

**DRAINAGE LETTER
18920 EAST SMITH ROAD
AURORA, CO 80011**

**OWNER/DEVELOPER:
Jaime Perez
3085 CARSON ST
AURORA, CO 80011**

**ENGINEER:
Brynn Boyd, P.E.
Radian Engineering, LLC
2438 Jack Creek Road
Grand Junction, Co 81505**

June 2019

"I hereby affirm that this report and plan for the Drainage design of 18920 East Smith Road Aurora, CO 80011 was prepared by me, or under my direct supervision, for the owners thereof, in accordance with the provisions of City of Aurora Stormwater Management Manual and the Urban Drainage and Flood Control District Criteria Manual, and approved variances and exceptions thereto. I understand that City of Aurora does not and will not assume liability for drainage facilities designed by others."



SIGNATURE: _____
Registered Professional Engineer
State of Colorado No. 44855

"Jaime Perez hereby certifies that the drainage facilities for 18920 East Smith Road Aurora, CO 80011 shall be constructed according to the design presented in this report. I understand that the City of Aurora does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the City of Aurora reviews drainage plans pursuant to Colorado Revised Statutes Title 30, Article 28; but cannot, on behalf of 1890 East Smith Road Aurora, CO 80011, guarantee that final drainage design review will absolve Jaime Perez and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat, Final Development Plan, and/or Subdivision Development Plan does not imply approval of my engineer's drainage design."

Name of Developer

Authorized Signature

EXISTING CONDITIONS

General Introduction:

The proposed development at 18920 East Smith Road lies east of Tower Road and south of I-70 in Aurora Colorado. The site is in Adams County in the part of Section 34, Township 3 South, Range 66 West of the 6th PM. The site is 1.01 acres, which will be developed into Parking lot/Storage area. Smith Road runs from east to west. A private driveway will be constructed to access the proposed site from Smith Road. See Figure 1 for location.

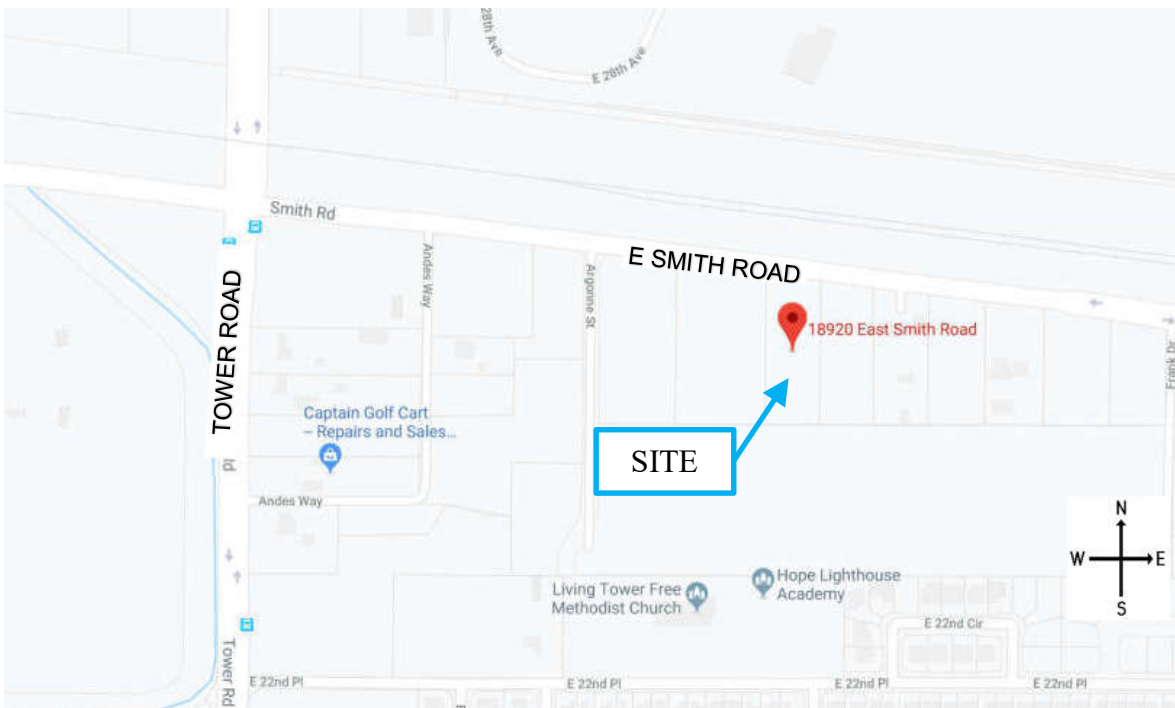


Figure 1: Location Map

There are no existing drainage ways or facilities on the site. The site historically has sheet flow to the south to an open area. The site will be accessed from Smith Road via a drive way. The property is steep and slopes range from 3% to 6%.

Geology and Soils:

The National Cooperative Soil Survey, Web Soil Survey, from the Natural Resources Conservation Service (NRCS) shows that the site is underlain by two main soil types: Ascalon-Planter association (At), Truckton loamy sand, 3 to 9 percent slopes(TtD). At has an SCS soil group type of 'B' and TtD has an SCS soil group type of 'A'. Truckton is the predominate soil type with around 85% of the site. See Appendix A for soils information pertinent to the subject property.

Floodplain Information:

The site has no floodplain designations.

Development Information:

The site is 1.01 acre, which will be developed into Parking lot for light industrial construction equipment with Storage sheds. See Site Plan in Appendix B. The property is zoned M-1 Light Industrial and is within the boundaries of the City of Aurora.

The parking area will consist of a city approved surface material and will have a 6 foot chain link privacy fence around the perimeter of the site and detention area. Access to the site will be via an entrance gravel driveway along East Smith Road. There are no known drainage studies in existence that pertain to this site.

Existing Storm water Facilities:

There are no existing drainage or irrigation facilities on site. Currently the property drains from north to south.

Pre-developed Site Runoff:

The total area of the site is 1.01 acres. The longest travel path for pre-developed drainage is from the northeastern boundary. The path is 350 linear feet at an average slope of 3.6%. Using short grass pasture – overland flow, the velocity is 1.4 feet per second. See Appendix C. This gives a travel time of 350 feet / 1.4 feet per second = 4 minutes. Considering an initial time to runoff of 10 minutes, the time of concentration is estimated at 14 minutes. Using the modified rational formula to estimate pre-developed runoff the peak discharge is calculated as follows:

Intensity of rainfall (from NOAA Maps: Appendix D) based on Time of Concentration of 14 minutes:

5 year: 2.77 in/hr

100 year: 6.09 in/hr

The parking area may be paved at any future time, so an imperviousness of 0.95 has been used for the runoff coefficient.

Peak flow using Modified Rational Formula:

Peak Flow Q (cfs) = runoff coefficient 'c' x rainfall intensity 'I' (inches/hour) x area (acres)

5 year: $0.95 \times 2.77 \times 1.01 = 2.66$ cfs

100 year: $0.95 \times 6.09 \times 1.01 = 5.84$ cfs

Post-developed Site Runoff:

According to City of Aurora storm water calculation standards, flows for the 5 year and 100 year storms have been provided in a table in this section. The City of Aurora recommends the Rational Method for calculation of the basin flows, and the one hour rainfall values for the intensity duration curves.

The total area of the site is 1.01 acres. The longest travel path for post-developed drainage is from the northeastern boundary. The path is 350 linear feet and at an average slope of 3.6%. Using the Velocities for a paved area (sheet flow), the velocity for these conditions is 3.8 feet per second. See Appendix C. This gives a travel time of $350 \text{ feet} / 3.8 \text{ feet per second} = 2$ minutes. Considering an initial time to runoff of 10 minutes, the time of concentration is estimated at 12 minutes. Using the modified rational formula to estimate pre-developed runoff the peak discharge is calculated as follows:

Intensity of rainfall (from NOAA Maps: Appendix D) based on Time of Concentration of 12 minutes:

5 year: 3.02 in/hr

100 year: 6.62 in/hr

The parking area may be paved at any future time, so an imperviousness of 0.95 has been used for the runoff coefficient.

Peak flow using Modified Rational Formula:

Peak Flow Q (cfs) = runoff coefficient 'c' x rainfall intensity 'I' (inches/hour) x area (acres)

5 year: $0.95 \times 3.02 \times 1.01 = 2.90$ cfs

100 year: $0.95 \times 6.62 \times 1.01 = 6.35$ cfs

Proposed Drainage Basin Areas:

Using a simple triangular hydrograph estimation with the full allowed discharge assumed at 30 minutes, the storage required to detain peak flows in excess of pre-developed conditions is 2977 CF (see Appendix E). This storage volume is provided by the detention volume shown on the site and grading plan. The pond will drain to the southwest as it currently does, at the historic rate, by an orifice plate placed over the 18" pipe installed in the outlet side of the pond.

Any offsite drainage will be handled with swales. Swales will keep all onsite drainage on the property as well.

Additional Permits:

No wetlands or floodplains have been identified on the property.

The following permits will be required: Public Improvement Permit, Street Cut and Right-of-Way Use Permit and a GESC permit.

Illicit Discharges:

Potential pollutant sources include spillages from stored vehicles.

Operations and Maintenance:

Potential conveyance problems with the proposed drainage pattern include shallow grades in the parking area, which can lead to potholes and other low spots within the parking lot. Solutions include maintenance of potential problem areas and low spots within the parking area. Maintenance will also need to be performed on the detention pond and outlet pipe to keep sediment and other debris from plugging the outlet pipe. Maintenance will need to be performed on the detention pond grass as necessary to ensure the grasses are covering the entire detention area and the grasses are well established.

Maintenance and access for maintenance will be within the parking area.

Clientele renting spaces shall be made aware of the potential for groundwater contamination in the event of a vehicle fluids spill. Clientele shall be responsible for cleanup of spillages and/or contacting the appropriate authorities in the event of a major spill.

References:

The following agencies' specifications or websites were utilized in calculating and concluding the parameters of the full spectrum facility:

- City of Aurora
- NOAA
- National Resources Conservation Services (NRCS)
- Federal Emergency Management Agency

APPENDIX A


SOILS INFORMATION

Hydrologic Soil Group—Adams County Area, Parts of Adams and Denver Counties, 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 1:20,000.

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: Adams County Area, Parts of Adams and Denver Counties, Colorado
 Survey Area Data: Version 15, Sep 13, 2018

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

Date(s) aerial images were photographed: Jun 10, 2014—Aug 21, 2014

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
At	Ascalon-Platner association	B	0.3	15.0%
TtD	Truckton loamy sand, 3 to 9 percent slopes	A	1.5	85.0%
Totals for Area of Interest			1.7	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

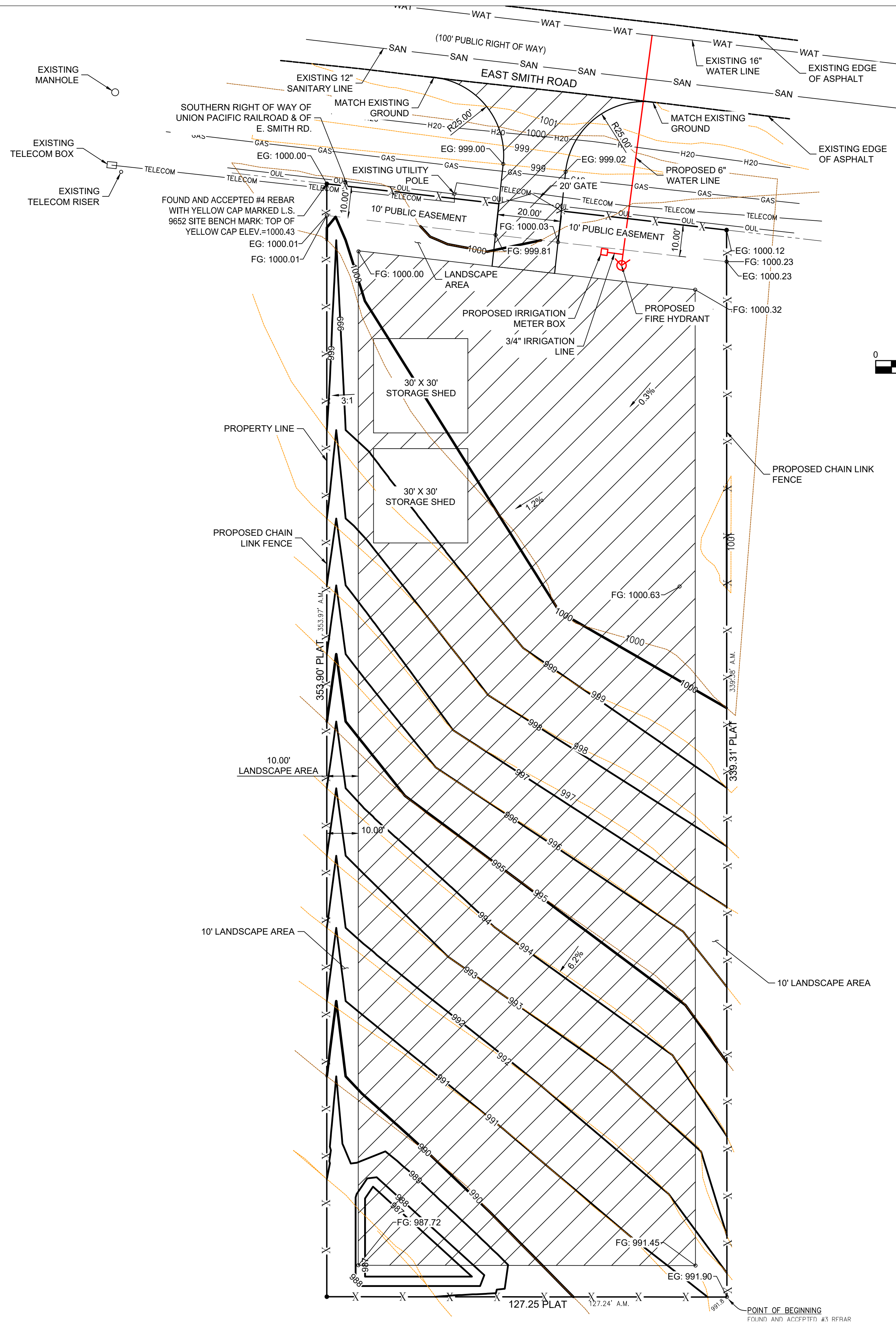
Tie-break Rule: Higher

APPENDIX B

SITE PLAN



Know what's below.
Call before you dig.



GRADING LEGEND

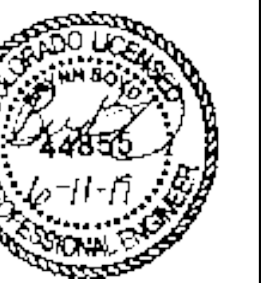
	PROPOSED CHAIN LINK FENCE
	RECYCLED ASPHALT
	EXISTING CONTOUR
	PROPOSED CONTOUR
	EXISTING GROUND ELEVATION
	FINISH GRADE ELEVATION

UTILITY LEGEND

	PROPOSED FIRE HYDRANT
	PROPOSED IRRIGATION BOX
	PROPOSED WATER LINE
	EXISTING SANITARY LINE
	EXISTING WATER LINE
	EXISTING TELECOMMUNICATIONS LINE
	EXISTING OVERHEAD UTILITY LINE
	EXISTING GAS LINE

NOT FOR CONSTRUCTION

2438 JACK CREEK RD
GRAND JCT, CO 81505
720-224-1095
BRYNN BOYD, P.E.



#	REVISION	DESCRIPTION	DATE
A		ISSUED FOR REVIEW	02/27/19

18920 E. SMITH ROAD
AURORA, CO 80011
GRADING & UTILITY PLAN

PROJ.#	19109
DESIGNED BY:	BMB
DRAWN BY :	JVA
DATE:	02/25/19
DRAWING NUMBER	C-3
	3 OF 5 DWGS

APPENDIX C

SCS VELOCITY METHOD DETERMINATION

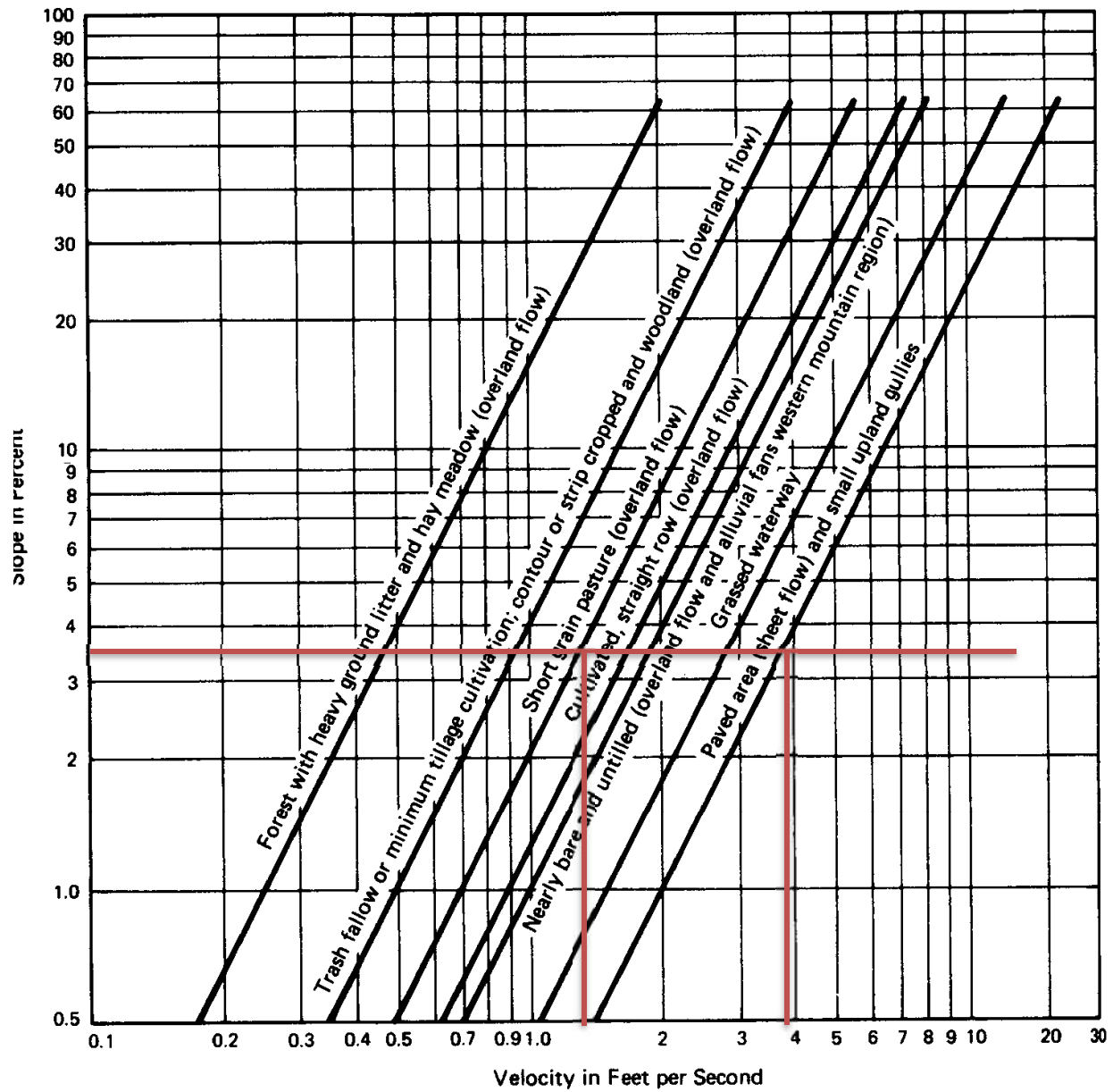


FIGURE 3-19 Velocities for upland method of estimating t_c .

APPENDIX D

NOAA MAPS



NOAA Atlas 14, Volume 8, Version 2
Location name: Aurora, Colorado, USA*
Latitude: 39.7528°, Longitude: -104.7672°
Elevation: 5458.45 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](#)

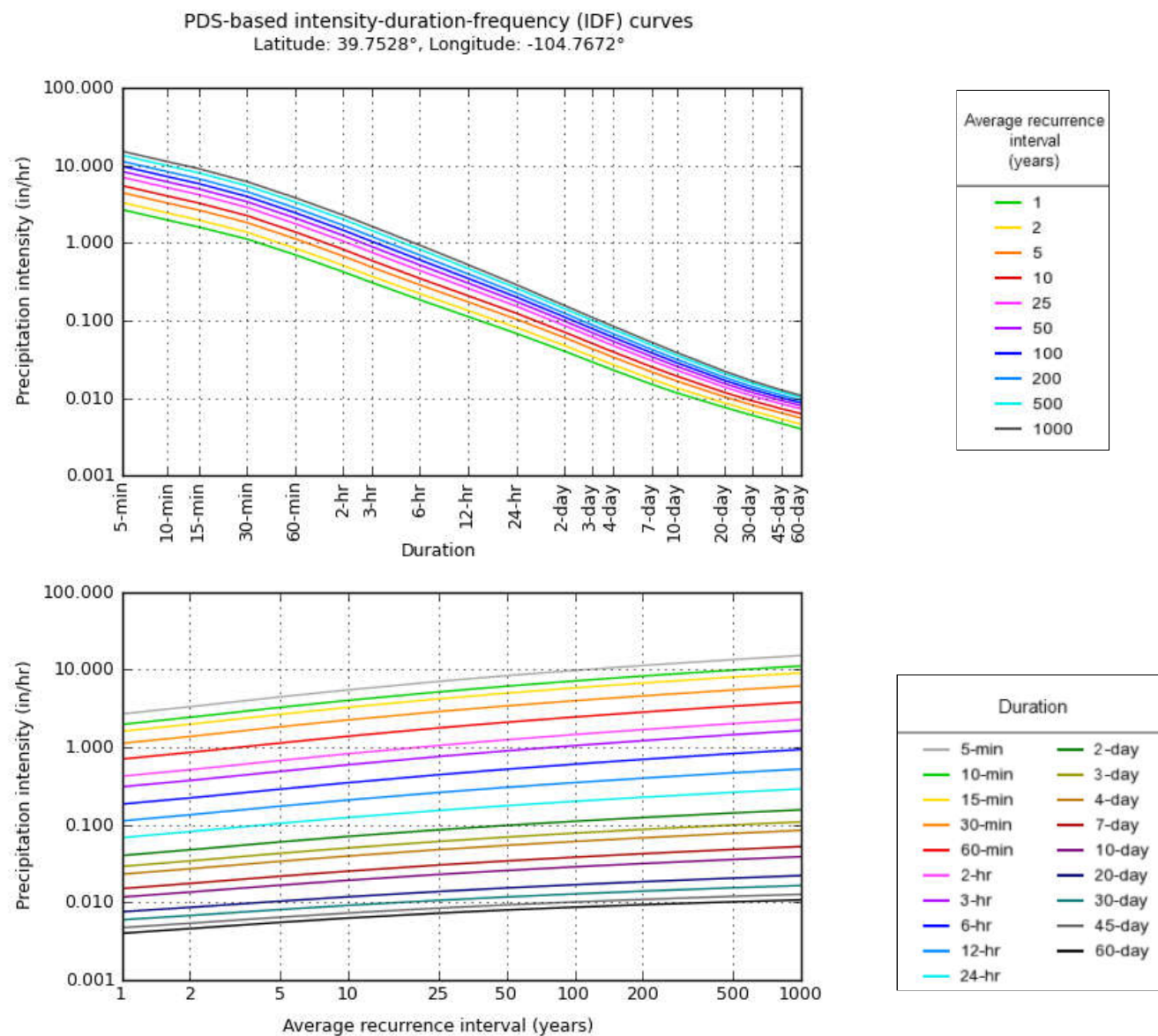
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.69 (2.16-3.37)	3.32 (2.66-4.16)	4.45 (3.55-5.60)	5.48 (4.36-6.94)	7.04 (5.46-9.36)	8.36 (6.30-11.2)	9.77 (7.10-13.4)	11.3 (7.87-15.9)	13.5 (9.01-19.4)	15.2 (9.88-22.1)
10-min	1.97 (1.58-2.47)	2.43 (1.95-3.05)	3.26 (2.60-4.10)	4.02 (3.19-5.08)	5.16 (4.00-6.85)	6.12 (4.61-8.20)	7.15 (5.20-9.80)	8.27 (5.77-11.6)	9.86 (6.60-14.2)	11.1 (7.24-16.2)
15-min	1.60 (1.28-2.01)	1.98 (1.58-2.48)	2.65 (2.12-3.34)	3.27 (2.59-4.12)	4.20 (3.25-5.57)	4.98 (3.75-6.67)	5.82 (4.23-7.97)	6.72 (4.69-9.45)	8.02 (5.37-11.5)	9.06 (5.88-13.1)
30-min	1.12 (0.898-1.41)	1.38 (1.10-1.73)	1.83 (1.46-2.31)	2.25 (1.78-2.84)	2.88 (2.23-3.82)	3.41 (2.57-4.56)	3.98 (2.89-5.45)	4.59 (3.20-6.45)	5.46 (3.66-7.87)	6.17 (4.00-8.94)
60-min	0.704 (0.564-0.882)	0.857 (0.686-1.08)	1.13 (0.904-1.43)	1.39 (1.10-1.75)	1.77 (1.38-2.36)	2.10 (1.58-2.81)	2.45 (1.78-3.36)	2.84 (1.98-3.98)	3.38 (2.26-4.87)	3.82 (2.48-5.54)
2-hr	0.424 (0.342-0.526)	0.512 (0.413-0.638)	0.674 (0.542-0.842)	0.824 (0.658-1.03)	1.05 (0.823-1.39)	1.25 (0.948-1.66)	1.46 (1.07-1.98)	1.69 (1.19-2.35)	2.02 (1.36-2.88)	2.28 (1.49-3.28)
3-hr	0.310 (0.251-0.383)	0.373 (0.301-0.462)	0.488 (0.393-0.606)	0.595 (0.477-0.742)	0.759 (0.596-0.996)	0.898 (0.686-1.19)	1.05 (0.773-1.42)	1.22 (0.858-1.68)	1.45 (0.985-2.06)	1.64 (1.08-2.35)
6-hr	0.185 (0.151-0.227)	0.222 (0.181-0.273)	0.288 (0.234-0.355)	0.349 (0.282-0.432)	0.442 (0.349-0.574)	0.520 (0.400-0.682)	0.605 (0.449-0.810)	0.697 (0.496-0.957)	0.828 (0.567-1.17)	0.935 (0.620-1.32)
12-hr	0.112 (0.092-0.137)	0.135 (0.110-0.164)	0.174 (0.142-0.212)	0.209 (0.170-0.256)	0.261 (0.207-0.334)	0.304 (0.235-0.394)	0.350 (0.261-0.463)	0.399 (0.286-0.541)	0.468 (0.323-0.651)	0.524 (0.350-0.734)
24-hr	0.068 (0.056-0.083)	0.082 (0.067-0.099)	0.104 (0.086-0.127)	0.124 (0.102-0.151)	0.153 (0.122-0.194)	0.176 (0.137-0.226)	0.201 (0.151-0.262)	0.227 (0.163-0.303)	0.262 (0.182-0.360)	0.290 (0.196-0.402)
2-day	0.040 (0.033-0.048)	0.048 (0.040-0.057)	0.060 (0.050-0.072)	0.071 (0.058-0.086)	0.086 (0.069-0.108)	0.098 (0.077-0.124)	0.111 (0.084-0.143)	0.124 (0.090-0.164)	0.142 (0.099-0.193)	0.156 (0.106-0.214)
3-day	0.029 (0.024-0.035)	0.034 (0.029-0.041)	0.043 (0.036-0.051)	0.050 (0.042-0.061)	0.061 (0.049-0.076)	0.069 (0.054-0.087)	0.078 (0.059-0.100)	0.087 (0.064-0.115)	0.100 (0.070-0.134)	0.109 (0.075-0.149)
4-day	0.023 (0.019-0.027)	0.027 (0.023-0.032)	0.034 (0.028-0.040)	0.040 (0.033-0.047)	0.048 (0.038-0.059)	0.054 (0.043-0.068)	0.061 (0.046-0.078)	0.068 (0.050-0.089)	0.078 (0.055-0.104)	0.085 (0.058-0.115)
7-day	0.015 (0.013-0.018)	0.018 (0.015-0.021)	0.022 (0.018-0.026)	0.025 (0.021-0.030)	0.030 (0.025-0.037)	0.034 (0.027-0.043)	0.038 (0.029-0.049)	0.042 (0.031-0.055)	0.048 (0.034-0.064)	0.052 (0.036-0.071)
10-day	0.012 (0.010-0.014)	0.014 (0.011-0.016)	0.017 (0.014-0.020)	0.019 (0.016-0.023)	0.023 (0.019-0.028)	0.026 (0.020-0.032)	0.029 (0.022-0.036)	0.032 (0.023-0.041)	0.036 (0.025-0.047)	0.039 (0.027-0.052)
20-day	0.008 (0.006-0.009)	0.009 (0.007-0.010)	0.010 (0.009-0.012)	0.012 (0.010-0.014)	0.014 (0.011-0.017)	0.015 (0.012-0.019)	0.017 (0.013-0.021)	0.018 (0.014-0.024)	0.021 (0.015-0.027)	0.022 (0.016-0.029)
30-day	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.011 (0.009-0.013)	0.012 (0.009-0.014)	0.013 (0.010-0.016)	0.014 (0.010-0.018)	0.015 (0.011-0.020)	0.017 (0.012-0.022)
45-day	0.005 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.010)	0.009 (0.007-0.011)	0.010 (0.008-0.012)	0.011 (0.008-0.014)	0.012 (0.009-0.015)	0.013 (0.009-0.017)
60-day	0.004 (0.003-0.005)	0.005 (0.004-0.005)	0.006 (0.005-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.009)	0.008 (0.006-0.010)	0.009 (0.007-0.011)	0.009 (0.007-0.012)	0.010 (0.007-0.013)	0.011 (0.008-0.014)

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



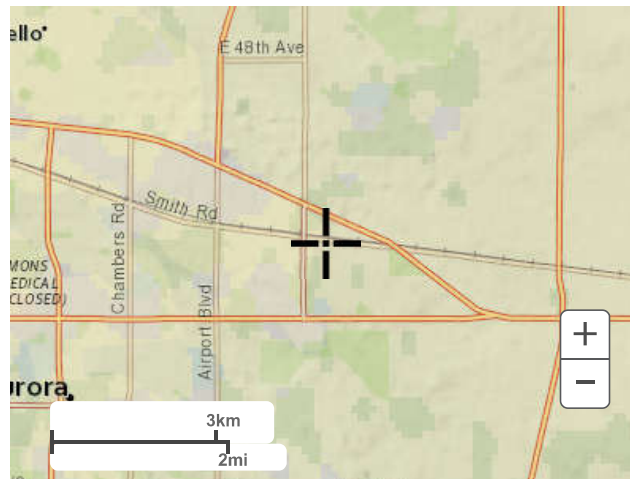
NOAA Atlas 14, Volume 8, Version 2

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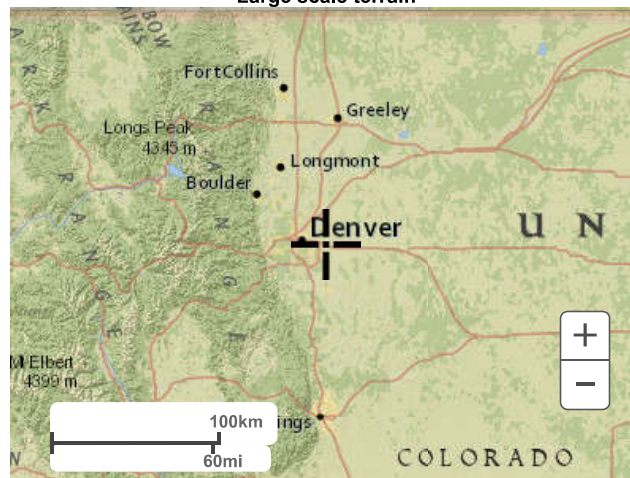
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Maps & aerals

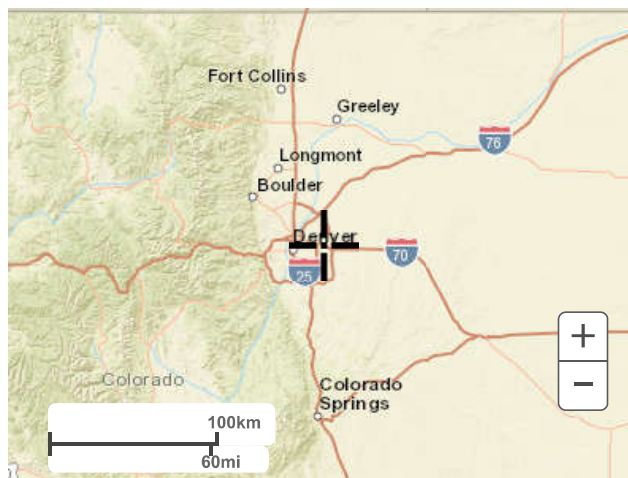
Small scale terrain



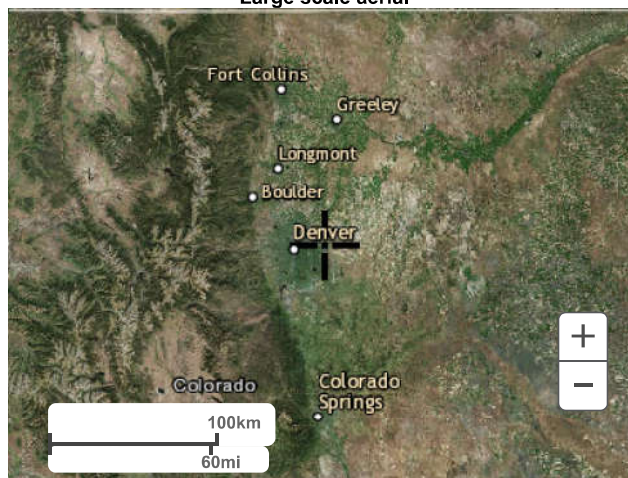
Large scale terrain



Large scale map



Large scale aerial

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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)



NOAA Atlas 14, Volume 8, Version 2
Location name: Aurora, Colorado, USA*
Latitude: 39.7529°, Longitude: -104.7668°
Elevation: 5461.02 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, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

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	0.224 (0.180-0.281)	0.277 (0.222-0.347)	0.371 (0.296-0.467)	0.457 (0.363-0.578)	0.587 (0.455-0.780)	0.697 (0.525-0.933)	0.814 (0.592-1.12)	0.942 (0.656-1.32)	1.12 (0.751-1.62)	1.27 (0.823-1.84)
10-min	0.328 (0.263-0.412)	0.405 (0.325-0.509)	0.544 (0.434-0.684)	0.670 (0.531-0.846)	0.860 (0.666-1.14)	1.02 (0.769-1.37)	1.19 (0.867-1.63)	1.38 (0.961-1.94)	1.64 (1.10-2.37)	1.86 (1.21-2.69)
15-min	0.401 (0.321-0.502)	0.494 (0.396-0.620)	0.663 (0.529-0.834)	0.817 (0.648-1.03)	1.05 (0.813-1.39)	1.24 (0.938-1.67)	1.45 (1.06-1.99)	1.68 (1.17-2.36)	2.00 (1.34-2.89)	2.27 (1.47-3.28)
30-min	0.561 (0.449-0.703)	0.688 (0.551-0.863)	0.917 (0.731-1.15)	1.13 (0.892-1.42)	1.44 (1.12-1.91)	1.70 (1.28-2.28)	1.99 (1.45-2.72)	2.30 (1.60-3.22)	2.73 (1.83-3.93)	3.08 (2.00-4.47)
60-min	0.704 (0.564-0.882)	0.857 (0.686-1.08)	1.13 (0.904-1.43)	1.39 (1.10-1.75)	1.77 (1.38-2.36)	2.10 (1.58-2.81)	2.45 (1.78-3.36)	2.84 (1.98-3.98)	3.38 (2.26-4.87)	3.82 (2.48-5.54)
2-hr	0.847 (0.683-1.05)	1.02 (0.826-1.28)	1.35 (1.08-1.68)	1.65 (1.32-2.07)	2.11 (1.65-2.78)	2.50 (1.90-3.32)	2.92 (2.14-3.97)	3.37 (2.37-4.70)	4.03 (2.72-5.76)	4.56 (2.99-6.55)
3-hr	0.930 (0.753-1.15)	1.12 (0.905-1.39)	1.47 (1.18-1.82)	1.79 (1.43-2.23)	2.28 (1.79-2.99)	2.70 (2.06-3.57)	3.15 (2.32-4.26)	3.65 (2.58-5.06)	4.36 (2.96-6.19)	4.94 (3.25-7.05)
6-hr	1.11 (0.904-1.36)	1.33 (1.08-1.63)	1.73 (1.40-2.13)	2.09 (1.69-2.59)	2.65 (2.09-3.44)	3.12 (2.39-4.08)	3.62 (2.69-4.85)	4.18 (2.97-5.73)	4.96 (3.39-6.98)	5.60 (3.71-7.92)
12-hr	1.35 (1.11-1.65)	1.62 (1.33-1.98)	2.09 (1.71-2.56)	2.52 (2.04-3.09)	3.14 (2.49-4.03)	3.66 (2.83-4.74)	4.22 (3.15-5.58)	4.81 (3.44-6.52)	5.64 (3.89-7.84)	6.31 (4.22-8.84)
24-hr	1.64 (1.36-1.98)	1.96 (1.62-2.37)	2.51 (2.06-3.04)	2.98 (2.44-3.63)	3.68 (2.92-4.64)	4.24 (3.29-5.41)	4.82 (3.62-6.30)	5.44 (3.92-7.28)	6.29 (4.36-8.63)	6.96 (4.70-9.66)
2-day	1.93 (1.61-2.32)	2.29 (1.90-2.75)	2.89 (2.39-3.47)	3.40 (2.80-4.11)	4.14 (3.31-5.17)	4.73 (3.69-5.97)	5.33 (4.03-6.89)	5.96 (4.33-7.89)	6.83 (4.77-9.26)	7.50 (5.10-10.3)
3-day	2.09 (1.75-2.50)	2.47 (2.06-2.95)	3.09 (2.57-3.70)	3.63 (3.00-4.36)	4.39 (3.52-5.45)	5.00 (3.92-6.28)	5.63 (4.27-7.22)	6.28 (4.58-8.26)	7.17 (5.03-9.66)	7.86 (5.37-10.7)
4-day	2.22 (1.86-2.64)	2.60 (2.18-3.10)	3.25 (2.71-3.88)	3.81 (3.16-4.56)	4.59 (3.70-5.68)	5.22 (4.10-6.53)	5.86 (4.46-7.50)	6.53 (4.78-8.56)	7.44 (5.24-9.99)	8.15 (5.59-11.1)
7-day	2.53 (2.13-2.99)	2.95 (2.48-3.49)	3.66 (3.07-4.33)	4.25 (3.55-5.06)	5.09 (4.12-6.25)	5.76 (4.55-7.15)	6.44 (4.93-8.16)	7.14 (5.25-9.27)	8.08 (5.73-10.8)	8.82 (6.10-11.9)
10-day	2.81 (2.38-3.31)	3.26 (2.75-3.84)	4.00 (3.37-4.72)	4.63 (3.87-5.48)	5.51 (4.47-6.71)	6.19 (4.92-7.64)	6.89 (5.30-8.69)	7.61 (5.62-9.83)	8.58 (6.11-11.4)	9.32 (6.47-12.5)
20-day	3.64 (3.10-4.25)	4.15 (3.53-4.84)	4.98 (4.22-5.83)	5.67 (4.78-6.67)	6.63 (5.42-8.00)	7.37 (5.89-9.00)	8.12 (6.28-10.1)	8.87 (6.61-11.3)	9.88 (7.09-12.9)	10.6 (7.46-14.1)
30-day	4.30 (3.68-4.99)	4.88 (4.17-5.68)	5.83 (4.96-6.79)	6.61 (5.59-7.73)	7.67 (6.28-9.17)	8.47 (6.80-10.3)	9.27 (7.20-11.5)	10.1 (7.53-12.8)	11.1 (8.01-14.4)	11.9 (8.38-15.7)
45-day	5.10 (4.38-5.90)	5.82 (4.99-6.73)	6.96 (5.95-8.07)	7.89 (6.70-9.17)	9.12 (7.49-10.8)	10.0 (8.08-12.1)	10.9 (8.52-13.4)	11.8 (8.86-14.9)	12.9 (9.35-16.7)	13.7 (9.73-18.0)
60-day	5.76 (4.96-6.63)	6.62 (5.69-7.62)	7.97 (6.83-9.21)	9.05 (7.72-10.5)	10.5 (8.60-12.4)	11.5 (9.28-13.8)	12.5 (9.77-15.3)	13.5 (10.1-16.8)	14.7 (10.6-18.8)	15.5 (11.0-20.2)

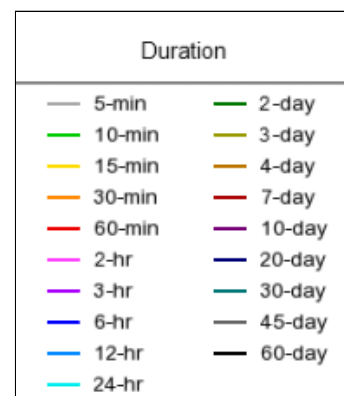
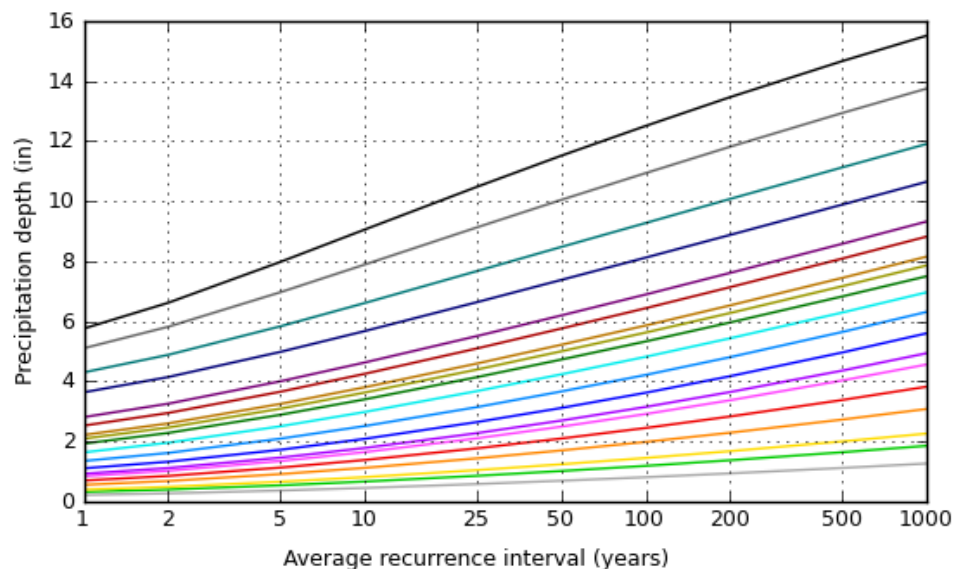
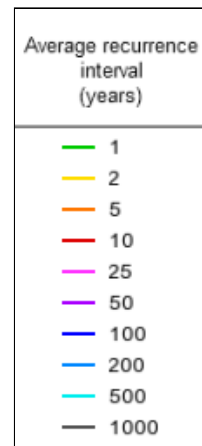
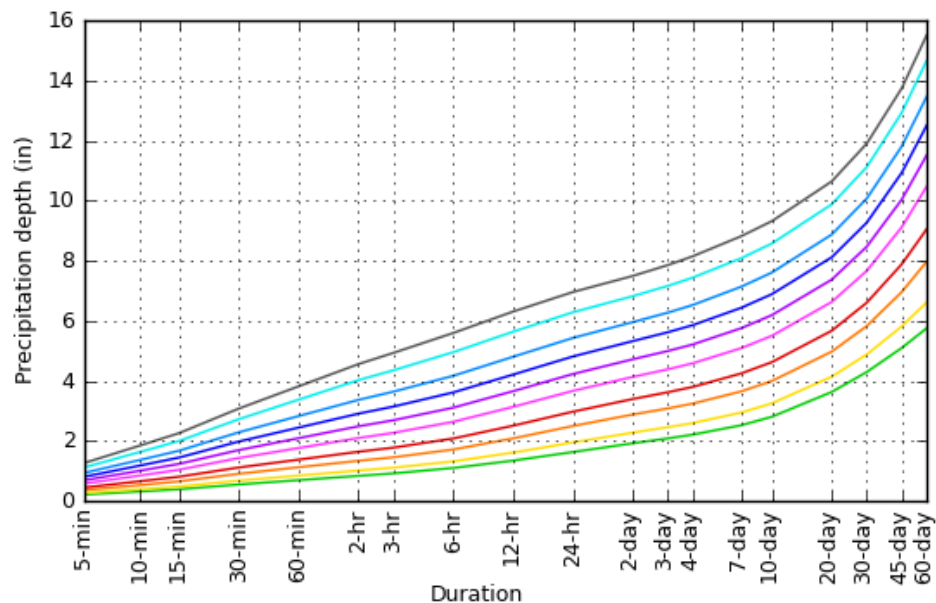
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

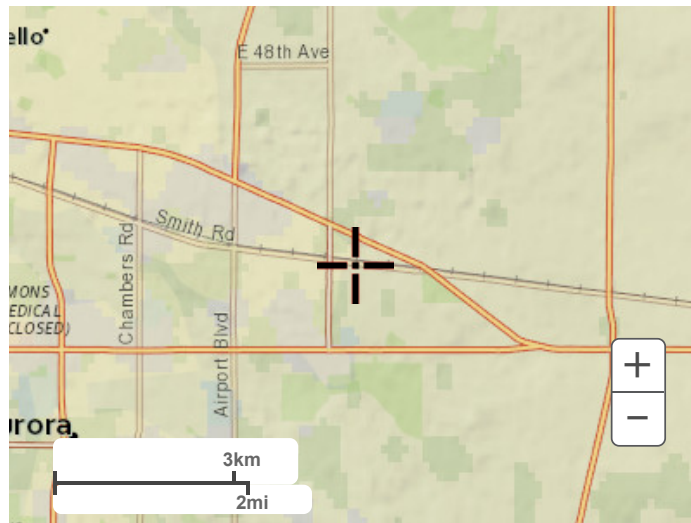
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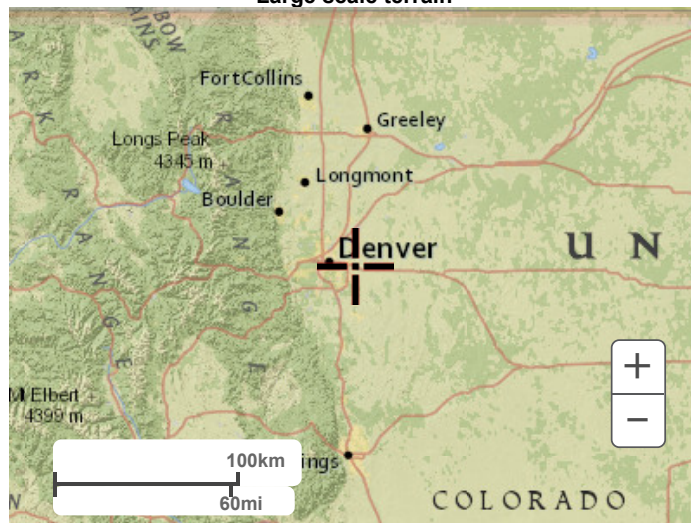
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Mar 18 04:54:04 2019

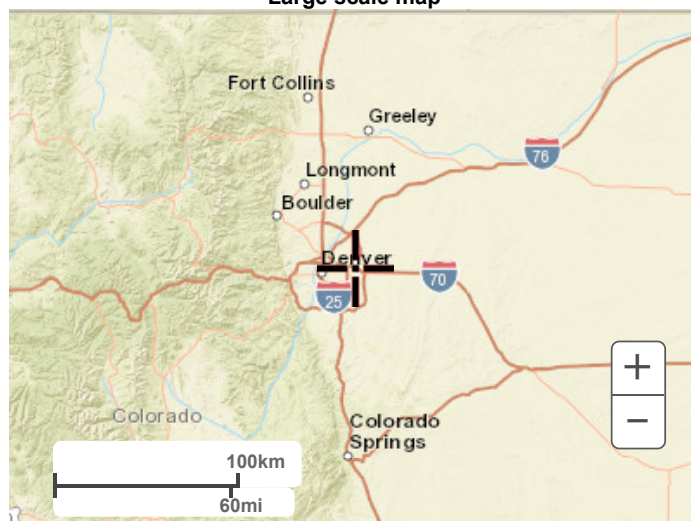
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Large scale terrain



Large scale map



Large scale aerial



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APPENDIX E

DETENTION INFORMATION

Detention Basin Calculations

City of Aurora
100 yr storm
18920 E Smith Road

Predeveloped discharge =	5.84 cfs
Allowable discharge =	5.84 cfs**
Detention Drainage Area =	1.01 Ac
Weighted 'c' value =	0.950

time	100 year rain	CA	runoff	discharge	discharge	detention
minutes	inches	sf	cf	cfs	cf	cf
5	0.814	41795.82	2835	0.00	0	2835
10	1.190	41795.82	4145	1.95	1168	2977
15	1.450	41795.82	5050	3.89	2628	2422
30	1.990	41795.82	6931	5.84	10512	-3581
40	2.143	41795.82	7464	5.84	14016	-6552
60	2.450	41795.82	8533	5.84	21024	-12491
80	2.606	41795.82	9077	5.84	28032	-18955
100	2.763	41795.82	9623	5.84	35040	-25417
120	2.920	41795.82	10170	5.84	42048	-31878

** Full allowed discharge assumed at 30 minutes