Jesik Consulting
Geotechnical, Water, Testing

102-D Oneida Street
Pueblo, Colorado 81004
(719) 582-5588
www.jesik.us

DRAINAGE REPORT

FOR PROPERTY AT

2727 Evergreen Road
Colorado Springs
El Paso County, Colorado

Update name of report to "Final Drainage Report for Studer Subdivision" and include date report was created.

PREPARED FOR

Harry Studer
Studer Construction
2727 Evergreen Road
Colorado Springs, Colorado

PREPARED BY JESIK CONSULTING
PROJECT NUMBER: 18-7882

Add "PCD File No. MS209"

COLORADO LICENSED
JOSEPH A. JESIK
39781
03-21-19
PROFESSIONAL ENGINEER

Jared Perea
Civil Engineer

Joseph A. Jesik, P.E.
Chief Engineer

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Update drainage letter to include a table of contents, engineer's statement, owner's statement, and El Paso County statement. See attachment to the left of this comment for statements that should be included in report.

Executive Summary

Jesik Consulting (JESIK) has completed a Drainage Report for an approximate 15.23-acre property located in Black Forest, El Paso County, Colorado. The property will be divided into 3 parcels, each approximately 5 acres. The parcels will be used as single-family residences.

There will be minimal impact from the proposed development and no storm water improvements are proposed in this report.

1.0 Subdivision Description

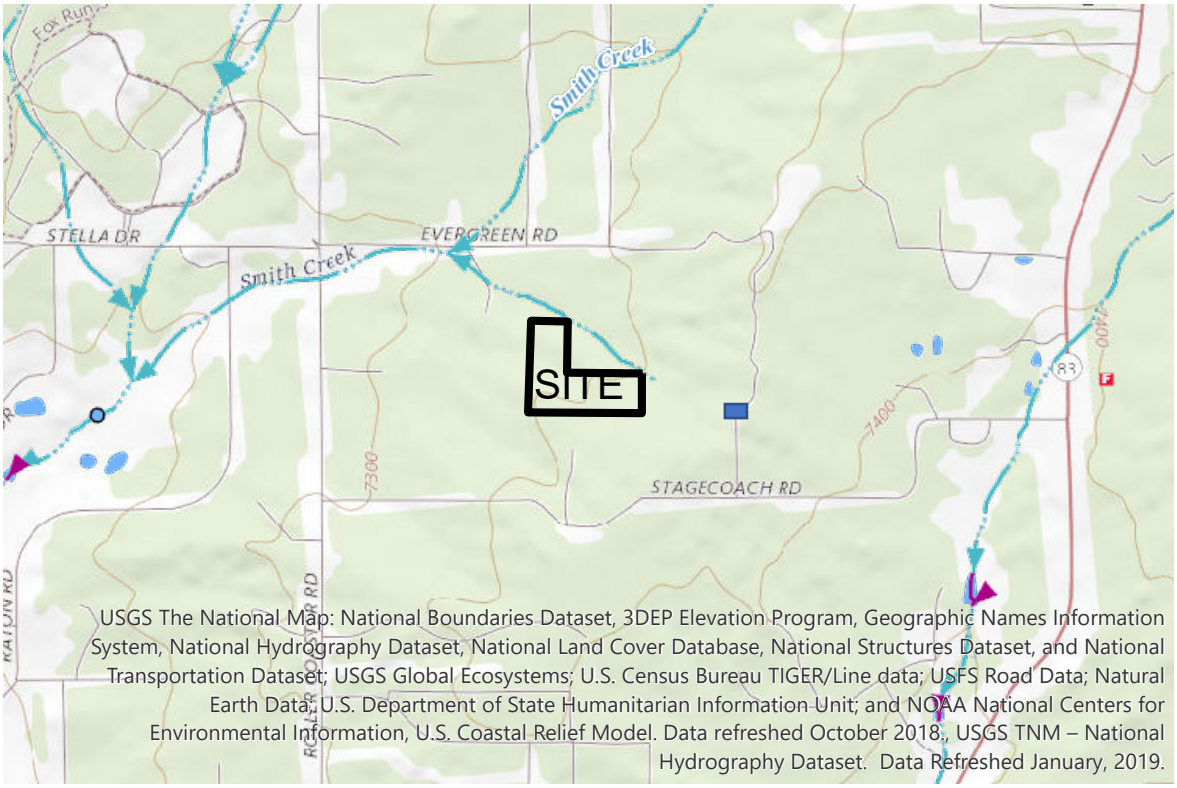
The project is in the Black Forest northeast of Colorado Springs in El Paso County, Colorado. Surrounding developments are Tall Pines Estates, and Stagecoach Spring Estates. The El Paso County schedule number for the property is 6133000043. The parcel is heavily forested with one single-family home. The proposed subdivision will divide the property into three, approximate 5-acre parcels which will be used for single-family homes.

1.1 Location

The project address is 2727 Evergreen Road, Colorado Springs, El Paso County, Colorado. An unnamed tributary to Smith Creek is adjacent to the north east corners of the property. The tributary drains the surrounding area northwesterly into Smith Creek.

Local streets north of the site are Fools Gold Lane, Evergreen Road, and Park Avenue. Roller Coaster Road is about 1,350 feet west of the property. The project location is Section 33, Township 11, Range 66, NE Quarter Section. Refer to Figure 1 below for the vicinity map.

Figure 1-Vicinity Map



1.2 Description

The Studer subdivision project will subdivide El Paso County, schedule no. 6133000043 into approximately 3, 5-acre parcels. There is a current home on the property in the northeast corner. The area of the Studer Subdivision is approximately 15.23-acres. The ground cover is trees, grasses, and shrubs. The ground elevation within the site ranges from approximately 7,428 above sea level on the east side of the site down to approximately 7,388 at the western property boundary. Generally surface water runs northeasterly into a tributary to Smith Creek then northwesterly into Smith Creek. The average grade ranges from 32 percent for side slopes and 13 percent for ridges and valleys.

1.3 Soils

A Natural Resources Conservation Service (NRCS) soils map is attached as Appendix A to this report. The map indicates the soil as Type “B” soil (moderate infiltration rate) for the entire site. Soils on-site are “Type 41: Kettle gravelly loamy sand with 8 to 40 percent slopes”.

1.4 Climate

Black Forest averages 21 inches of rain per year, and an average of 40 inches of snow, per year. There is an average of 251 sunny days each year with an average summer high of 81 degrees and the winter low is around 13 degrees.

1.5 Site Impacts

Update the narrative to state the FIRM panel no. and effective date.

An additional 2 single-family h[illegible]ructed on the property after subdivision. Increases in runoff will be minimal due to the increase in the relatively small amount of impervious area. Runoff will sheet flow across heavily forested and vegetated ground before leaving the property. There will be minimal off-site impacts.

1.6 Floodplain Designations

Update Major Basin Description by noting whether or not Smith Creek has a drainage basin planning study (DBPS) and whether or not the study identifies public improvements within or in the vicinity of the property.

The property is not located in a 100-year floodplain. The National Flood Hazard Insurance map for th[illegible]d of this report.

2.0 Drainage Basins

Gene[illegible] northeast to a tributary to Smith Creek, then northwest into Smith Cree[illegible]rea in a south westerly direction and empties into Monument Creek appro[illegible]west of the property.

Update section to explain how drainage basin areas were determined. Also include a description of any offsite flows that travel through property.

2.1 Major Basin Descriptions

The site drains northeast into a tributary to Smith Creek. Smi[illegible] Monument Creek. The Smith Creek tributary is developed with single family homes on lots larger than an acre. The tributary will drain into Smith Creek approximately 950 feet from the project site, and Smith Creek will drain into Monument Creek approximately 4.2 miles from the project site.

2.2 Minor Basin Descriptions

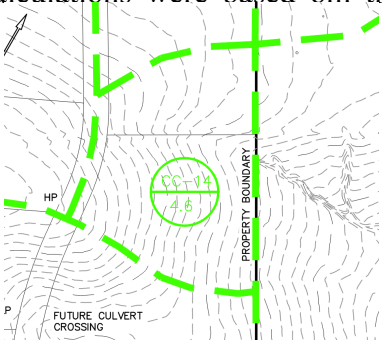
Surface water from the site sheet flows northeasterly across about 30% slopes into the Smith Creek tributary. Tributary slopes average 13 percent.

Revise title to sub-basin description.

Provide two sub-section. One for the historic condition and the other for the developed condition.

The intent is to describe each sub-basin (on-site & off-site) that are delineated in the associated historic and developed condition drainage map. See example below

[illegible]ess than 100 acres, therefore, the Rational [illegible]he peak flows Presentation of existing and [illegible]ate flow rates entering and exiting the [illegible]ns. The calculations were based om the



Basin CC-14 (Q_2 = 0.4 cfs Q_5 = 2 cfs, Q_{100} = 8 cfs) represents sheet flow from the rear portion of two future residential lots. The majority of this area is not anticipated to be developed, therefore not significantly changing the drainage conditions from the pre-development condition. Also, given the lot size, no water quality is required.

Hydraulic criteria may change based on the offsite subbasin impacting the property

Remove the 2yr.

Notice: County adopted chapter 6 of the City DCM and it only requires a 5-yr design storm for the minor event.

- Design storm (minor) 2-year
- Design storm (minor) 10-year
- Design storm (major) 100-year
- Rainfall intensities El Paso County I-D-F C
- Hydraulic Soil Type B

	C2	C10	C100
• Runoff Coefficients-Undeveloped			
○ Roof, Gravel (packed), 15.23-acres	0.03	0.17	0.36
• Runoff Coefficients-Developed			
	0.12	0.27	0.44

Elaborate on the runoff coefficient by describing the assumptions made to generate in determining the c-value.
Example: The developed condition values appear to be values for 1 ac residential. However plat indicates 5 ac lots. Values are conservative, explain why.

Basin 1 at 3.18cfs, Basin 2 at 1.48cfs, and
re enclosed in Appendix B.

Update section to clarify what these runoff coefficients are in reference to per City DCM Vol.1 table 6-6.

ge Manual," October 31, 2108

El Paso County "Engineering Criteria Manual." October 31, 2018

Add the Smith Creek DBPS

F ry 16, 2018

USDA Natural Resources Conservation Service, "Custom Soil Resource Report for El Paso County Area," January 16, 2019

Update Drainage Letter to include all latest EPC reference manuals.

5.0 CONCLUSION

The proposed development will have minimal storm water impacts to adjacent properties. The increased flow as seen in the rational method calculations sheet in Appendix B for the 100-year storm for Basin 1 is 3.18 cfs, Basin 2 is 1.48 cfs, and Basin 3 is 0.40 cfs. The increased flows from 2 single-family homes and driveways will not affect the surrounding areas. Water will sheet flow across vegetated and forested ground before leaving each of the new parcels.

Update drainage letter to include a description on drainage fee calculation. Parcels are situated in Smith Creek drainage basin which is part of a Drainage Basin Planning Study and has fees based on impervious acre. Make sure to use 21 Drainage Basin Fees. Per ECM Appendix I.3.10.2a Fee Reductions for Low Density Lots, applicant may qualify for drainage fee reductions.

Please include a section that talks about the Four Step Process per ECM Appendix I.7.2.A, describing how this project addresses this criteria.

Add a section regarding drainage facility design.

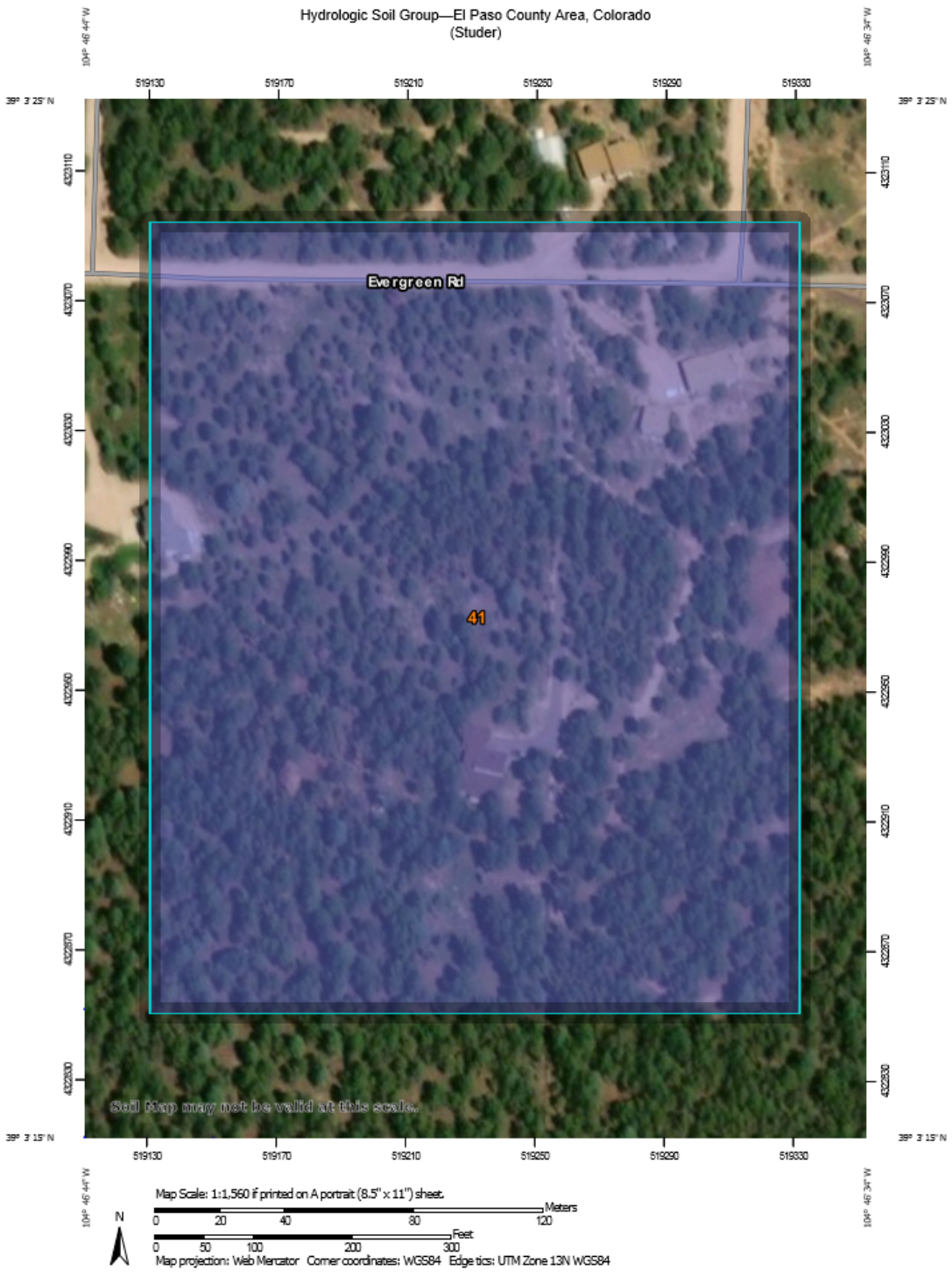
1. Discuss the existing and proposed hydrologic condition entering and existing the subdivision. County criteria DCM 2.5.2 is to provide detention storage so new development release rate will not exceed the historic runoff rate or capacity of downstream facilities. What is the increase in runoff? If the design engineer does not recommend permanent detention facility, explain why.

2. Discuss water quality requirements. Provide a narrative for why this subdivision does not require a permanent water quality facility and reference the specific section of the ECM. See ECM Appendix I Section I.7.1.B.5.

3. Discuss any site constraints in the site. The drainage map shows a drainageway bisecting Lot 1 with 19.14 cfs. Driveway crossing is likely required to access lots 2 and 3. Provide hydraulic analysis and recommendation for the culvert to be used. The access easement to lots 2 and 3 are along the eastern property line therefore check to make sure the culvert does not result in backwater effect that may impact the upstream property.

APPENDIX A

CURRENT CONDITIONS


Hydrologic Soil Group—El Paso County Area, Colorado
(Studer)
104° 46' 44" W
104° 46' 34" W
39° 3' 25" N
39° 3' 15" N
519130
519170
519210
519250
519290
519330
4323110
4323070
4323030
4322990
4322950
4322910
4322870
4322830
Evergreen Rd
41
Soil Map may not be valid at this scale.
Map Scale: 1:1,560 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 20 40 80 120
Feet
0 50 100 200 300
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 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 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 4, 2010—Oct 16, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	12.2	100.0%
Totals for Area of Interest			**12.2**	**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.

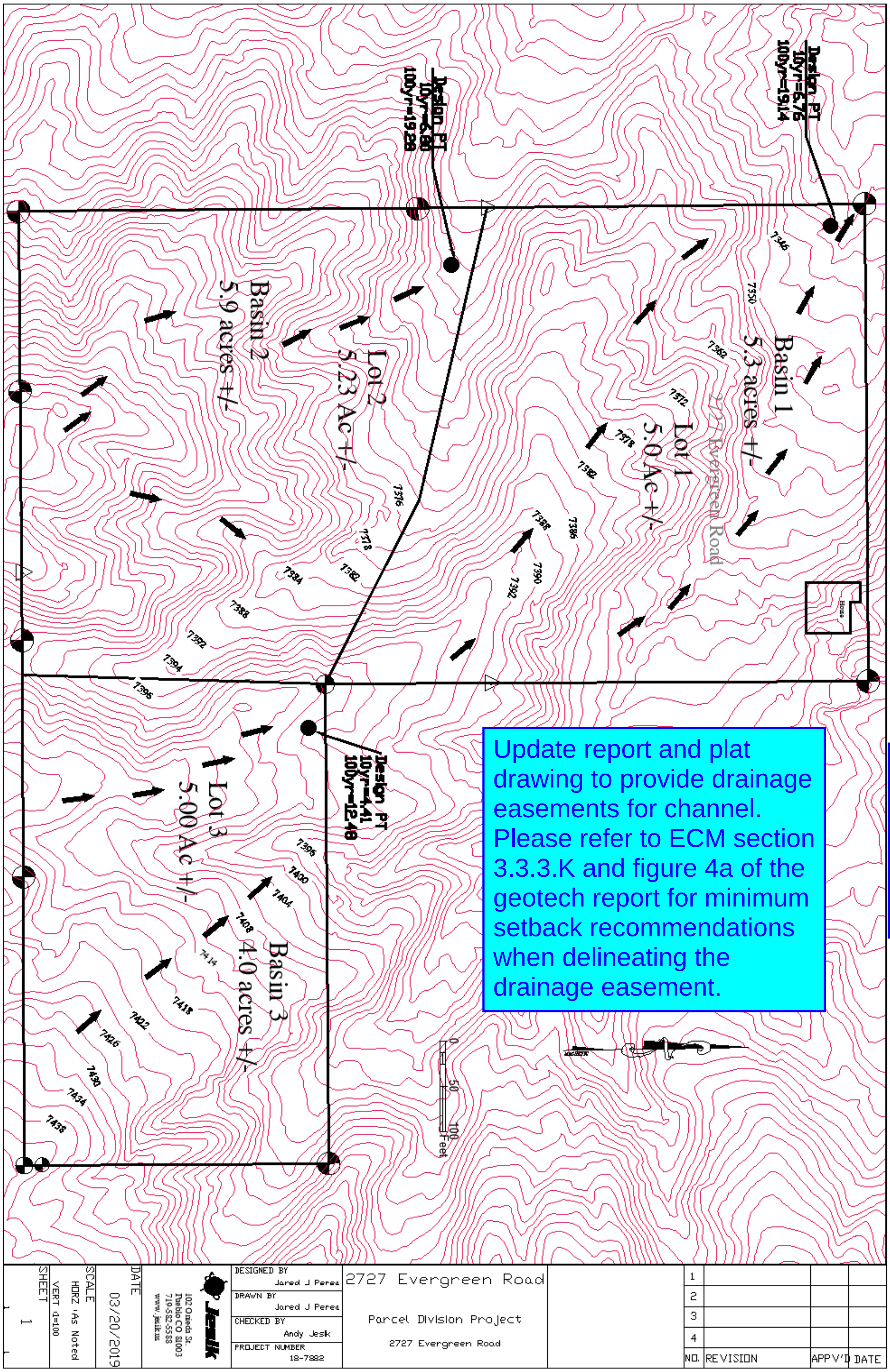
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Update report and plat drawing to provide drainage easements for channel. Please refer to ECM section 3.3.3.K and figure 4a of the geotech report for minimum setback recommendations when delineating the drainage easement.

Update drainage map to show sub basins for onsite and offsite flows.

Update report to include a drainage map of the proposed conditions.

Please revise report to place drainage map at the end of drainage letter.

APPENDIX B
HYDROLOGIC CALCULATIONS

Table 6-6 Coefficients for Rational Method

(Source: UDFCD 2001)

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

Paved	100	0.89	0.89	0.92	0.92	0.96	0.96
Gravel	80	0.57	0.60	0.63	0.66	0.70	0.74
Drive and Walks	100	0.89	0.89	0.92	0.92	0.96	0.96
Roofs	90	0.71	0.73	0.75	0.77	0.81	0.83
Lawns	0	0.02	0.04	0.15	0.25	0.35	0.50

3.2. - Time of Concentration

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

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

$t_c = t_i + t_t$ (Eq. 6-7)

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min) ;0h5; 3.2.1.\Overland (Initial)

Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

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

Where:

t_i = overland (initial) flow time (min)

C_5 = runoff coefficient for 5-year frequency (see Table 6-6)

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize. ;0h5; 3.2.2.\Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	**C_v**
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried) *	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15

Paved areas and shallow paved swales	20
*For buried riprap, select Cv value on type or vegetative cover.	

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7. ;0h5; 3.2.3.\First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = L / 180 + 10 \quad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

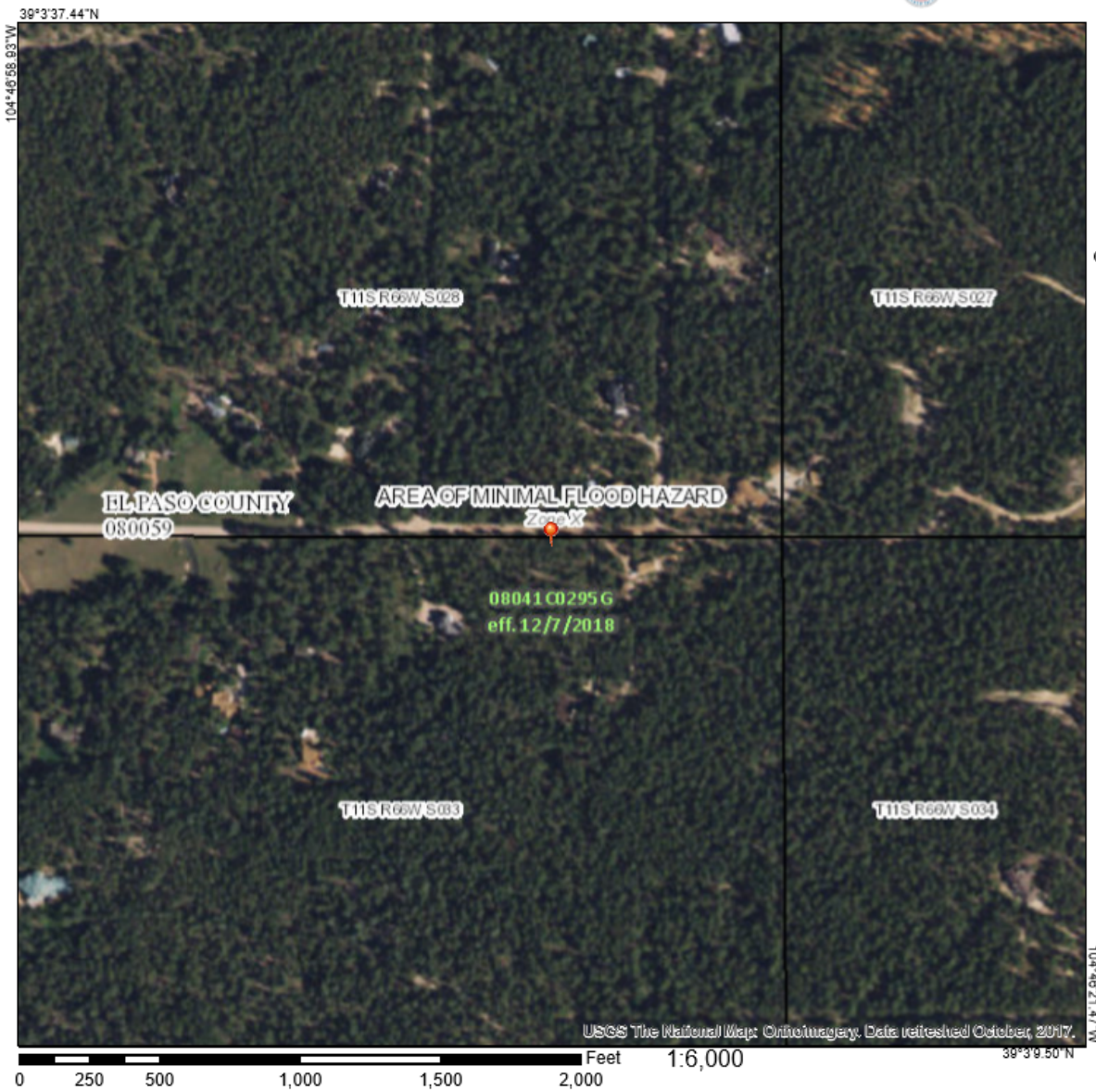
Peak Flows

	5-year (cfs)	10-year (cfs)	100-year (cfs)
Basin 1	1.85	4.26	15.66
Basin 1-Developed	4.11	6.76	19.14
Change in flow	2.26	2.50	3.48
Basin 2	1.86	4.28	15.75
Basin 2-Developed	4.13	6.80	19.25
Change in flow	2.27	2.52	3.50
Basin 3	1.20	2.78	10.21

Basin 3-Developed	2.68	4.41	12.48
Change in flow	1.48	1.63	2.27

National Flood Hazard Layer FIRMette

FEMA



Legend

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

- SPECIAL FLOOD HAZARD AREAS
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- OTHER AREAS OF FLOOD HAZARD
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- OTHER AREAS
  - NO SCREEN Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- GENERAL STRUCTURES
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- OTHER FEATURES
  - 20.2 Cross Sections with 1% Annual Chance
  - 17.5 Water Surface Elevation
  - Coastal Transect
  - 513 Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
- MAP PANELS
  - Digital Data Available
  - No Digital Data Available
  - Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/16/2019 at 10:33:38 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

will be reviewed in detail on the resubmittal once basins are delineated

Staff recommends revising per ECM Appendix L Table 3-1

thod Calculations

Calculation of Peak Runof

Designer: Jared J Perea
Company: Jesik Consulting
Date: 2/22/2019
Project: 18-7882
Location: 2727 Evergreen Road

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

$t_{minimum} = 5$
$t_{minimum} = 1$
Selected $t_c =$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channel		
				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)
Basin 1	5.30	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.5	500.00			7.200	5.01	0.00		
				0.03	0.09	0.17	0.26	0.31	0.36						4.65			
Basin 1-Dev	5.30	B	12.0	0.07	0.09	0.15	0.32	0.39	0.48	0.5	500.00			7.200	4.67	0.00		
				0.12	0.20	0.27	0.35	0.40	0.44						4.14			
Basin 2	5.90	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.5	400.00			1.600	7.36	0.00		
				0.03	0.09	0.17	0.26	0.31	0.36						6.83			
Basin 2-Dev	5.90	B	12.0	0.07	0.09	0.15	0.32	0.39	0.48	0.5	400.00			1.600	6.86	0.00		
				0.12	0.20	0.27	0.35	0.40	0.44						6.09			
Basin 3	4.00	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.5	391.00			1.000	8.50	0.00		
				0.03	0.09	0.17	0.26	0.31	0.36						7.89			
Basin 3-Dev	4.00	B	12.0	0.07	0.09	0.15	0.32	0.39	0.48	0.5	391.00			1.000	7.93	0.00		
				0.12	0.20	0.27	0.35	0.40	0.44						7.03			

Revise to 300 max

ff using Rational Method

(urban)
0 (non-urban)

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

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)

1-hour rainfall depth, P1 (in) =	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
	0.83	1.09	1.33	1.69	1.99	2.31	3.14

Rainfall Intensity Equation Coefficients =	a	b	c
	28.50	10.00	0.786

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

$Q(cfs) = CIA$

ized (Travel) Flow Time				Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
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
7.200	10	26.83	0.00	5.01	25.66	10.00	2.23	2.95	3.60	4.57	5.38	6.25	8.50	0.10	0.19	1.39	6.34	9.68	14.42	24.46
				4.65		4.14	2.93	3.87	4.73	6.00	7.07	8.21	11.16	0.47	1.85	4.26	8.27	11.62	15.66	32.13
7.200	10	26.83	0.00	4.67	23.96	10.00	2.23	2.95	3.60	4.57	5.38	6.25	8.50	0.83	1.33	2.93	7.86	11.27	15.96	26.11
				4.14		4.14	2.93	3.87	4.73	6.00	7.07	8.21	11.16	1.86	4.11	6.76	11.14	14.99	19.14	34.29
1.600	10	12.65	0.00	7.36	25.66	10.00	2.23	2.95	3.60	4.57	5.38	6.25	8.50	0.11	0.21	1.55	7.06	10.77	16.05	27.23
				6.83		6.09	2.65	3.50	4.27	5.42	6.39	7.41	10.08	0.47	1.86	4.28	8.32	11.68	15.75	32.31
1.600	10	12.65	0.00	6.86	23.96	10.00	2.23	2.95	3.60	4.57	5.38	6.25	8.50	0.92	1.48	3.27	8.75	12.55	17.77	29.07
				6.09		6.09	2.65	3.50	4.27	5.42	6.39	7.41	10.08	1.87	4.13	6.80	11.20	15.07	19.25	34.49
1.000	10	10.00	0.00	8.50	25.66	10.00	2.23	2.95	3.60	4.57	5.38	6.25	8.50	0.08	0.14	1.05	4.78	7.30	10.88	18.46
				7.89		7.03	2.53	3.35	4.08	5.19	6.11	7.09	9.64	0.30	1.20	2.78	5.40	7.58	10.21	20.95
1.000	10	10.00	0.00	7.93	23.96	10.00	2.23	2.95	3.60	4.57	5.38	6.25	8.50	0.63	1.01	2.21	5.93	8.51	12.04	19.71
				7.03		7.03	2.53	3.35	4.08	5.19	6.11	7.09	9.64	1.22	2.68	4.41	7.26	9.77	12.48	22.36