BUCKHORN
ENGINEERING

DRAINAGE REPORT
GENESEE PROPERTIES, INC.
SOCIETY TURN PARCEL
SAN MIGUEL COUNTY, COLORADO

June 30,2022

Prepared for:
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Society Turn Parcel – Preliminary Plan
Drainage Report
San Miguel County, Colorado

1. INTRODUCTION

This drainage study was prepared as part of the sketch plan Site Development application for the Society Turn Parcel in San Miguel County, Colorado. This report generally follows the requirements of the San Miguel County Land Use Code, Section 4-302G and Section 5-502AA.

Section 2 of this report discusses the historic hydrologic conditions on the site. Section 3 addresses the developed hydrologic analysis used in sizing detention structures within the project area. Section 4 provides conclusions about the potential impacts of development to the site. The remaining sections provide certification and references employed in the report preparation.

A. Site Location - The Society Turn Parcel is in the San Miguel River valley, approximately 3 miles west of the Town of Telluride (see Figure 1 below). It is southwest of the Society Turn intersection (round-about), with Highway 145 on the north and east sides, and Society Drive to the south. The Society Turn Parcel is on mostly gently-sloping terrain that sits on the north side of the San Miguel Valley at the base of a steep slope, which is the toe of Deep Creek Mesa.

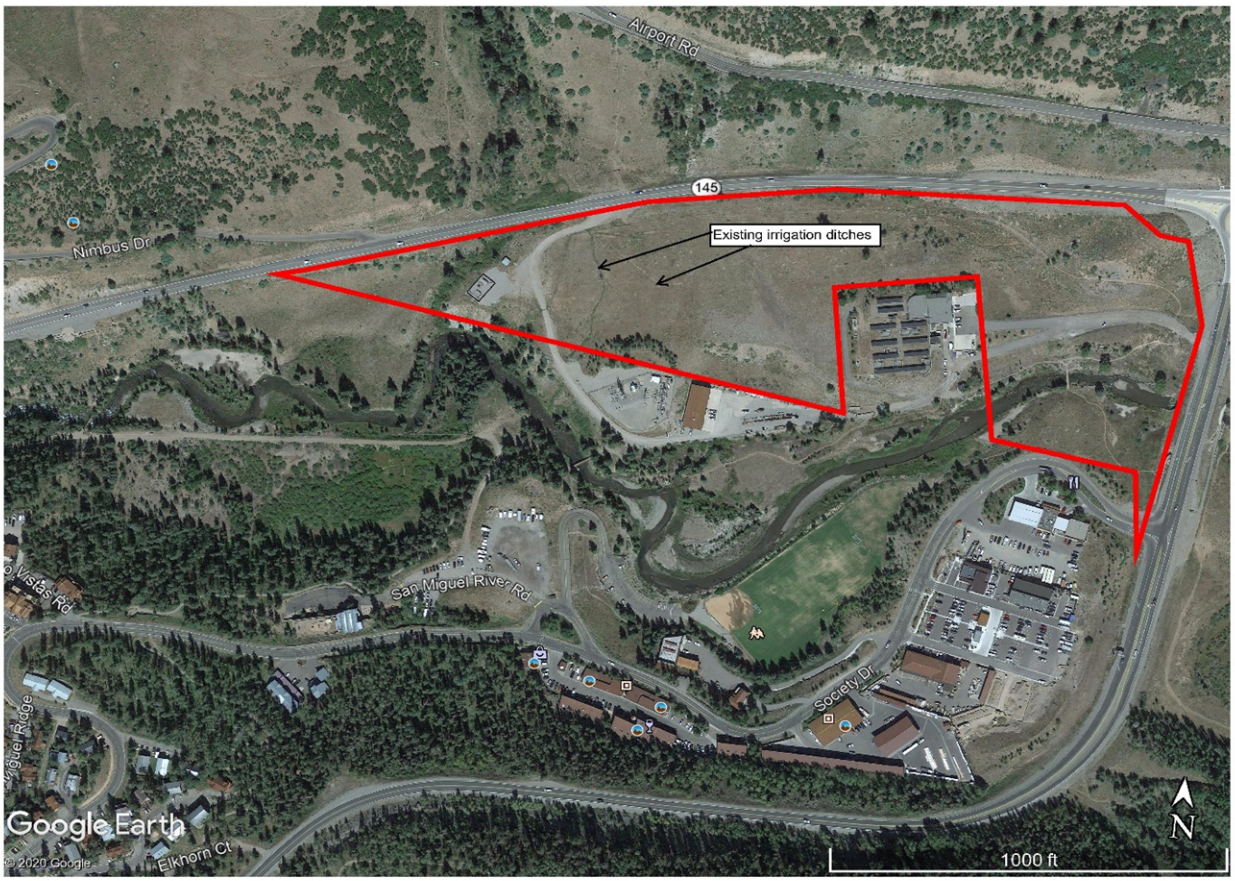

Figure1. Google© image of the Society Turn Parcel (outlined in red)

B. Site Vegetation - The site is generally cleared but remaining vegetation consists of native grasses, shrubs and scattered elm and cottonwood trees. The areas near the San Miguel River and Remine Creek that are intended to remain as open spaces have concentrations of willows and other wetland plants adjacent to the waterways.

C. Adjacent Development – The site is bounded to the south by developed commercial sites and undeveloped land. To the north and east, the parcel is bounded by State Highway 145. The western boundary of the property is bounded by vacant land

D. Site Description - The site generally slopes at an average of 1.0% from north to south at elevations from 8712 to 8650 feet above MSL. It is on an elevated terrace of the San Miguel River and has two man-made irrigation ditches crossing the property that are currently in use. The San Miguel River bisects the parcel and flows from east to west at a low gradient. Remine Creek is located on the western portion of the parcel and flows from north to south to its confluence with the San Miguel River. No other water courses are located within 500 feet of the property.

E. Site Soils - The project area has been mapped by the NRCS on their Web Soil Survey (WSS) online site to contain two soil units. They are the Cryaquolls-Borohemists complex which covers approximately 19% of the parcel along the San Miguel River corridor and the Cryoborolls-Cryaquolls association which covers the remaining 81% of the project site. Both of these units are classified as Hydrologic Soil Group (HSG) type B soils, which indicates moderately well drained soil with a moderate infiltration rate and low runoff potential. The site is characterized by storm water sheet flows across the entire portion of the site from north to south towards the San Miguel River. Drainage plans for the site are presented in Appendix E of this report. Detailed soil information is presented in Appendix B of this report.

F. Existing Drainage Facilities - There are two existing irrigation ditches which generally run from north to south in the western portions of the site. The ditches convey water from the north side of Highway 145 through corrugated metal pipe (CMP) culverts to the elevated portion of the site to provide irrigation for pasture grass. The upper portion of the project site is used seasonally for cattle grazing.

G. Project Description – The proposed development of the Society Turn Parcel is a mixed-use phased development of commercial and residential buildings with associated infrastructure improvements including roads, sanitary sewer, water, dry utilities and storm drain systems. Approximately 5.63 acres of the site will be dedicated to open space parks and recreation areas and will remain undeveloped. Domestic water will be supplied by the Town of Telluride under an existing "will serve" agreement with the developer, Genesee Properties, Inc. Sanitary sewer services will also be provided by the Town of Telluride under a service connection agreement.

H. Relevant Flood Hazard and Drainage Studies – The project area is contained on FEMA FIRM panel 08113C0286-C and the San Miguel River channel is located in a FEMA flood Zone A, which indicates that detailed hydraulic analyses have not been performed and that no base flood elevations or depths are shown on the FEMA floodplain maps for this area. The Flood Insurance Study (FIS) for San Miguel County, issued on September 30, 1992, includes the project area. A FIRMette of the project site is included in Appendix C.

2. HISTORIC DRAINAGE SYSTEM

This section of the report reviews the historic or pre-developed conditions on the project site. Historic flows for the site are limited to the 17.61-acre extent of the Society Turn property and are characterized by sheet flows over the vegetated, low sloping terrain from north and south towards the San Miguel River drainage. The pre-developed flows for 10 and 100-year storm events were calculated using the Modified FAA-Rational Method spreadsheet from the USDCM Volume 2 Storage Chapter. The UDFCM Rational Method spreadsheet was used to calculate historic flows for the site. These flows were estimated to be 1.7 cfs for the 10-year storm and 18.96 cfs for the 100-year event assuming 2% impervious cover for undeveloped land. Historic flow patterns for the site are shown on Sheet DR-1 in Appendix E of this report.

3. PROPOSED DRAINAGE SYSTEM

A. Criteria - In order to calculate the required detention storage for the proposed Society Turn development, the following design criteria and assumptions were used:

- Average basin slope = 1.0%
- 12-hour drain time was used due to low runoff type soils (HSG B) as reported by the NRCS-WSS
- Rational Method was used for hydrologic analysis
- Design storms of 10-year, 1-hour (0.773 inches) and 100-year, 1-hour (1.44 inches) were used for analysis using information from the NOAA Atlas Volume 14
- Developed weighted runoff coefficients for 10-yr. and 100-yr return periods were calculated using the UD-Rational workbook
- Infiltration rate of 10 minutes per inch for site soils – HSG = B

B. Hydrologic Data The current NOAA Atlas 14 was consulted for calculations of rainfall depth, intensity, and frequency-duration for the interval storms. The NOAA 14 IDF data for Telluride, Colorado (Station ID 05-8204) with a 90% confidence interval was used for our analysis and is presented in Appendix B.

RETURN PERIOD	1-HR TOTAL PRECIPITATION (IN)
2-year	0.517
5-year	0.641
10-year	0.773
25-year	0.998
50-year	1.21
100-year	1.44

Table 1. Summary of NOAA Atlas 14 precipitation data for 60-minute duration precipitation events varying recurrence periods in Telluride, CO. Shaded values were used for design and drainage analyses in this report.

Return Period	5-min.	10-min.	15-min.	30-min.	1-hr.	2-hr.	3-hr.	6-hr.	24-hr.
2-yr	0.185	0.271	0.330	0.424	0.517	0.609	0.685	0.883	1.55
5-yr	0.234	0.342	0.418	0.535	0.641	0.747	0.832	1.07	1.87
10-yr	0.286	0.419	0.511	0.653	0.773	0.893	0.983	1.24	2.15
25-yr	0.375	0.549	0.670	0.855	0.998	1.14	1.23	1.52	2.57
50-yr	0.457	0.670	0.817	1.04	1.21	1.37	1.46	1.75	2.91
100-yr	0.552	0.808	0.985	1.26	1.44	1.63	1.71	2.02	3.26

Table 2. Summary of NOAA 14 Intensity-Duration-Frequency values for the project site. Rainfall intensity is given in inches per hour

C. Runoff

The developed flow rates for the project area were calculated using the Rational Method as described in Volume 1 of the USDCM. Peak developed runoff flows for the 10-year and 100-year design storms are 9.10 cfs and 19.34 cfs respectively for the portion of the development (Basin #3). Detailed calculation results for pre-developed and developed conditions are presented in Appendices D.1 and D.2 of this report. Developed flow patterns are presented on Sheet DR-2 in Appendix E of this report. Historically, storm drainage has been intercepted by permeable site soils and transmitted in shallow sheet flow across the site from north to south towards the San Miguel River. Developed flows will be drained into storm drains on the side of project roads and designated detention basins and underground detention structures and allowed to percolate naturally into the soils. Field percolation tests performed by Buckhorn Engineering staff during the geotechnical investigation for the project indicate rates of approximately 10 minutes per inch. Storm flows will percolate into the underlying alluvial soil within the prescribed time per Colorado Revised Statutes (CRS) section 37-92-602(8).

The Society Turn parcel was divided into seven (7) drainage basins labeled Basins #1 through Basin #7. Table 3 details those basins' runoff and detention

calculations. These basins are presented in exhibit DR-2 in Appendix E of this report. Detailed calculation worksheets for each basin are presented in Appendices D.1 and D.2 of this report.

Phase 2 Basin ID	Drainage Area (Acres)	10-yr. 1-hr. Runoff (cfs)	100-yr. 1- hr. Runoff (cfs)	Required 10-yr. Detention Volume (cu. ft.)	Required 100-yr. Detention Volume (cu. ft.)
Basin #1	2.06	0.20	2.22	None	None
Basin #2	4.18	5.60	11.89	5,880	6,969
Basin #3	6.80	9.10	19.34	6,640	7,455
Basin #4	0.52	0.70	1.48	740	830
Basin #5	0.48	0.64	1.37	873	1045
Basin #6	1.80	0.17	1.94	None	None
Basin #7	1.77	0.19	2.15	None	None
Totals	**17.61**	-	-	**16,421**	**16,654**

Table 3. Phased Runoff and Retention Values. Weighted c (10-yr) = 0.44, weighted c (100-yr) = 0.55), i (10-yr) = 0.994, i (100-yr) = 1.71. Basins 1, 6 and 7, with no required detention, are to remain as open space and will drain as they have historically towards the San Miguel River.

Phase 2 Basin ID	Drainage Basin Area (Acres)	Required 100-yr. Detention Volume (cu. ft.)	Provided 100-yr. Detention Volume (cu. ft.)
Basin #1	2.06	None	None
Basin #2	4.18	6,969	7,088
Basin #3	6.80	7,455	7,623
Basin #4	0.52	830	856
Basin #5	0.48	1,045	1,087
Basin #6	1.80	None	None
Bain #7	1.77	None	None
Totals	**17.61**	**16,299**	**16,654**

Table 4. Summary of proposed 100-year retention volume per sub-basin. Provided retention volume is a combination of infiltration trenches and retention ponds.

B. Roads

The majority of rooftop flows will be contained in landscaping at or near the building. The majority of surface storm flows will be from sidewalks, driveways, parking lots and roadways. Those flows will be conveyed in strom drains to detention basins and underground detention structures as described in Section C above. Storm flows will sheet flow from the crown of roads curbs and gutters on both sides of Road B and to distributed detention areas that double as snow storage sites in the winter.

C. Open Channel Flow

Open channel flows through landscaped drainage swales are proposed for the site development to convey flows to designated detention basins and/or underground detention structures. All storm runoff will be routed on the surface to detention facilities as outlined in Section C above. The existing drainage ditches, located in the western portion of the project site, will be graded over in Phase 1 of the proposed development. Vertical curbs with gutters are proposed for project roads. Gutter capacity and curb opening capacity calculations are as follows:

Eq. 1 $Q = \{0.56/n\} S_x^{5/3} S^{1/2} T^{8/3}$

Where: Manning's n = 0.013
Road/Gutter Cross-slope (S_x) = 2%
Road Longitudinal slope (S) = 0.5%
Flow width (T) = 18 inches

Therefore: Q = 0.013 cfs for gutter flow rate

Eq. 2 $Q_i = 2.3(L+1.8W_o)d^{1.5}$

Where: Opening length (L) = 1.5 feet
Curb opening width (W_o) = 0.5 feet
Depth of Flow (d) = 0.5 feet

Therefore: Q_i =1.95 cfs

Drainage swales are proposed to convey storm flow from curb openings to adjacent roadway inlets or detention facilities. Calculations for the triangular drainage swales using Manning's equation are:

Eq. 3 $Q = V/A$

$V = k/n[A/P]^{2/3}S^{1/2}$

Where: n = 0.025
Side slopes = 2H:1V
Longitudinal Slope (S) = 0.01 ft/ft
Flow depth = 1 foot

Solving for velocity and discharge (Q)

Q - 9.51 cfs, v = 3.48 ft/sec.

D. Storm Sewers and Culverts

Storm drain inlets along Road B will convey storm flows in 18-inch diameter ADS storm drain pipe to designated outlets at the detention basin and underground detention structures as outlined on Sheet DR-2 in Appendix E. Storm drain systems will be constructed during the initial phase of development to provide storm drainage for the entire project site.

E. Detention Basins and Structures

As shown on Sheet DR-2 in Appendix E, a combination of one above grade detention basin and four (4) underground ADS storm detention structures are proposed to detain storm flows and release them at historic drainage rates. Use of the below grade ADS detention structures will allow parking areas and roadways to be constructed on grade and still provide adequate detention storage. Figure 2. below presents a typical ADS detention structure.

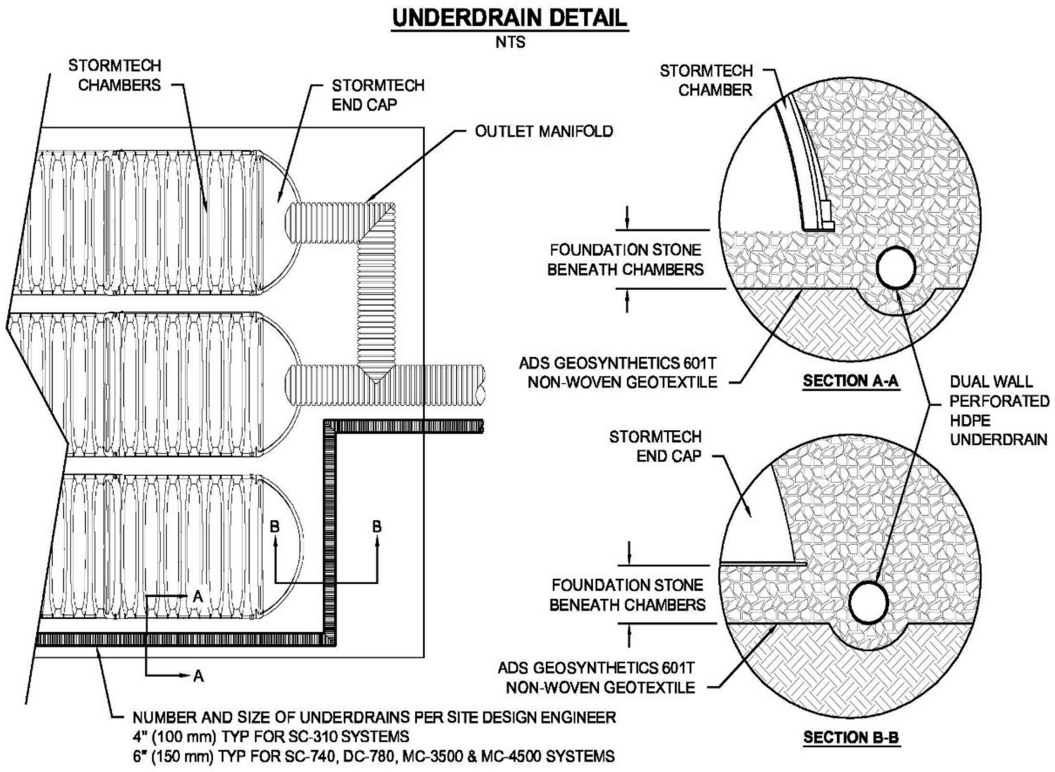

Figure 2. Typical underdrain detail of ADS Stormtech© detention structure

4. CONCLUSION

The proposed development of the Society Turn parcel has been designed in consideration of retaining storm flows on site as required by San Miguel County Land Use Code, Section 4-302G and Section 5-502AA. Drainage will be conveyed by both subsurface storm drains and surface means across the roadways, parking areas and impervious areas to subsurface detention structures or detention basins.

5. REPORT CERTIFICATION

I, Daniel C. Quigley, a duly registered professional engineer in the State of Colorado, (registration #38334), have prepared this report, related documents, and supervised the preparation of the drawings enclosed. The information included is, to the best of my knowledge, accurate and conforming to the requirements of the San Miguel County Land Use Code and current practices for the preparation of drainage reports.

June 30, 2022

Daniel C. Quigley, P.E.
Project Engineer

6. REFERENCES

- Urban Drainage and Flood Control District (UDFCD) Criteria Manual, Volumes 1-3, March 2017
- Flood Insurance Study, San Miguel County, September 30, 1992
- NOAA Atlas 14, Volume 8, 2013
- Mays, Larry W., Stormwater Collections Systems Design Handbook, McGraw-Hill, 2001

7. SOFTWARE

- UDFCD Detention calculator, v. 3.07, February 2017
- UDFCD Rational calculator, V 2.00, May 2017

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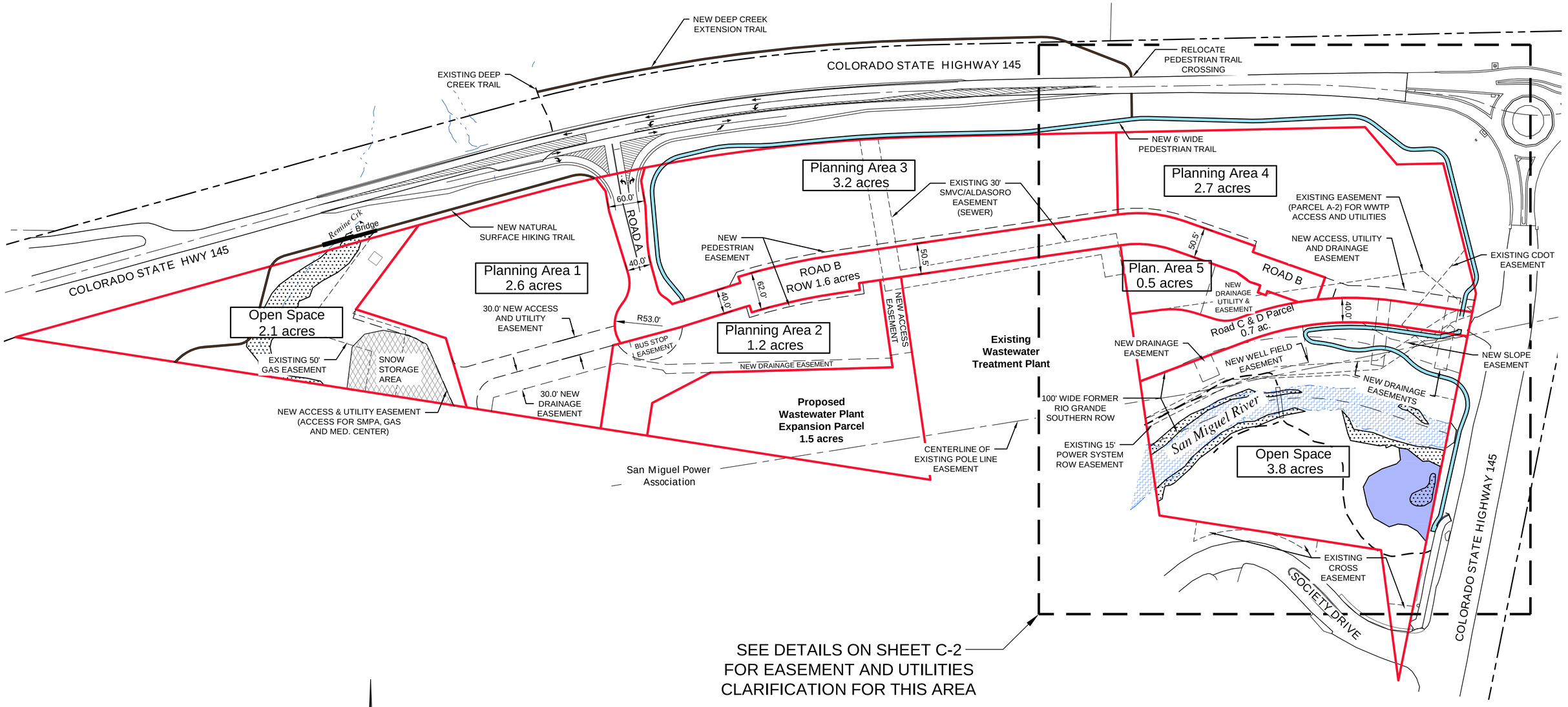
APPENDIX A

SITE PLAN



REVISIONS			
REV	DATE	DESCRIPTION	BY

DOWL
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222 South Park Avenue
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GENESEE PROPERTIES, INC.

SOCIETY TURN PARCEL SKETCH PLAN
GENERAL SITE PLAN

PROJECT 7122-74614
DATE 07/21/2020

SHEET
C-1
2 OF 11

Q:\22\7461 4-01\65CAD\Civil\Dwg2-Sketch Plan\SC1-Sketch Plan-Site Plans.dwg PLOT DATE 2020-7-27 08:19 SAVED DATE 2020-07-21 08:37 USER: dcastillo

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APPENDIX B

NRCS SOILS AND NOAA 14 RAINFALL DATA

Soil Map—Ouray Area, Colorado, Parts of Gunnison, Hinsdale, Ouray, San Juan, and San Miguel Counties
(Society Turn Parcel - Soils Map)

Map Scale: 1:3,760 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

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: Ouray Area, Colorado, Parts of Gunnison, Hinsdale, Ouray, San Juan, and San Miguel Counties
Survey Area Data: Version 12, Jun 10, 2020

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

Date(s) aerial images were photographed: Nov 26, 2010—Oct 13, 2017

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
109	Cryaquolls-Borohemists complex, 0 to 5 percent slopes	6.2	18.9%
111	Cryoborolls-Cryaquolls association, 0 to 15 percent slopes	26.8	81.1%
Totals for Area of Interest		**33.0**	**100.0%**

NOAA Atlas 14, Volume 8, Version 2
TELLURIDE 4WNW
Station ID: 05-8204
Location name: Telluride, Colorado, USA*
Latitude: 37.9492°, Longitude: -107.8733°
Elevation:
Elevation (station metadata): 8672 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	**0.162** (0.143–0.195)	**0.185** (0.162–0.223)	**0.234** (0.204–0.282)	**0.286** (0.247–0.347)	**0.375** (0.315–0.491)	**0.457** (0.366–0.600)	**0.552** (0.417–0.740)	**0.659** (0.466–0.905)	**0.820** (0.545–1.15)	**0.956** (0.605–1.34)
10-min	**0.238** (0.209–0.286)	**0.271** (0.237–0.326)	**0.342** (0.298–0.413)	**0.419** (0.362–0.508)	**0.549** (0.461–0.719)	**0.670** (0.536–0.879)	**0.808** (0.610–1.08)	**0.965** (0.682–1.33)	**1.20** (0.798–1.69)	**1.40** (0.886–1.96)
15-min	**0.290** (0.255–0.349)	**0.330** (0.289–0.398)	**0.418** (0.364–0.504)	**0.511** (0.441–0.619)	**0.670** (0.562–0.877)	**0.817** (0.654–1.07)	**0.985** (0.744–1.32)	**1.18** (0.832–1.62)	**1.46** (0.973–2.06)	**1.71** (1.08–2.39)
30-min	**0.374** (0.328–0.450)	**0.424** (0.372–0.511)	**0.535** (0.466–0.646)	**0.653** (0.564–0.792)	**0.855** (0.717–1.12)	**1.04** (0.834–1.37)	**1.26** (0.949–1.69)	**1.50** (1.06–2.06)	**1.87** (1.24–2.63)	**2.18** (1.38–3.05)
60-min	**0.459** (0.403–0.553)	**0.517** (0.452–0.622)	**0.641** (0.558–0.774)	**0.773** (0.667–0.938)	**0.998** (0.836–1.30)	**1.21** (0.963–1.58)	**1.44** (1.09–1.93)	**1.71** (1.21–2.35)	**2.12** (1.41–2.97)	**2.46** (1.55–3.44)
2-hr	**0.544** (0.480–0.649)	**0.609** (0.536–0.727)	**0.747** (0.655–0.894)	**0.893** (0.776–1.07)	**1.14** (0.962–1.47)	**1.37** (1.10–1.77)	**1.63** (1.24–2.16)	**1.92** (1.37–2.61)	**2.36** (1.59–3.29)	**2.73** (1.75–3.80)
3-hr	**0.613** (0.543–0.727)	**0.685** (0.605–0.813)	**0.832** (0.731–0.991)	**0.983** (0.857–1.18)	**1.23** (1.04–1.57)	**1.46** (1.18–1.87)	**1.71** (1.31–2.25)	**2.00** (1.44–2.70)	**2.43** (1.65–3.36)	**2.79** (1.80–3.86)
6-hr	**0.787** (0.701–0.926)	**0.883** (0.786–1.04)	**1.07** (0.942–1.26)	**1.24** (1.09–1.47)	**1.52** (1.28–1.90)	**1.75** (1.43–2.22)	**2.02** (1.56–2.61)	**2.31** (1.67–3.07)	**2.73** (1.87–3.73)	**3.08** (2.02–4.23)
12-hr	**1.05** (0.940–1.22)	**1.19** (1.06–1.39)	**1.44** (1.28–1.68)	**1.66** (1.47–1.95)	**2.00** (1.69–2.46)	**2.28** (1.86–2.84)	**2.58** (2.01–3.30)	**2.91** (2.13–3.82)	**3.37** (2.33–4.55)	**3.75** (2.49–5.10)
24-hr	**1.36** (1.22–1.57)	**1.55** (1.39–1.79)	**1.87** (1.68–2.17)	**2.15** (1.91–2.51)	**2.57** (2.18–3.11)	**2.91** (2.39–3.57)	**3.26** (2.55–4.11)	**3.63** (2.68–4.71)	**4.15** (2.90–5.54)	**4.57** (3.07–6.17)
2-day	**1.69** (1.53–1.94)	**1.92** (1.74–2.20)	**2.30** (2.07–2.64)	**2.63** (2.35–3.04)	**3.10** (2.65–3.72)	**3.48** (2.88–4.23)	**3.87** (3.06–4.83)	**4.28** (3.19–5.49)	**4.85** (3.43–6.40)	**5.29** (3.60–7.08)
3-day	**1.93** (1.76–2.20)	**2.17** (1.97–2.48)	**2.58** (2.33–2.95)	**2.93** (2.62–3.36)	**3.42** (2.94–4.07)	**3.82** (3.18–4.61)	**4.22** (3.36–5.24)	**4.65** (3.49–5.93)	**5.23** (3.73–6.87)	**5.69** (3.91–7.59)
4-day	**2.12** (1.93–2.40)	**2.38** (2.16–2.70)	**2.81** (2.54–3.20)	**3.17** (2.86–3.63)	**3.70** (3.19–4.38)	**4.12** (3.44–4.95)	**4.55** (3.63–5.61)	**4.99** (3.76–6.34)	**5.60** (4.01–7.33)	**6.08** (4.20–8.08)
7-day	**2.55** (2.34–2.88)	**2.86** (2.62–3.23)	**3.38** (3.08–3.82)	**3.82** (3.45–4.34)	**4.44** (3.85–5.22)	**4.93** (4.15–5.89)	**5.44** (4.37–6.66)	**5.97** (4.54–7.52)	**6.68** (4.84–8.68)	**7.23** (5.06–9.55)
10-day	**2.94** (2.71–3.30)	**3.28** (3.02–3.68)	**3.85** (3.52–4.33)	**4.34** (3.93–4.90)	**5.02** (4.37–5.87)	**5.56** (4.70–6.60)	**6.11** (4.94–7.45)	**6.69** (5.12–8.39)	**7.46** (5.44–9.65)	**8.07** (5.68–10.6)
20-day	**4.13** (3.82–4.59)	**4.52** (4.17–5.02)	**5.16** (4.74–5.75)	**5.70** (5.20–6.38)	**6.46** (5.67–7.46)	**7.05** (6.01–8.28)	**7.66** (6.26–9.24)	**8.28** (6.42–10.3)	**9.13** (6.74–11.7)	**9.78** (6.99–12.7)
30-day	**5.10** (4.74–5.64)	**5.56** (5.16–6.15)	**6.32** (5.83–7.00)	**6.94** (6.37–7.73)	**7.80** (6.87–8.95)	**8.47** (7.26–9.88)	**9.14** (7.50–10.9)	**9.81** (7.66–12.1)	**10.7** (7.97–13.6)	**11.4** (8.21–14.8)
45-day	**6.29** (5.86–6.91)	**6.91** (6.43–7.60)	**7.90** (7.33–8.71)	**8.71** (8.02–9.65)	**9.79** (8.65–11.1)	**10.6** (9.12–12.3)	**11.4** (9.41–13.6)	**12.2** (9.56–14.9)	**13.2** (9.89–16.7)	**13.9** (10.1–18.0)
60-day	**7.26** (6.78–7.94)	**8.07** (7.53–8.84)	**9.35** (8.69–10.3)	**10.4** (9.57–11.4)	**11.7** (10.4–13.3)	**12.7** (10.9–14.6)	**13.6** (11.3–16.1)	**14.6** (11.5–17.7)	**15.7** (11.8–19.7)	**16.5** (12.1–21.3)

[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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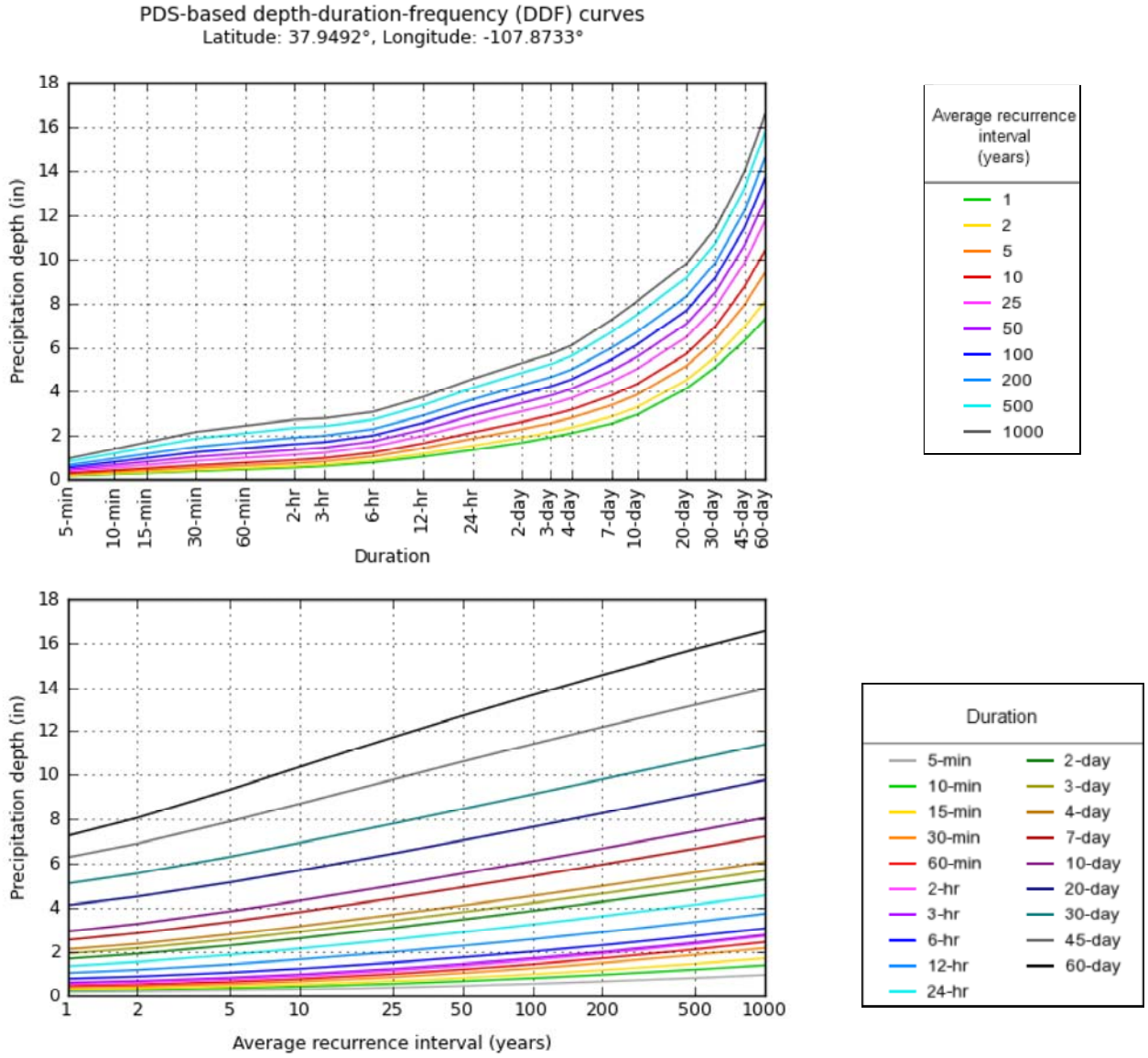
PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Thu Feb 15 14:31:23 2018

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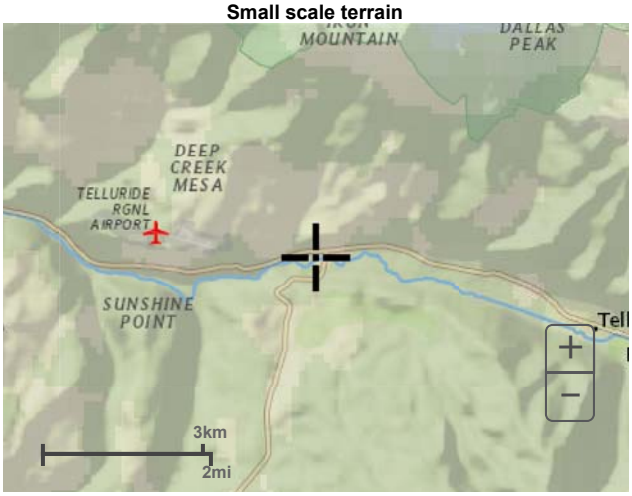
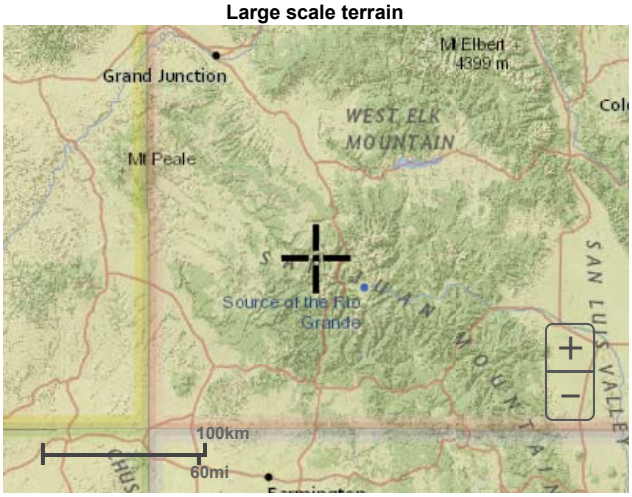
Maps & aerials

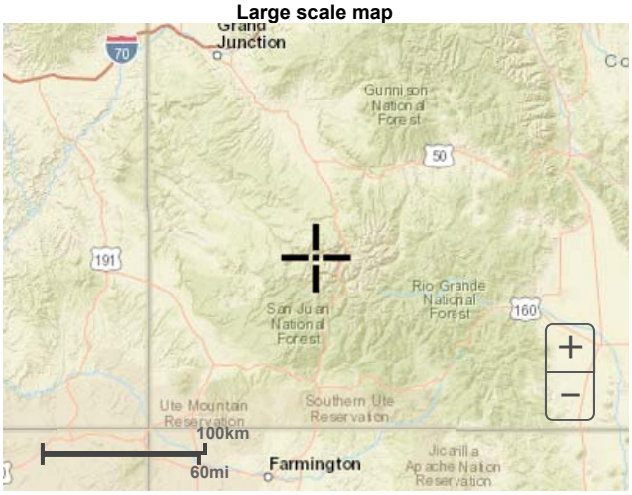
Small scale terrain



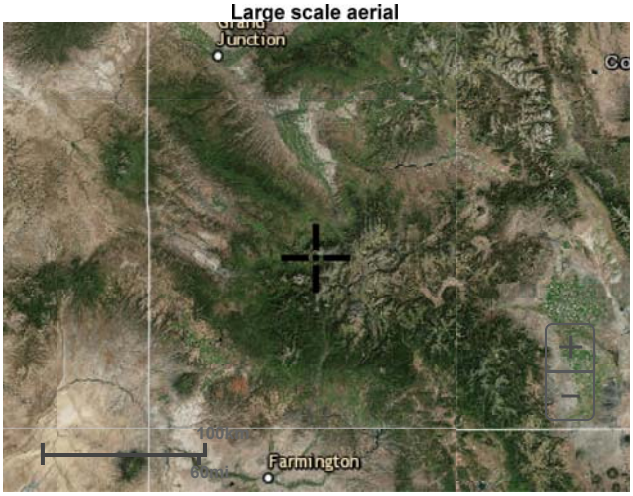
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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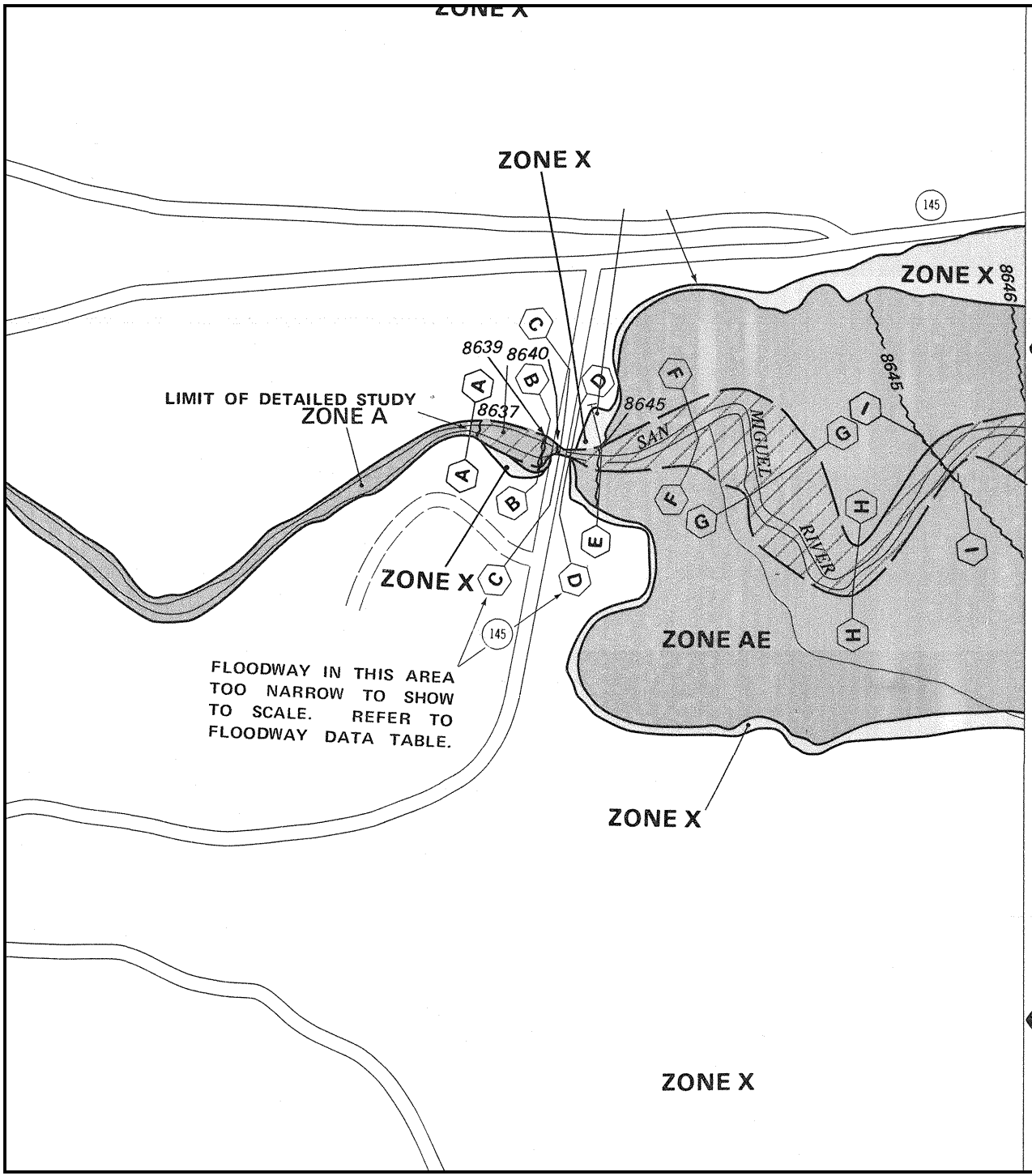
BUCKHORN
ENGINEERING

APPENDIX C

FEMA Firmette



638-6620.

APPROXIMATE SCALE IN FEET

500

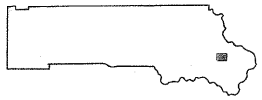
NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SAN MIGUEL COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 286 OF 400



PANEL LOCATION

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
UNINCORPORATED AREAS	080186	0286	C

MAP NUMBER
08113C0286 C

EFFECTIVE DATE:
SEPTEMBER 30, 1988

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

BUCKHORN
ENGINEERING

APPENDIX D.1

PRE-DEVELOPED CONDITIONS

CALCULATIONS

Calculation of Peak Runoff using Rational Method

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Pre-Developed Conditions
Location: Telluride

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$

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

Computed $t_c = t_i + t_t$

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

$t_{minimum} = 5$ (urban)
$t_{minimum} = 10$ (non-urban)

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

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

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.52	0.64	0.77	1.00	1.21	1.44	2.12
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

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

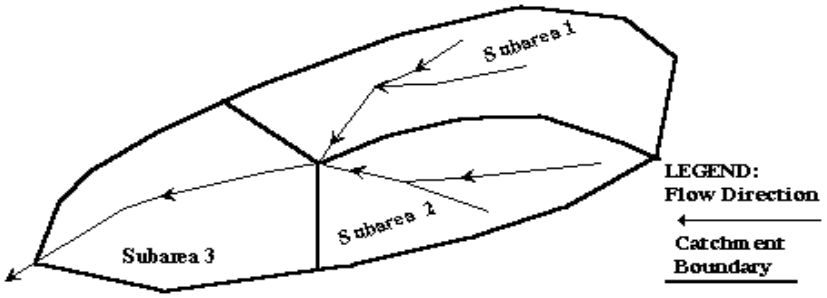
$Q(cfs) = CIA$

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_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (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
ociety Turn Paroc	17.61	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	300.00			0.010	34.02	0.00			0.010	10	1.00	0.00	34.02	25.66	25.66	0.89	1.10	1.32	1.72	2.08	2.47	3.64	0.14	0.24	1.70	7.91	12.41	18.96	34.83

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Pre-Developed Conditions
Location: Telluride



Subcatchment Name
Society Turn

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

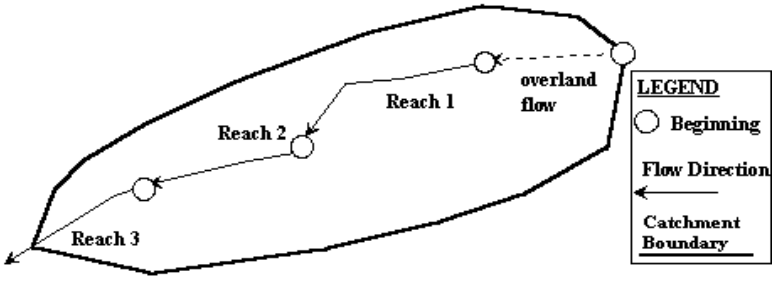
See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Society Trun Parce	17.61	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54

Length-Weighted Slope Calculations

Version 2.00 released May 2017

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Pre-Developed Conditions
Location: Telluride



Subcatchment Name	Percent Imperviousness (%)
Society Turn Pre	2

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
Society Turn	300.00			0.100

Total Overland Length (ft)	300.00	Length-Weighted Slope (ft/ft)	0.100

CHANNELIZED FLOW

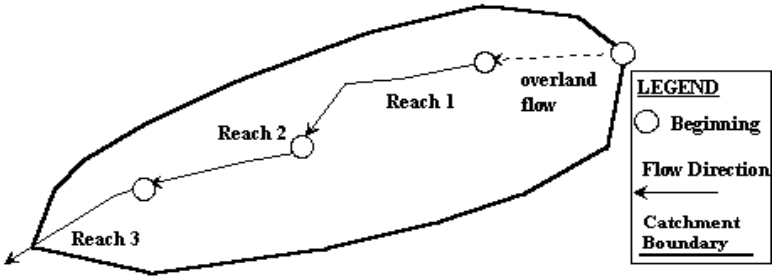
Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)

Total Channelized Length (ft)		Length-Weighted Slope (ft/ft)	

Reach-Weighted Time of Concentration Calculations

Version 2.00 released May 2017

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Pre-Developed Conditions
Location: Telluride



Subcatchment Name	Percent Imperviousness (%)
Society Turn Pre	2

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
Society Turn Pre	300.00	0.010	0.58	16.26
Weighted Totals	**300.00**	**0.010**	**Total t_i (min)**	**16.26**

CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
Weighted Totals			**Total t_t (min)**	

Computed t_c (min)	**0.00**
Regional t_c (min)	
Selected t_c (min)	

BUCKHORN
ENGINEERING

APPENDIX D.2

DEVELOPED CONDITION

CALCULATIONS

Calculation of Peak Runoff using Rational Method

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Developed Conditions
Location: Telluride

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$

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

Computed $t_c = t_i + t_t$

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

$t_{minimum} = 5$ (urban)
$t_{minimum} = 10$ (non-urban)

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

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

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.52	0.64	0.77	1.00	1.21	1.44	2.12
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

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

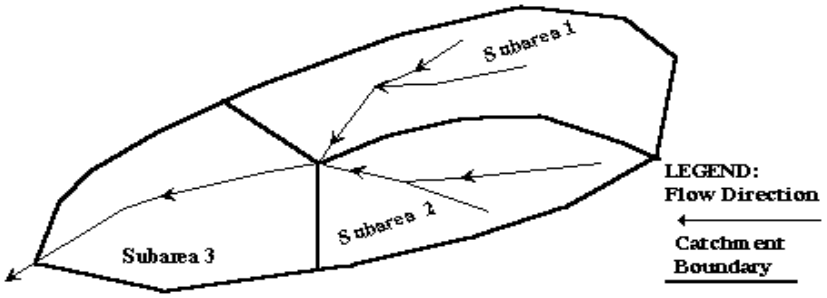
$Q(cfs) = CIA$

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_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (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
Basin #1	2.06	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	500.00			0.010	43.92	0.00			0.010	7	0.70	0.00	43.92	25.66	25.66	0.89	1.10	1.32	1.72	2.08	2.47	3.64	0.02	0.03	0.20	0.93	1.45	2.22	4.07
Basin #2	4.18	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83	300.00			0.010	13.38	0.00			0.010	20	2.00	0.00	13.38	12.40	12.40	1.29	1.58	1.91	2.47	2.99	3.56	5.25	3.46	4.45	5.60	7.77	9.69	11.89	18.18
Basin #3	6.80	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83	300.00			0.010	13.38	0.00			0.010	20	2.00	0.00	13.38	12.40	12.40	1.29	1.58	1.91	2.47	2.99	3.56	5.25	5.63	7.24	9.10	12.65	15.77	19.34	29.57
Basin #4	0.52	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83	300.00			0.010	13.38	0.00			0.010	20	2.00	0.00	13.38	12.40	12.40	1.29	1.58	1.91	2.47	2.99	3.56	5.25	0.43	0.55	0.70	0.97	1.21	1.48	2.26
Basin #5	0.48	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83	300.00			0.010	13.38	0.00			0.010	20	2.00	0.00	13.38	12.40	12.40	1.29	1.58	1.91	2.47	2.99	3.56	5.25	0.40	0.51	0.64	0.89	1.11	1.37	2.09
Basin #6	1.80	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	500.00			0.010	43.92	0.00			0.010	7	0.70	0.00	43.92	25.66	25.66	0.89	1.10	1.32	1.72	2.08	2.47	3.64	0.01	0.02	0.17	0.81	1.27	1.94	3.56
Basin #7	1.77	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	500.00			0.100	20.54	0.00			0.010	7	0.70	0.00	20.54	25.66	20.54	1.01	1.24	1.49	1.94	2.35	2.79	4.11	0.02	0.03	0.19	0.90	1.41	2.15	3.95

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Developed Conditions
Location: Telluride



Subcatchment Name
Developed

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

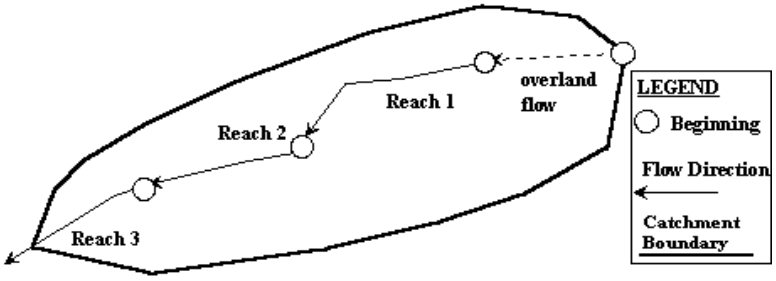
See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin #1	2.06	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
Basin #2	4.18	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83
Basin #3	6.80	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83
Basin #4	0.52	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83
Basin #5	0.48	B	80.0	0.64	0.67	0.70	0.75	0.77	0.80	0.83
Basin #6	1.80	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
Basin #7	1.77	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
Total Area (ac)	**17.61**		**Area-Weighted C**	**0.44**	**0.46**	**0.50**	**0.59**	**0.64**	**0.68**	**0.74**
			Area-Weighted Override C	**0.44**	**0.46**	**0.50**	**0.59**	**0.64**	**0.68**	**0.74**

Length-Weighted Slope Calculations

Version 2.00 released May 2017

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Developed Conditions
Location: Telluride



Subcatchment Name	Percent Imperviousness (%)
Society Turn Post	2

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
Basin #1	300.00			0.010
Basin #2	100.00			0.010
Basin #3	100.00			0.010
Basin #4	100.00			0.010
Basin #5	100.00			0.010
Basin #6	300.00			0.010
Basin #7	300.00			0.010
Total Overland Length (ft)	**1300.00**		**Length-Weighted Slope (ft/ft)**	**0.010**

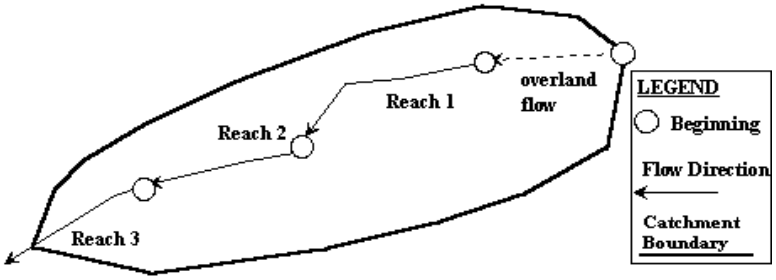
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
Total Channelized Length (ft)			**Length-Weighted Slope (ft/ft)**	

Reach-Weighted Time of Concentration Calculations

Version 2.00 released May 2017

Designer: D. Quigley
Company: DOWL
Date: 8/24/2020
Project: Society Turn - Developed Conditions
Location: Telluride



Subcatchment Name	Percent Imperviousness (%)
Society Turn Pre	2

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
Basin #1	300.00	0.010	0.01	34.09
Basin #2	100.00	0.010	0.67	7.76
Basin #3	100.00	0.010	0.67	7.76
Basin #4	100.00	0.010	0.67	7.76
Basin #5	100.00	0.010	0.67	7.76
Basin #6	300.00	0.010	0.01	34.09
Basin #7	300.00	0.010	0.01	34.09
Weighted Totals	**1300.00**	**0.010**	**Total t_i (min)**	**133.31**

CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
Weighted Totals			**Total t_t (min)**	

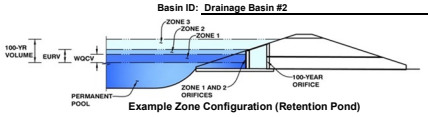
Computed t_c (min)	**0.00**
Regional t_c (min)	
Selected t_c (min)	

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Society Turn

Basin ID: Drainage Basin #2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	1.78	acres	Note: L / W Ratio < 1
Watershed Length =	100	ft	L / W Ratio = 0.1
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	80.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.049	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.158	acre-feet	
2-yr Runoff Volume (P1 = 0.52 in.) =	0.058	acre-feet	0.52 inches
5-yr Runoff Volume (P1 = 0.64 in.) =	0.075	acre-feet	0.64 inches
10-yr Runoff Volume (P1 = 0.77 in.) =	0.096	acre-feet	0.77 inches
25-yr Runoff Volume (P1 = 0.99 in.) =	0.131	acre-feet	0.99 inches
50-yr Runoff Volume (P1 = 1.21 in.) =	0.162	acre-feet	1.21 inches
100-yr Runoff Volume (P1 = 1.44 in.) =	0.199	acre-feet	1.44 inches
500-yr Runoff Volume (P1 = 2.12 in.) =	0.305	acre-feet	2.12 inches
Approximate 2-yr Detention Volume =	0.054	acre-feet	
Approximate 5-yr Detention Volume =	0.071	acre-feet	
Approximate 10-yr Detention Volume =	0.090	acre-feet	
Approximate 25-yr Detention Volume =	0.109	acre-feet	
Approximate 50-yr Detention Volume =	0.123	acre-feet	
Approximate 100-yr Detention Volume =	0.137	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (100-year) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	6	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	1.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.001	ft/ft
Slopes of Main Basin Sides (S_{main}) =	3	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1200	
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

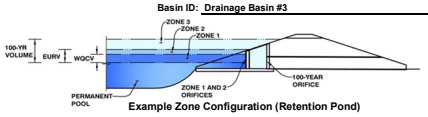
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Society Turn

Basin ID: Drainage Basin #3



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	2.56	acres	Note: L / W Ratio < 1
Watershed Length =	100	ft	L / W Ratio = 0.1
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	80.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.070	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.227	acre-feet	
2-yr Runoff Volume (P1 = 0.52 in.) =	0.083	acre-feet	0.52 inches
5-yr Runoff Volume (P1 = 0.64 in.) =	0.108	acre-feet	0.64 inches
10-yr Runoff Volume (P1 = 0.77 in.) =	0.138	acre-feet	0.77 inches
25-yr Runoff Volume (P1 = 0.99 in.) =	0.189	acre-feet	0.99 inches
50-yr Runoff Volume (P1 = 1.21 in.) =	0.233	acre-feet	1.21 inches
100-yr Runoff Volume (P1 = 1.44 in.) =	0.287	acre-feet	1.44 inches
500-yr Runoff Volume (P1 = 2.12 in.) =	0.439	acre-feet	2.12 inches
Approximate 2-yr Detention Volume =	0.078	acre-feet	
Approximate 5-yr Detention Volume =	0.101	acre-feet	
Approximate 10-yr Detention Volume =	0.130	acre-feet	
Approximate 25-yr Detention Volume =	0.156	acre-feet	
Approximate 50-yr Detention Volume =	0.176	acre-feet	
Approximate 100-yr Detention Volume =	0.198	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (100-year) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	9	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	1.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.001	ft/ft
Slopes of Main Basin Sides (S_{main}) =	3	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1200	
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

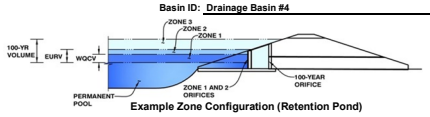
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Society Turn

Basin ID: Drainage Basin #4



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	0.52	acres	Note: L / W Ratio < 1
Watershed Length =	100	ft	L / W Ratio = 0.4
Watershed Slope =	0.010	ft/ft	
Watershed Imperviousness =	80.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.014	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.046	acre-feet	
2-yr Runoff Volume (P1 = 0.52 in.) =	0.017	acre-feet	0.52 inches
5-yr Runoff Volume (P1 = 0.64 in.) =	0.022	acre-feet	0.64 inches
10-yr Runoff Volume (P1 = 0.77 in.) =	0.028	acre-feet	0.77 inches
25-yr Runoff Volume (P1 = 0.99 in.) =	0.038	acre-feet	0.99 inches
50-yr Runoff Volume (P1 = 1.21 in.) =	0.047	acre-feet	1.21 inches
100-yr Runoff Volume (P1 = 1.44 in.) =	0.058	acre-feet	1.44 inches
500-yr Runoff Volume (P1 = 2.12 in.) =	0.089	acre-feet	2.12 inches
Approximate 2-yr Detention Volume =	0.016	acre-feet	
Approximate 5-yr Detention Volume =	0.021	acre-feet	
Approximate 10-yr Detention Volume =	0.026	acre-feet	
Approximate 25-yr Detention Volume =	0.032	acre-feet	
Approximate 50-yr Detention Volume =	0.036	acre-feet	
Approximate 100-yr Detention Volume =	0.040	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (100-year) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	2	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	1.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.001	ft/ft
Slopes of Main Basin Sides (S_{main}) =	3	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1200	
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

Depth Increment = ft

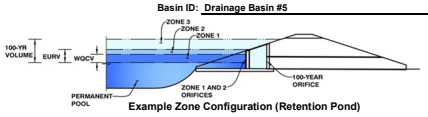
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Society Turn

Basin ID: Drainage Basin #5



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	0.48	acres	Note: L / W Ratio < 1
Watershed Length =	100	ft	L / W Ratio = 0.5
Watershed Slope =	0.010	ft/ft	
Watershed Imperviousness =	80.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.013	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.043	acre-feet	
2-yr Runoff Volume (P1 = 0.52 in.) =	0.016	acre-feet	0.52 inches
5-yr Runoff Volume (P1 = 0.64 in.) =	0.020	acre-feet	0.64 inches
10-yr Runoff Volume (P1 = 0.77 in.) =	0.026	acre-feet	0.77 inches
25-yr Runoff Volume (P1 = 0.99 in.) =	0.035	acre-feet	0.99 inches
50-yr Runoff Volume (P1 = 1.21 in.) =	0.044	acre-feet	1.21 inches
100-yr Runoff Volume (P1 = 1.44 in.) =	0.054	acre-feet	1.44 inches
500-yr Runoff Volume (P1 = 2.12 in.) =	0.082	acre-feet	2.12 inches
Approximate 2-yr Detention Volume =	0.015	acre-feet	
Approximate 5-yr Detention Volume =	0.019	acre-feet	
Approximate 10-yr Detention Volume =	0.024	acre-feet	
Approximate 25-yr Detention Volume =	0.029	acre-feet	
Approximate 50-yr Detention Volume =	0.033	acre-feet	
Approximate 100-yr Detention Volume =	0.037	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (100-year) =		acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =		acre-feet
Initial Surcharge Volume (ISV) =	2	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	1.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.001	ft/ft
Slopes of Main Basin Sides (S_{main}) =	3	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1200	
Initial Surcharge Area (A_{ISV}) =		ft^2
Surcharge Volume Length (L_{ISV}) =		ft
Surcharge Volume Width (W_{ISV}) =		ft
Depth of Basin Floor (H_{FLOOR}) =		ft
Length of Basin Floor (L_{FLOOR}) =		ft
Width of Basin Floor (W_{FLOOR}) =		ft
Area of Basin Floor (A_{FLOOR}) =		ft^2
Volume of Basin Floor (V_{FLOOR}) =		ft^3
Depth of Main Basin (H_{MAIN}) =		ft
Length of Main Basin (L_{MAIN}) =		ft
Width of Main Basin (W_{MAIN}) =		ft
Area of Main Basin (A_{MAIN}) =		ft^2
Volume of Main Basin (V_{MAIN}) =		ft^3
Calculated Total Basin Volume (V_{total}) =		acre-feet

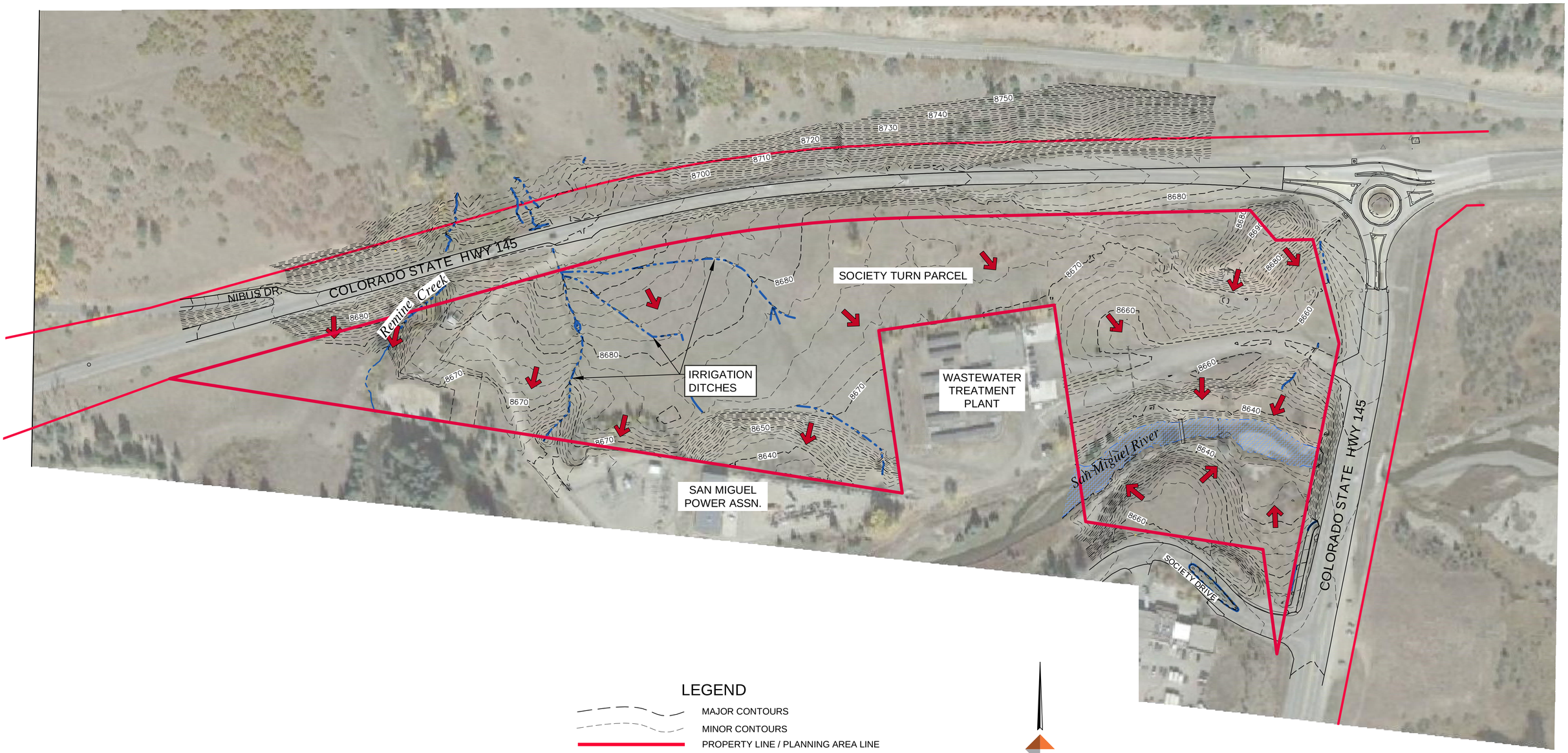
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

BUCKHORN
ENGINEERING

APPENDIX E

DRAINAGE PLANS AND DETAILS



LEGEND

- MAJOR CONTOURS
- MINOR CONTOURS
- PROPERTY LINE / PLANNING AREA LINE
- DRAINAGE FLOW ARROW

N

100 0 100 200

SCALE IN FEET
2-FOOT CONTOUR INTERVAL

REVISIONS			
REV	DATE	DESCRIPTION	BY

DOWL
WWW.DOWL.COM
222 South Park Avenue
Montrose, Colorado 81401
970-249-6828

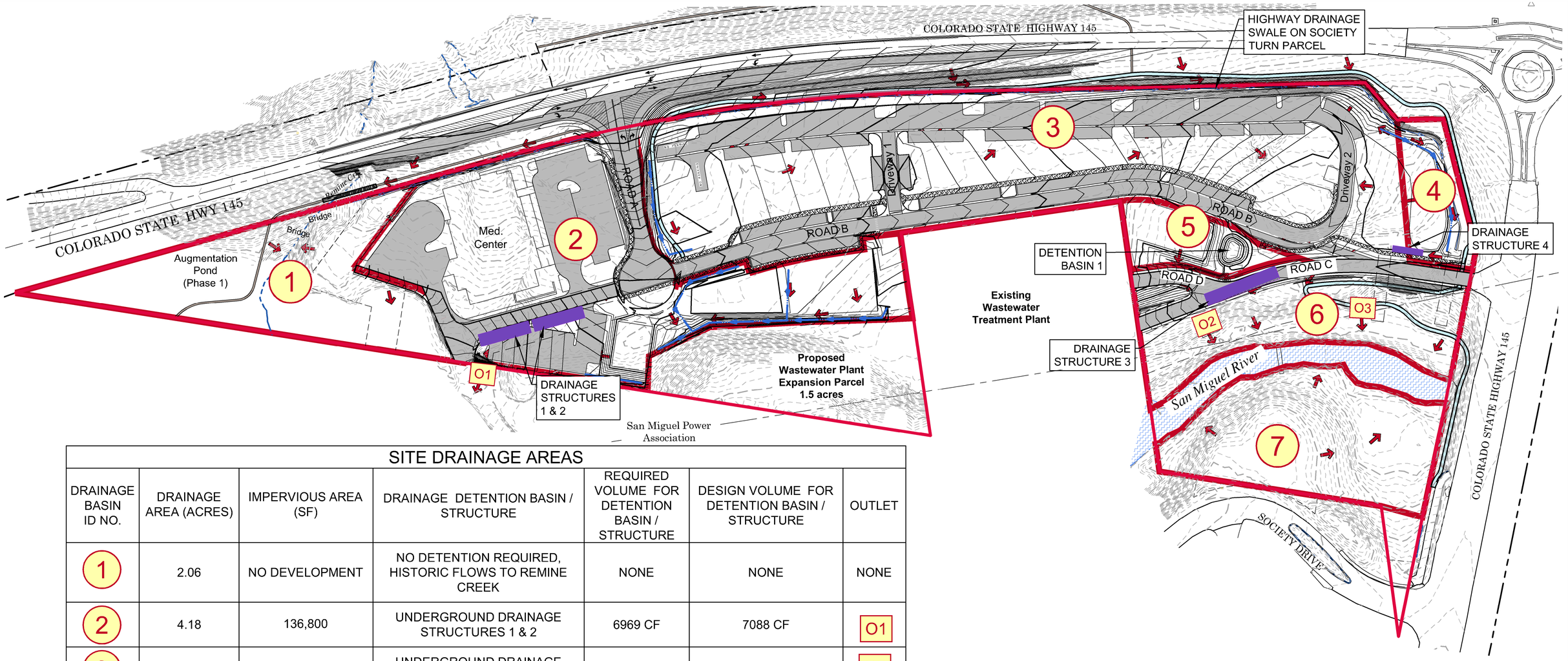
GENESEE PROPERTIES, INC.

SOCIETY TURN PARCEL
PRE-DEVELOPED DRAINAGE

PROJECT 7122-74614
DATE 08/21/2020

SHEET
DR-1
1 OF 2

G:\22\74614-01\65CAD\Civil\Dwg2-Sketch Plan\DR1-Drainage Report.dwg PLOT DATE 2020-8-24 10:57 SAVED DATE 2020-08-24 10:48 USER: dcastillo



SITE DRAINAGE AREAS

DRAINAGE BASIN ID NO.	DRAINAGE AREA (ACRES)	IMPERVIOUS AREA (SF)	DRAINAGE DETENTION BASIN / STRUCTURE	REQUIRED VOLUME FOR DETENTION BASIN / STRUCTURE	DESIGN VOLUME FOR DETENTION BASIN / STRUCTURE	OUTLET
1	2.06	NO DEVELOPMENT	NO DETENTION REQUIRED, HISTORIC FLOWS TO REMINE CREEK	NONE	NONE	NONE
2	4.18	136,800	UNDERGROUND DRAINAGE STRUCTURES 1 & 2	6969 CF	7088 CF	O1
3	6.80	200,800	UNDERGROUND DRAINAGE STRUCTURE 3	7455 CF	7623 CF	O2
4	0.52	7,472	UNDERGROUND DRAINAGE STRUCTURE 4	830 CF	856 CF	O3
5	0.48	6,871	DETENTION BASIN 1	1045 CF	1087 CF	O2
6	1.80	12,200 (ROAD C & D)	NO DETENTION REQUIRED, HISTORIC FLOWS TO SAN MIGUEL RIVER	NONE	NONE	NONE
7	1.77	NO DEVELOPMENT	NO DETENTION REQUIRED. HISTORIC FLOWS TO SAN MIGUEL RIVER	NONE	NONE	NONE

LEGEND

- DRAINAGE AREA BOUNDARY LIMITS
- UNDGROUND DRAINAGE STRUCTURE
- NEW ASPHALT PAVEMENT
- DRAINAGE FLOW ARROW
- 7 — DRAINAGE BASIN ID NO.
- O3 — DRAINAGE OUTLET ID NO.

N

80 0 80 160

SCALE IN FEET
1-FOOT CONTOUR INTERVAL

REVISIONS

REV	DATE	DESCRIPTION	BY

DOWL
WWW.DOWL.COM
222 South Park Avenue
Montrose, Colorado 81401
970-249-6828

GENESEE PROPERTIES, INC.
SOCIETY TURN PARCEL
DEVELOPED DRAINAGE PLAN

PROJECT 7122-74614
DATE 08/21/2020

SHEET
DR-2
2 OF 2

O:\221\74614-01\65CAD\Civil\Dwg\2-Sketch Plan\DR1-Drainage Report.dwg PLOT DATE 2020-08-24 10:48 USER: dcastillo
DATE 2020-08-24 10:55 SAVED