



Drainage Report

15435 East Chaparral Loop, Peyton, CO 80831

PREPARED FOR: Mike Cartmell

PREPARED BY: WaterVation, PLLC

DATE: September 24th, 2021

Please add PCD File
No. VR-225



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Purpose

The purpose of this drainage report is to evaluate existing and proposed drainage characteristics for the proposed subdivision of 15435 East Chaparral Loop, Peyton, CO 80831 (Project). This report was prepared on September 24th, 2021.

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 city/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.

Name: _____

Seal: _____

Developer’s Statement

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

Business Name:

By: _____

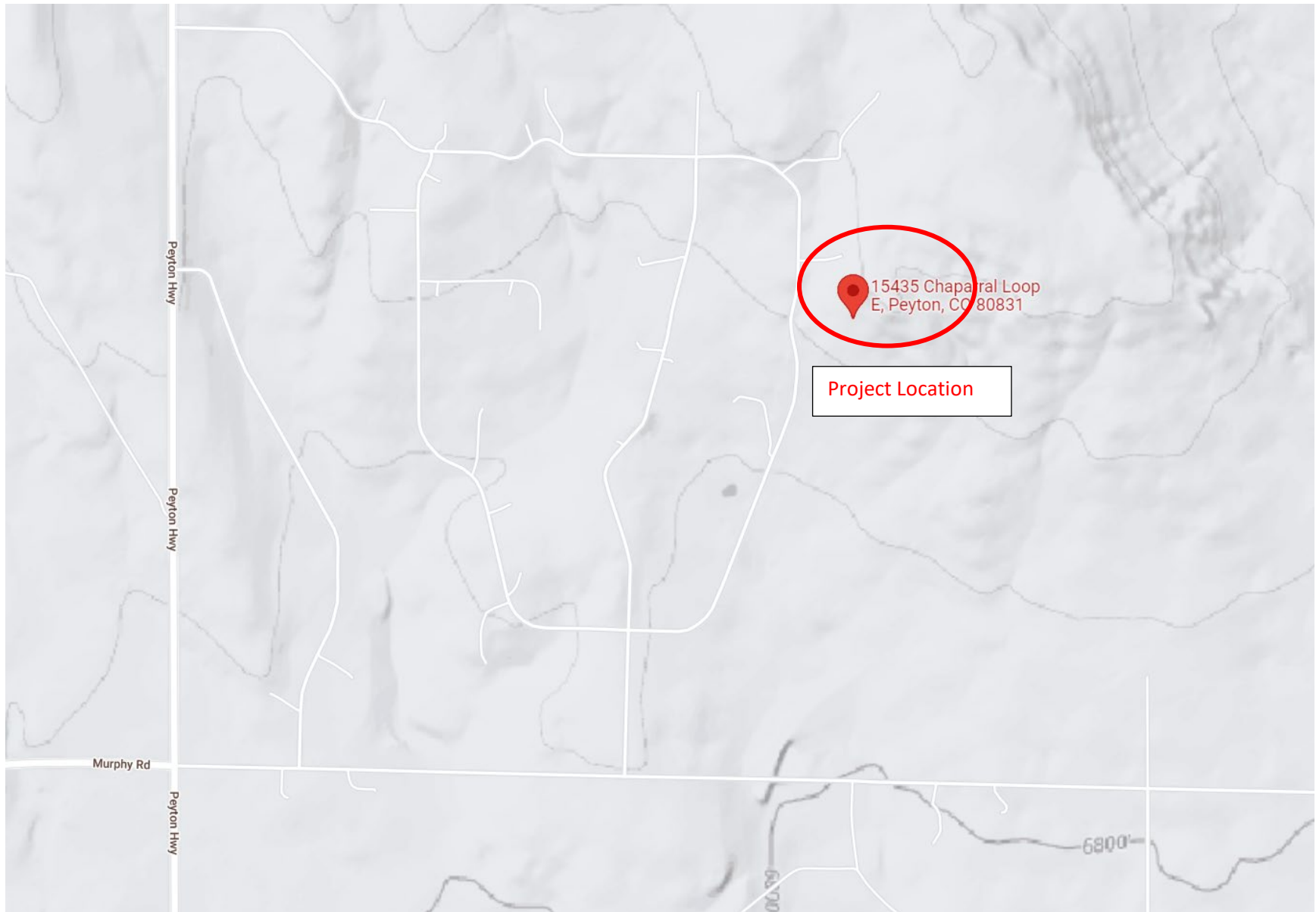
Title: _____

Address: _____

Property Description

This Project is located approximately 0.75 miles to the northwest of the intersection of Murphy Road and Peyton Highway (Figure 1). The Project area is comprised of one 17.82-acre lot and is proposed to be subdivided into three lots.

Figure 1. Site Map



Discuss what the suitable outfall is for this development. Where does runoff go when it exits site?

Please review DCM Vol 1. 4.4 for final drainage report contents. Revise report to include missing sections. Provide narratives for subbasins and design points in existing and proposed conditions. Also, discuss whether water quality and detention are required for the development.

Existing Drainage Characteristics

The existing lot slopes to the south and southwest at slopes ranging from 0.01 ft/ft to 0.015 ft/ft. The Project area was delineated into size drainage basins and two different design points. Existing impervious area was delineated using aerial imagery flown in July 2021.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was referenced to identify hydrologic soil groups within the Project area. The Project area is comprised of Hydrologic Soil Group (HSG) A and HSG B soils. However, HSG B soils were assumed to be the most representative of existing conditions since most of the existing Project area has either been developed or the soils have been modified (compacted) through the process of development.

Hydrologic soil groups are based on estimates of runoff potential. HSG A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. HSG B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Soil maps for the Project area are provided in Appendix A.

Peak flow rates were calculated using the Rational Method with precipitation data from NOAA Atlas 14, Volume 8, Version 2. Runoff coefficients were calculated as a function of impervious area storm frequency using impervious area. A summary of estimated peak flows for existing conditions is provided in Table 1.

Table 1. Peak Flows for Existing Conditions

EXISTING SUBBASIN CHARACTERISTICS				EXISTING PEAK FLO			
SUBBASIN	AREA (AC)	NRCS HYDROLOGIC SOIL GROUP	PERCENT IMPERVIOUS	2-YR	25-YR		
A	0.60	B	0.00%	0.00	0.69		
B	3.10	B	0.72%	0.01	2.78		
C	5.20	B	1.42%	0.06	5.17		
D	6.70	B	0.47%	0.02	6.35		14.5
E	3.50	B	0.27%	0.01	3.95		9.04
F	1.70	B	0.00%	0	1.79		4.11

Revise calculations to use EPC's figure 6-5 in City of Colorado Springs DCM Vol. 1 for storm intensities.

Proposed Drainage Characteristics

Proposed development conditions are not known at this time.

Are drainage fees going to be due for this replat? Discuss in a narrative.

Please provide a conclusion summarizing what is being proposed and include potential impacts and mitigation if applicable.

Please provide a narrative describing whether there are any floodplains on the site. Provide the firm panel number and attach a printout of it to the appendix.

Provide a list of references used to make report.

Please provide a conclusion summarizing what is being proposed and include potential impacts and mitigation if applicable.

Put calculations under the appendix.

Update storm intensities.

Hydrologic Calculations

A summary of the hydrologic calculations for this Project are provided in Table 3 and Table 4. Rational calculations were performed using the UD-RATIONAL 2.00 software.

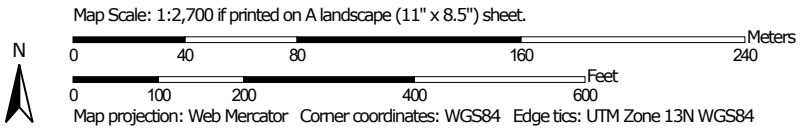
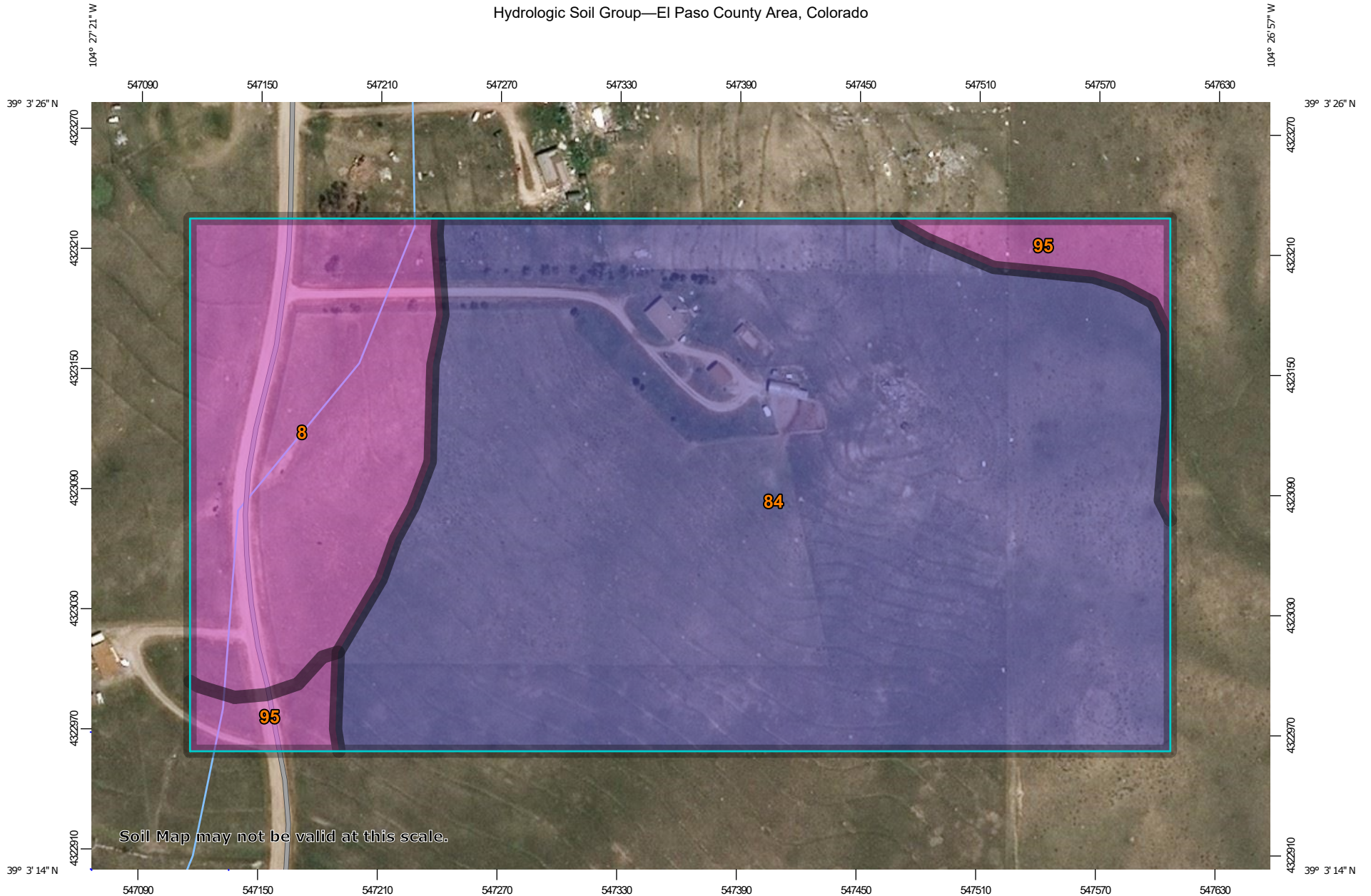
Table 2. Hydrologic Calculations for Existing Conditions

Calculation of Peak Runoff using Rational Method																																																											
Designer: L. Babbitt /ersion 2.00 released May 201			$t_1 = \frac{0.395(1.1 - C_c)\sqrt{L_1}}{S_1^{0.33}}$ $t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$										Computed $t_c = t_1 + t_t$			$t_{\text{minimum}} = 5$ (urban) $t_{\text{minimum}} = 10$ (non-urban)		Selected $t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$										1-hour rainfall depth, P1 (in) = <table border="1"><tr><td>2-yr</td><td>5-yr</td><td>10-yr</td><td>25-yr</td><td>50-yr</td><td>100-yr</td><td>500-yr</td></tr><tr><td>0.94</td><td>1.23</td><td>1.48</td><td>1.86</td><td>2.17</td><td>2.50</td><td>3.35</td></tr></table>						2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	0.94	1.23	1.48	1.86	2.17	2.50	3.35	Fall Intensity Equation Coefficients = <table border="1"><tr><td>a</td><td>b</td><td>c</td></tr><tr><td>28.50</td><td>10.00</td><td>0.788</td></tr></table>		a	b	c	28.50	10.00	0.788	$I(\text{in/hr}) = \frac{a + P_1}{(b + t_c)^c}$		$Q(\text{cfs}) = CIA$	
2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr																																																					
0.94	1.23	1.48	1.86	2.17	2.50	3.35																																																					
a	b	c																																																									
28.50	10.00	0.788																																																									
Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time					Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)																												
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_1 (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_1 (ft/ft)	Overland Flow Time t_1 (min)	Channelized Flow Length L_1 (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr																				
A (EX)	0.80	B	0.00	0.00	0.00	0.06	0.25	0.33	0.43	0.54	84.00	7026.00	7015.00	0.131	7.79	518.00	7015.00	6974.00	0.079	7	1.97	4.38	12.17	29.41	12.17	2.35	3.07	3.69	4.64	5.41	6.24	8.36	0.00	0.00	0.13	0.69	1.07	1.59	2.69																				
B (EX)	3.10	B	0.72	0.00	0.00	0.06	0.25	0.33	0.43	0.54	117.00	7051.00	7035.00	0.137	9.03	1333.00	7035.00	6948.00	0.067	7	1.81	12.28	21.31	35.33	21.31	1.79	2.34	2.81	3.54	4.13	4.76	6.37	0.01	0.03	0.55	2.78	4.25	6.33	10.64																				
C (EX)	5.20	B	1.42	0.01	0.01	0.07	0.26	0.34	0.43	0.54	142.00	7051.00	7035.00	0.113	10.56	960.00	7035.00	6946.00	0.093	7	2.13	7.51	18.07	31.47	18.07	1.95	2.55	3.07	3.86	4.50	5.18	6.94	0.06	0.11	1.09	5.17	7.88	11.86	19.54																				
D (EX)	6.70	B	0.47	0.00	0.00	0.06	0.25	0.33	0.43	0.54	111.00	7051.00	7040.00	0.099	9.79	1115.00	7040.00	6948.00	0.084	7	2.03	9.14	18.94	32.98	18.94	1.90	2.49	3.00	3.76	4.39	5.06	6.78	0.02	0.04	1.22	6.35	9.73	14.51	24.42																				
E (EX)	3.50	B	0.27	0.00	0.00	0.06	0.25	0.33	0.43	0.54	114.00	7043.00	7030.00	0.114	9.49	481.00	7030.00	6981.00	0.102	7	2.23	3.59	13.07	28.73	13.07	2.28	2.97	3.58	4.50	5.25	6.04	8.10	0.01	0.01	0.74	3.95	6.05	9.04	15.22																				
F (EX)	1.70	B	0.00	0.00	0.00	0.06	0.25	0.33	0.43	0.54	234.00	7043.00	7023.00	0.085	14.97	1.00	7023.00	7022.50	0.500	7	4.95	0.00	14.97	26.00	14.97	2.14	2.80	3.36	4.23	4.93	5.68	7.61	0.00	0.00	0.33	1.79	2.75	4.11	6.94																				
DP 1 (EX)	16.60	B	0.20	0.00	0.00	0.06	0.25	0.33	0.43	0.54	142.00	7051.00	7035.00	0.113	10.83	960.00	7035.00	6948.00	0.093	7	2.13	7.51	18.14	31.79	18.14	1.95	2.54	3.06	3.85	4.49	5.17	6.93	0.02	0.04	2.80	15.02	23.05	34.44	58.02																				
DP 2 (EX)	3.50	B	0.27	0.00	0.00	0.06	0.25	0.33	0.43	0.54	114.00	7043.00	7030.00	0.114	9.49	481.00	7030.00	6981.00	0.102	7	2.23	3.59	13.07	28.73	13.07	2.28	2.97	3.58	4.50	5.25	6.04	8.10	0.01	0.01	0.74	3.95	6.05	9.04	15.22																				
DP 3 (EX)	1.70	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	234.00	7043.00	7023.00	0.085	14.97	1.00	7023.00	7022.50	0.500	7	4.95	0.00	14.97	26.00	14.97	2.14	2.80	3.36	4.23	4.93	5.68	7.61	0.00	0.00	0.33	1.79	2.75	4.11	6.94																				

Drainage Plan


Appendix A

Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points


-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	6.4	19.6%
84	Stapleton sandy loam, 8 to 15 percent slopes	B	24.6	75.7%
95	Truckton loamy sand, 1 to 9 percent slopes	A	1.5	4.7%
Totals for Area of Interest			32.5	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 39.0557°, Longitude: -104.4528°
Elevation: 7001.93 ft**



* source: ESRI Maps
 ** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.243 (0.191-0.311)	0.296 (0.232-0.378)	0.386 (0.302-0.495)	0.466 (0.363-0.600)	0.583 (0.441-0.781)	0.678 (0.501-0.918)	0.778 (0.556-1.08)	0.884 (0.607-1.25)	1.03 (0.682-1.50)	1.15 (0.739-1.68)
10-min	0.356 (0.279-0.455)	0.433 (0.340-0.554)	0.566 (0.442-0.725)	0.683 (0.531-0.879)	0.853 (0.646-1.14)	0.993 (0.734-1.34)	1.14 (0.814-1.58)	1.29 (0.889-1.83)	1.51 (0.999-2.19)	1.68 (1.08-2.47)
15-min	0.434 (0.341-0.555)	0.528 (0.414-0.675)	0.690 (0.540-0.885)	0.833 (0.648-1.07)	1.04 (0.788-1.39)	1.21 (0.895-1.64)	1.39 (0.993-1.92)	1.58 (1.08-2.24)	1.84 (1.22-2.67)	2.05 (1.32-3.01)
30-min	0.616 (0.484-0.787)	0.748 (0.587-0.957)	0.976 (0.763-1.25)	1.18 (0.914-1.51)	1.46 (1.11-1.96)	1.70 (1.26-2.30)	1.95 (1.39-2.69)	2.21 (1.52-3.13)	2.57 (1.70-3.73)	2.85 (1.84-4.18)
60-min	0.779 (0.612-0.996)	0.941 (0.739-1.20)	1.23 (0.959-1.57)	1.48 (1.15-1.91)	1.86 (1.41-2.50)	2.17 (1.61-2.94)	2.50 (1.79-3.46)	2.85 (1.96-4.05)	3.35 (2.22-4.87)	3.75 (2.41-5.49)
2-hr	0.942 (0.745-1.19)	1.14 (0.897-1.44)	1.48 (1.16-1.88)	1.79 (1.40-2.28)	2.25 (1.72-3.01)	2.64 (1.97-3.56)	3.05 (2.20-4.21)	3.50 (2.43-4.94)	4.13 (2.76-5.97)	4.64 (3.01-6.76)
3-hr	1.03 (0.815-1.29)	1.23 (0.975-1.55)	1.60 (1.26-2.02)	1.94 (1.52-2.46)	2.45 (1.89-3.27)	2.89 (2.17-3.89)	3.36 (2.44-4.62)	3.88 (2.71-5.46)	4.61 (3.10-6.65)	5.21 (3.40-7.56)
6-hr	1.18 (0.944-1.47)	1.40 (1.12-1.75)	1.81 (1.44-2.27)	2.20 (1.74-2.77)	2.79 (2.18-3.71)	3.31 (2.51-4.43)	3.87 (2.84-5.29)	4.49 (3.16-6.28)	5.37 (3.65-7.71)	6.10 (4.01-8.79)
12-hr	1.36 (1.10-1.69)	1.61 (1.29-1.99)	2.06 (1.65-2.56)	2.48 (1.98-3.10)	3.15 (2.47-4.14)	3.72 (2.84-4.93)	4.34 (3.21-5.89)	5.03 (3.58-6.99)	6.02 (4.12-8.58)	6.83 (4.54-9.78)
24-hr	1.58 (1.28-1.94)	1.85 (1.50-2.27)	2.35 (1.90-2.89)	2.81 (2.26-3.48)	3.53 (2.79-4.60)	4.14 (3.19-5.44)	4.81 (3.59-6.47)	5.54 (3.97-7.65)	6.60 (4.56-9.33)	7.46 (5.00-10.6)
2-day	1.84 (1.50-2.23)	2.14 (1.75-2.61)	2.70 (2.20-3.30)	3.22 (2.61-3.94)	4.00 (3.18-5.15)	4.66 (3.61-6.06)	5.37 (4.03-7.15)	6.15 (4.44-8.40)	7.25 (5.05-10.2)	8.15 (5.51-11.5)
3-day	2.00 (1.65-2.42)	2.35 (1.93-2.84)	2.96 (2.42-3.60)	3.52 (2.87-4.29)	4.36 (3.48-5.58)	5.07 (3.94-6.55)	5.83 (4.39-7.71)	6.64 (4.82-9.03)	7.80 (5.46-10.9)	8.74 (5.94-12.3)
4-day	2.15 (1.77-2.59)	2.52 (2.07-3.03)	3.17 (2.60-3.83)	3.76 (3.07-4.56)	4.64 (3.71-5.91)	5.38 (4.20-6.92)	6.17 (4.66-8.13)	7.02 (5.11-9.51)	8.22 (5.77-11.4)	9.19 (6.28-12.9)

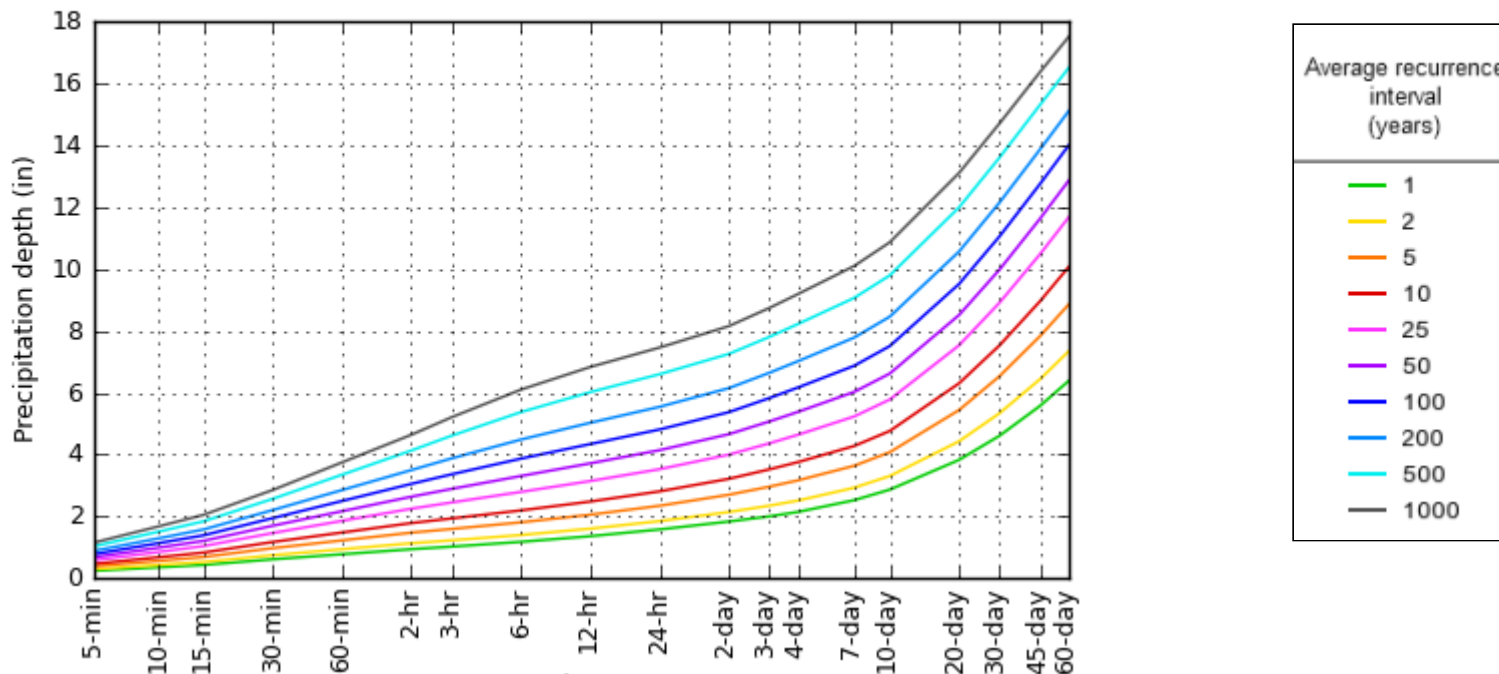
7-day	2.53 (2.09-3.02)	2.93 (2.42-3.50)	3.64 (3.00-4.37)	4.28 (3.51-5.16)	5.23 (4.20-6.60)	6.02 (4.73-7.69)	6.87 (5.23-8.99)	7.78 (5.70-10.5)	9.06 (6.41-12.5)	10.1 (6.94-14.1)
10-day	2.87 (2.38-3.41)	3.31 (2.75-3.94)	4.08 (3.38-4.87)	4.76 (3.93-5.71)	5.78 (4.66-7.24)	6.62 (5.21-8.40)	7.51 (5.73-9.77)	8.46 (6.22-11.3)	9.79 (6.95-13.5)	10.9 (7.51-15.1)
20-day	3.83 (3.21-4.51)	4.43 (3.71-5.23)	5.44 (4.54-6.44)	6.30 (5.24-7.49)	7.53 (6.09-9.29)	8.51 (6.74-10.6)	9.51 (7.31-12.2)	10.6 (7.82-14.0)	12.0 (8.57-16.3)	13.1 (9.14-18.1)
30-day	4.61 (3.88-5.40)	5.34 (4.49-6.26)	6.53 (5.48-7.69)	7.53 (6.29-8.90)	8.91 (7.22-10.9)	9.98 (7.92-12.4)	11.1 (8.51-14.1)	12.1 (9.02-15.9)	13.6 (9.76-18.4)	14.7 (10.3-20.2)
45-day	5.58 (4.72-6.50)	6.44 (5.44-7.51)	7.83 (6.60-9.16)	8.96 (7.51-10.5)	10.5 (8.50-12.7)	11.6 (9.25-14.3)	12.7 (9.85-16.1)	13.9 (10.3-18.1)	15.3 (11.0-20.5)	16.4 (11.6-22.4)
60-day	6.39 (5.42-7.42)	7.34 (6.22-8.53)	8.86 (7.49-10.3)	10.1 (8.47-11.8)	11.7 (9.49-14.0)	12.9 (10.3-15.7)	14.0 (10.8-17.6)	15.1 (11.3-19.6)	16.5 (11.9-22.1)	17.5 (12.4-23.9)

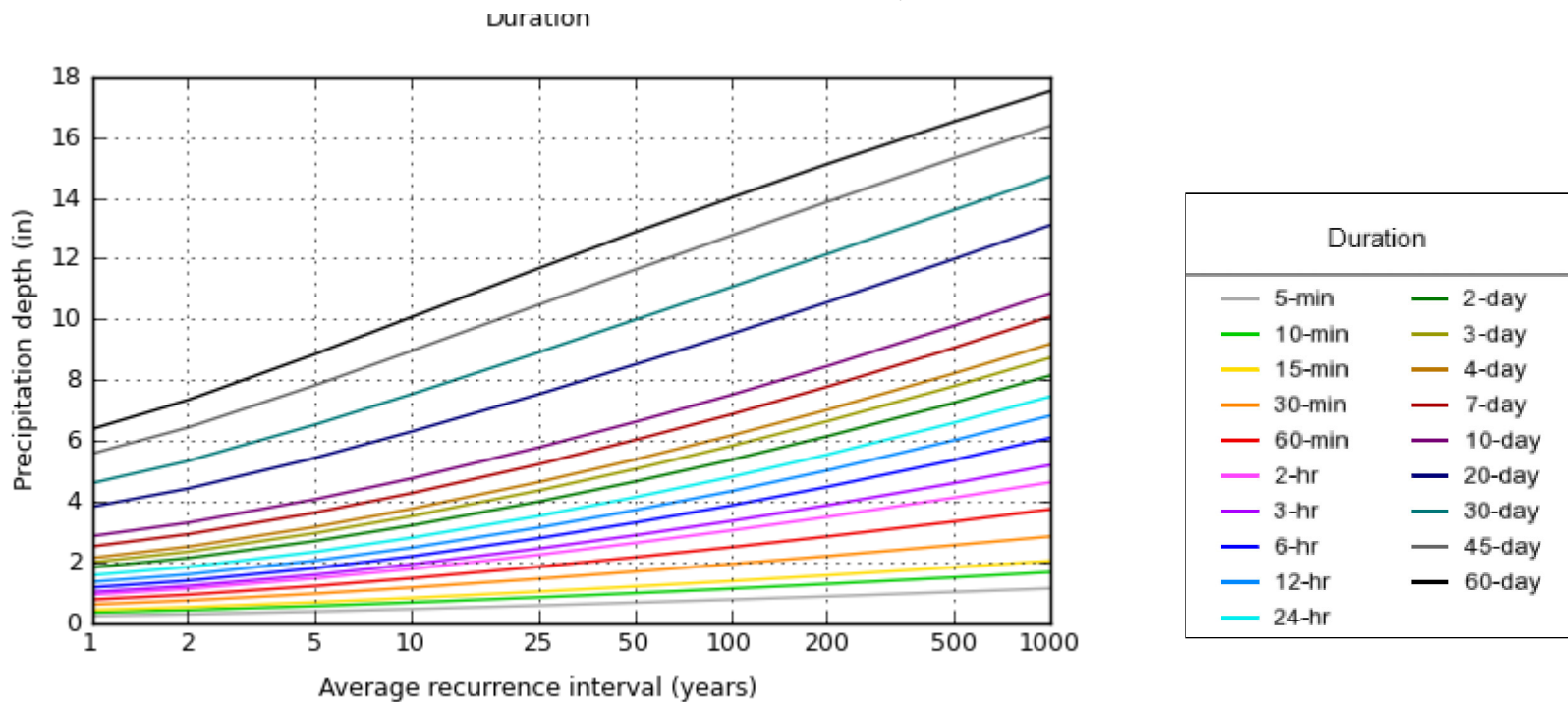
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.0557°, Longitude: -104.4528°





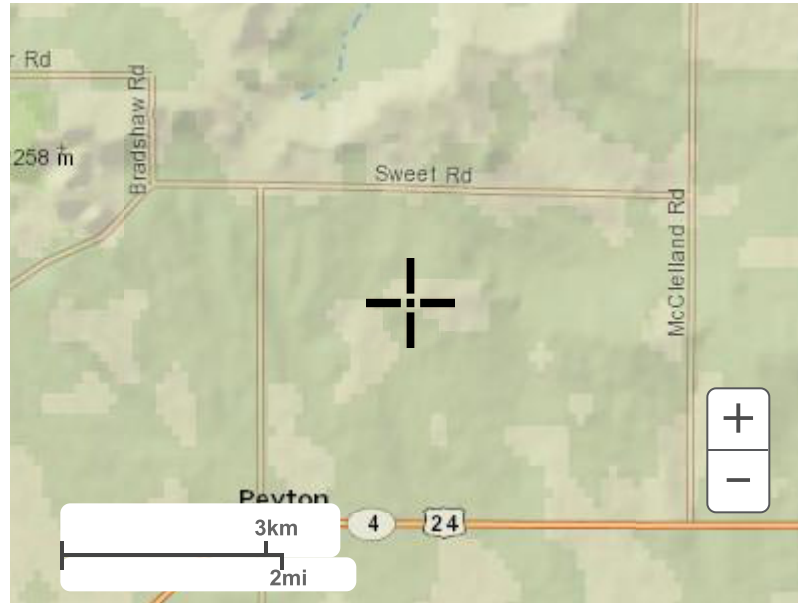
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Thu Sep 16 21:31:32 2021

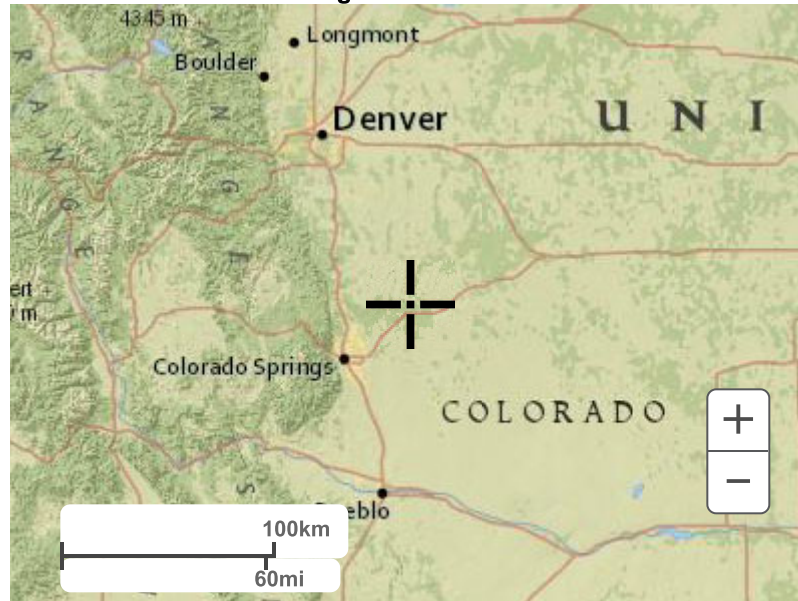
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Maps & aerials

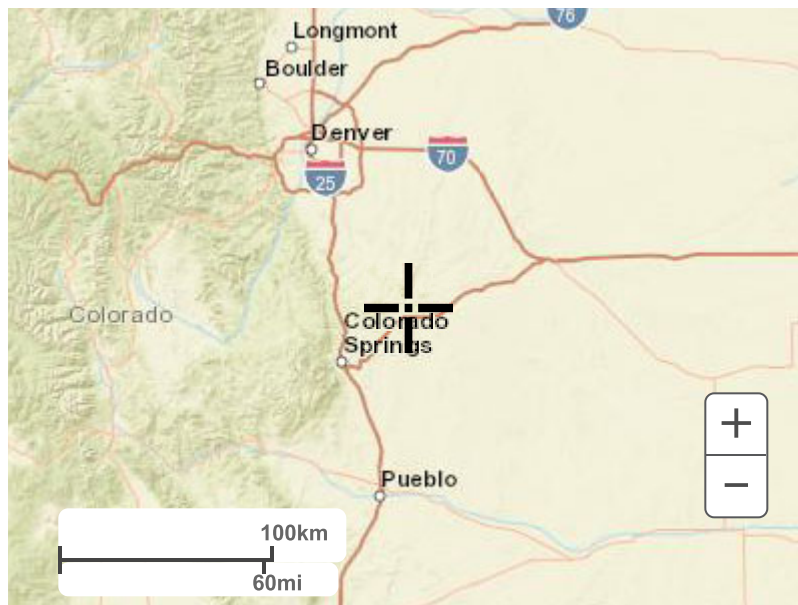
Small scale terrain



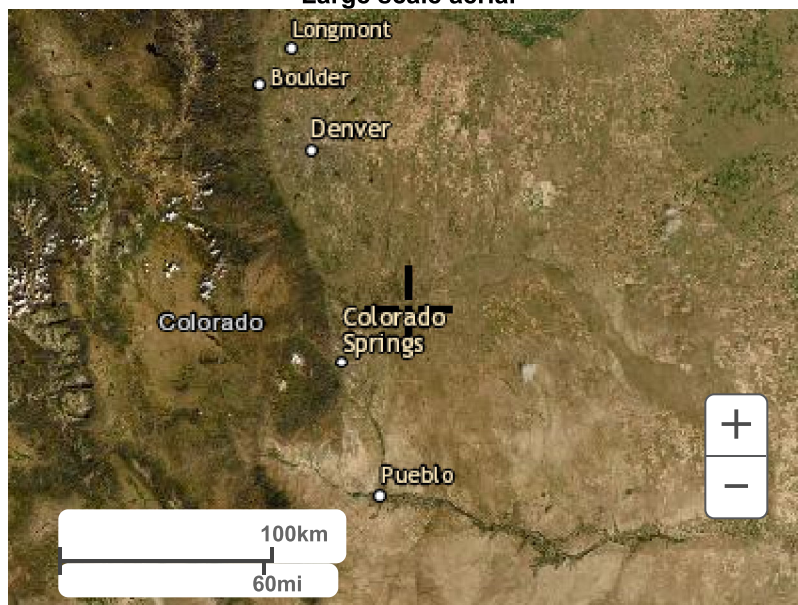
Large scale terrain



Large scale map



Large scale aerial



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