Final Drainage Letter
Hanover School District – Prairie Heights Elementary School
7930 Indian Village Heights
Lot 110 Midway Ranches Fil No 7
El Paso County, Colorado

Prepared for:

Hanover School District – Prairie Heights Elementary School
17050 S. Peyton Hwy,
Colorado Springs, Colorado
(719) 683-2247

Prepared by:

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
Ph: (719)630-7342

Kiowa Project No. 24047

EPC Project Number:

January 24, 2025

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Design Engineer's Statement:

The attached drainage plan and letter were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage letter has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

Signature (Affix Seal): _____ _____

Todd Cartwright, P.E. No. 33365 Date

School District Statement:

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

Signature: _____Date: _____

[Name, Title]
Hanover School District
[Address]

El Paso County Statement:

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

_____ _____

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

Conditions:

I. GENERAL LOCATION AND DESCRIPTION

The purpose of this Drainage Letter is to identify on-site and off-site drainage patterns, storm sewers, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfalls for Prairie Heights Elementary School.

A vicinity map showing the general location of the site is presented in Appendix A. Prairie Heights Elementary School is comprised of 38.56 acres, located in southwest El Paso County. The street address for the site is 7930 Indian Village Heights. The platted name is Lot 110 Midway Ranches Fil No 7. The property is primarily located in Sections 28, Township 17 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. The site also extends into sections 29, 32 and 33. The school itself is primarily in section 33. The expansion will extend into section 28.

The vegetation on the site consists of native grass. There are no proposed developments within a designated floodplain, as indicated on FEMA panel 08041C1170G, effective 12/7/2018. A FEMA firmette for the site is located in Appendix A.

95 % of the site consists of hydrologic group 'C' soils Kimera Loam and Wilid Silt Loam and less than 5% hydrologic group 'A' soils Schamber-Razor Complex. A copy of the USDA Custom Soil Resource Report is located in Appendix A.

The school is located in the southwest corner of the site. Are area of disturbance for this project will be 2.81 acres. The outline of the area of disturbance encompasses 3.27 acres, however the portion of existing school to remain has a 0.46 acre foot print resulting in the 2.81 acres of disturbance. The portable buildings (modulars) will be removed with this project.

II. GENERAL CONCEPT

A. EXISTING DRAINAGE PATTERNS

In the existing condition, the site generally drains from south to the north to Sand Creek at the north property line. Sand Creek flows across the north end of the property. Sand Creek flows east to Fountain Creek

The following is a description of the existing drainage sub-basins.

Sub-basin E-1: Sub-basin E-1 is 19.71 acres, with 5 and 100-year runoff of 7.7 and 40 CFS respectively. The runoff from this sub-basin flows north down overland to sand creek as mostly unconcentrated flow. The design point is depicted as Design Point E1. Sand creek flows through the site.

Sub-basin E-2: Sub-basin E-2 is 16.77 acres, with 5 and 100-year runoff of 14 and 61 CFS respectively. It is not expected to receive any offsite flow. The flows around the school generally flow around the school on the surface starting at the southeast corner of the school and flowing around the south or the east side as appropriate. The design point is depicted as Design Point E2.

Sub-basin E-3: Sub-basin E-3 is 0.72 acres, with 5 and 100-year runoff of 0.5 and 2.5 CFS respectively. It is not expected to receive any offsite flow. The runoff from this sub-basin flows north and off site to sand creek as mostly unconcentrated flow. The design point is depicted as Design Point E3.

Sub-basin E-4: Sub-basin E-4 is 0.23 acres, with 5 and 100-year runoff of 0.2 and 1.0 CFS respectively. It is not expected to receive any offsite flow. The runoff from this sub-basin flows south as mostly unconcentrated flow. The design point is depicted as Design Point E4.

Sub-basin E-5: Sub-basin E-5 is 0.35 acres, with 5 and 100-year runoff of 0.9 and 2.0 CFS respectively. It is not expected to receive any offsite flow. The runoff from this sub-basin flows south as mostly unconcentrated flow. The design point is depicted as Design Point E5.

B. PROPOSED DRAINAGE PATTERNS

Similar to the existing conditions, the proposed drainage will generally travel to the North into Sand Creek, then ultimately flow into the Fountain creek drainage basin.

The runoff in the developed condition will be basically the same as the existing condition.

The following is a description of the proposed drainage sub-basins.

Sub-basin P-1: Sub-basin P-1 is 19.71 acres, with 5 and 100-year runoff of 7.7 and 40 CFS respectively. The runoff from this sub-basin flows north down overland to sand creek as mostly unconcentrated flow. The design point is depicted as Design Point P1. Sand creek flows through the site.

Sub-basin P-2: Sub-basin P-2 is 16.77 acres, with 5 and 100-year runoff of 15 and 62 CFS respectively. It is not expected to receive any offsite flow. The flows around the school generally flow around the school on the surface starting at the southeast corner of the school and flowing around the south or the east side as appropriate. The design point is depicted as Design Point P2.

Sub-basin P-3: Sub-basin P-3 is 0.72 acres, with 5 and 100-year runoff of 0.5 and 2.5 CFS respectively. It is not expected to receive any offsite flow. The runoff from this sub-basin flows north and off site to sand creek as mostly unconcentrated flow. The design point is depicted as Design Point P3. P-6 & P-7 areas and runoff are included in the runoff for basin P-3.

Sub-basin P-4: Sub-basin P-4 is 0.23 acres, with 5 and 100-year runoff of 0.2 and 1.0 CFS respectively. It is not expected to receive any offsite flow. The runoff from this sub-basin flows south as mostly unconcentrated flow. The design point is depicted as Design Point P4.

Sub-basin P-5: Sub-basin P-5 is 0.35 acres, with 5 and 100-year runoff of 0.9 and 2.0 CFS respectively. It is not expected to receive any offsite flow. The runoff from this sub-basin flows south as mostly unconcentrated flow. The design point is depicted as Design Point P5.

Sub-basin P-6: Sub-basin P-6 is 0.12 acres, with 5 and 100-year runoff of 0.3 and 0.7 CFS respectively. This is part of subbasin P-2. This basin was used only to identify the flow in the curb chase. The design point is depicted as Design Point P6.

Sub-basin P-7: Sub-basin P-6 is 0.12 acres, with 5 and 100-year runoff of 1.1 and 2.6 CFS respectively. This is part of subbasin P-2. This basin was used only to identify the flow in the culvert under the internal drive. The design point is depicted as Design Point P7.

III. DRAINAGE DESIGN CRITERIA

This report followed the criteria and format included in "Colorado Springs Drainage Criteria Manual (DCM) Volume 1", "Volume 2" and "Colorado Springs Engineering Criteria Manual".

The report also followed the "Master Development Drainage Plan Drennan Subdivision Filing No. 1." And Amendment 1. The design of this site is in conformance with the MDDP.

Hydrologic and hydraulic calculations for the site were performed using the methods outlined in the *Colorado Springs Drainage Criteria Manual*. Topography for the site was compiled using a one-foot contour interval and is presented on the Drainage Plan.

The hydrologic calculations were made for the historic and developed site conditions. The Drainage Plan presents the drainage patterns for the site, including the sub-basins. The peak flow rates for the sub-basins were estimated using the Rational Method. The 5-year (Minor Storm) and 100-year (Major Storm) recurrence intervals were determined. The one-hour rainfall depth was determined from Table 6-2 of the Drainage Criteria Manual. These depths are shown in the runoff calculations spreadsheet.

I. OFF-SITE RUNOFF CONSIDERATION

No significant off-site flows are expected to enter the site.

Flows leave the site in Sand Creek

II. HYDROLOGIC AND HYDRAULIC CALCULATIONS

Hydrologic and hydraulic calculations for the site were performed using the methods outlined in the *Colorado Springs Drainage Criteria Manual*. Topography for the site was compiled using a one-foot contour interval and is presented on the Drainage Plan. Detailed topography is not available for the northern portion of the site in a CADD format.

The hydrologic calculations were made for the historic and developed site conditions. The Drainage Plan presents the drainage patterns for the site, including the sub-basins. The peak flow rates for the sub-basins were estimated using the Rational Method. The 5-year (Minor Storm) and 100-year (Major Storm) recurrence intervals were determined. The one-hour rainfall depth was determined from Table 6-2 of the *Drainage Criteria Manual*. These depths are shown in the runoff calculations spreadsheet.

III. SOILS CONSIDERATIONS

The onsite soils were considered to be Hydrologic Soil Group C, based on the *Soil Survey*. 95 % of the site consists of hydrologic group 'C' soils Kimera Loam and Wilid Silt Loam and less than 5% hydrologic group 'A' soils Schamber-Razor Complex. A copy of the USDA Custom Soil Resource Report is located in Appendix A

A Grading and Erosion Control plan is required for this project since the area of disturbance is greater then 1.0 acres. The area of disturbance is 3.27 acre. A Grading and Erosion Control plan will be submitted to EPC or review and approval with the development of the construction drawings.

IV. DRAINAGE BASIN FEES

The site is already platted and will not be required to pay drainage fees.

V. SUMMARY

The site runoff proposed for Prairie Heights Elementary School expansion will increase the runoff by approximately 1% and not adversely affect the downstream and surrounding developments.

Runoff Summary

Design Point	Existing		Proposed	
	5 yr Flow (cfs)	100-yr Flow (cfs)	5 yr Flow (cfs)	100 yr flow (cfs)
E-1 / P-1	7.7	40	7.7	40
E-2 / P-2	14	61	15	62
E-3 / P-3	0.5	2.5	0.5	2.5
E-4 / P-4	0.2	1.0	0.2	1.0
E-5 / P-5	0.9	2.0	0.9	2.0

A. AGENCY REQUIREMENTS

I. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

The subject property limits are shown on Flood Insurance Rate Map (FIRM) 08041C1170G with effective dates of December 7, 2018 that are included in Appendix A. The FIRMs also show that the property to be developed is located outside of the FEMA regulated floodplain.

VI. REFERENCES

1) El Paso County Drainage Criteria Manual Volume 1, dated July 2014, Revised January 2021.
2) El Paso County Drainage Criteria Manual Volume 2, dated July 2014, revised December 2020.
3) El Paso County Engineering Criteria Manual, dated July 2019.
4) National Flood Insurance Hazard layer FIRMette portion of panel 08041C1170G, Federal Emergency Management Agency, Effective Date 12/7/2018.

APPENDIX A

Figure 1: Vicinity Map

Figure 2: Soils Report

Figure 3: FEMA Flood Insurance Rate Map

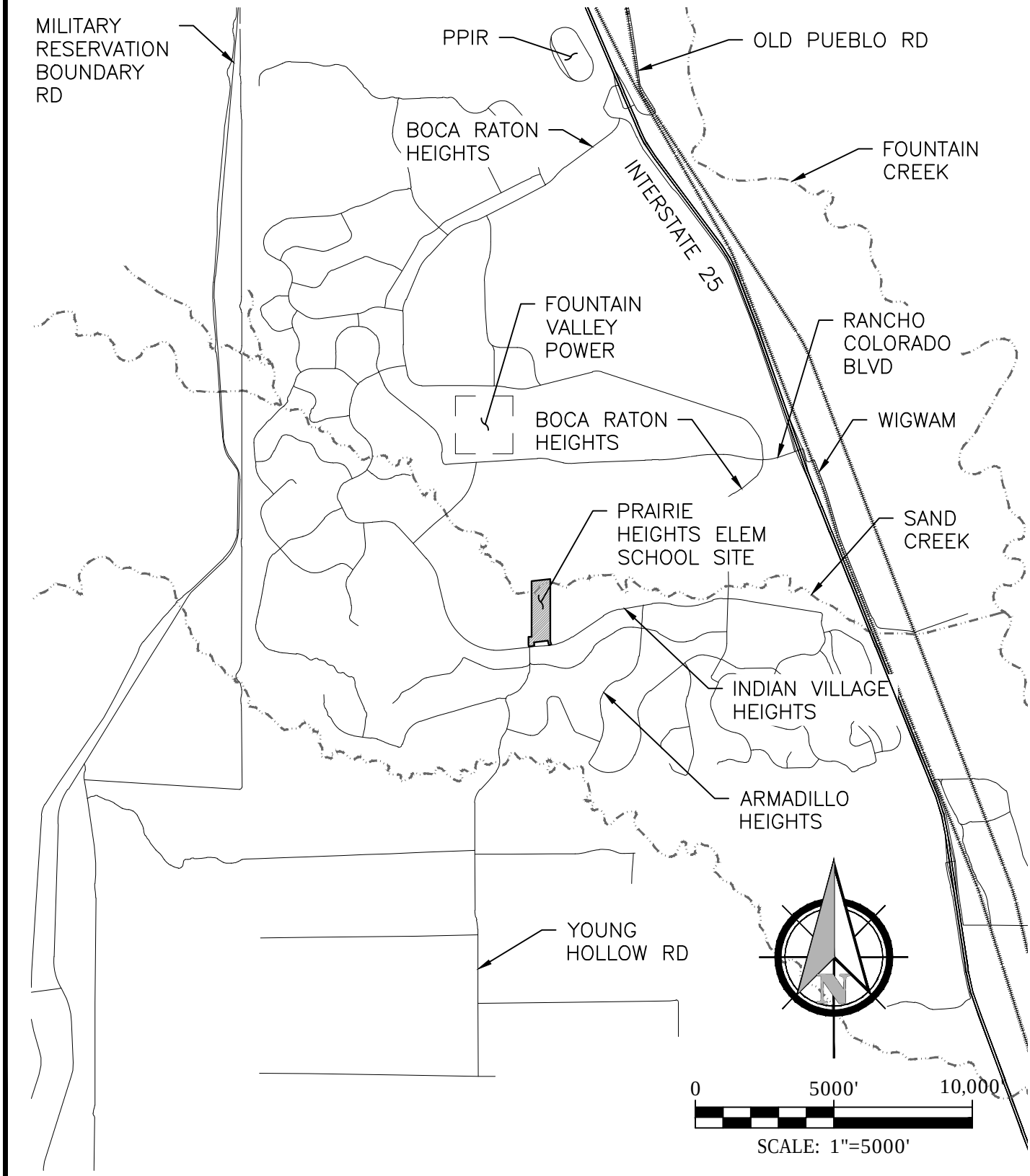


FIGURE 1

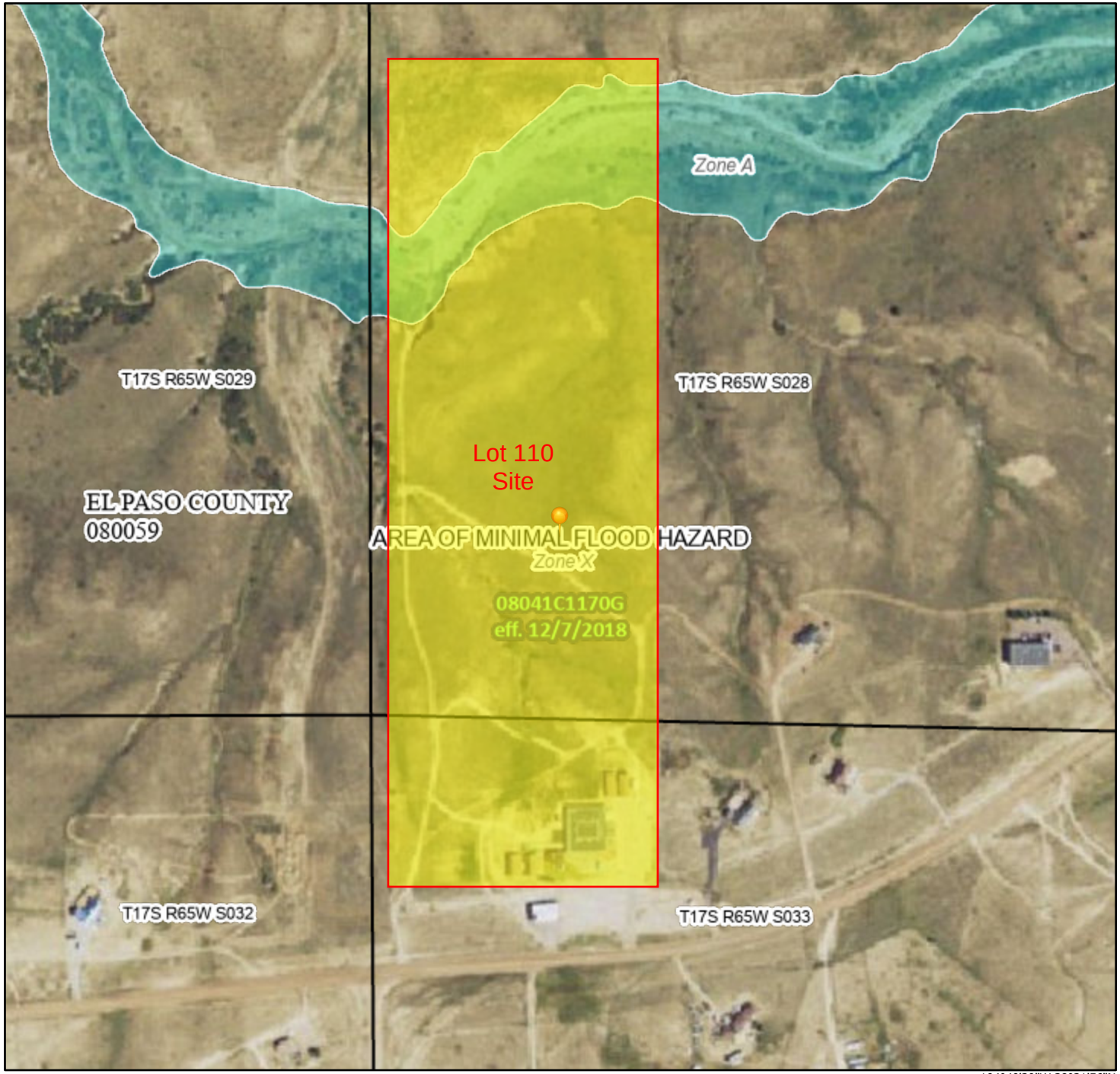
Kiowa
Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

Vicinity Map
Prairie Heights Elementary School
7930 Indian Village Heights, Fountain, CO 80817

National Flood Hazard Layer FIRMette

FEMA

104°41'7"W 38°32'24"N



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

1:6,000

104°40'30"W 38°31'56"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/27/2025 at 3:57 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

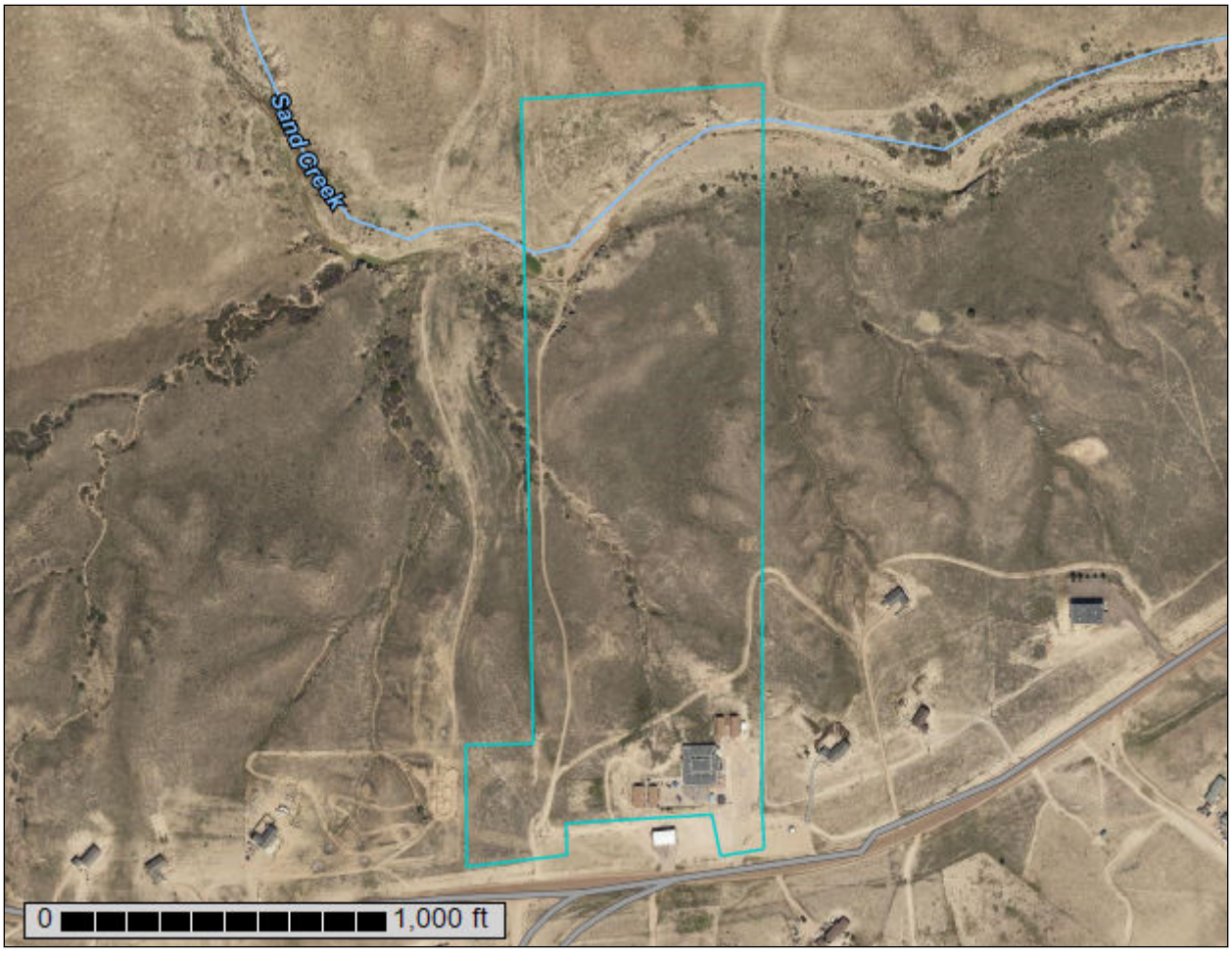
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

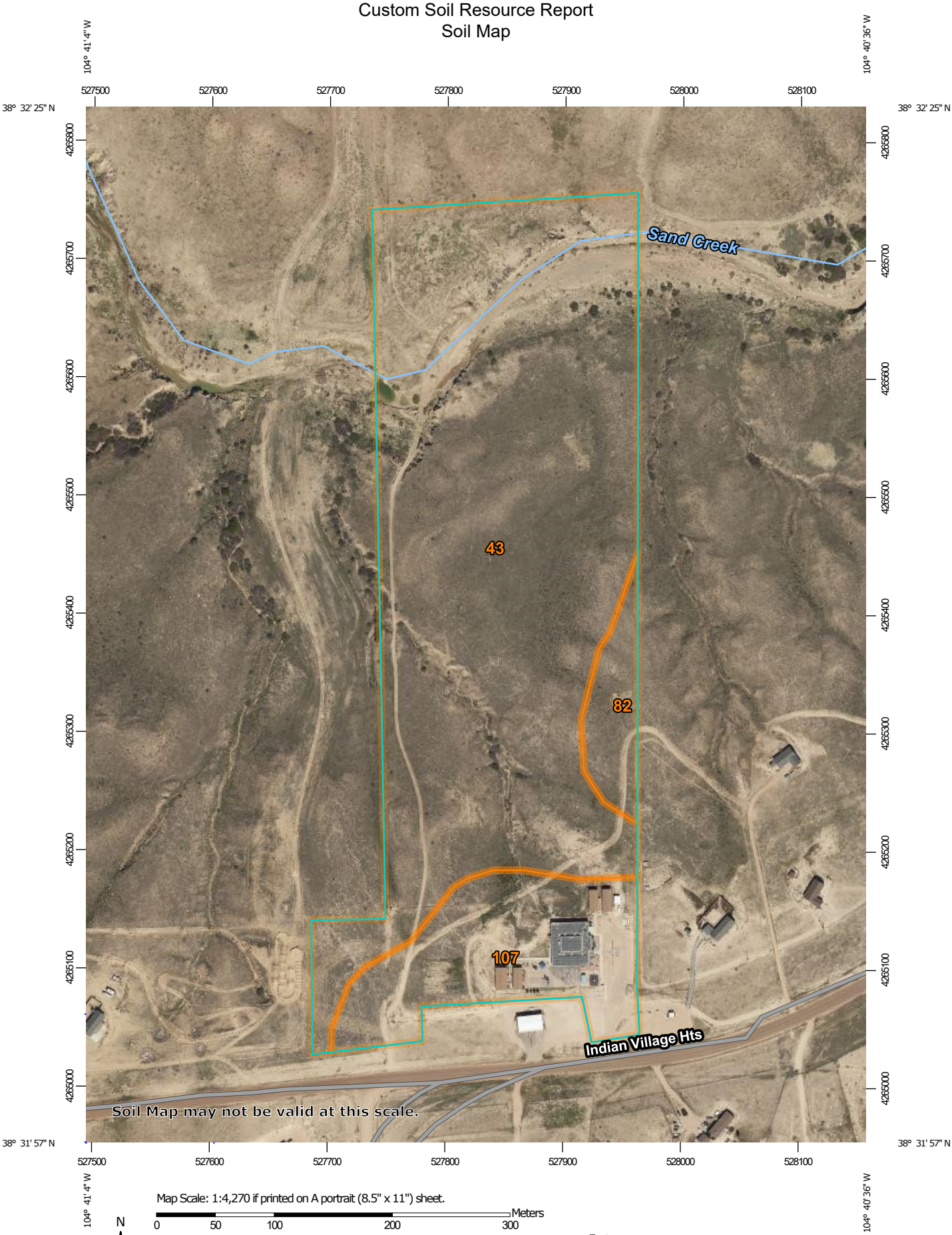
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



January 26, 2025

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,270 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
43	Kimera loam, 0 to 5 percent slopes	31.1	79.5%
82	Schamber-Razor complex, 8 to 50 percent slopes	1.7	4.3%
107	Wilid silt loam, 0 to 3 percent slopes	6.3	16.1%
Totals for Area of Interest		**39.1**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

43—Kimera loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2t51v
Elevation: 3,700 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days

Map Unit Composition

Kimera and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kimera

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Old alluvium and/or eolian deposits

Typical profile

A - 0 to 6 inches: loam
Bw - 6 to 16 inches: loam
Bk1 - 16 to 28 inches: clay loam
Bk2 - 28 to 38 inches: loam
Bk3 - 38 to 79 inches: loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.21 to 0.71 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 supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R069XY006CO - Loamy Plains
Forage suitability group: Loamy (G069XW017CO)
Other vegetative classification: Loamy (G069XW017CO), Loamy Plains #6 (069XY006CO_2)

Hydric soil rating: No

Minor Components

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
Other vegetative classification: Loamy (G069XW017CO), Loamy Plains #6 (069XY006CO_2)
Hydric soil rating: No

Oterodry

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: R069XY026CO - Sandy Plains
Hydric soil rating: No

Fort

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains
Other vegetative classification: Loamy (G069XW017CO), Loamy Plains #6 (069XY006CO_2)
Hydric soil rating: No

Travessilla

Percent of map unit: 5 percent
Landform: Scarps
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R069XY053CO - Sandstone Breaks
Other vegetative classification: Needs Field Review (G069XW050CO), Sandstone Breaks #53 (069XY053CO_2)
Hydric soil rating: No

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 supply, 0 to 60 inches: 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
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 supply, 0 to 60 inches: 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
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

107—Wilid silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2qnmq
Elevation: 4,000 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 125 to 175 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Wilid

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess and/or eolian deposits

Typical profile

A - 0 to 6 inches: silt loam
Bt - 6 to 10 inches: silty clay loam
Btk - 10 to 30 inches: silty clay loam
Bk1 - 30 to 44 inches: silty clay loam
Bk2 - 44 to 79 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.5 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: R069XY006CO - Loamy Plains
Forage suitability group: Loamy (G069XW017CO)
Other vegetative classification: Loamy (G069XW017CO), Loamy Plains #6 (069XY006CO_2)
Hydric soil rating: No

Minor Components

Minnequa

Percent of map unit: 5 percent
Landform: Ridges, pediments
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Almagre

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains
Other vegetative classification: Loamy Plains #6 (069XY006CO_2), Loamy (G069XW017CO)
Hydric soil rating: No

Manzanola

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains
Other vegetative classification: Clayey (G069XW001CO), Loamy Plains #6 (069XY006CO_2)
Hydric soil rating: No

APPENDIX B
Rational and Hydraulic Calculations

Hanover School District - Prairie Heights Elementary School

Final Drainage Letter

Area Runoff Coefficient Summary - EXISTING

			DEVELOPED			UNDEVELOPED			WEIGHTED	
BASIN	TOTAL AREA		AREA	C_5	C_{100}	AREA	C_5	C_{100}	C_5	C_{100}
	(SF)	(Acres)	(Acres)			(Acres)				
E-1	859,316	19.73	0.00	0.53	0.68	19.73	0.16	0.51	***0.16***	***0.51***
E-2	730,396	16.77	2.20	0.53	0.68	14.57	0.16	0.51	***0.21***	***0.53***
E-3	31,395	0.72	0.00	0.53	0.68	0.72	0.16	0.51	***0.16***	***0.51***
E-4	10,231	0.23	0.00	0.53	0.68	0.23	0.16	0.51	***0.16***	***0.51***
E-5	15,029	0.35	0.35	0.53	0.68	0.00	0.16	0.51	***0.54***	***0.68***
		0.00	0.00	0.53	0.68	0.00	0.16	0.51	***#DIV/0!***	***#DIV/0!***
Total	1,646,367	37.8								

Calculated by: TAC

Date: 1/24/2025

Checked by: TAC

Hanover School District - Prairie Heights Elementary School

Final Drainage Letter

Area Runoff Coefficient Summary - PROPOSED

			DEVELOPED			UNDEVELOPED			WEIGHTED	
BASIN	TOTAL AREA		AREA	C_5	C_{100}	AREA	C_5	C_{100}	C_5	C_{100}
	(SF)	(Acres)	(Acres)			(Acres)				
P-1	859,316	19.73	0.00	0.53	0.68	19.73	0.16	0.51	***0.16***	***0.51***
P-2	730,396	16.77	3.27	0.53	0.68	13.50	0.16	0.51	***0.23***	***0.54***
P-3	31,395	0.72	0.00	0.53	0.68	0.72	0.16	0.51	***0.16***	***0.51***
P-4	10,231	0.23	0.00	0.53	0.68	0.23	0.16	0.51	***0.16***	***0.51***
P-5	15,029	0.35	0.35	0.53	0.68	0.00	0.16	0.51	***0.54***	***0.68***
Total	1646367	37.80								
P-6	5,259	0.12	0.12	0.53	0.68	0.00	0.16	0.51	***0.53***	***0.68***
P-7	20,443	0.47	0.47	0.53	0.68	0.00	0.16	0.51	***0.53***	***0.68***
		0.00	0.00	0.53	0.68	0.00	0.16	0.51	***#DIV/0!***	***#DIV/0!***

Calculated by: TAC
Date: 1/24/2025
Checked by: TAC

Hanover School District - Prairie Heights Elementary School

Final Drainage Letter

Area Drainage Summary - EXISTING

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW					T_t	CA		INTENSITY		TOTAL FLOW	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Grass/ Paved	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	CA_5	CA_{100}	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
		* For Calcs See Runoff Summary																	
E-1	19.73	0.16	0.51	0.16	75	4.0	8.8	Grass Grass	560 1300	2.0% 6.0%	1.3 1.4	7.1 15.2	31.0	3.16	10.06	2.4	4.0	**8**	**40**
E-2	16.77	0.21	0.53	0.16	50	2.0	7.9	Grass Grass	150 100	2.0% 6.0%	1.3 1.4	1.9 1.2	10.9	3.50	8.93	3.9	6.8	**14**	**61**
E-3	0.72	0.16	0.51	0.16	50	2.0	7.9	Grass	250	2.0%	1.3	3.2 0.0	11.0	0.12	0.37	3.9	6.8	**0.5**	**2.5**
E-4	0.23	0.16	0.51	0.16	25	1.0	5.6	Grass	45	2.0%	1.3	0.6 0.0	6.1	0.04	0.12	4.7	8.5	**0.2**	**1.0**
E-5	0.35	0.54	0.68	0.16	15	0.5	4.6	Paved	125	2.0%	1.4	1.4 0.0	6.0	0.18	0.24	4.8	8.5	**0.9**	**2.0**

Calculated by: TAC
Date: 1/24/2025
Checked by: TAC

Hanover School District - Prairie Heights Elementary School

Final Drainage Letter

Area Drainage Summary - PROPOSED

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW					T_t	CA		INTENSITY		TOTAL FLOW	
BASIN	AREA TOTAL (Acres)	C_5 * For Calcs See Runoff Summary	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Grass/ Paved	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	CA_5	CA_{100}	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
P-1	19.73	0.16	0.51	0.16	75	4.0	8.8	Grass Grass	560 1300	2.0% 6.0%	1.3 1.4	7.1 15.2	31.0	3.16	10.06	2.4	4.0	**8**	**40**
P-2	16.77	0.23	0.54	0.16	50	2.0	7.9	Grass Grass	150 100	2.0% 6.0%	1.3 1.4	1.9 1.2	10.9	3.89	9.11	3.9	6.8	**15**	**62**
P-3	0.72	0.16	0.51	0.16	50	2.0	7.9	Grass	250	2.0%	1.3	3.2 0.0	11.0	0.12	0.37	3.9	6.8	**0.5**	**2.5**
P-4	0.23	0.16	0.51	0.16	25	1.0	5.6	Grass	45	2.0%	1.3	0.6 0.0	6.1	0.04	0.12	4.7	8.5	**0.2**	**1.0**
P-5	0.35	0.54	0.68	0.16	15	0.5	4.6	Paved	125	2.0%	1.4	1.4 0.0	6.0	0.18	0.24	4.8	8.5	**0.9**	**2.0**
Total	37.80																		
P-6	0.12	0.53	0.68	0	10	0.5	3.8	Paved	55	0.8%	1.4	0.7 0.0	5.0 MIN 5 USED	0.06	0.08	5.0	9.1	**0.3**	**0.7**
P-7	0.47	0.53	0.68	0	10	0.5	3.8	Paved Grass	50 200	1.0% 1.0%	1.4 1.3	0.6 2.6	7.0	0.25	0.32	4.6	8.1	**1.1**	**2.6**

Calculated by: TAC
Date: 1/24/2025
Checked by: TAC

Hanover School District - Prairie Heights Elementary School

Final Drainage Letter

Surface Routing Summary

Design Points	*Contributing Basins & Design Points*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*STREET / CHANNEL FLOW*				*T_t*	*INTENSITY*		*FLOW*	
					Length (ft)	*Slope (%)*	*Velocity (fps)*	*T_t (min)*	*TOTAL (min)*	*I_5*	*I_{100}*	*Q_5*	*Q_{100}*
P7	**P6**	0.06	0.08	5.0	230	1.0%	2.0	1.9	6.9				
	P7	0.25	0.32	7.0					7.0				
		0.31	0.40						7.0	4.6	8.1	***1.4***	***3.3***

Calculated by: TAC
Date: 1/24/2025
Checked by: TAC

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

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

3.2 Time of Concentration

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

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

APPENDIX C
Drainage Conditions Maps

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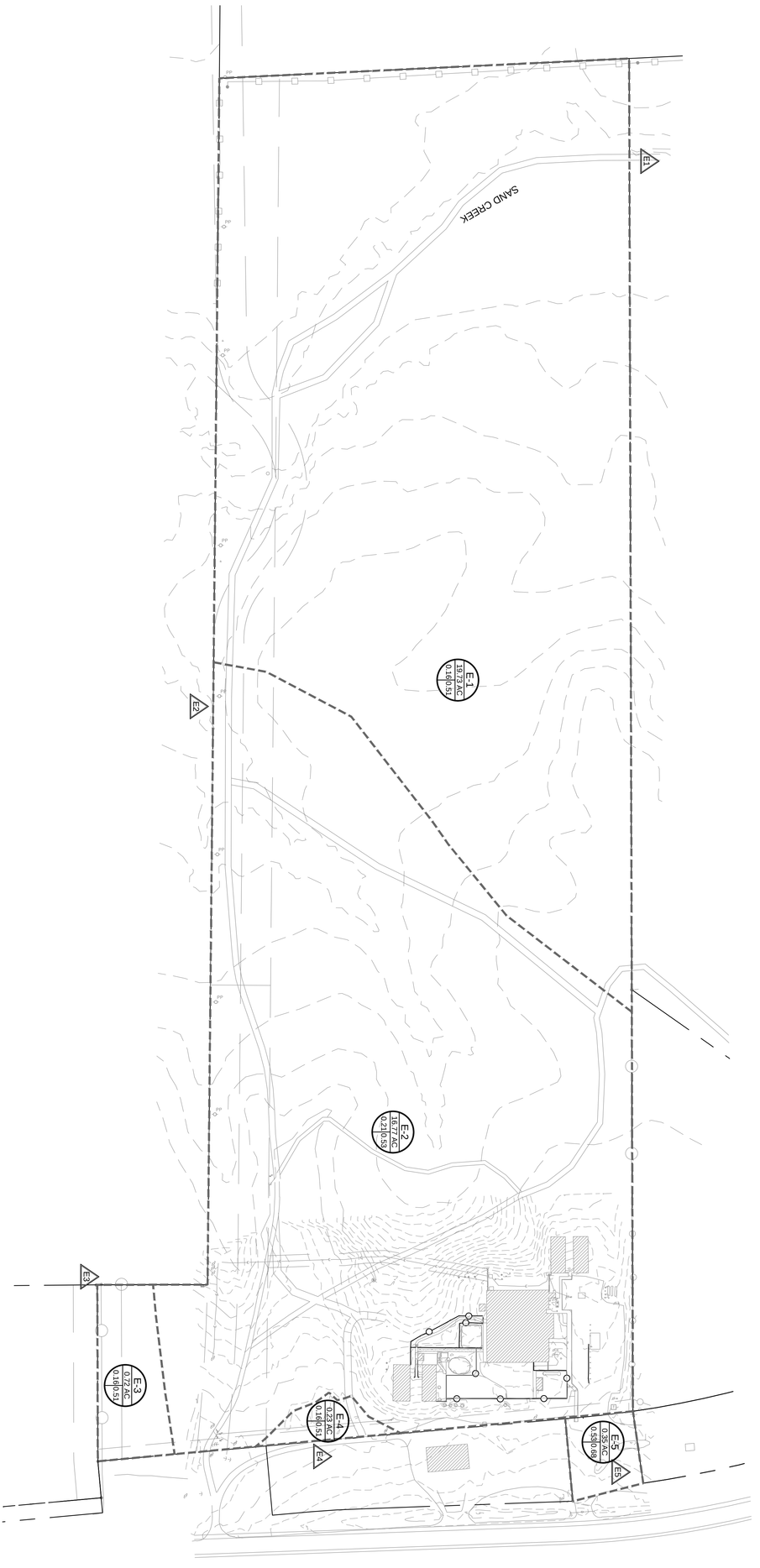

DRAINAGE REPORT LEGEND

- E1 — DRAINAGE BASIN DESIGNATION
- 2.67AC — DRAINAGE BASIN ACRES
- C5: 0.31 — C5 RUNOFF
- C100: 0.50 — C100 RUNOFF
- DIRECTIONAL FLOW ARROW
- DRAINAGE BASIN BOUNDARY
- 1 — DESIGN POINT
- TIME OF CONCENTRATION PATH
- (S10) — HYDRAULIC STRUCTURE IDENTIFIER
- S10 — STORM SEWER IDENTIFIER
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM DRAINAGE CURB INLET
- EXISTING CONTOURS
- PROPOSED CONTOURS
- PROPERTY BOUNDARY
- LIMIT OF CONSTRUCTION

NOTES:
1. ALL ELEVATIONS ARE FLOW LINE UNLESS OTHERWISE NOTED.
2. ADD 4100 TO SPOT ELEVATIONS.
3.

0 100' 200'
SCALE: 1"=100'

EXISTING DRAINAGE STUDY
PRAIRIE HEIGHTS ELEMENTARY SCHOOL
EXISTING DRAINAGE MAP
FOUNTAIN, COLORADO

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

Project No.:	24047
Date:	1/26/25
Design:	TAC
Drawn:	JDC
Check:	-
Revisions:	

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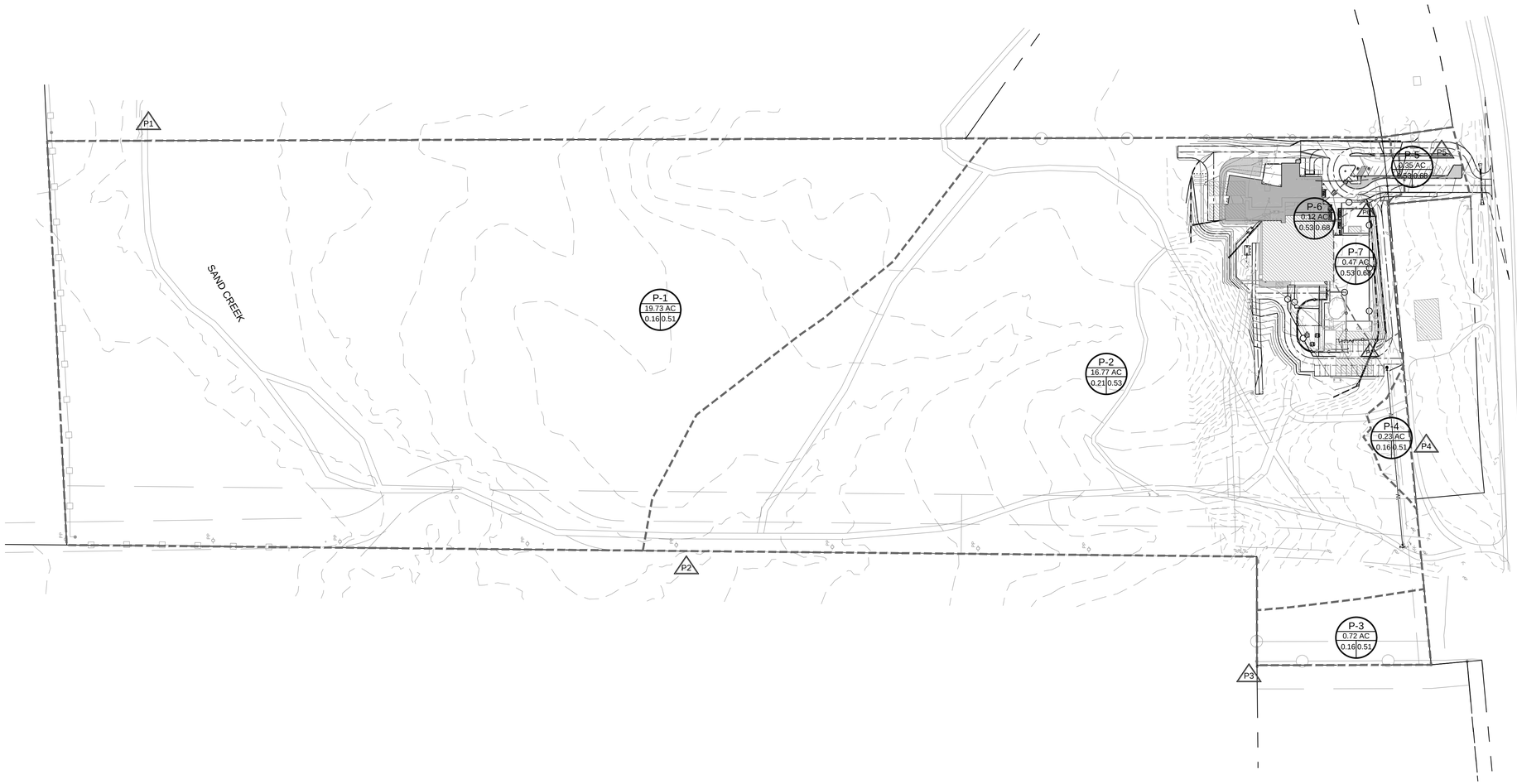

DRAINAGE REPORT LEGEND

E1 — DRAINAGE BASIN DESIGNATION
2.67AC — DRAINAGE BASIN ACRES
C5 RUNOFF 0.31 | 0.50 C100 RUNOFF

- DIRECTIONAL FLOW ARROW
- DRAINAGE BASIN BOUNDARY
- 1 — DESIGN POINT
- TIME OF CONCENTRATION PATH
- 10 — HYDRAULIC STRUCTURE IDENTIFIER
- S10 — STORM SEWER IDENTIFIER
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM DRAINAGE CURB INLET
- EXISTING CONTOURS
- PROPOSED CONTOURS
- PROPERTY BOUNDARY
- LIMIT OF CONSTRUCTION

NOTES:

1. ALL ELEVATIONS ARE FLOW LINE UNLESS OTHERWISE INDICATED.
2. ADD 4100 TO SPOT ELEVATIONS.
3.

0 100' 200'
SCALE: 1"=100'

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

PROPOSED DRAINAGE STUDY
PRAIRIE HEIGHTS ELEMENTARY SCHOOL
PROPOSED DRAINAGE MAP
FOUNTAIN, COLORADO

Project No.:	24047
Date:	1/26/25
Design:	TAC
Drawn:	JDC
Check:	-
Revisions:	

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DM2
OF _ SHEETS

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