

**FINAL DRAINAGE REPORT
FOR
MEISMAN PROPERTY
THAT PART OF S2 LY WLY OF HWY 85 AND SELY OF PLATTED...
21255 CALLE PACIFICO POINT
PUEBLO, COLORADO**

MARCH 2022

Prepared For:
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Prepared By:
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TNE Job No. 2071.00
County Job No. PPR2173

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**FINAL DRAINAGE REPORT
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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.

L Ducett, P.E. 32339
On behalf of Terra Nova Engineering, Inc.

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.

Authorized Signature

Date

Gary Meisman, Property Owner
Printed Name, Title

N/A
Business Name

612 Harvard St, Colorado Springs, CO 80911
Address

EL PASO COUNTY:

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

Jennifer Irvine, P.E.
County Engineer / ECM Administrator

Date

Conditions:

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PURPOSE

The purpose of this Final Drainage Report is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size drainage structures for conveyance of developed runoff, and present solutions to drainage impacts on-site and off-site resulting from this development. The site has not previously been platted and has not been previously studied.

GENERAL DESCRIPTION

This Final Drainage Report (FDR) is an analysis of approximately 40.2 acres of undeveloped land located at 21255 Calle Pacifico Point. This site is being developed as a residential property with a house and a detached shop area to be used by the owners trucking business. The site is in the southeast quarter of Section 35, Township 17 South, Range 65 West of the 6th Principal Meridian within El Paso County. The parcels are bounded to the north by Calle Bernardo, Calle Pacifico Point, and Lot 52 Villa Casitas Filing No 3; to the east by Interstate 25; to the south by unplatted land (in Pueblo County); and to the west by lot 14 Villa Casitas Filing No 1 and Calle Bernardo (see vicinity map in appendix).

The site lies within the Young Hollow Drainage Basin, with storm runoff surface draining west to east across the site, then crossing under I-25 and railroad tracks in culverts, before continuing to surface flow east toward Fountain Creek.

Soils for this project are delineated by the map in the appendix as 16% Kim loam (43), 17% Schamber-Razor complex (82), and 22% Manzanola silty clay loam (MzC). Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area" and contains soils of Hydrologic Group A, B, and C, with Hydrologic Groups A & B being used for this project.

The site is undeveloped with mostly grass and dirt surfaces, some scrub brush, and a small number of trees near I-25. The site drains to the east, with an average slope of 5%-6%.

EXISTING DRAINAGE CONDITIONS

There are no existing structures on the site, though earthwork appears to have been done several times in the past. The west side of the site appears to have been graded in recent years, there is an older dirt road/path crossing the east side of the site, and there are a couple drainage ditches near the east edge of the property. There are offsite culverts crossing I-25 that runoff from the property flows through after leaving the site.

There are five drainage basins, two of which are offsite. See attached Existing Drainage Map (in appendix).

Basin OS-Z is 8.18 acres and drains to Design Point Z on the west property line of the site. This basin is offsite and runoff from this basin flows onto the site and into basin EX-B. Basin OS-Z has flows of $Q_5 = 3.2$ cfs and $Q_{100} = 22.5$ cfs.

Basin OS-Y is 13.1 acres and drains to Design Point Y at the southwest corner of the site. This basin is offsite and runoff from this basin flows onto the site and into basin EX-A. Basin OS-Y has flows of $Q_5 = 5.0$ cfs and $Q_{100} = 34.9$ cfs.

Basin EX-A is 10.7 acres and drains to Design Point A at a drainage ditch on the west side of the site. Runoff enters culverts under I-25 after leaving the site. Basin EX-A has flows of $Q_5 = 3.8$ cfs and $Q_{100} = 26.3$ cfs. Design Point A has combined flows of $Q_5 = 8.8$ cfs and $Q_{100} = 61.2$ cfs from basins OS-Y and EX-A.

Basin EX-B is 27.0 acres and drains to Design Point B at the east side of the site. Runoff enters culverts under I-25 after leaving the site. Basin EX-B has flows of $Q_5 = 9.4$ cfs and $Q_{100} = 64.7$ cfs. Design Point B has combined flows of $Q_5 = 12.6$ cfs and $Q_{100} = 87.2$ cfs from basins OS-Z and EX-B.

Basin EX-C is 1.16 acres on the side of the property and drains to Design Point C at the north side of the site. This is a downhill portion of the property that drains toward the adjacent road. Runoff leaves the site and enters a road side ditch before flowing east. Basin EX-C has flows of $Q_5 = 0.4$ cfs and $Q_{100} = 2.9$ cfs.

PROPOSED DRAINAGE CONDITIONS

Runoff in the developed conditions consists of six basins; Four onsite basins and two offsite basins. Below is a description of the runoff in the developed conditions and how it will be safely routed, treated and detained. See appendix for calculations.

Offsite Basins

See the Existing Drainage Conditions section for Basin OS-Z.

See the Existing Drainage Conditions section for Basin OS-Y.

Onsite Basins

Basin PR-3 is 10.7 acres and drains to Design Point 3 at a drainage ditch on the west side of the site and includes the same area as Basin EX-A, but now includes a portion of the proposed gravel storage area. Runoff enters culverts under I-25 after leaving the site in the same way as the existing conditions. Basin PR-3 has flows of $Q_5 = 4.3$ cfs and $Q_{100} = 27.0$ cfs. Design Point 3 has combined flows of $Q_5 = 9.3$ cfs and $Q_{100} = 61.9$ cfs from basins OS-Y and PR-3. The increase in flows from the existing conditions at Design Point 3 is less than 1 cfs in both the 5-year and 100-year events and is, therefore, not significant.

Basin PR-2 is 1.16 acres on the side of the property and drains to Design Point 2 at the north side of the site and includes the same area as Basin EX-C. This area still drains toward the adjacent road, but now includes small portions of a proposed 16' gravel driveway and a proposed 30' gravel driveway. Runoff leaves the site and enters a road side ditch before flowing east in the same way as the existing conditions. The disturbance in this basin is less than 1 acre and would qualify for an exclusion from the need for water quality treatment (Per ECM App I.7.1.C.1) as it is not practicable to capture runoff from this basin which is not able to drain towards control measures

and instead drains directly towards an existing gravel road. Basin PR-2 has flows of $Q_5 = 0.7$ cfs and $Q_{100} = 3.3$ cfs. The increase in flows from the existing conditions at Design Point 2 is less than 1 cfs in both the 5-year and 100-year events and is, therefore, not significant.

Basin PR-1 is 27.0 acres and drains to Design Point 1 at the east edge of the site. Basin PR-1 covers most of the site, includes the two proposed buildings, most of the gravel roads, a portion of the gravel storage area, and an area of concrete around the proposed shop building. There are existing drainage channels near the east end of the basin that direct runoff as it nears I-25 and enters a 6' X 7' RCP culvert which is in good condition and will not be significantly impacted by this site. Basin PR-1 has flows of $Q_5 = 13.4$ cfs and $Q_{100} = 70.5$ cfs. Design Point 1 has combined flows of $Q_5 = 16.6$ cfs and $Q_{100} = 93.0$ cfs from basins OS-Z and PR-1. This is an increase in flows of 4 cfs in the 5-year event and 5.8 cfs in the 100-year event which is easily handled by the existing drainage ditches and culvert beneath I-25.

Please see comments provided on the calculations and revise accordingly.

Water quality treatment for the proposed impervious areas in Basin PR-1, Basin-PR-2, and Basin-PR-3 is provided by the landscaping / undeveloped areas. The Runoff Reduction Spreadsheet shows the areal representation of these areas is shown on the Proposed landscaping / undeveloped area on the site than are development affects these areas being used for water quality treatment, water quality treatment of the impervious areas proposed here may need to be revisited.

CHANNEL FLOW HAS BEEN ADDED FOR THE DEVELOPED CONDITIONS IN BASIN PR-1. THIS HAS DECREASED THE FLOWS IN THE DEVELOPED CONDITIONS TO A SUITABLE LEVEL.

In an effort to protect receiving water and as part of the “four-step process to minimize adverse impacts of urbanization” this site was analyzed in the following manner:

1. Reduce Runoff- The proposed impervious areas on the site are surrounded by landscaping / undeveloped areas, which extend approximately 1,000 feet downstream of the proposed impervious areas. This will reduce the volume of runoff using ponding and infiltration. See the Runoff Reduction spreadsheet in the appendix for calculations showing how runoff from this impervious area is treated by the receiving pervious area.
2. Stabilize Drainageways- The existing drainageways onsite are next to I-25, approximately 1,000 feet from the area of the site to be developed, and are not directly connected to the

area to be developed. A couple diversion swales are proposed near the proposed structures, and these swales have been designed to be stable.

3. Provide Water Quality Capture Volume (WQCV)- The large landscaping / undeveloped areas will provide the water quality treatment for the proposed impervious areas. See the Runoff Reduction Spreadsheet in the appendix.
4. Consider Need for Industrial and Commercial BMPs- The proposed residence won't involve any industrial and commercial BMPs. The proposed shop building is expected to contain lubricants, solvents, and similar typically associated with basic truck maintenance, and appropriate BMPs should be implemented for this area. See SWMP for methods to contain possible spills.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County Storm Drainage Design Criteria Manual - Volumes 1 & 2, latest editions. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County Storm Drainage Design Criteria Manual – Volumes 1 & 2, latest editions. The pertinent data sheets are included in the appendix of this report.

Swale capacity calculation were performed for the proposed diversion swales.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C1170 G, dated December 7, 2018 (see appendix).

WATER QUALITY

Water quality treatment for the proposed impervious areas in Basin PR-1, Basin PR-2, and Basin PR-3 is provided by the landscaping / undeveloped areas downstream of the impervious areas. The Runoff Reduction Spreadsheet shows the areas being used (see appendix), and a visual

representation of these areas is shown on the Proposed Drainage Map. There is much more landscaping / undeveloped area on the site than are required for water quality treatment. If future development affects these areas being used for water quality treatment, water quality treatment of the impervious areas proposed here may need to be revisited. Detention is not necessary as the increase in runoff is not significant.

CONSTRUCTION COST OPINION

Public Reimbursable

None

Public Non-Reimbursable

None

Private Non-Reimbursable

None

DRAINAGE FEES

This drainage report is part of a site development application; therefore, no drainage fees are due.

MAINTENANCE

There are no stormwater facilities proposed as part of this development.

SUMMARY

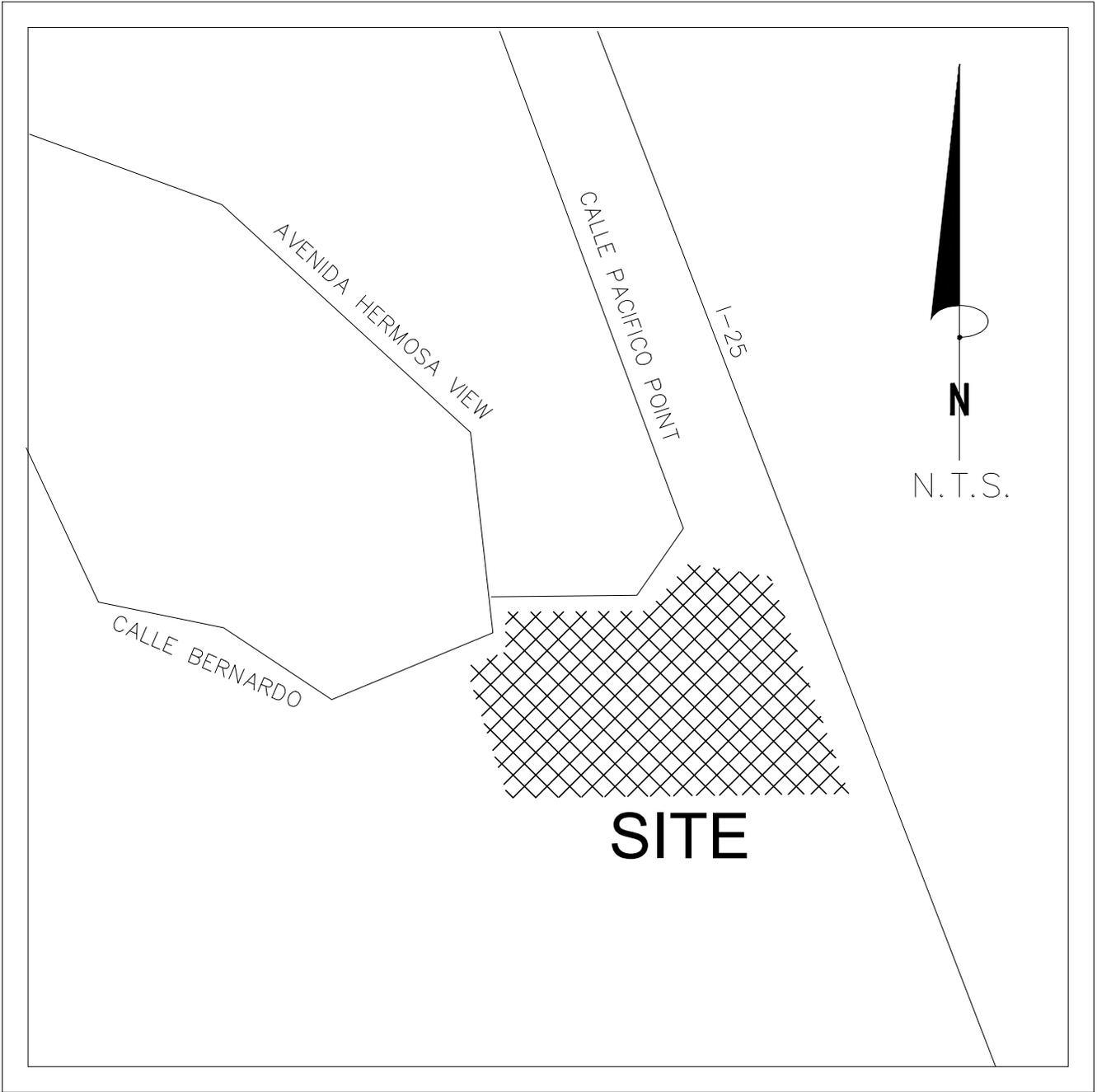
Development of this site will not adversely affect the surrounding development. There are no known previous reports associated with this site. Water quality treatment for the proposed impervious areas is being provided by downstream landscaping / undeveloped areas.

BIBLIOGRAPHY

El Paso County Drainage Criteria Manual-Volumes 1 & 2, latest edition

El Paso County Board Resolution No 15-042 (Adoption of Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014, Hydrology and Full Spectrum Detention)

VICINITY MAP



VICINITY MAP

N.T.S.

S.C.S. SOILS MAP

El Paso County Area, Colorado

43—Kim loam, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 368k
Elevation: 5,300 to 5,600 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Kim

Setting

Landform: Fans, hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

A - 0 to 6 inches: loam
C - 6 to 60 inches: loam

Properties and qualities

Slope: 1 to 8 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 to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

Survey Area Data: Version 19, Jun 5, 2020

El Paso County Area, Colorado

82—Schamber-Razor complex, 8 to 50 percent slopes

Map Unit Setting

National map unit symbol: 369y
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Schamber and similar soils: 55 percent
Razor and similar soils: 43 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Schamber

Setting

Landform: Breaks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite and/or colluvium derived from granite and/or eolian deposits derived from granite

Typical profile

A - 0 to 5 inches: gravelly loam
AC - 5 to 15 inches: very gravelly loam
C - 15 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 50 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
***Hydrologic Soil Group:* A**

Ecological site: R069XY064CO - Gravel Breaks LRU's A & B
Hydric soil rating: No

Description of Razor

Setting

Landform: Breaks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 3 inches: clay loam
Bw - 3 to 9 inches: clay loam
Bk - 9 to 31 inches: clay
Cr - 31 to 35 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY047CO - Alkaline Plains LRU's A & B
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
Hydric soil rating: No

Minor Components

Other soils

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

Pleasant

Percent of map unit: 1 percent
Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

Survey Area Data: Version 19, Jun 5, 2020

El Paso County Area, Colorado

MzC—Manzanola silty clay loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2rgrk
Elevation: 3,700 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Manzanola and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanola

Setting

Landform: Hillslopes, fan remnants
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from shale

Typical profile

A - 0 to 5 inches: silty clay loam
Bt - 5 to 26 inches: silty clay loam
Btk - 26 to 37 inches: silty clay loam
Bk1 - 37 to 48 inches: silty clay loam
Bk2 - 48 to 79 inches: silt loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline to very slightly saline (0.5 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C

Ecological site: R069XY042CO - Clayey Plains LRU's A & B

Forage suitability group: Clayey (G069XW001CO)

Other vegetative classification: Loamy Plains #6
(069XY006CO_2), Clayey (G069XW001CO)

Hydric soil rating: No

Minor Components

Fort

Percent of map unit: 5 percent

Landform: Fan remnants

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14
Inches, P.Z.

Other vegetative classification: Loamy Plains #6 (069XY006CO_2),
Loamy (G069XW017CO)

Hydric soil rating: No

Wilid

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14
Inches, P.Z.

Other vegetative classification: Loamy Plains #6 (069XY006CO_2),
Loamy (G069XW017CO)

Hydric soil rating: No

Razor

Percent of map unit: 5 percent

Landform: Pediments, hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear, convex

Ecological site: R069XY042CO - Clayey Plains LRU's A & B

Other vegetative classification: CLAYEY PLAINS (069AY042CO),
Clayey, Dry-Saline (G069XW006CO)

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

Survey Area Data: Version 19, Jun 5, 2020

Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

CaE—Cascajo very gravelly sandy loam, 2 to 20 percent slopes

Map Unit Setting

National map unit symbol: 2t50z
Elevation: 4,260 to 5,900 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Cascajo, very gravelly, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cascajo, Very Gravelly

Setting

Landform: Terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Old alluvium

Typical profile

A - 0 to 4 inches: very gravelly sandy loam
Bk - 4 to 22 inches: very gravelly loam
2C1 - 22 to 39 inches: extremely gravelly sand
2C2 - 39 to 79 inches: extremely gravelly sand

Properties and qualities

Slope: 2 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Very slightly saline (2.0 to 3.9 mmhos/cm)
Available water capacity: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: R069XY064CO - Gravel Breaks LRU's A & B

Hydric soil rating: No

Minor Components

Cascajo, gravelly

Percent of map unit: 10 percent

Landform: Terraces

Landform position (three-dimensional): Riser

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: R069XY064CO - Gravel Breaks LRU's A & B

Hydric soil rating: No

Kimera

Percent of map unit: 5 percent

Landform: Interfluves

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: R069XY026CO - Sandy Plains LRU's A & B

Other vegetative classification: Loamy (G069XW017CO)

Hydric soil rating: No

Data Source Information

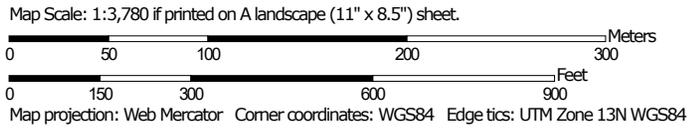
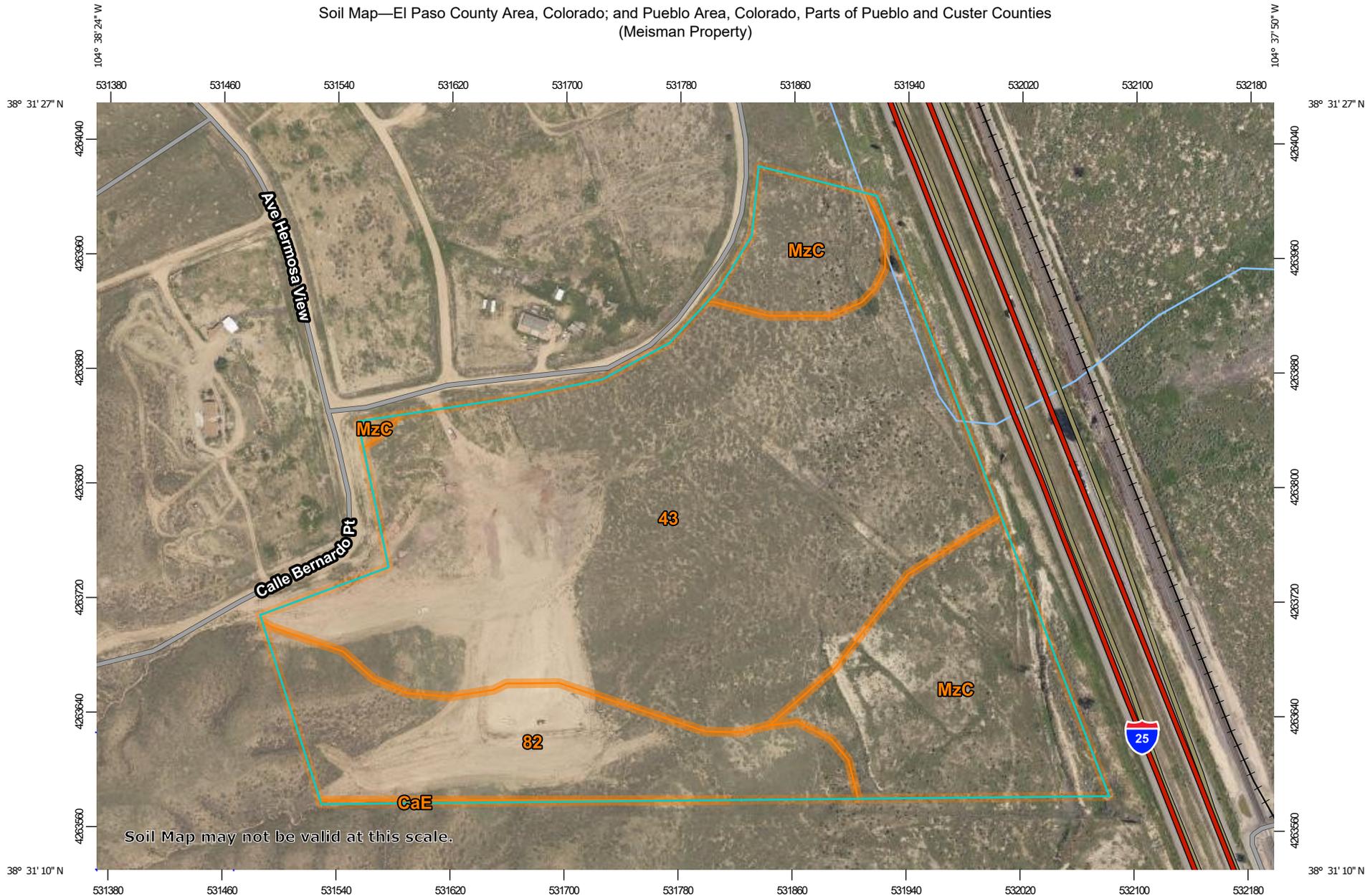
Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

Survey Area Data: Version 19, Jun 5, 2020

Soil Map—El Paso County Area, Colorado; and Pueblo Area, Colorado, Parts of Pueblo and Custer Counties
(Meisman Property)



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 18, Jun 5, 2020

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties
Survey Area Data: Version 19, Jun 5, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Aug 14, 2018—Sep 23, 2018

MAP LEGEND

MAP INFORMATION

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
43	Kim loam, 1 to 8 percent slopes	24.3	60.8%
82	Schamber-Razor complex, 8 to 50 percent slopes	6.8	17.1%
MzC	Manzanola silty clay loam, 3 to 9 percent slopes	8.7	21.8%
Subtotals for Soil Survey Area		39.8	99.8%
Totals for Area of Interest		39.9	100.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CaE	Cascajo very gravelly sandy loam, 2 to 20 percent slopes	0.1	0.2%
Subtotals for Soil Survey Area		0.1	0.2%
Totals for Area of Interest		39.9	100.0%

FEMA FIRM MAP

NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services
NOAA, NGS-14
National Geodetic Survey
SSMC-3, #5202
1315 East-West Highway
Silver Spring, MD 20910-3282

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

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

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

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

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

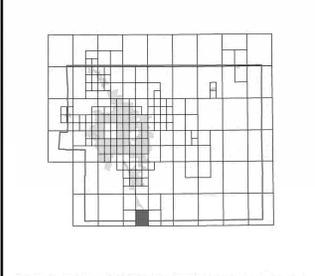
Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

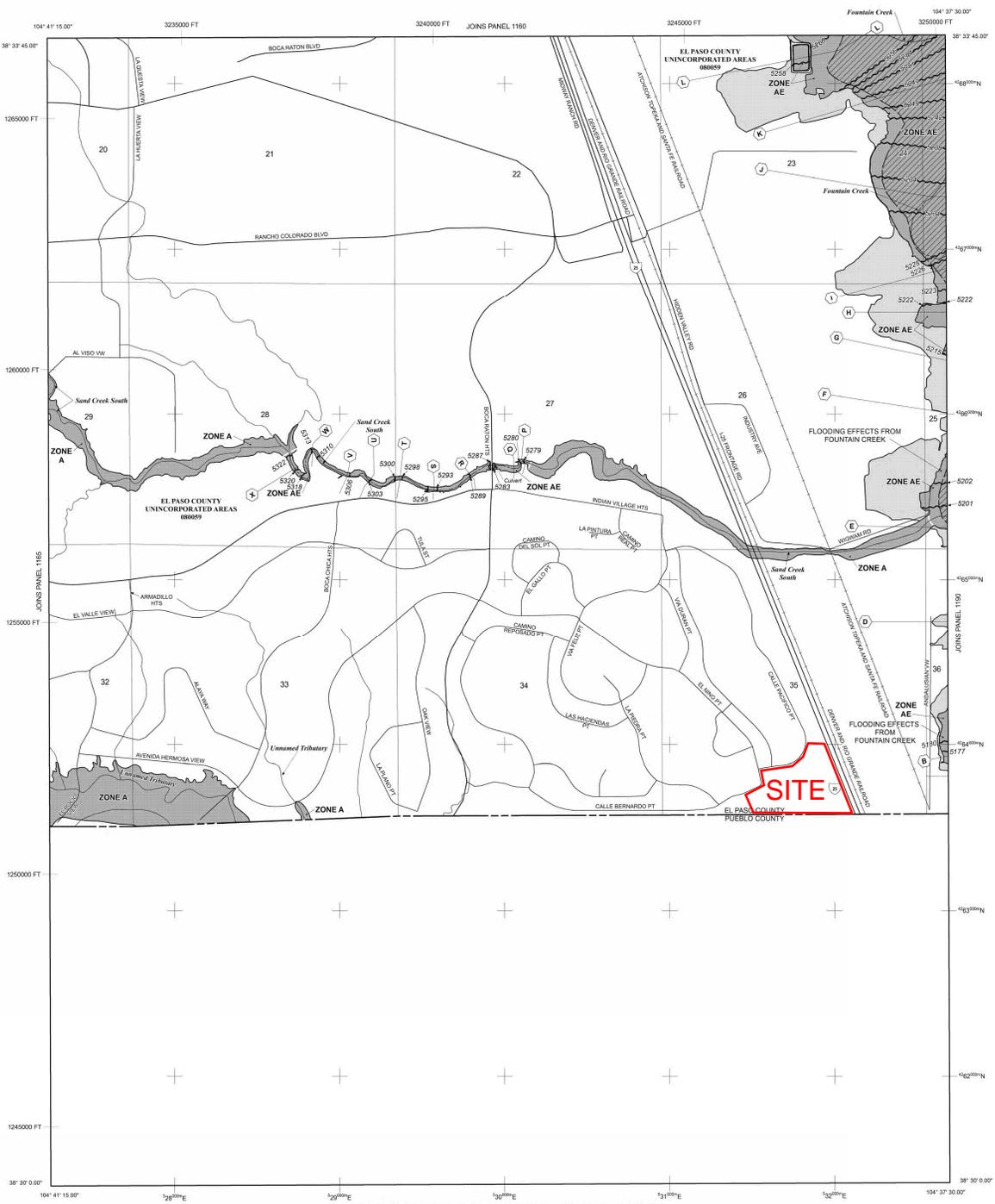
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM-BY-STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



LEGEND

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

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. This Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, AV, VE, V, and VE-1. The base flood elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A
No Base Flood Elevations determined.
Base Flood Elevations determined.

ZONE AE
Base Flood Elevations determined.
Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AH
Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, vehicles also determine.

ZONE AO
Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, vehicles also determine.

ZONE AR
Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that is no longer in service. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE AV9
Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V
Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE
Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE
The floodway is the segment 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 0.5 to 1 foot in areas not subsequently identified. Zone XH indicates that the former flood control system is being restored to provide protection from the 0.2% annual chance or greater flood.

OTHER AREAS

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

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary defining Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
Base Flood Elevation value where uniform within zone; elevation in feet.
Referenced to the North American Vertical Datum of 1988 (NAVD 88)

Cross section line
Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
1000-meter Universal Transverse Mercator grid ticks, zone 13
5000-foot grid ticks; Colorado State Plane coordinate system, central zone (PROJCODE 020), Lambert Conformal Conic Projection

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

M 1.5
River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2011, to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Tables 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'

0 500 1000 2000 FEET
0 300 600 METERS

NFP PANEL 1170G

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

PANEL 1170 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	COMMUNITY NUMBER	PANEL	SUFFIX
EL PASO COUNTY	08041C	1170	G

MAP NUMBER 08041C1170G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

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

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 17 SOUTH, RANGE 65 WEST.

HYDROLOGIC CALCULATIONS

MEISMAN PROPERTY
(Area Runoff Coefficient Summary)

EXISTING CONDITIONS

		<i>DEVELOPED</i>			<i>UNDEVELOPED</i>			<i>GRAVEL STREET</i>			<i>GRAVEL YARD</i>			<i>WEIGHTED</i>	
BASIN	TOTAL AREA	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	C₅	C₁₀₀
	<i>(Acres)</i>	<i>(Acres)</i>			<i>(Acres)</i>			<i>(Acres)</i>			<i>(Acres)</i>				
OS-Z	8.18	0.00	0.90	0.96	8.18	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36
OS-Y	13.10	0.00	0.90	0.96	13.10	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36
EX-A	10.70	0.00	0.90	0.96	10.70	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36
EX-B	27.00	0.00	0.90	0.96	27.00	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36
EX-C	1.16	0.00	0.90	0.96	1.16	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36

DEVELOPED CONDITIONS

		<i>DEVELOPED</i>			<i>UNDEVELOPED</i>			<i>GRAVEL STREET</i>			<i>GRAVEL YARD</i>			<i>WEIGHTED</i>	
BASIN	TOTAL AREA	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	AREA	C₅	C₁₀₀	C₅	C₁₀₀
	<i>(Acres)</i>	<i>(Acres)</i>			<i>(Acres)</i>			<i>(Acres)</i>			<i>(Acres)</i>				
OS-Z	8.18	0.00	0.90	0.96	8.18	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36
OS-Y	13.10	0.00	0.90	0.96	13.10	0.09	0.36	0.00	0.59	0.70	0.00	0.30	0.50	0.09	0.36
PR-3	10.70	0.00	0.90	0.96	10.06	0.09	0.36	0.00	0.59	0.70	0.64	0.30	0.50	0.10	0.37
PR-2	1.16	0.00	0.90	0.96	1.04	0.09	0.36	0.12	0.59	0.70	0.00	0.30	0.50	0.14	0.40
PR-1	27.00	0.65	0.90	0.96	25.13	0.09	0.36	0.71	0.59	0.70	0.51	0.30	0.50	0.13	0.39

Calculated by: JF
Date: #####
Checked by: LD

MEISMAN PROPERTY AREA DRAINAGE SUMMARY

EXISTING CONDITIONS

BASIN	AREA TOTAL (Acres)	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				T _t	INTENSITY		TOTAL FLOWS	
		C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
OS-Z	8.18	0.09	0.36	0.09	300	31.9	8.2	0	10.6%	1.6	0.0	8.2	4.3	7.6	3.2	22.5
OS-Y	13.10	0.09	0.36	0.09	300	24.8	9.0	0	8.3%	1.4	0.0	9.0	4.2	7.4	5.0	34.9
EX-A	10.70	0.09	0.36	0.09	300	13.7	10.9	0	4.6%	1.1	0.0	10.9	3.9	6.8	3.8	26.3
EX-B	27.00	0.09	0.36	0.09	300	11.6	11.5	0	3.9%	1.0	0.0	11.5	3.9	6.7	9.4	64.7
EX-C	1.16	0.09	0.36	0.09	300	16.4	10.3	0	5.5%	1.2	0.0	10.3	4.0	7.0	0.4	2.9

DEVELOPED CONDITIONS

BASIN	AREA TOTAL (Acres)	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				T _t	INTENSITY		TOTAL FLOWS	
		C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
OS-Z	8.18	0.09	0.36	0.09	300	31.9	8.2	0	10.6%	1.6	0.0	8.2	4.3	7.6	3.2	22.5
OS-Y	13.10	0.09	0.36	0.09	300	24.8	9.0	0	8.3%	1.4	0.0	9.0	4.2	7.4	5.0	34.9
PR-3	10.70	0.10	0.37	0.10	300	13.7	10.8	0	4.6%	1.1	0.0	10.8	4.0	6.9	4.3	27.0
PR-2	1.16	0.14	0.40	0.14	300	16.4	9.8	0	5.5%	1.2	0.0	9.8	4.1	7.1	0.7	3.3
PR-1	27.00	0.13	0.39	0.13	300	11.6	11.1	0	3.9%	1.0	0.0	11.1	3.9	6.8	13.4	70.5

Calculated by: JF
Date: 3/13/2022
Checked by: LD

Thanks for catching this for us! There was an error in the formula which has been corrected for each basin. The time of concentration is a good deal higher now.

Please double check your time of concentration as it appears low and ensure that the equation from DCM Ch6 (eq 6-8) is used

Please include the proposed swale around the shop area. This would increase the Tc and reduce the total flows so that the difference between the existing and developed conditions is less.

CHANNEL FLOW HAS BEEN ADDED FOR THE DEVELOPED CONDITIONS IN BASIN PR-1. THIS HAS DECREASED THE FLOWS IN THE DEVELOPED CONDITIONS TO A SUITABLE LEVEL.

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

**MEISMAN PROPERTY
PROPOSED SURFACE ROUTING SUMMARY**

<i>Design Point(s)</i>	<i>Contributing Basins</i>	<i>Area Ac</i>	<i>Flow</i>	
			<i>Q₅</i>	<i>Q₁₀₀</i>
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.10	5.0	34.9
A	EX-A, OS-Y	23.80	8.8	61.1
B	EX-B, OS-Z	35.18	12.6	87.2
C	EX-C	1.16	0.4	2.9

This is the existing conditions summary not the proposed. please revise accordingly.

Updated.

Each Area should be under 1 column for pervious and impervious areas.
 See Proposed Drainage Map markups for more details. If you have any questions, please feel free to email or call me prior to your next submittal.

Design Procedure Form: Runoff Reduction

Designer: John Fornander
 Company: Terra Nova Engineering
 Date: March 17, 2022
 Project: Meisman Property
 Location: 21255 Calle Pacifico

Each area is now under one column. A fourth area has been added to plans and runoff reduction spreadsheet.

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth = 0.60 inches
 Depth of Average Runoff Producing Storm, d_p = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	SPA	UIA:RPA	SPA	UIA:RPA	SPA				
Area ID	PR-1a(imp)	PR-1a(per)	PR-3(imp)	PR-3(per)	PR-1b(imp)	PR-1b(per)				
Downstream Design Point ID	1	1	3	3	1	1				
Downstream BMP Type	None	None	None	None	None	None				
DCIA (ft ²)	--	--	--	--	--	--				
UIA (ft ²)	40,000	--	11,194	--	20,868	--				
RPA (ft ²)	40,000	--	11,194	--	20,868	--				
SPA (ft ²)	--	40,000	--	11,194	--	20,868				
HSG A (%)	0%	0%	100%	100%	0%	0%				
HSG B (%)	100%	100%	0%	0%	100%	100%				
HSG C/D (%)	0%	0%	0%	0%	0%	0%				
Average Slope of RPA (ft/ft)	0.050	--	0.040	--	0.050	--				
UIA:RPA Interface Width (ft)	210.00	--	120.00	--	190.00	--				

CALCULATED RUNOFF RESULTS

Area ID	PR-1a(imp)	PR-1a(per)	PR-3(imp)	PR-3(per)	PR-1b(imp)	PR-1b(per)				
UIA:RPA Area (ft ²)	80,000	--	22,388	--	41,736	--				
L / W Ratio	1.81	--	1.55	--	1.16	--				
UIA / Area	0.5000	--	0.5000	--	0.5000	--				
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00				
Runoff (ft ³)	0	0	0	0	0	0				
Runoff Reduction (ft ³)	1667	2000	466	560	870	1043				

CALCULATED WQCV RESULTS

Area ID	PR-1a(imp)	PR-1a(per)	PR-3(imp)	PR-3(per)	PR-1b(imp)	PR-1b(per)				
WQCV (ft ³)	1667	0	466	0	870	0				
WQCV Reduction (ft ³)	1667	0	466	0	870	0				
WQCV Reduction (%)	100%	0%	100%	0%	100%	0%				
Untreated WQCV (ft ³)	0	0	0	0	0	0				

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

Downstream Design Point ID	1	1	3	3	1	1				
DCIA (ft ²)	0	0	0	0	0	0				
UIA (ft ²)	60,868	60,868	11,194	11,194	60,868	60,868				
RPA (ft ²)	60,868	60,868	11,194	11,194	60,868	60,868				
SPA (ft ²)	60,868	60,868	11,194	11,194	60,868	60,868				
Total Area (ft ²)	182,604	182,604	33,582	33,582	182,604	182,604				
Total Impervious Area (ft ²)	60,868	60,868	11,194	11,194	60,868	60,868				
WQCV (ft ³)	2,536	2,536	466	466	2,536	2,536				
WQCV Reduction (ft ³)	2,536	2,536	466	466	2,536	2,536				
WQCV Reduction (%)	100%	100%	100%	100%	100%	100%				
Untreated WQCV (ft ³)	0	0	0	0	0	0				

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

Total Area (ft ²)	797,580
Total Impervious Area (ft ²)	265,860
WQCV (ft ³)	3,003
WQCV Reduction (ft ³)	3,003
WQCV Reduction (%)	100%
Untreated WQCV (ft ³)	0

impervious

pervious

length of interface

HYDRAULIC CALCULATIONS

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Meisman Property** Location: **Diversion Swale West of Shop Building (Capacity)**
 By: **Dane Frank** Date: **1/25/2021**
 Chk By: _____ Date: _____ version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_n^{2/3}S^{1/2}$$

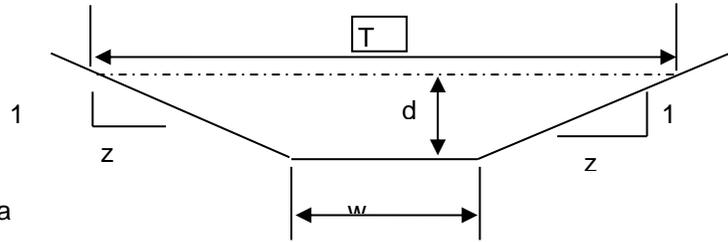
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_n^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 4
 z (sideslope)= 4
 b (btm width, ft)= 4
 d (depth, ft)= 2
 S (slope, ft/ft) 0.05
 n low = 0.025
 n high = 0.035

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		T =	Dm =
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
2	24.00	20.49	1.17	14.7676498	354.424	10.54832	253.16	20	1.200

Sc low = 0.0088 Sc high = 0.0173

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

.7 Sc	1.3 Sc	.7 Sc	1.3 Sc
0.0062	0.0115	0.0121	0.0225

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Meisman Property** Location: **Diversion Swale West of House (Capacity)**
 By: **Dane Frank** Date: **1/25/2021**
 Chk By: _____ Date: _____ version 12-2004

Mannings Formula

$$Q = (1.486/n)AR_n^{2/3}S^{1/2}$$

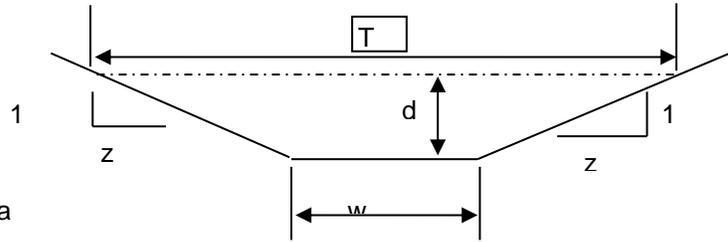
$$R = A/P$$

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$$V = (1.49/n)R_n^{2/3}S^{1/2}$$

$$Q = V \times A$$

INPUT

z (sideslope)= 8
 z (sideslope)= 8
 b (btm width, ft)= 4
 d (depth, ft)= 1
 S (slope, ft/ft) 0.02
 n low = 0.025
 n high = 0.035

Clear Data
Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N		High N		T =	Dm =
				Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
1	12.00	20.12	0.60	5.9551155	71.4614	4.253654	51.0438	20	0.600

Sc low = 0.0109 Sc high = 0.0213

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

.7 Sc	1.3 Sc	.7 Sc	1.3 Sc
0.0076	0.0141	0.0149	0.0277

DRAINAGE MAPS

MEISMAN PROPERTY

EL PASO COUNTY

EXISTING DRAINAGE MAP

MARCH 2022

BASIN SUMMARY

DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.1	5.0	34.9
A	EX-A	10.7	3.8	26.3
B	EX-B	27.0	9.4	64.7
C	EX-C	1.16	0.4	2.9

Design Point(s)	Contributing Basins	Area Ac	Flow	
			Q ₅	Q ₁₀₀
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.10	5.0	34.9
A	EX-A, OS-Y	23.80	8.8	61.1
B	EX-B, OS-Z	35.18	12.6	87.2
C	EX-C	1.16	0.4	2.9

LEGEND

- P-7
12.22 BASIN DESIGNATION
- 12.22 AREA IN BASIN (AC)
- D DESIGN POINT
- BASIN BOUNDARY
- EXISTING 1' CONTOUR
- EXISTING 10' CONTOUR
- GROUND SURFACE FLOW DIRECTION
- ROAD AND DITCH FLOW DIRECTION
- FENCE LINE

NOTES

1. ALL FEATURE SHOWN ARE EXISTING.
2. EXISTING VEGETATION ONSITE ARE GRASSES, SCRUB BRUSH, CACTUS, AND A COUPLE ISOLATED TREES NEAR THE EAST PROPERTY LINE.
3. THE OFFSITE BASINS ARE BASED ON USGS TOPO MAPS.



REVISIONS	NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, INCORPORATING THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
GARY MEISMAN
ATTN:
612 HARVARD ST
COLORADO SPRINGS, CO 80911
719.492.0612


Terra Nova
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721 S. 23RD STREET
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MEISMAN PROPERTY

EXISTING DRAINAGE MAP

DESIGNED BY DLF
DRAWN BY DLF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 2071.00
DATE ISSUED 3/12/22
SHEET NO. 1 OF 4

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MEISMAN PROPERTY EL PASO COUNTY EXISTING OFFSITE DRAINAGE MAP MARCH 2022

BASIN SUMMARY

DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.1	5.0	34.9
A	EX-A	10.7	3.8	26.3
B	EX-B	27.0	9.4	64.7
C	EX-C	1.16	0.4	2.9

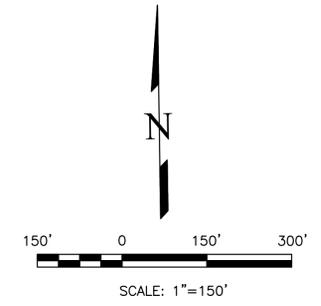
Design Point(s)	Contributing Basins	Area Ac	Flow	
			Q ₅	Q ₁₀₀
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.10	5.0	34.9
A	EX-A, OS-Y	23.80	8.8	61.1
B	EX-B, OS-Z	35.18	12.6	87.2
C	EX-C	1.16	0.4	2.9

NOTES

1. ALL FEATURE SHOWN ARE EXISTING.
2. EXISTING VEGETATION ONSITE ARE GRASSES, SCRUB BRUSH, CACTUS, AND A COUPLE ISOLATED TREES NEAR THE EAST PROPERTY LINE.
3. THE OFFSITE BASINS ARE BASED ON USGS TOPO MAPS.

LEGEND

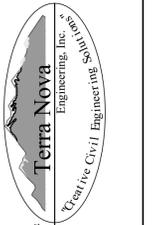
-  BASIN DESIGNATION
-  AREA IN BASIN (AC)
-  DESIGN POINT
-  BASIN BOUNDARY
-  EXISTING 1' CONTOUR
-  EXISTING 10' CONTOUR
-  GROUND SURFACE FLOW DIRECTION
-  ROAD AND DITCH FLOW DIRECTION
-  FENCE LINE



REVISIONS	DESCRIPTION	DATE
NO.		

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MEISMAN PROPERTY
EXISTING OFFSITE DRAINAGE MAP

DESIGNED BY DLF
DRAWN BY DLF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 2071.00
DATE ISSUED 3/12/22
SHEET NO. 2 OF 4

MEISMAN PROPERTY EL PASO COUNTY PROPOSED DRAINAGE MAP MARCH 2022

NOTES
1. LANDSCAPING / UNDEVELOPED LAND IS BEING USED FOR WATER QUALITY TREATMENT. IF FUTURE DEVELOPMENT AFFECTS THESE AREAS, WATER QUALITY TREATMENT OF THE IMPERVIOUS AREAS PROPOSED HERE MAY NEED TO BE REVISITED.

BASIN SUMMARY

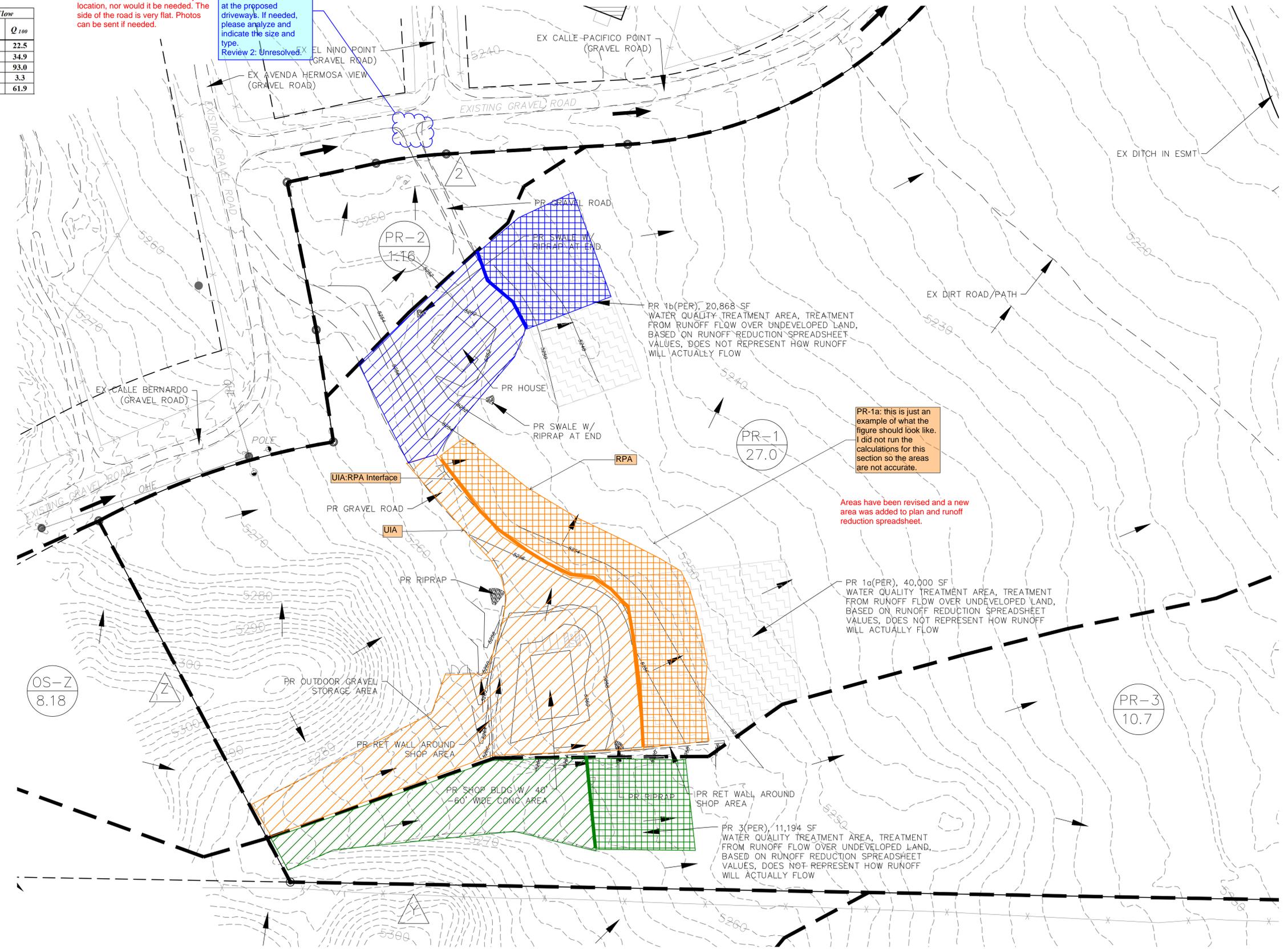
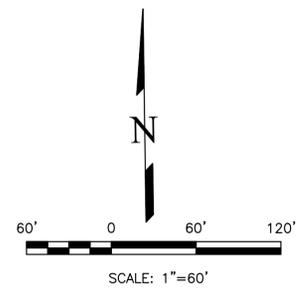
DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.1	5.0	34.9
3	PR-3	10.7	4.3	27.0
2	PR-2	1.16	0.7	3.3
1	PR-1	27.0	13.4	70.5

Design Point(s)	Contributing Basins	Area Ac	Flow	
			Q ₅	Q ₁₀₀
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.10	5.0	34.9
1	PR-1, OS-Z	35.18	16.6	93.0
2	PR-2	1.16	0.7	3.3
3	PR-3+OS-Y	23.80	9.3	61.9

A site visit determined that a culvert would not work in either driveway location, nor would it be needed. The side of the road is very flat. Photos can be sent if needed.

Review 1 comment: Please indicate whether or not a culvert is needed/recommended at the proposed driveways. If needed, please analyze and indicate the size and type.
Review 2: Unresolved

- LEGEND**
- P-7
12.22 BASIN DESIGNATION
 - 2.22 AREA IN BASIN (AC)
 - D DESIGN POINT
 - BASIN BOUNDARY
 - EXISTING 1' CONTOUR
 - EXISTING 10' CONTOUR
 - GROUND SURFACE FLOW DIRECTION
 - ROAD AND DITCH FLOW DIRECTION
 - FENCE LINE



REVISIONS NO.	DESCRIPTION	DATE

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MEISMAN PROPERTY
PROPOSED DRAINAGE MAP

DESIGNED BY DLF
DRAWN BY DLF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 2071.00
DATE ISSUED 3/12/22
SHEET NO. 3 OF 4

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MEISMAN PROPERTY EL PASO COUNTY PROPOSED OFFSITE DRAINAGE MAP MARCH 2022

DESIGN POINT	BASIN	AREA (ACRES)	FLOW	
			5 YR (cfs)	100 YR (cfs)
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.1	5.0	34.9
A	EX-A	10.7	3.8	26.3
C	EX-C	1.16	0.4	2.9
1	PR-1	27.0	11.5	67.8

5 year and 100 year flows are inconsistent with flows on page 32. Please revise.

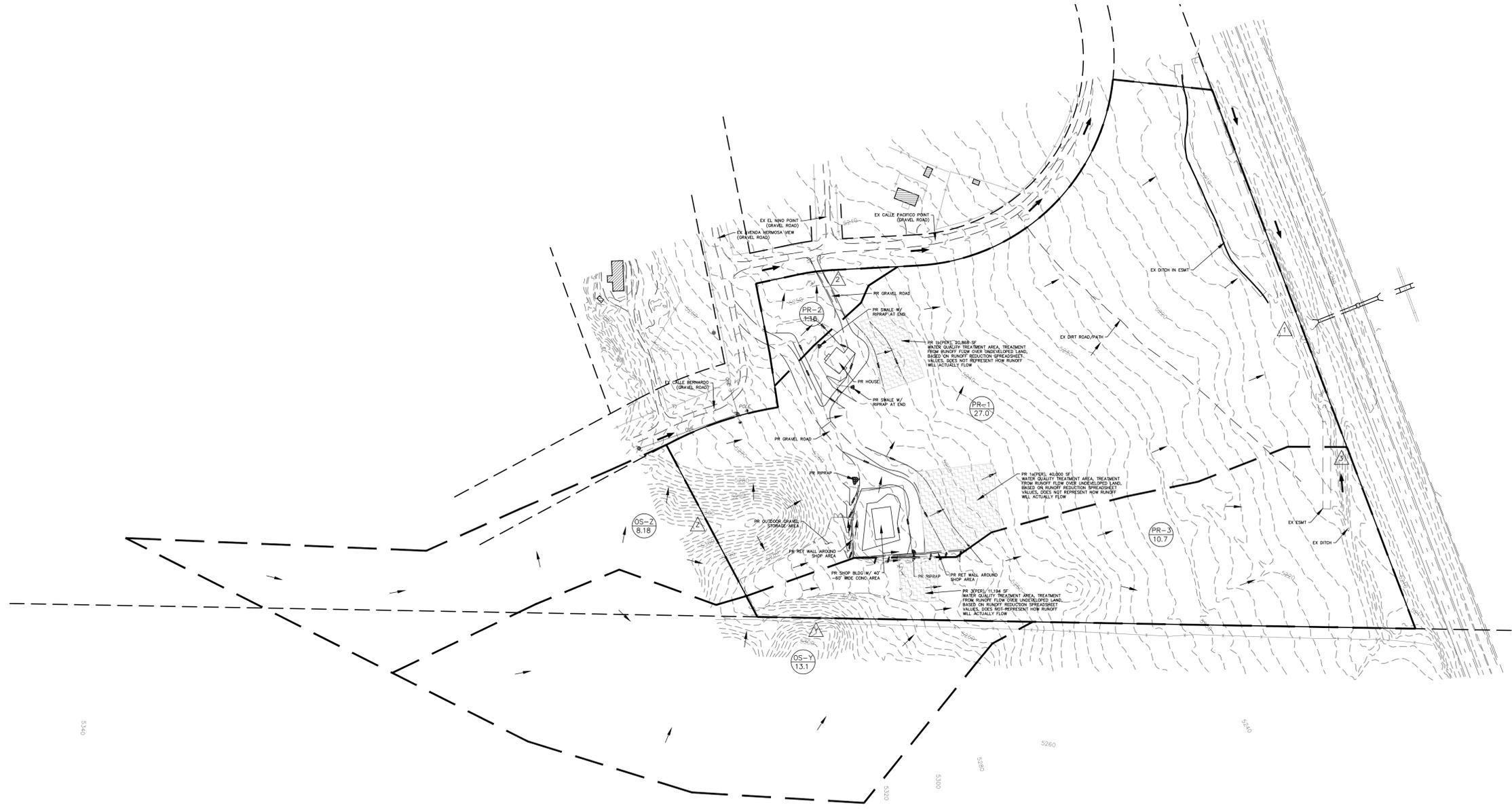
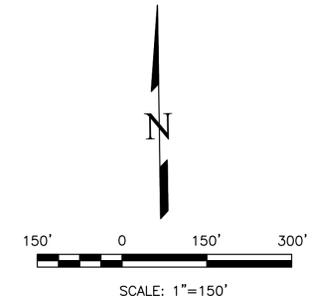
Updated.

Design Point(s)	Contributing Basins	Area Ac	Flow	
			Q ₅	Q ₁₀₀
Z	OS-Z	8.18	3.2	22.5
Y	OS-Y	13.10	5.0	34.9
1	PR-1, OS-Z	35.18	16.6	93.0
2	PR 2	1.16	0.7	3.3
3	PR-3+OS-Y	23.80	9.3	61.9

NOTES
1. THE OFFSITE BASINS ARE BASED ON USGS TOPO MAPS.

LEGEND

- P-7
12.22 BASIN DESIGNATION
- D DESIGN POINT
- BASIN BOUNDARY
- EXISTING 1' CONTOUR
- EXISTING 10' CONTOUR
- GROUND SURFACE FLOW DIRECTION
- ROAD AND DITCH FLOW DIRECTION
- X FENCE LINE



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MEISMAN PROPERTY

PROPOSED OFFSITE DRAINAGE MAP

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SHEET NO. 4 OF 4