



DRAINAGE REPORT
for
ASPEN WILLOW ESTATES
EL PASO COUNTY, COLORADO

2N Civil Project No. 25011

Date: March 30, 2026

PREPARED FOR:

ASPEN WILLOW ESTATES, LLC
1480 Higby Road
Monument, CO 80132
Contact: Charles Woodall
719-492-4123

PREPARED BY:

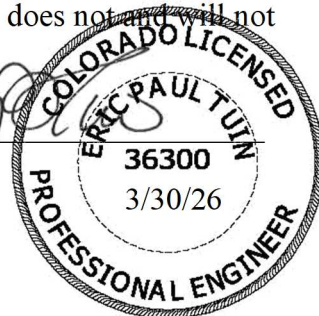
2N CIVIL, LLC
Eric P. Tuin, P.E. M. ASCE
6 Inverness Ct. E. #125
Englewood, CO 80112
303.925.0544

Engineer's Certification

"This drainage report and plan for the drainage of Aspen Willow Estates was prepared by me (or under my direct supervision) in accordance with the provisions of El Paso County Construction Standards & Specifications for the owners thereof. I understand that El Paso does not and will not assume liability for drainage facilities designed by others."

SIGNATURE: _____

Eric P. Tuin, P.E. M. ASCE
Registered Professional Engineer
State of Colorado No. 36300
(Affix Seal)



Owner's Certification

"Aspen Willow Estates, LLC hereby certifies that the drainage facilities for Aspen Willow Estates shall be constructed according to the design presented in this report. I understand that El Paso County does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that El Paso County reviews drainage plans, but cannot, on behalf of Aspen Willow Estates, ensure that final drainage design review will absolve Aspen Willow Estates, LLC. guarantee and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design."

SIGNATURE: _____

Aspen Willow Estates, LLC
Owner

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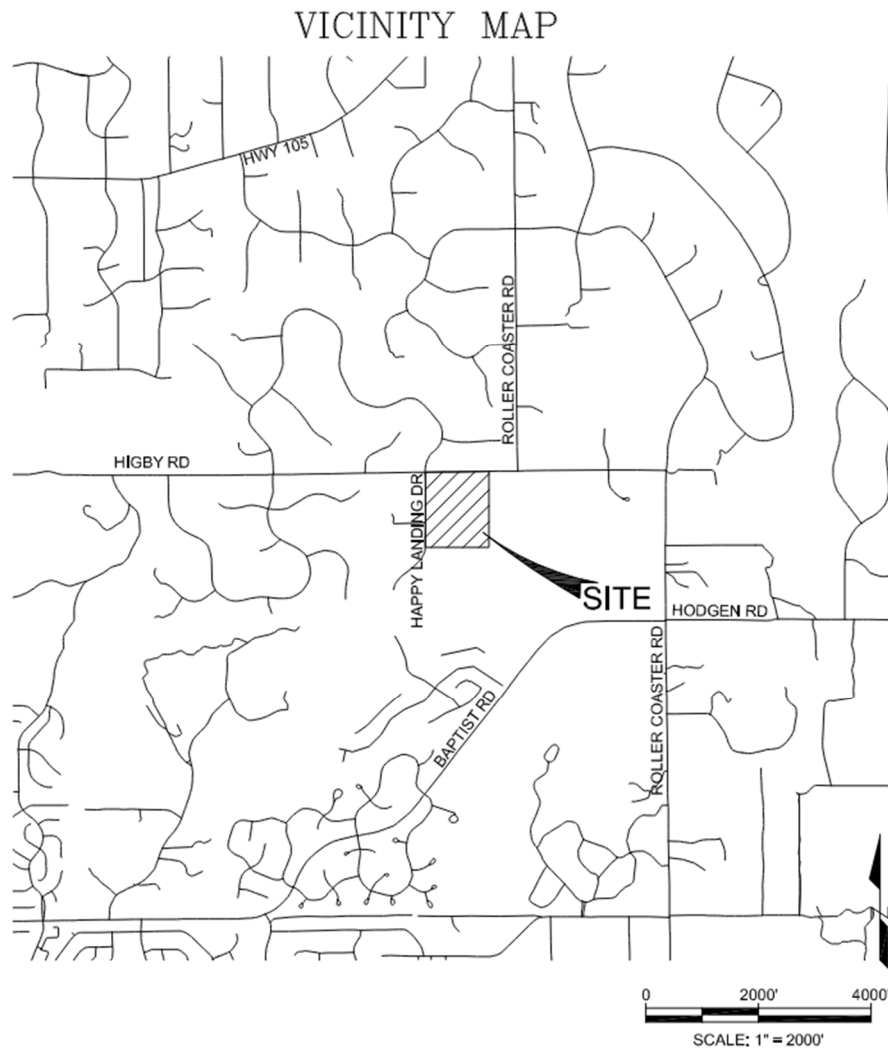
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A. INTRODUCTION

This Drainage Report presents the final drainage plan and design characteristics for the proposed development known as Aspen Willow Estates located approximately 3 miles southeast of the Town of Monument, Colorado. This report was prepared in accordance with the El Paso County Storm Drainage Criteria Manual and the Mile High Flood District.

Location

Aspen Willow Estates is a request to subdivide a 35-acre property into 3 – 5 acre lots and 1 – 20-acre lot. The development is in the southeast quarter of Section 20, Township 11 South, Range 66 West of the 6th Principal Meridian, El Paso County, State of Colorado. The project is bounded by Higby Road to the north, Happy Landing Drive to the west, and agricultural land to the south and east. See Vicinity Map below.



Description of Property

The property contains an existing house, barn, gravel driveway, and other buildings supporting a horse facility. The site is approximately 35 acres. The site is served by well and septic for water and sewer. The existing ground cover on the site is composed of native grasses with a stand of Ponderosa Pine trees on the west 7-8 acres. The site generally slopes from west to east ranging from 2 to 10 percent grade. The property will be subdivided into four lots and create a single private driveway to serve the lots with a hammerhead turnaround at the end. The soil types present onsite are presented on the table below as designated by the Natural Resources Conservation Service.

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	0.1	0.3%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	34.9	99.7%
Totals for Area of Interest			35.0	100.0%

Group B soils have a moderate infiltration rate when thoroughly wet and a moderate rate of water transmission. Please see Appendix B for additional soils information from NRCS.

Proposed Development

The proposed development will include 4 lots, 3- 5 acre lots and 1-20 acre lot. The guidance from Mile High Flood District and El Paso County Criteria suggest an impervious value of 20% which would lead to approximately 7 acres of land that would be distributed in the proposed development. This value is conservative for a 5-acre lot and would assume 1 acre (20% of 5 acres) of impervious surface on each of the 3-5 acre lots. After completing many plot and drainage plans on lots throughout Douglas, Elbert and El Paso Counties, we would expect an actual impervious value of 9% or less. Further discussion is contained in the proposed basins below.

B. DRAINAGE BASINS

Overall Basin Description

The proposed development is outside of any mapped flood area according to FEMA FIRM for El Paso County, Colorado Panel 0285, Map Number 08041C0285G with the effective date of December 07, 2018. The property is upstream of an unnamed tributary of West Cherry Creek. See map below.

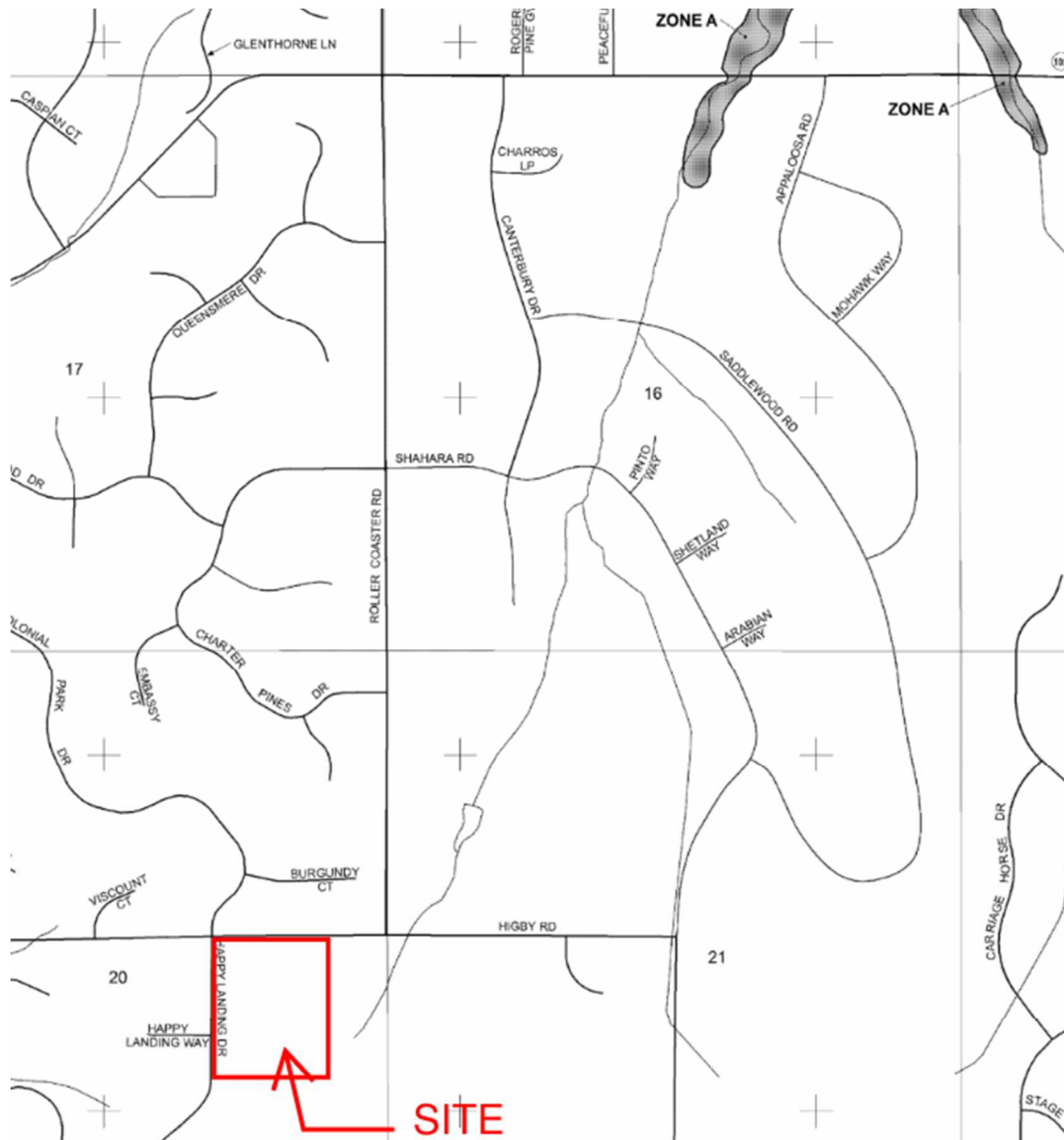


Figure 1- Portion of Map No. 08041C0285G

All drainage on site will flow from the west to the east. The nearest Zone A floodplain is almost 2 miles northeast of the site.

Descriptions of the two existing drainage basins are as follows:

EXISTING BASINS

Basin EX-1

Basin EX-1 is the north end of the site along Highby Road and adjacent to Happy Landing Drive. Basin EX-1 drains from the west to east side of the site. The existing impervious value used for this basin is 2% impervious per MHFD and El Paso County Drainage

Criteria. In reality the basin is partially developed in the existing condition so the value of 2% represents the “historic” condition rather than a true “existing” condition. A summary of the basin characteristics is shown in the following table.

Basin Area (ac)	Existing Impervious	Ex. 2 Year Peak Flow	Ex. 100 Year Peak Flow
12.4	2%	0.66	16.74

Basin EX-2

Basin EX-2 contains the south portion of the site and extends offsite to the south of the property another 750 feet. This basin is 42.8 acres with an existing imperviousness of 2.0%. The basin consists of native grasses. The basin flows towards the east of the property. A summary of the basin characteristics and resulting flow rates is shown below.

Basin Area (ac)	Existing Impervious	Ex. 2 Year Peak Flow	Ex. 100 Year Peak Flow
42.8	2%	2.17	55.12

The Existing Drainage Basin Map can be found in Appendix C.

PROPOSED BASINS

Impervious areas and Detention

The proposed development will create a driveway with a hammerhead turnaround to serve the 3- 5 Acre lots while the remaining 20 Acre lot will be served by the existing entrance. There is no overlot grading planned for the lots, rather the existing terrain will remain with the home construction and grading isolated to the house location. The driveway will maintain existing ground elevations as much as possible to accommodate any drainage improvements. With the lots not being initially disturbed or over-lot graded, drainage patterns are not being changed. Rather, existing drainage paths are being maintained and the stormwater mitigated to accommodate the construction of the roadway. Stormwater in this condition cannot be routed to a central location or locations to accommodate typical detention or water quality measures usually undertaken on urban developments.

The benefit of rural acreage lots is that drainage from impervious surfaces does not flow in directly connected impervious surfaces. Runoff from impervious surfaces is dispersed across landscaping, absorbed by soils and velocity decreased due to the native vegetation. This minimizes the risk of local flooding generated by the lots while treating stormwater through natural infiltration in grass swales.

To determine a more accurate runoff from the developed lots an assumed typical 5-acre lot was broken out into its impervious areas for roof, driveway, paved surfaces as well as a portion of the gravel private access road. Applying El Paso County's impervious values for these surfaces to determine a composite impervious value for the developed condition of the lot. The resulting composite impervious value for the developed condition is 8.56% which will be rounded to 9% for the purposes of this drainage report. Please see the table below.

Composite Impervious Per El Paso County Drainage Criteria			Typical 5 AC lot	
Land Area	Area (SqFt)	Area (AC)	% Impervious	Composite
Native	203,926	4.68	2	1.86
Gravel	10,700	0.25	80	0.64
Roof	3,000	0.07	90	1.24
Total:		5		8.56

Detention for this site, if required, should be handled on an individual lot basis to accommodate the development that occurs on the lot.

Suggested alternatives to detention would be to encourage rain gardens, permeable pavements, improved grass lined swales and even rain barrels to reduce the immediate impact of storm runoff.

Basin PR-1

Basin PR-1 contains the same area as EX-1. PR-2 will include a portion of the developed road, part of the 20-acre lot which includes an existing gravel drive and rooftops, and one of the 5 acre lots with a composite impervious value of 12.5%. The basin flows from east to west. A summary of the basin characteristics and resulting flow rates is shown below.

Basin Area (ac)	Existing Impervious	Ex. 2 Year Peak Flow	Ex. 100 Year Peak Flow	Proposed Impervious	Proposed 2 Year Peak Flow	Proposed 100 Year Peak Flow
12.4	2%	0.66	16.74	12.5%	2.47	20.07

Basin PR-2

Basin PR-2 is about half of the of the area of EX-2. PR-2 will have additional developed areas for the road and 2- 5 acre lots with a large portion of the undeveloped area on the 20-acre lot. Considering the gravel and rooftop for 2 lots as above, the basin has an impervious value of 4.1% flowing from west to east. A basin summary follows.

Basin Area (ac)	Proposed Impervious	Proposed 2 Year Peak Flow	Proposed 100 Year Peak Flow
24.1	14.7%	1.9	32.26

Basin OS-1

Basin OS-1 is the offsite area that is part of EX-2, reducing the basin area. OS-1 captures offsite flow from the south of the site. OS-1 crosses into PR-2 at design point 3 and has an imperviousness of 2%. A summary follows.

Basin Area (ac)	Proposed Impervious	Proposed 2 Year Peak Flow	Proposed 100 Year Peak Flow
18.80	2%	1.10	27.98

Routing Basin OS-1 through and combining basin PR-2 yields a combined flow at design point 2R as follows.

Basin Area (ac)	Proposed 100 Year Peak Flow
42.9	56.73

C. **DESIGN CRITERIA**

Hydrologic Criteria

The drainage analysis was performed using the Rational Method for basins under 90 acres. This method is consistent with the El Paso County and the Mile High Flood District criteria. El Paso County's rainfall frequency was used per "Section 2.1 – Rainfall Depths" as outlined in the El Paso County Drainage Criteria Manual.

Using the UD-Rational Spreadsheet as necessary, the peak runoff was calculated for the 2-year (minor) and 100-year (major) storm events for existing and developed conditions. Calculation Results can be found in the basin descriptions above and in Appendix B.

Culvert Design

The only infrastructure required for the subdivision is a single culvert for the driveway. The culvert will convey flows generated from proposed Basin 1 and is sized for the 100-year storm at 18.39 cfs. Culvert calculations are included in the appendix.

D. **EROSION CONTROL**

Erosion control measures required during construction will be shown on the Construction

Documents for this project. These measures, including (but not limited to) vehicle tracking control, silt fence, stabilized staging area, inlet protection, sediment control logs, diversion ditches, check dams, riprap, rock berms, sediment basins, seeding and mulching, and erosion control blanket, will act to stabilize disturbed areas and mitigate sediment transport during construction.

The individual homeowner is encouraged to implement steps to help prevent erosion and stormwater pollution. Limiting the use of impervious surfaces for walks/patios allows stormwater to soak into the ground instead of running downstream and causing erosion. Permeable pavers can be used to allow water to pass through them, rather than run off the surface. Redirecting downspouts away from hard surfaces and onto grass or shallow depressed planting beds can help reduce the amount of runoff. Planting native vegetation and minimizing the use of fertilizers and pesticides will help reduce the impact of stormwater on the environment.

E. PERMITTING

Construction sites that disturb one acre or greater or are part of a larger common plan of development are required to obtain a Construction Stormwater Discharge Permit issued by the Colorado Department of Public Health and Environment (CDPHE). Additional permit requirements such as a Grading Permit will be required by El Paso County.

F. CONCLUSION

This Drainage Report is prepared in conformance with the Drainage Criteria Manual of El Paso, Colorado, with supplemental data from the MHFD USDCM Volume 1. This report provides stormwater calculations regarding the historic drainage of the site and anticipated proposed storm peak flows based on published impervious values. El Paso County building department will determine if any stormwater mitigation based on the individual lot impervious values is required. Stormwater conveyance and peak flow attenuation for the proposed area to be developed will be in conformance with the applicable El Paso County criteria.

G. REFERENCES

El Paso County, Co Drainage Criteria Manual. El Paso County Colorado. October 31, 2018.

Federal Emergency Management Agency. *Flood Insurance Rate Map*. Panel 08041C0285G. El Paso County. December 7, 2018.

Urban Storm Drainage Criteria Manual. Mile High Flood District (MHFD); September 1969. Revised August 2018.

Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service, September 2021.

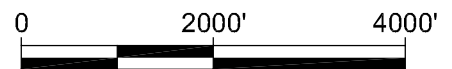
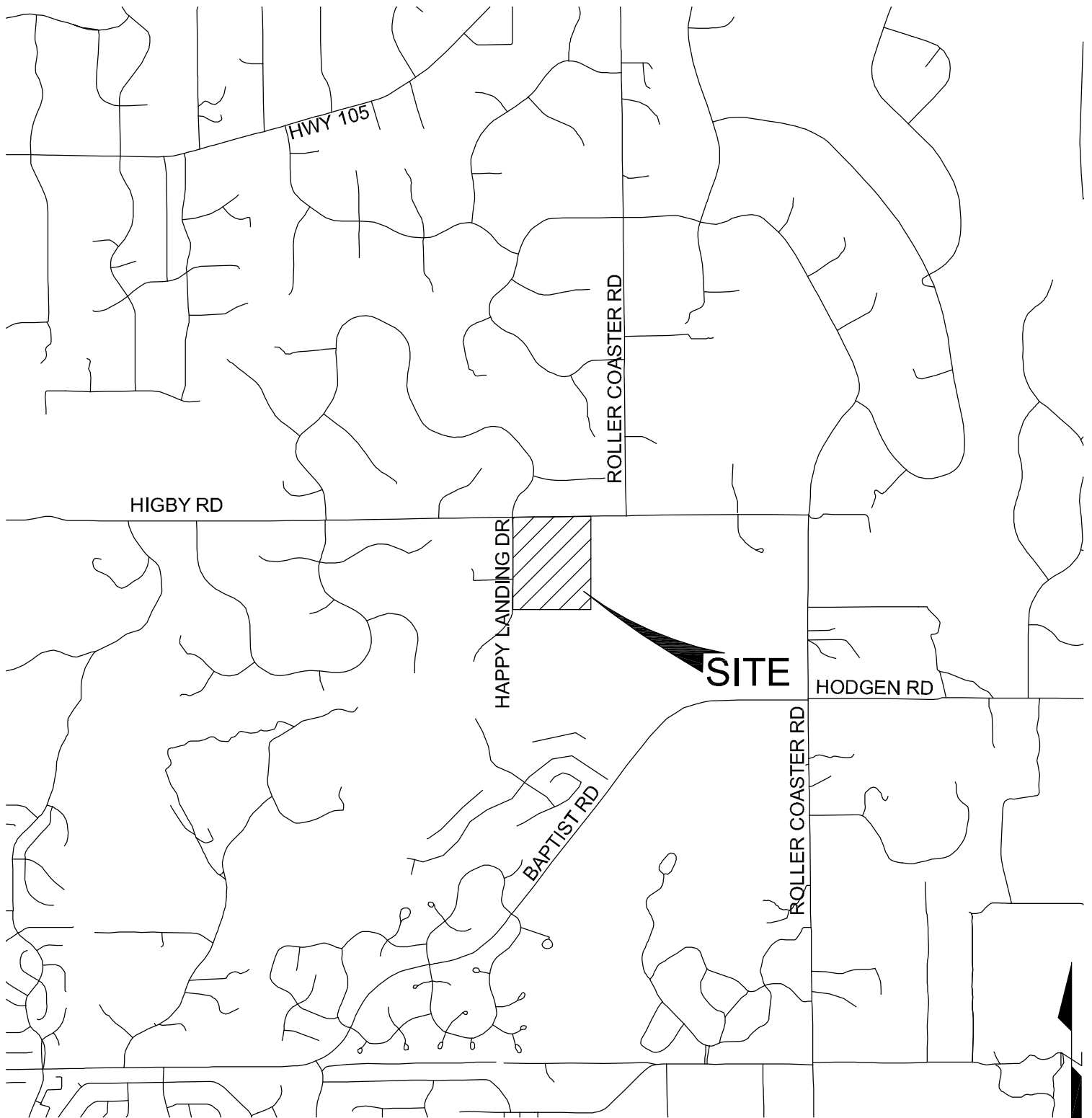
APPENDIX A

Vicinity Map

Soils Map

FIRM

VICINITY MAP



SCALE: 1" = 2000'

Project Number: 25011

J:\Projects\25011\dwg\case\VICINITY MAP.dwg

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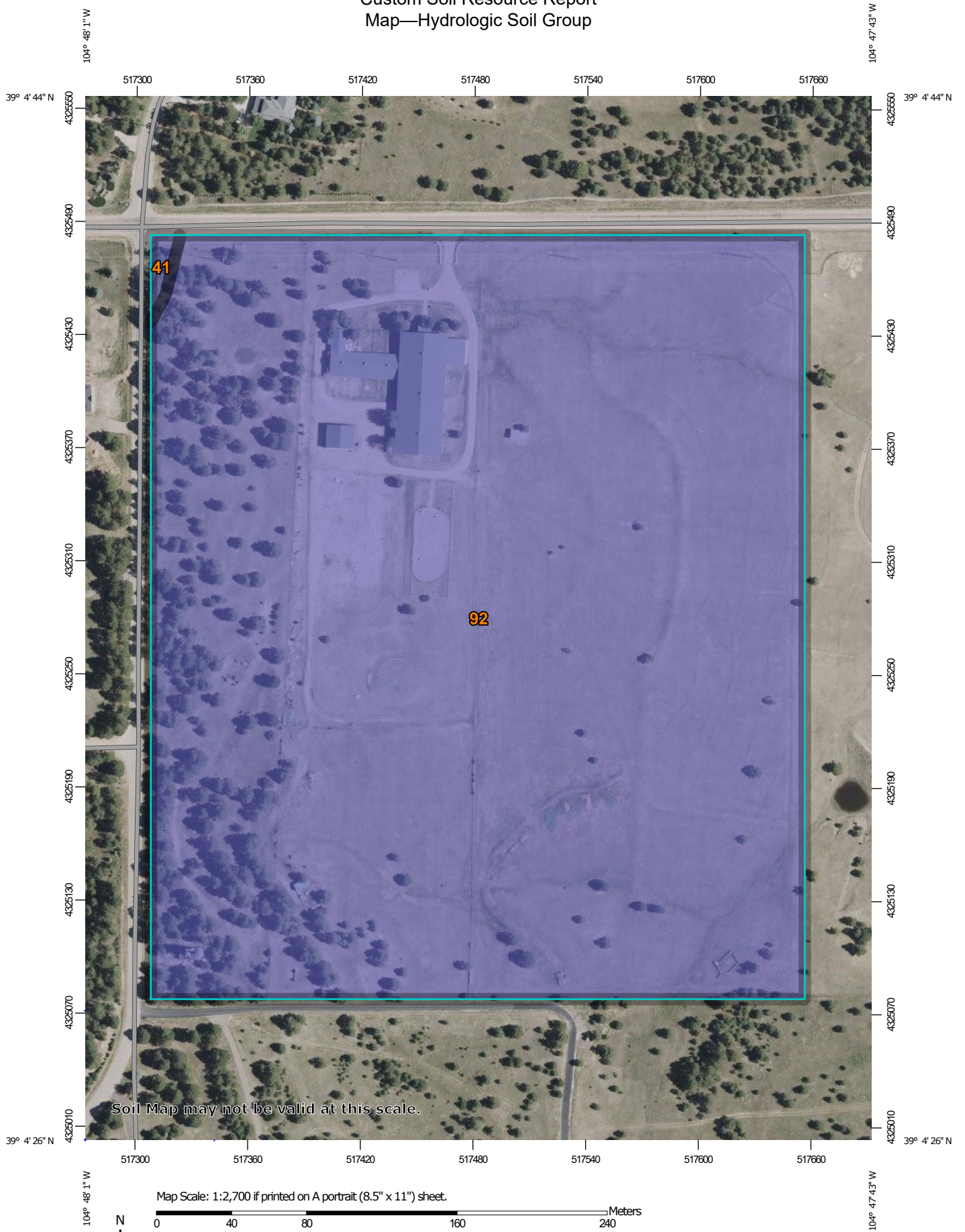
**ASPEN WILLOW SUBDIVISION
EL PASO COUNTY, CO**

Drawn By: EPT
Checked By:
Revisions: 2-17-26

Page 1

2N CIVIL

Custom Soil Resource Report Map—Hydrologic Soil Group



Soil Map may not be valid at this scale.

Map Scale: 1:2,700 if printed on A portrait (8.5" x 11") sheet.

0 40 80 160 240 Meters
0 100 200 400 600 Feet

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

Custom Soil Resource Report

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 23, Aug 29, 2025

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	0.1	0.3%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	34.9	99.7%
Totals for Area of Interest			35.0	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

Coastal Base Flood Elevations shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD83). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Coastal flood elevations are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

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

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

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

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD83)**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NDA, NGS-12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3422 or visit its website at <http://www.ngs.noaa.gov>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

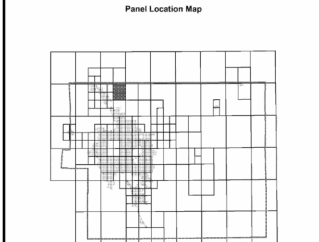
Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information exchange (FIRM) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-338-6620 and its website at <http://www.msc.fema.gov>.

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

El Paso County Vertical Datum Offset Table

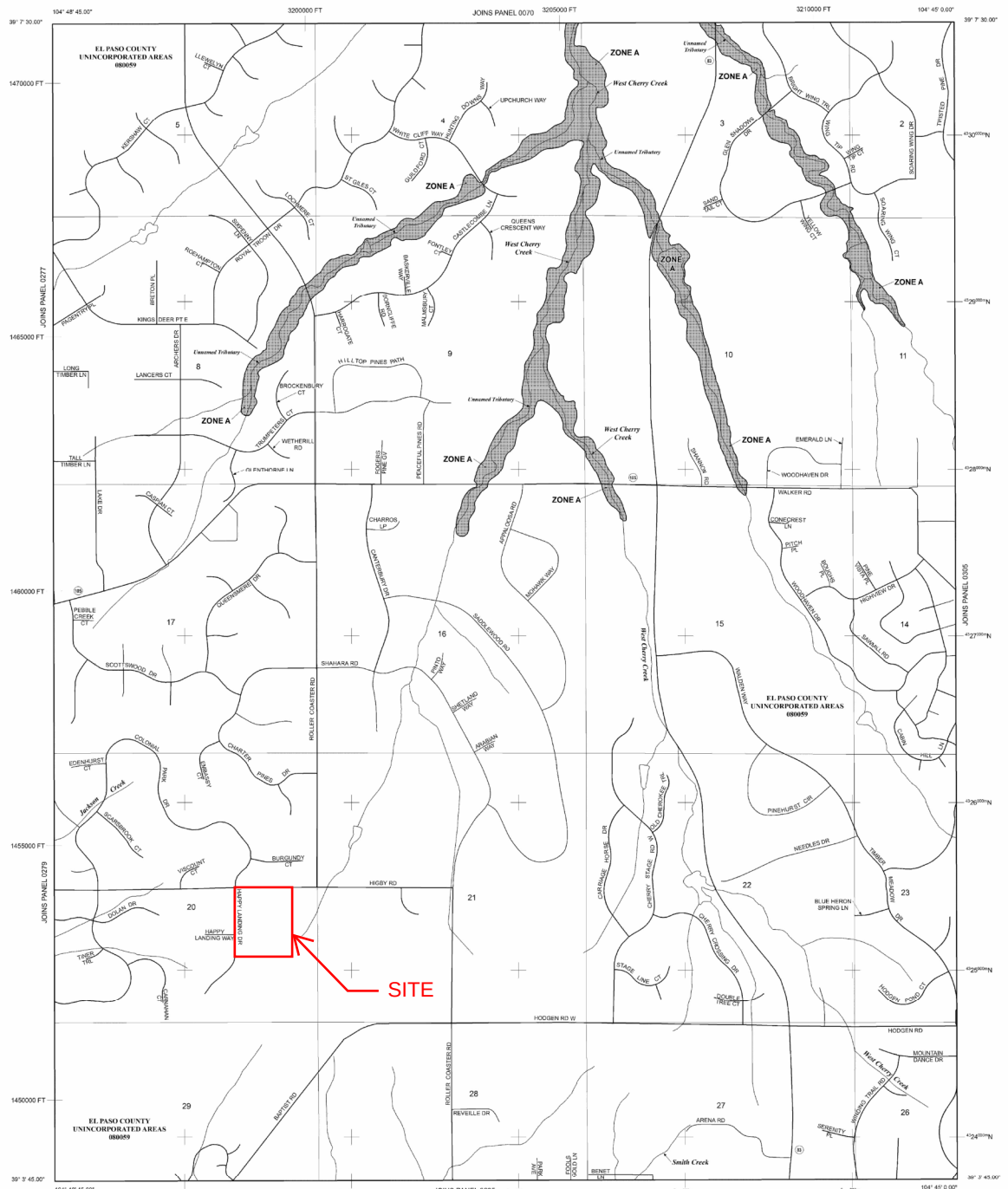
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 SOUTH, RANGE 66 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

ZONE X
Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or areas of flood depths of 1 foot or greater, but areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X
Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D
Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodway boundary

Floodplain boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities

Base Flood Elevation line and value; elevation in feet*

Base Flood Elevation value where uniform within zone; elevation in feet*

* referenced to the North American Vertical Datum of 1988 (NAVD83)

Cross section line

Traverse line

Geographic coordinates referenced to the North American Vertical Datum of 1988 (NAVD83)

1000-meter Universal Transverse Mercator grid ticks, zone 13

5000-foot grid ticks: Colorado State Plane coordinate system, central zone (EPSKOE 030), Lambert Conformal Conic Projection

Bench mark (see explanation in Notes to Users section of this FIRM panel)

Road Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTRYWIDE FLOOD INSURANCE RATE MAP

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

DECEMBER 2, 2018 is update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and rail names, and to incorporate previously issued Letters of Map Change.

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

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

MAP SCALE 1" = 1000'

500 1000 2000 FEET

500 1000 2000 METERS

PANEL 0285G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 285 OF 1300

(SEE MAP INDEX FOR FIRM LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	0808	0285	0

Notice to User: The Map Number shown below should be used when citing your panel. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
0804C0285G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

APPENDIX B

Hydrology Calculations / Results

Calculation of Peak Runoff using Rational Method

Designer:	Eric Tuin, P.E.
Company:	2N Civil, LLC
Date:	3/30/2026
Project:	Apsen Willow Estates
Location:	El Paso County, Colorado

MHFD-Rational, Version 3.00 (August 2025)

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_i + t_t$

$$t_{c \text{ minimum}} = 5 \text{ (urban)}$$

$$t_{c \text{ minimum}} = 10 \text{ (non-urban)}$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$$\text{Selected } t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Calculation of Peak Runoff using Rational Method

Calculation of Peak Runoff using Rational Method

[Select MHFD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website \(click this link\)](#)

	WQF	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P ₁ (in) =	0.60	1.19	1.50	1.75	2.00	2.25	2.52	
	a	b	c					
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786					
				$I(\text{in/hr}) = \frac{a \cdot P_1}{(b + t_c)^c}$				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$Q(cfs) = CIA$

Provide input for area, soil type, and imperviousness on the Runoff Coeffs worksheet.

[illegible]

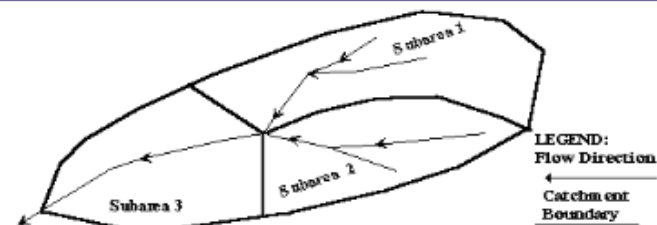
Determination of Runoff Coefficients for Rational Method

MHFD-Rational, Version 3.00 (August 2025)

Designer: Eric Tuin, P.E.
Company: 2N Civil, LLC
Date: 3/30/2026
Project: Apsen Willow Estates
Location: El Paso County, Colorado

Cells of this color are for required user-input

Cells of this color are for optional override values



Provide subcatchment names on the Rational Calcs worksheet to open up the table below.

Subcatchment Name	# of Subareas	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness				Runoff Coefficient, C							(Optional) Override Runoff Coefficient, C						
				Imperviousness Source	Imperviousness Category	Calculated Imperviousness	(Optional) Override Imperviousness	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
EX-1	1	12.40	B			5.0%	2.0%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36	0.54
		12.40	B	Surface Type	Historic Flow Analysis	5%	2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36	
EX-2	1	42.88	B			5.0%	2.0%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36	0.54
		42.88	B	Surface Type	Historic Flow Analysis	5%	2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36	

Calculation of Peak Runoff using Rational Method

$$Q(cfs) = CIA$$

Runoff Coefficient, C

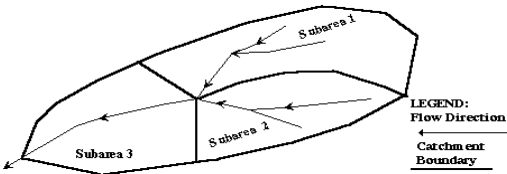
3/30/2026, 1:58 PM

Determination of Runoff Coefficients for Rational Method

Designer: Eric Tuin, P.E.
Company: 2N Civil, LLC
Date: 3/30/2026
Project: Apsen Willow Estates
Location: El Paso County, Colorado

MHFD-Rational, Version 3.00 (August 2025)

Cells of this color are for required user-input
Cells of this color are for optional override values



Provide subcatchment names on the Rational Calcs worksheet to open up the table below.

Subcatchment Name	# of Subareas	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness				Runoff Coefficient, C							(Optional) Override Runoff Coefficient, C							Comments
				Imperviousness Source	Imperviousness Category	Calculated Imperviousness	(Optional) Override Imperviousness	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	
PR-1	3	12.40	B			13.9%	12.5%	0.10	0.10	0.16	0.33	0.40	0.48	0.58	0.11	0.16	0.24	0.32	0.36	0.41	0.58	
		10.81	B	Surface Type	Historic Flow Analysis	5%	2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36		
		0.93	B	Surface Type	Gravel - Low Traffic Areas	60%	80%	0.64	0.67	0.70	0.75	0.77	0.80	0.83	0.57	0.59	0.63	0.66	0.68	0.70		
		0.66	B	Surface Type	Blue Roof	95%	90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87	0.71	0.73	0.75	0.78	0.80	0.81		
PR-2	3	24.10	B			6.7%	4.1%	0.03	0.03	0.09	0.27	0.35	0.45	0.55	0.05	0.11	0.18	0.27	0.32	0.37	0.55	
		23.46	B	Surface Type	Historic Flow Analysis	5%	2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36		
		0.50	B	Surface Type	Gravel - Low Traffic Areas	60%	80%	0.64	0.67	0.70	0.75	0.77	0.80	0.83	0.57	0.59	0.63	0.66	0.68	0.70		
		0.14	B	Surface Type	Blue Roof	95%	90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87	0.89	0.90	0.92	0.94	0.95	0.96		
OS-1	1	18.80	B			5.0%	2.0%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36	0.54	
		18.80	B	Surface Type	Historic Flow Analysis	5%	2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54	0.03	0.09	0.17	0.26	0.31	0.36		

Combined Peak Runoff Calculations for Inlets and Storm Drains

Design Storm Return Period (Note: this worksheet can only evaluate one design storm at a time)
To evaluate additional design storms, create a copy of this worksheet to save current results and then change the return period to evaluate the next design storm.

APPENDIX C

Hydraulics – Culvert Calculations

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Thursday, Mar 19 2026

Culvert at Design Point 1

Invert Elev Dn (ft) = 7472.00
Pipe Length (ft) = 84.00
Slope (%) = 5.95
Invert Elev Up (ft) = 7477.00
Rise (in) = 24.0
Shape = Circular
Span (in) = 24.0
No. Barrels = 1
n-Value = 0.012
Culvert Type = Circular Concrete
Culvert Entrance = Square edge w/headwall (C)
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

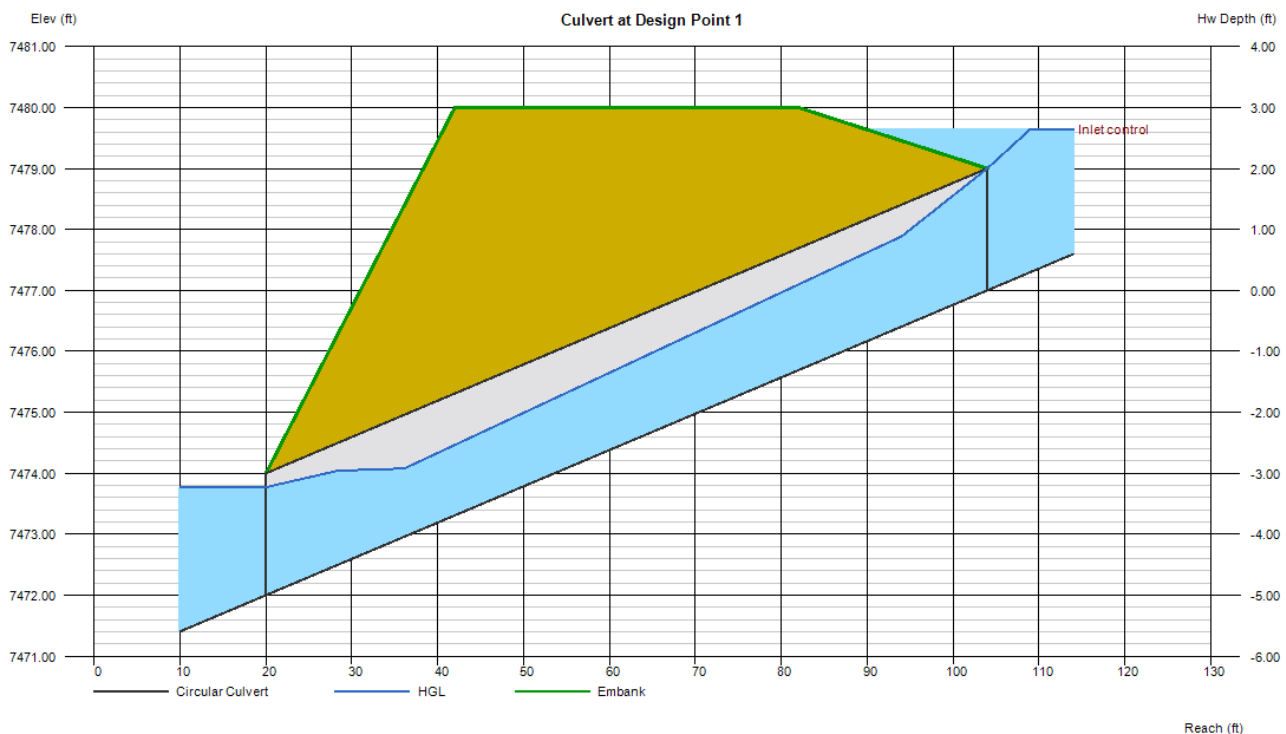
Top Elevation (ft) = 7480.00
Top Width (ft) = 40.00
Crest Width (ft) = 30.00

Calculations

Qmin (cfs) = 18.39
Qmax (cfs) = 18.39
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 18.39
Qpipe (cfs) = 18.39
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 6.25
Veloc Up (ft/s) = 7.07
HGL Dn (ft) = 7473.77
HGL Up (ft) = 7478.54
Hw Elev (ft) = 7479.64
Hw/D (ft) = 1.32
Flow Regime = Inlet Control



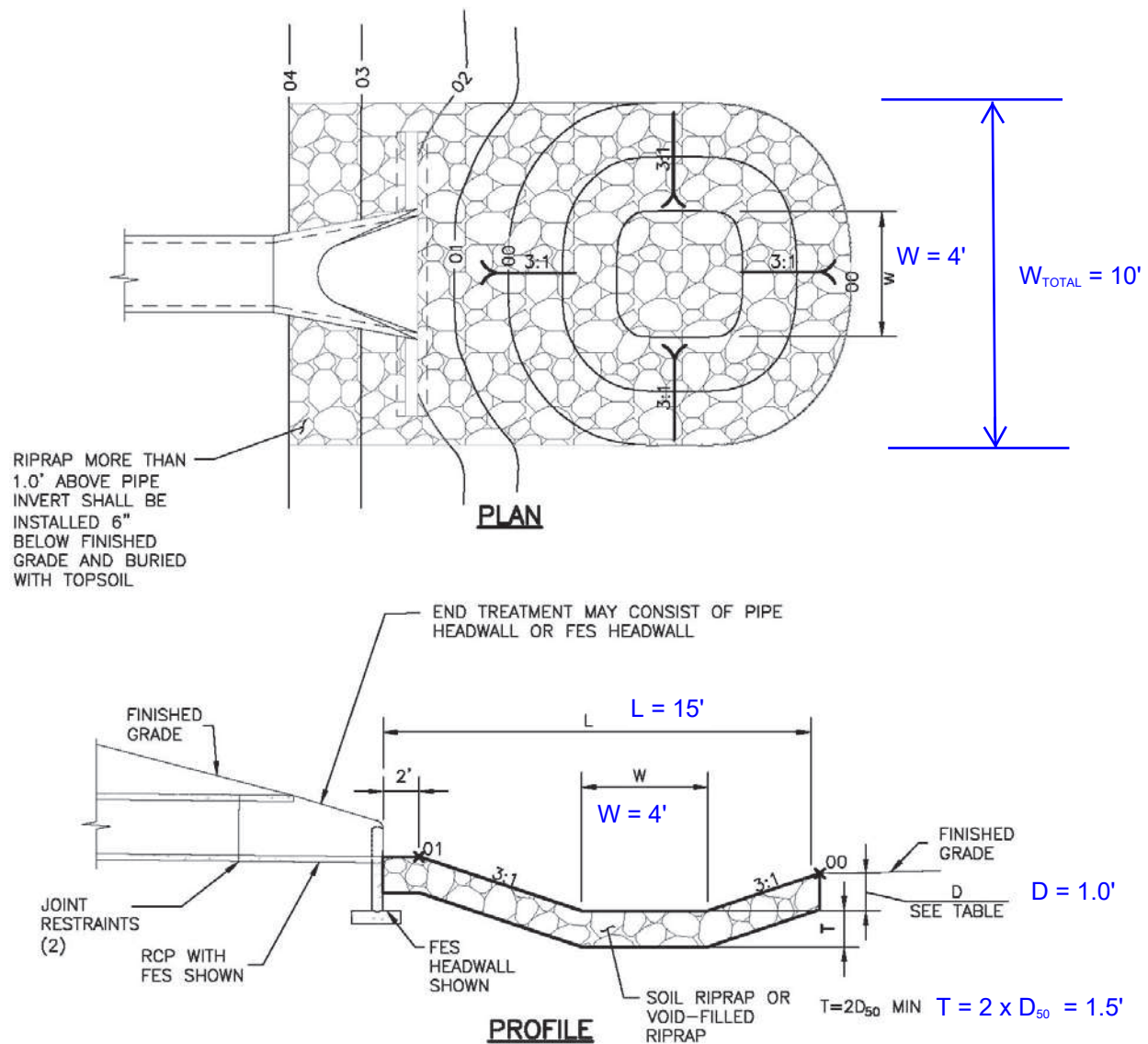


Figure 9-37. Low tailwater riprap basin

$$H_a = \frac{(H + Y_n)}{2}$$

Equation 9-19

Where the maximum value of H_a shall not exceed H , and:

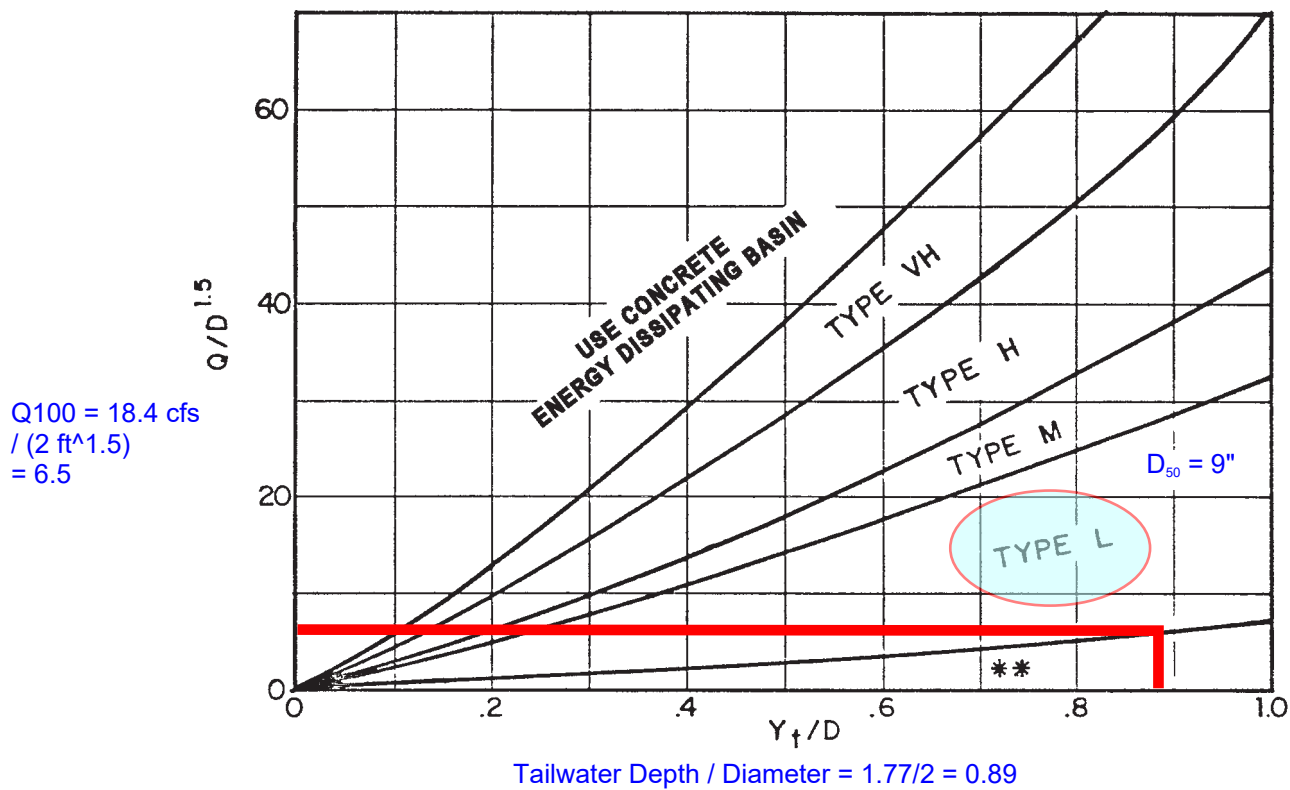
D_a = parameter to use in place of D in Figure 9-38 when flow is supercritical (ft)

D_c = diameter of circular culvert (ft)

H_a = parameter to use in place of H in Figure 9-39 when flow is supercritical (ft)

H = height of rectangular culvert (ft)

Y_n = normal depth of supercritical flow in the culvert (ft)



Use D_a instead of D whenever flow is supercritical in the barrel.

** Use Type L for a distance of 3D downstream.

Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for $Q/D^{2.5} \leq 6.0$)

APPENDIX D

Drainage Basin Maps

ASPEN WILLOW ESTATES

FINAL DRAINAGE - EXISTING BASINS

PART OF SECTION 20, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M. - ELPASO COUNTY, COLORADO

EX-1

1.50

2.0%

12%

BASIN I.D.

EXISTING IMPERVIOUS PERCENT

PROPOSED IMPERVIOUS PERCENT

BASIN AREA IN ACRES

▲

DESIGN POINT DESIGNATION

DRAINAGE BASIN BOUNDARY

DRAINAGE BASIN FLOW PATH

→

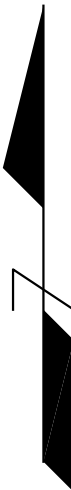
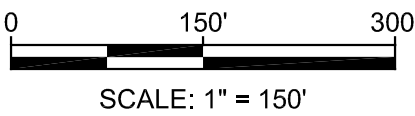
FLOW DIRECTION

PROPERTY BOUNDARY

EXISTING MAJOR CONTOUR

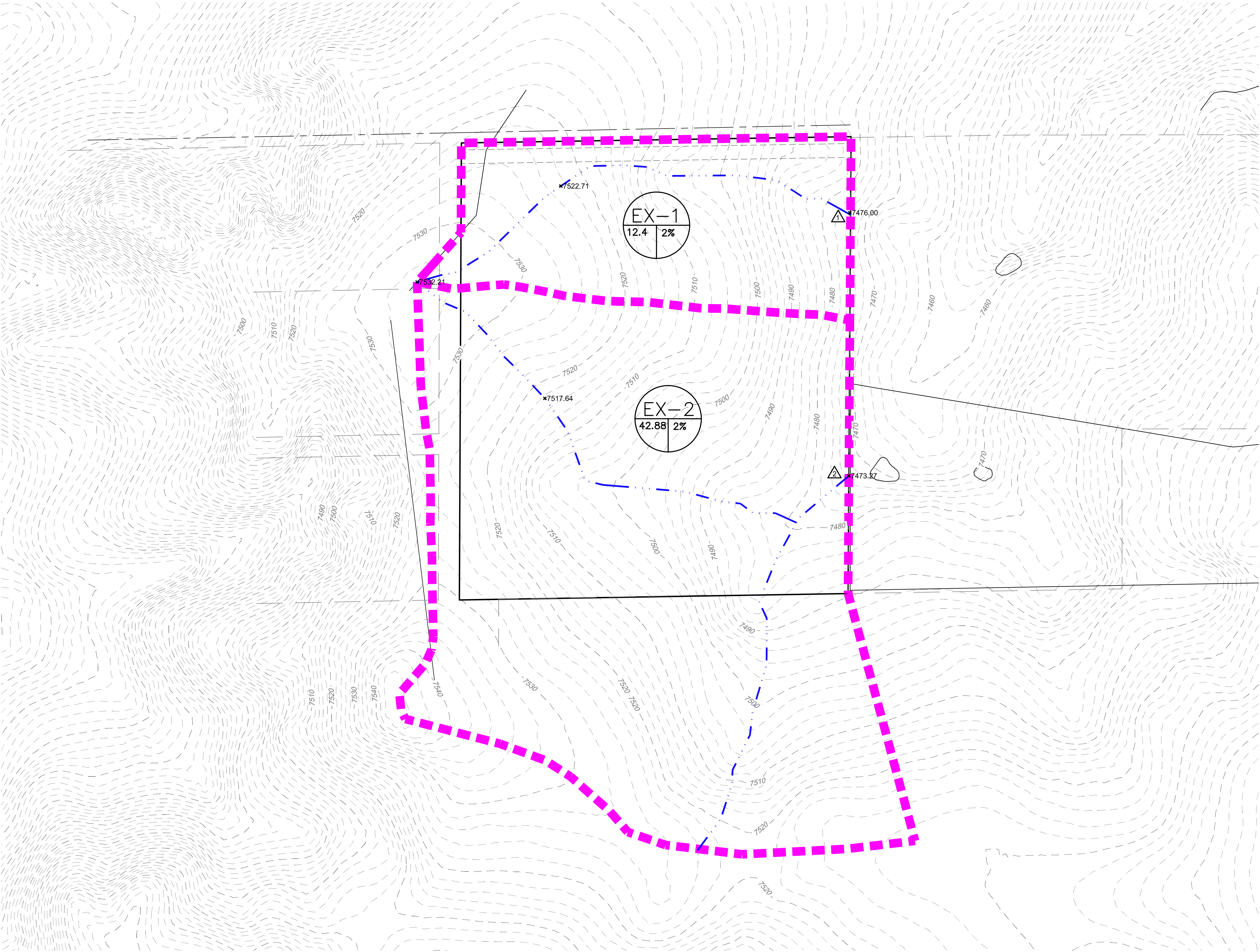
EXISTING MINOR CONTOUR

NOTE: TOPO SHOWN IS AT 2' CONTOUR INTERVAL AND IS TAKEN FROM PUBLIC INFORMATION SOURCES (USGS) AND IS NOT TO BE USED FOR ANY CONSTRUCTION RELATED DESIGN.



SUMMARY - EXISTING PEAK FLOWS:

EX - 1 / DESIGN POINT 1		
STORM : 2-YEAR	10-YEAR	100-YEAR
0.66 CFS	5.49 CFS	16.74 CFS
EX - 2 / DESIGN POINT 2		
STORM : 2-YEAR	10-YEAR	100-YEAR
1.09 CFS	18.08 CFS	55.12 CFS



ASPEN WILLOW ESTATES

FINAL DRAINAGE - PROPOSED BASINS

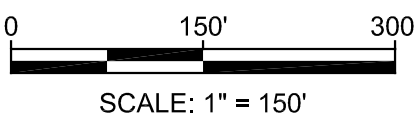
PART OF SECTION 20, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M. - ELPASO COUNTY, COLORADO



LEGEND

- BASIN I.D.
- EXISTING IMPERVIOUS PERCENT
- PROPOSED IMPERVIOUS PERCENT
- BASIN AREA IN ACRES
- DESIGN POINT DESIGNATION
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH
- FLOW DIRECTION
- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR

NOTE: TOPO SHOWN IS AT 2' CONTOUR INTERVAL AND IS TAKEN FROM PUBLIC INFORMATION SOURCES (USGS) AND IS NOT TO BE USED FOR ANY CONSTRUCTION RELATED DESIGN.



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**NOT FOR
CONSTRUCTION**

PREPARED FOR:
CHARLES WOODALL
1480 HIGBY RD
MONUMENT, CO 80132

PROPOSED DRAINAGE BASINS
ASPEN WILLOW ESTATES
EL PASO COUNTY, COLORADO

BY: DATE:

REVISIONS:

25011

3/20/26

CP

EPT

PROJECT NUMBER:

ISSUED DATE:

DESIGNED BY:

REVIEWED BY:

**PROPOSED
BASINS**