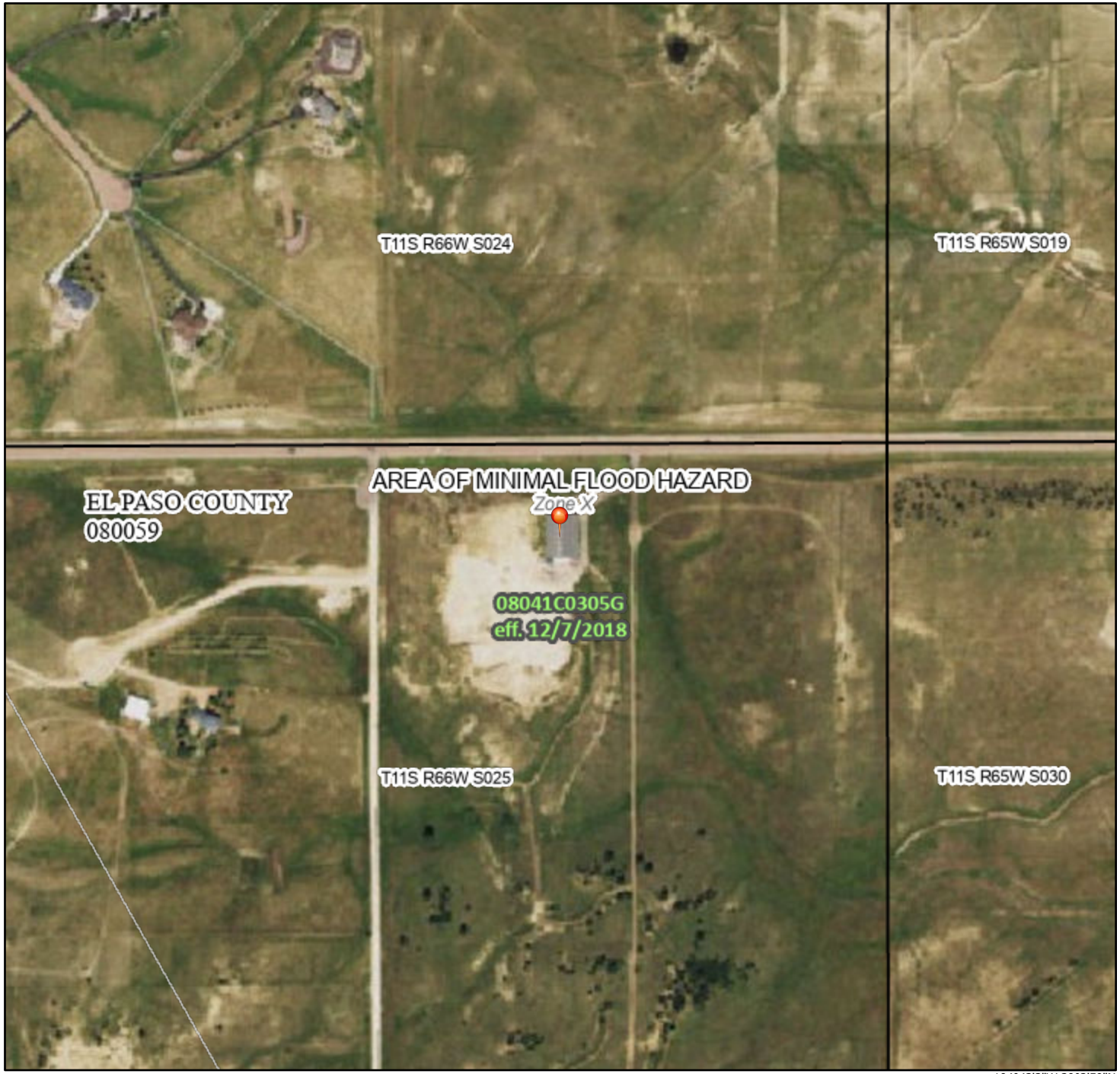
FIGURE A1

JPS PROJ NO. 022501

National Flood Hazard Layer FIRMette

FEMA

104°43'40"W 39°4'27"N



104°43'3"W 39°3'59"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

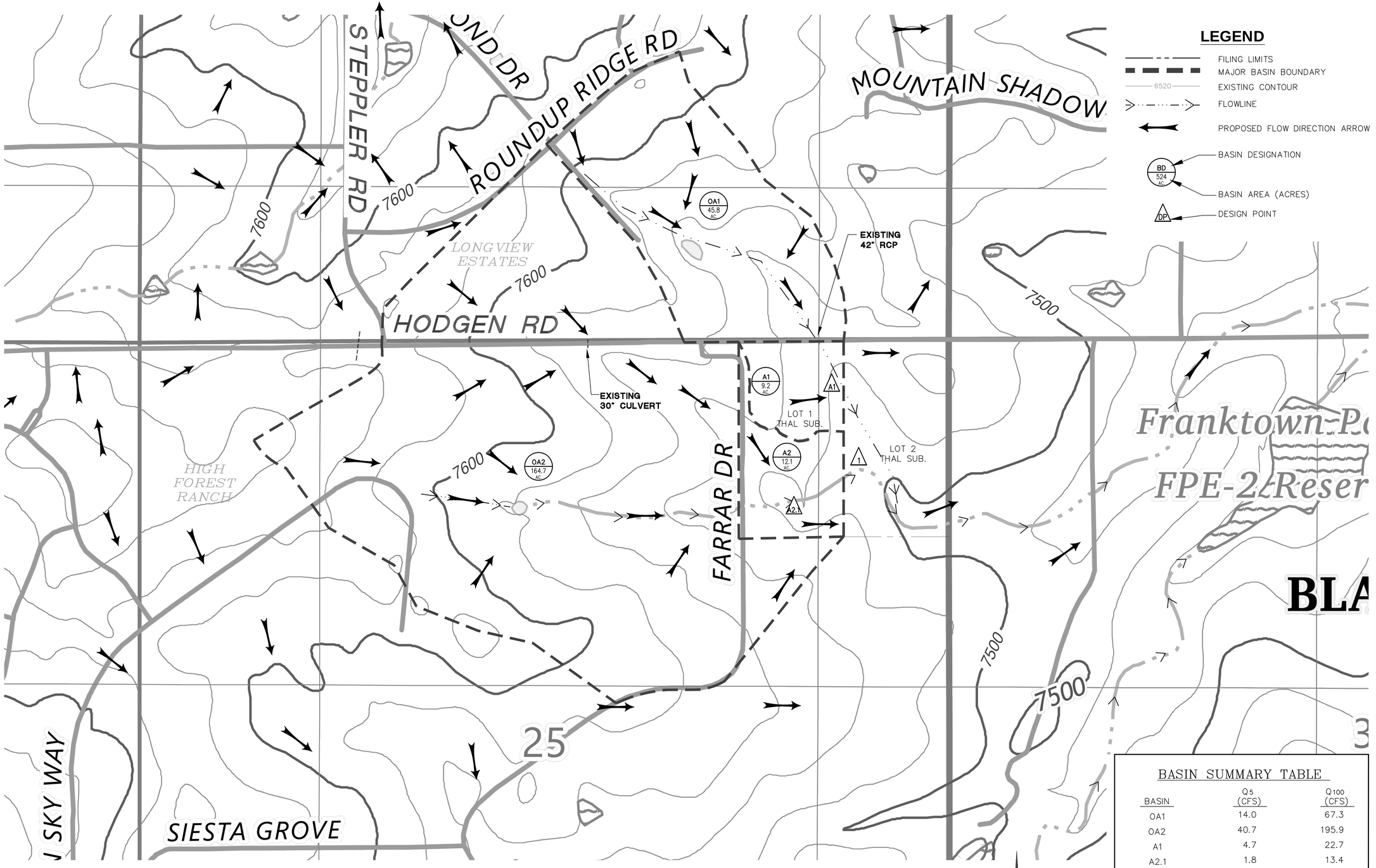
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/6/2025 at 7:47 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



BASIN SUMMARY TABLE

BASIN	Q5 (CFS)	Q100 (CFS)
OA1	14.0	67.3
OA2	40.7	195.9
A1	4.7	22.7
A2.1	1.8	13.4
A2.2	1.5	11.0

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	16.0	77.1
A2.1	40.3	195.9
1	24.3	241.1

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

SUNDANCE WEST SUBDIVISION

REVISION | No. | BY | DATE

MAJOR BASIN / HISTORIC DRAINAGE PLAN

HORZ. SCALE:	1"=500'	DRAWN:	MSP
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	USGS	CHECKED:	JPS
CREATED:	02/16/25	LAST MODIFIED:	10/13/26
PROJECT NO:	022501	MODIFIED BY:	MSP

SHEET: EX1

EXISTING 30" RCP

EXISTING 42" RCP

50' SIGHT TRIANGLE

show culverts

TRACT IN THE SW1/4 SECTION 19 T11S R65W & E1/2SE1/4 SECTION 24 T11S R66W, 6th P.M.
PETER J. TIEK
5815 MOUNTAIN SHADOW VW
COLORADO SPRINGS, COLORADO, 80908 PARCEL NO. 6124000012
ZONING: RR-5
(NOT A PART OF THIS PLAT)

TRACT IN THE E1/2SE1/4 SECTION 24, T11S R66W, 6th P.M.
MARK MCDONALD
577 MOUNTAIN SHADOW VW
COLORADO SPRINGS, COLORADO 80908
PARCEL NO. 6124000013
ZONING: RR-5
(NOT A PART OF THIS PLAT)

LOT 2 THAL SUB.
BRANDON LAVALLEY
5735 HODGEN ROAD
COLORADO SPRINGS, CO 80908
PARCEL NO. 6125001004
ZONING: RR-5
(NOT A PART OF THIS PLAT)

1

N00°00'16"E 1296.16'

A1

10' PUBLIC UTILITY AND DRAINAGE EASEMENT

EX. CHANNEL A2.2

EXISTING RESIDENCE/GARAGE

EXISTING GRAVEL PARKING & STORAGE AREA

A2.2
4.8 AC.

A1
9.2 AC.

A2.1

EX. 12" DRAIN PIPE
INV EL=7514.56

EXISTING STOCK POND A2
BOT EL=7510
SPILLWAY=7520
5-YR WSL=7518.33
100-YR WSL=7521.01

A2.1
7.3 AC.

EX. CHANNEL A2.1

OA1
45.8 AC.

HODGEN ROAD

N89°38'24"E 666.89'

20' PUBLIC UTILITY AND DRAINAGE EASEMENT

HAES HAVEN VIEW

S89°42'12"W 666.52'

SE1/4NE1/4 SECTION 25, T11S R66W, 6th P.M. KRYSTAL STEARNS PARCEL NO. 6100000378 ZONING: RR-5 (NOT A PART OF THIS PLAT)

20' PUBLIC UTILITY AND DRAINAGE EASEMENT

N00°00'12"W 1295.42'

FARRAR ROAD 60' ROW

EXISTING 24" RCP CULVERT

LOT 1 PROVIDENCE POINT ESTATES
RICHARD LAWSON
5490 HAES HAVEN VW
COLORADO SPRINGS, COLORADO, 80908
PARCEL NO. 6125004001
ZONING: RR-5
(NOT A PART OF THIS PLAT)

LOT 6 PROVIDENCE POINT ESTATES
NOBLE HAGEN FAMILY TRUST
5489 HAES HAVEN VW
COLORADO SPRINGS, COLORADO 80908
PARCEL NO. 6125004012
ZONING: RR-5
(NOT A PART OF THIS PLAT)

See comment in narrative regarding culvert here.

A TRACT IN THE NE1/4 SECTION 25, T11S R66W, 6TH P.M
JONATHAN J EWELL
TRUST PARCEL NO. 6100000283 .
ZONING: RR-5
(NOT A PART OF THIS PLAT)

OA2
164.7 AC.

LEGEND

- PROPOSED LOT LINES
- PROPERTY LINES
- DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- FLOWLINE
- PROPOSED FLOW DIRECTION ARROW
- WSL WATER SURFACE LEVEL
- BD 524 AC. BASIN DESIGNATION
- BASIN AREA (ACRES)
- DP DESIGN POINT

60' 0 60' 120'
ORIGINAL SCALE: 1"=60'
CONTOUR INTERVAL=2'

LEGEND:

- SET 5/8" REBAR AND PINK CAP STAMPED "RAMPART PLS 38315"
- FOUND AS SHOWN (1/16 CORNER)
- FOUND 2-1/2" ALUMINUM CAP IN RANGE BOX STAMPED AS SHOWN (SECTION CORNER)
- FOUND AS SHOWN (1/4 CORNER)
- UTILITY POLE
- OVERHEAD UTILITY

EX. POND CONTOUR AREAS:
7510 = 631
7512 = 8,656
7514 = 16,444
7516 = 23,316
7518 = 35,716
7520 = 61,152

BASIN SUMMARY TABLE

BASIN	Q5 (CFS)	Q100 (CFS)
OA1	14.0	67.3
OA2	40.7	195.9
A1	4.7	22.7
A2.1	1.8	13.4
A2.2	1.5	11.0

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	16.0	77.1
A2.1	40.3	195.9
1	24.3	241.1

SUNDANCE WEST SUBDIVISION

EXISTING CONDITIONS DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE

HORZ. SCALE: 1"=60'	DRAWN: PV
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RAMPART	CHECKED: JPS
CREATED: 02/16/25	LAST MODIFIED: 10/13/26
PROJECT NO: 022501	MODIFIED BY: PV

SHEET: EX2

Access to Farrar Road will be removed as a part of this subdivision. Please see depict and see comment on GEC and depict any changes here.

I'm measuring about 17% imperviousness for this lot. See previous comments in drainage report text - if using the large lot exclusion the lots cannot be greater than 10% or between 10-20% without a study demonstrating infiltration. Increase re-vegetation limits or adjust approach.

Is this channel A1? Please label

Informational Note: I recommend the use of concrete or steel instead of HDPE. Recommendation only as these are private driveways.

Include analysis of the volume of flows going over the spillway in the 100 year event. Is erosion protection needed for the spillway? Is a drainage easement needed here? Include depth of water that will be overtopping the proposed driveway for lot 7. It doesn't seem ideal to have a driveway as the top of the spillway..please include erosion protection.

GEC plans have different information than this map. Please revise so same information is shown across all plans and maps

Provide more detail for any improvements that will be completed on the spillway. This spillway doesn't seem adequate for the volume of flows provided. Is a pipe overflow needed instead of, or in addition to, this spillway?

see comment on page PDF page 10.

Provide design calculations for rundown & riprap outlet protection

Please delineate wetlands and address in the report and whether or not they are jurisdictional. Please contact USACE and provide documentation.

EXISTING 30" RCP DRIVEWAY CULVERT

EXISTING 42" RCP CULVERT

EXISTING 24" RCP CULVERT

TRACT IN THE SW1/4 SECTION 19, T11S R65W & E1/2SE1/4 SECTION 24, T11S R66W, 6th P.M. PETER ZIEK 5815 MOUNTAIN SHADOW VW COLORADO SPRINGS, COLORADO, 80908 PARCEL NO. 6124000012 ZONING: RR-5 (NOT A PART OF THIS PLAT)

TRACT IN THE E1/2SE1/4 SECTION 24, T11S R66W, 6TH P.M. MARK MCDONALD 577 MOUNTAIN SHADOW VW COLORADO SPRINGS, COLORADO 80908 PARCEL NO. 6124000013 ZONING: RR-5 (NOT A PART OF THIS PLAT)

LOT 2 THAL SUB. BRANDON LAVALLEY 5735 HODGEN ROAD COLORADO SPRINGS, CO 80908 PARCEL NO. 6125001004 ZONING: RR-5 (NOT A PART OF THIS PLAT)

LOT 1 PROVIDENCE POINT ESTATES RICHARD LAWSON 5490 HAES HAVEN VW COLORADO SPRINGS, COLORADO, 80908 PARCEL NO. 6125004001 ZONING: RR-5 (NOT A PART OF THIS PLAT)

LOT 6 PROVIDENCE POINT ESTATES NOBLE HAGEN FAMILY TRUST 5489 HAES HAVEN VW COLORADO SPRINGS, COLORADO 80908 PARCEL NO. 6125004012 ZONING: RR-5 (NOT A PART OF THIS PLAT)

A TRACT IN THE NE1/4 SECTION 25, T11S R66W, 6TH P.M. JONATHAN J EWELL TRUST PARCEL NO. 6100000283 . ZONING: RR-5 (NOT A PART OF THIS PLAT)

SE1/4NE1/4 SECTION 25, T11S R66W, 6th P.M. KRYSTAL STEARNS PARCEL NO. 6100000378 ZONING: RR-5 (NOT A PART OF THIS PLAT)

N00°00'16"E 1296.16'

N89°38'24"E 1333.40'

N89°38'24"E 666.89'

S89°42'12"W 666.52'

N00°00'12"W 1295.42'

60' ACCESS EASEMENT FOR LOT 1 AND LOT 2 OF THAL SUBDIVISION, REC. NO. 200009228

10' PUBLIC UTILITY AND DRAINAGE EASEMENT

20' WELL ACCESS EASEMENT

50' SIGHT TRIANGLE

50' SIGHT TRIANGLE REC. NO. 200009228

TRACT A (30' WIDE)

30" RCP CULVERT ELEV.=7513.33

ELEV.=7511.33

CP-6 ELEV.=7517.68

CP-9 ELEV.=7507.

CP-8 ELEV.=7532.97

LIMIT OF DISTURBANCE = 6.5 AC.

33,802.09 sf

EXISTING RESIDENCE/GARAGE

lot 5 4.80 Ac.

EXISTING GRAVEL PARKING & STORAGE AREA

A1 9.2 AC.

OA1 45.8 AC.

A2.2 4.8 AC.

A2.1 7.3 AC.

OA2 164.7 AC.

DISTURBED AREA TO BE RE-VEGETATED WITH NATIVE SEED

PROPOSED LOT LINE (TYPICAL)

EXCAVATE EXISTING BERM; MATCH INTO EX. 7518.0 CONTOUR

CHANNEL A2.2

(P) 80' W DRAINAGE ESMT.

LOT 6 2.51 Ac

LOT 7 2.50 Ac

(P) 12" SD INV=11.0

(P) 103 LF PRIVATE DRIVEWAY CULVERT A2.1 (12" HDPE) W/ RR APRON

(E) SPILLWAY EL=7520.0 (L=24')

CUT

FILL

(P) LOT 7 DRIVEWAY (PRELIMINARY)

EXISTING STOCK POND A2 TO BE PRESERVED/UPGRADED

(P) BOT EL=7512.0

(E) SPILLWAY=7520.0

5-YR WSL=7520.23

100-YR WSL=7522.88

EXISTING STOCK POND

(P) 18" SD INV=17.0

(P) 18" SD INV=18.0

(P) 75 LF PRIVATE DRIVEWAY CULVERT A2.1A (18" HDPE) W/ RR APRON

(P) 12" SD INV=12.0

(P) RIPRAP RUNDOWN (CHANNEL A2.1B)

(P) 24'W GRAVEL SHARED DRIVEWAY

LOT 3 2.51 Ac

LOT 4 2.50 Ac

LOT 1 2.50 AC

LOT 2 2.50 Ac

(P) CHANNEL A2.1A

22.0: MATCH INTO EXISTING GRASS-LINED SWALE

20' PUBLIC UTILITY AND DRAINAGE EASEMENT

MATCH INTO EX. GRAVEL ROAD

(P) 80' W DRAINAGE ESMT.

FARRAR ROAD 60' ROW

HODGEN ROAD

HAES HAVEN VIEW

24' ACCESS EASEMENT FOR LOTS 3 & 4

20' PUBLIC UTILITY AND DRAINAGE EASEMENT

25' EPC TRAIL EASEMENT

50' CIG EASEMENT

100' MOUNTAIN VIEW ELECTRIC EASEMENT

104.0' TO CIG ESMT

NOT QUITE ACCEPTED.

LEGEND

- PROPOSED LOT LINES
- PROPERTY LINES
- DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- FLOWLINE
- PROPOSED FLOW DIRECTION ARROW
- BD / 524 AC. BASIN DESIGNATION
- BASIN AREA (ACRES)
- DP DESIGN POINT

ORIGINAL SCALE: 1"=60'
CONTOUR INTERVAL=2'

LEGEND:

- SET 5/8" REBAR AND PINK CAP STAMPED "RAMPART PLS 38315"
- FOUND AS SHOWN (1/16 CORNER)
- FOUND 2-1/2" ALUMINUM CAP IN RANGE BOX STAMPED AS SHOWN (SECTION CORNER)
- FOUND AS SHOWN (1/4 CORNER)
- UTILITY POLE
- OVERHEAD UTILITY
- PERMANENT EASEMENT
- TEMPORARY EASEMENT WITH PERMANENT DRAINAGE AND SLOPE CONDITIONS

BASIN SUMMARY TABLE

BASIN	Q5 (CFS)	Q100 (CFS)
OA1	14.0	67.3
OA2	40.7	195.8
A1	5.9	24.4
A2.1	4.0	16.5
A2.2	3.3	13.5

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	16.7	77.9
A2.1	41.2	197.4
1	30.5	228.8

JPS ENGINEERING
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CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

REVISION | BY | DATE | No.

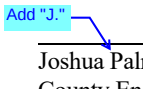
SUNDANCE WEST SUBDIVISION

DEVELOPED DRAINAGE PLAN

HORZ. SCALE:	1"=60'
VERT. SCALE:	N/A
SURVEYED:	RAMPART
CREATED:	02/16/25
PROJECT NO:	022501
DRAWN:	PV
DESIGNED:	JPS
CHECKED:	JPS
LAST MODIFIED:	10/13/26
MODIFIED BY:	PV
SHEET:	D1

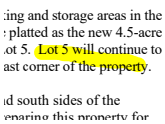
V2_Drainage Report Final.pdf Markup Summary

CDurham (9)



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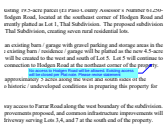


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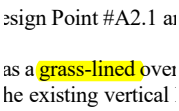
utilize the existing access drive connection to Hodgen Road at the northeast corner of the property.



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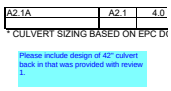
No access to Hodgen Road will be allowed. Existing access will be closed per Plat note. Please revise statement

---



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grass-lined



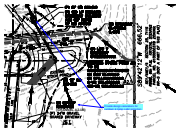
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Date: 11/3/2026 3:32:20 PM
Status:
Color:
Layer:
Space:

Please include design of 42" culvert back in that was provided with review 1.



Subject: Text Box
Page Label: 50
Author: CDurham
Date: 11/3/2026 3:32:39 PM
Status:
Color:
Layer:
Space:

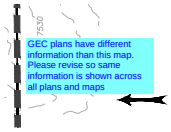
Include design calculations for riprap aprons for culverts



Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 11/4/2026 11:16:31 AM
Status:
Color:
Layer:
Space:

Provide design calculations for rundown & riprap outlet protection

---

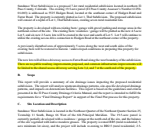


Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 11/4/2026 11:17:29 AM
Status:
Color:
Layer:
Space:

GEC plans have different information than this map. Please revise so same information is shown across all plans and maps

---

Joseph Sandstrom (57)



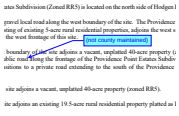
Subject: Highlight
Page Label: 3
Author: Joseph Sandstrom
Date: 11/4/2026 6:26:43 AM
Status:
Color:
Layer:
Space:

There are no public roadway improvements proposed, and common infrastructure improvements will
be limited to the shared access driveway serving Lots 3,4, and 7 at the south end of the property.



Subject: Callout
Page Label: 3
Author: Joseph Sandstrom
Date: 11/4/2026 6:28:21 AM
Status:
Color:
Layer:
Space:

Farrar Road does not meet minimum County roadway standards and therefore improvements are required to meet criteria of approval for suitable access. Please revise.



Subject: Callout
Page Label: 4
Author: Joseph Sandstrom
Date: 11/4/2026 6:30:57 AM
Status:
Color:
Layer:
Space:

(not county maintained)



Subject: Highlight
Page Label: 6
Author: Joseph Sandstrom
Date: 11/4/2026 6:34:27 AM
Status:
Color:
Layer:
Space:

Q100 = 205.4 cfs crossing Farrar Road at the west

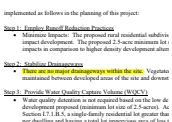
boundary of the Sundance West Subdivision property.



Subject: Callout
Page Label: 6
Author: Joseph Sandstrom
Date: 11/4/2026 7:45:20 AM
Status:
Color:
Layer:
Space:

Include the size of the culvert under Farrar and analyze whether or not it is adequate to convey these flows (are flows contained in the pipe, does the road overtop in the 100 year, etc.) If it is not adequate please, provide recommendation of what the minimum culvert size should be based on analysis.

In aerial imagery, I'm only able to see the western end of the culvert. Please verify that the eastern end, please verify that the eastern end daylights as well. Providence Point FDR mentioned an existing culvert here.



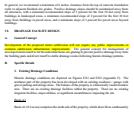
Subject: Highlight
Page Label: 7
Author: Joseph Sandstrom
Date: 11/4/2026 6:46:09 AM
Status:
Color:
Layer:
Space:

There are no major drainageways within the site.



Subject: Callout
Page Label: 7
Author: Joseph Sandstrom
Date: 11/4/2026 6:47:07 AM
Status:
Color:
Layer:
Space:

A2.1 and A2.2 should be considered a major drainageway. Please revise.



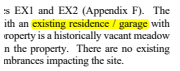
Subject: Highlight
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:47:46 AM
Status:
Color:
Layer:
Space:

Development of the proposed minor subdivision will not require any public improvements or common subdivision infrastructure improvements.



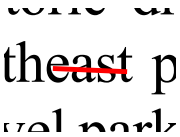
Subject: Callout
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:49:04 AM
Status:
Color:
Layer:
Space:

Both of these are not correct. Common subdivision infrastructure improvements are shown on the GEC and Farrar Road does not meet minimum county standards for a roadway.

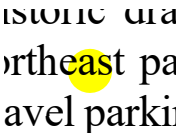


Subject: Highlight
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:49:25 AM
Status:
Color:
Layer:
Space:

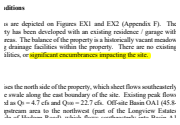
existing residence / garage



Subject: Line
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:49:59 AM
Status:
Color:
Layer:
Space:

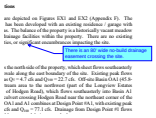


Subject: Highlight
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:50:21 AM
Status:
Color:
Layer:
Space:



Subject: Highlight
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:50:57 AM
Status:
Color:
Layer:
Space:

significant encumbrances impacting the site.



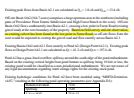
Subject: Callout
Page Label: 8
Author: Joseph Sandstrom
Date: 11/4/2026 6:51:40 AM
Status:
Color:
Layer:
Space:

There is an 80' wide no-build drainage easement crossing the site.



Subject: Highlight
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:08:16 AM
Status:
Color:
Layer:
Space:

crossing a low point in Farrar Road (existing gravel road



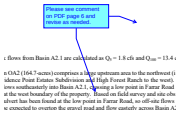
Subject: Highlight
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:08:30 AM
Status:
Color:
Layer:
Space:

Based on field survey and site observation,
no existing culvert has been found at the low point in Farrar Road,

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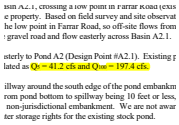


Subject: Image
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:11:01 AM
Status:
Color:
Layer:
Space:



Subject: Callout
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:45:40 AM
Status:
Color:
Layer:
Space:

Please see comment on PDF page 6 and revise as needed.



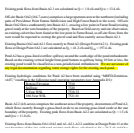
Subject: Highlight
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:13:27 AM
Status:
Color:
Layer:
Space:

Q5 = 41.2 cfs and Q100 = 197.4 cfs.



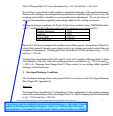
Subject: Callout
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:46:06 AM
Status:
Color:
Layer:
Space:

Update to match maps/calcs.



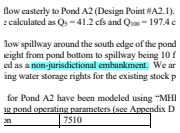
Subject: Highlight
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 7:47:23 AM
Status:
Color:
Layer:
Space:

We are not aware of
any legal documentation regarding water storage rights for the existing stock pond.



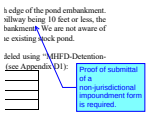
Subject: Callout
Page Label: 9
Author: Joseph Sandstrom
Date: 11/9/2026 4:17:42 PM
Status:
Color:
Layer:
Space:

This is being used as a detention pond and not functioning as a stock pond. Please update terminology accordingly throughout. If this is not holding water then legal documentation is not needed for a stock pond. Please update narrative as needed.



Subject: Highlight
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 9:05:11 AM
Status:
Color:
Layer:
Space:

non-jurisdictional embankment.



Subject: Callout
Page Label: 9
Author: Joseph Sandstrom
Date: 11/4/2026 12:05:09 PM
Status:
Color:
Layer:
Space:

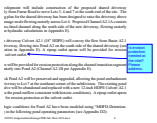
Proof of submittal of a non-jurisdictional impoundment form is required.



Subject: Callout
Page Label: 10
Author: Joseph Sandstrom
Date: 11/4/2026 7:03:20 AM
Status:
Color:
Layer:
Space:

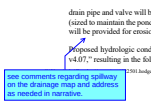
See comment on drainage map regarding basin A1 and revise section as needed

---



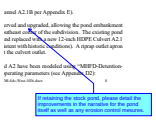
Subject: Callout
Page Label: 10
Author: Joseph Sandstrom
Date: 11/4/2026 8:58:16 AM
Status:
Color:
Layer:
Space:

Is erosion protection needed at the inlet? Please address.



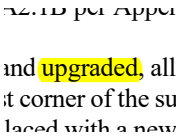
Subject: Callout
Page Label: 10
Author: Joseph Sandstrom
Date: 11/4/2026 1:38:57 PM
Status:
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Space:

see comments regarding spillway on the drainage map and address as needed in narrative.



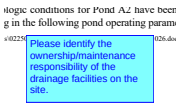
Subject: Callout
Page Label: 10
Author: Joseph Sandstrom
Date: 11/4/2026 2:04:23 PM
Status:
Color:
Layer:
Space:

If retaining the stock pond, please detail the improvements in the narrative for the pond itself as well as any erosion control mesures.



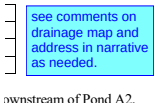
Subject: Highlight
Page Label: 10
Author: Joseph Sandstrom
Date: 11/4/2026 2:04:35 PM
Status:
Color:
Layer:
Space:

upgraded



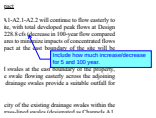
Subject: Text Box
Page Label: 10
Author: Joseph Sandstrom
Date: 11/4/2026 3:25:26 PM
Status:
Color:
Layer:
Space:

Please identify the ownership/maintenance responsibility of the drainage facilities on the site.



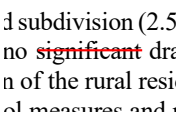
Subject: Text Box
Page Label: 11
Author: Joseph Sandstrom
Date: 11/4/2026 8:43:22 AM
Status:
Color:
Layer:
Space:

see comments on drainage map and address in narrative as needed.

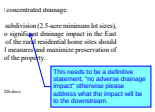


Subject: Callout
Page Label: 11
Author: Joseph Sandstrom
Date: 11/4/2026 11:50:31 AM
Status:
Color:
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Space:

Include how much increase/decrease for 5 and 100 year.

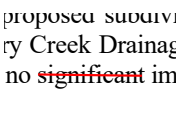


Subject: Line
Page Label: 11
Author: Joseph Sandstrom
Date: 11/4/2026 11:51:17 AM
Status:
Color:
Layer:
Space:

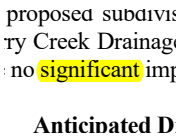


Subject: Callout
Page Label: 11
Author: Joseph Sandstrom
Date: 11/4/2026 11:53:32 AM
Status:
Color:
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Space:

This needs to be a definitive statement, "no adverse drainage impact" otherwise please address what the impact will be to the downstream.

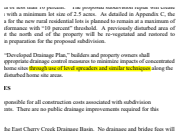


Subject: Line
Page Label: 12
Author: Joseph Sandstrom
Date: 11/4/2026 11:53:05 AM
Status:
Color:
Layer:
Space:



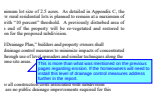
Subject: Highlight
Page Label: 12
Author: Joseph Sandstrom
Date: 11/4/2026 11:53:41 AM
Status:
Color:
Layer:
Space:

significant



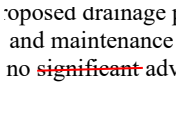
Subject: Highlight
Page Label: 13
Author: Joseph Sandstrom
Date: 11/4/2026 11:57:13 AM
Status:
Color:
Layer:
Space:

through use of level spreaders and similar techniques

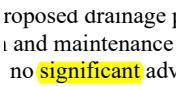


Subject: Callout
Page Label: 13
Author: Joseph Sandstrom
Date: 11/4/2026 12:06:42 PM
Status:
Color:
Layer:
Space:

This is more than what was mentioned on the previous pages regarding erosion. If the homeowners will need to install this level of drainage control measures address further in the report.

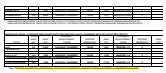


Subject: Line
Page Label: 13
Author: Joseph Sandstrom
Date: 11/4/2026 12:08:07 PM
Status:
Color:
Layer:
Space:



Subject: Highlight
Page Label: 13
Author: Joseph Sandstrom
Date: 11/4/2026 12:08:11 PM
Status:
Color:
Layer:
Space:

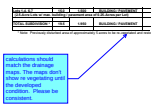
significant



Subject: Highlight
Page Label: 27
Author: Joseph Sandstrom
Date: 11/4/2026 12:12:52 PM
Status:
Color:
Layer:
Space:

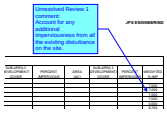
Previously disturbed area of approximately 5 acres to be re-vegetated and restored to undeveloped conditions in preparation for subdivision

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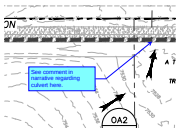
Subject: Callout
Page Label: 27
Author: Joseph Sandstrom
Date: 11/4/2026 12:21:50 PM
Status:
Color:
Layer:
Space:

calculations should match the drainage maps. The maps don't show re vegetating until the developed condition. Please be consistent.



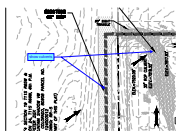
Subject: Callout
Page Label: 28
Author: Joseph Sandstrom
Date: 11/4/2026 1:22:00 PM
Status:
Color:
Layer:
Space:

Unresolved Review 1 comment:
Account for any additional imperviousness from all the existing disturbance on the site.



Subject: Callout
Page Label: [1] EX2
Author: Joseph Sandstrom
Date: 11/4/2026 1:26:25 PM
Status:
Color:
Layer:
Space:

See comment in narrative regarding culvert here.



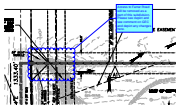
Subject: Callout
Page Label: [1] EX2
Author: Joseph Sandstrom
Date: 11/4/2026 6:57:26 AM
Status:
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show culverts

Subject: Highlight
Page Label: [1] EX2
Author: Joseph Sandstrom
Date: 11/4/2026 7:44:10 AM
Status:
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Subject: Highlight
Page Label: [1] EX2
Author: Joseph Sandstrom
Date: 11/4/2026 1:26:02 PM
Status:
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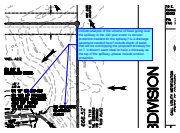
Subject: Cloud+
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 7:01:05 AM
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Access to Farrar Road will be removed as a part of this subdivision. Please see depict and see comment on GEC and depict any changes here.



Subject: Callout
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 7:56:12 AM
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see comment on page PDF page 10.

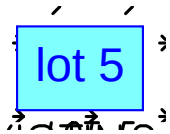


Subject: Callout
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 2:05:10 PM
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Include analysis of the volume of flows going over the spillway in the 100 year event. Is erosion protection needed for the spillway? Is a drainage easement needed here? Include depth of water that will be overtopping the proposed driveway for lot 7. It doesn't seem ideal to have a driveway as the top of the spillway..please include erosion protection.

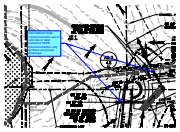


Subject: Highlight
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 8:39:28 AM
Status:
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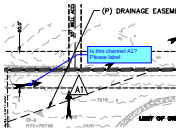
Subject: Text Box
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 8:45:20 AM
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lot 5



Subject: Callout
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 8:57:00 AM
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Informational Note:
I recommend the use of concrete or steel instead of HDPE. Recommendation only as these are private driveways.

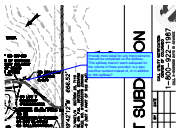


Subject: Callout
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 1:39:59 PM
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Is this channel A1? Please label



Subject: Highlight
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/4/2026 1:40:14 PM
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Subject: Callout
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/9/2026 1:17:17 PM
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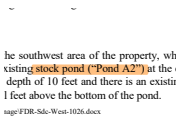
Provide more detail for any improvements that will be completed on the spillway. This spillway doesn't seem adequate for the volume of flows provided. Is a pipe overflow needed instead of, or in addition to, this spillway?



Subject: Text Box
Page Label: [1] D1
Author: Joseph Sandstrom
Date: 11/9/2026 1:11:32 PM
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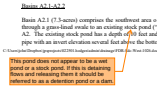
Please delineate wetlands and address in the report and whether or not they are jurisdictional. Please contact USACE and provide documentation.

Mikayla Hartford (6)



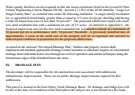
Subject: SW - Highlight
Page Label: 8
Author: Mikayla Hartford
Date: 11/5/2026 12:27:05 PM
Status:
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stock pond ("Pond A2")



Subject: SW - Textbox with Arrow
Page Label: 8
Author: Mikayla Hartford
Date: 11/9/2026 10:27:32 AM
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This pond does not appear to be a wet pond or a stock pond. If this is detaining flows and releasing them it should be referred to as a detention pond or a dam.



Subject: SW - Highlight
Page Label: 13
Author: Mikayla Hartford
Date: 11/9/2026 10:23:27 AM
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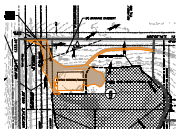
nned to remain at a maximum of
10 percent per lot in conformance with "10 percent" threshold. A previously disturbed area of approximately 5 acres at the north end of the property will be re-vegetated and restored to undeveloped conditions in preparation for the proposed subdivision.



Subject: SW - Textbox with Arrow
Page Label: 13
Author: Mikayla Hartford
Date: 11/9/2026 10:26:41 AM
Status:
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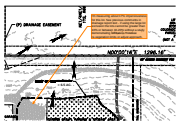
Unresolved - Currently Lot 5 appears to have approximately 17% impervious cover. Per ECM Section I.6.1.B.5, large lots utilizing the large lot exclusion must be less than 10% impervious OR:

A total lot imperviousness greater than 10 percent is allowed when a study specific to the watershed and/or MS4 shows that expected soil and vegetation conditions are suitable for infiltration/filtration of the WQCV for a typical site, and the permittee accepts such study as applicable within its MS4 boundaries. The maximum total lot impervious covered under this exclusion shall be 20 percent.



Subject: Area Measurement
Page Label: [1] D1
Author: Mikayla Hartford
Date: 11/5/2026 10:40:58 AM
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33,802.09 sf



Subject: SW - Textbox with Arrow
Page Label: [1] D1
Author: Mikayla Hartford
Date: 11/9/2026 11:03:46 AM
Status:
Color:
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I'm measuring about 17% imperviousness for this lot. See previous comments in drainage report text - if using the large lot exclusion the lots cannot be greater than 10% or between 10-20% without a study demonstrating infiltration. Increase re-vegetation limits or adjust approach.