

PRELIMINARY/FINAL DRAINAGE REPORT

FOR

APPALOOSA HWY 24 SUBDIVISION FILING NO. 2, LOTS 1, 2 & 3

**Prepared For:
Platte Valley, LLC
1378 Promontory Bluff View
Colorado Springs, CO 80921**

**Prepared By:
Associated Design Professionals, Inc.
3520 Austin Bluffs Parkway Suite 102
Colorado Springs, CO 80918
719.266-5212**

**ADP Project No. 160504
May 16, 2018**

This is the final drainage report completed for the Appaloosa Vacation and Replat (VR1813). Provide a drainage letter meeting the requirements in DCM Vol. 1 Section 4.5.





ENGINEER'S STATEMENT:

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

Michael A. Bartusek, P.E. #23329

DEVELOPER'S STATEMENT:

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

By: _____
Ron Waldthausen

Title: President

Address: Platte Valley, LLC
1378 Promontory Bluff View
Colorado Springs, CO 80921

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

Jennifer Irvine, County Engineer/ECM Administrator

Date

Conditions:

PRELIMINARY/FINAL DRAINAGE REPORT
APPALOOSA SUBDIVISION
FILING No. 2, LOTS 1, 2 & 3

PROJECT DESCRIPTION

This drainage report is for the development of the Appaloosa Subdivision, Filing No. 2, Lots 1, 2 & 3. The currently vacant 4.67 acre site is located north of U.S. Hwy 24 and east of Amelia Street. It is further described as the southern portion of Section 7, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado.

All of this lot is located in Sand Creek drainage basin and drains into the central tributary of Sand Creek. An existing 4'x4' box culvert is located at the southeast corner of U.S. Hwy 24 and Amelia St. Also an existing concrete channel is located on the east side of proposed Lot 3.

SOILS

The soil on the site can be described as having a rapid permeability, medium-surface runoff, and moderate to high hazard of erosion. The soils within the site are Truckton sandy loams. These soils are classified as Hydrologic Group 'B'.

FLOODPLAIN STATEMENT

A small portion of the developed site is located within a designated FEMA 100-year floodplain according to the information published in the Federal Emergency Management Agency Flood Plain Map No. 080059C0754F, dated March 17, 1997, and LOMR 05-08-0368P dated May 23, 2007. This area falls within the existing concrete channel.

METHOD OF COMPUTATION

The methodology utilized for this report is in accordance with the *City Drainage Criteria Manual, Volumes 1*, dated May 2014. The Rational Method for computation of runoff was used for determining Sub-Basin flows.

$$Q = cia$$

Where

- Q = maximum rate of runoff in cubic feet per second
- c = runoff coefficient representing drainage area characteristics
- i = average rainfall intensity, in inches per hour, for the duration required for the runoff to become established
- a = drainage basin size in acres

EXISTING DRAINAGE CONDITIONS

The existing site has been overlotted graded and is covered with rangeland grasses. The western portion of the site drains in a southerly direction toward the existing 4' x 4' box culvert under U.S. Hwy 24. The eastern portion of the site drains westerly toward the 4' x 4' box culvert. An existing concrete channel is located on the east side of the lot, but no flows from this parcel drain to the concrete channel. A portion of the concrete channel has failed with other portions showing signs of joint failure.

The existing sub-basin AEX produces flows of 0.8 cfs for the 5-year storm and 6.3 cfs for the 100-year storm.

DEVELOPED DRAINAGE CONDITIONS

The developed site will be divided into three (3) lots. Lots 1 and 2 will encompass 0.98 acres each and Lot 3 will encompass 2.7 acres. The proposed land is zoned I-2 (Limited Industrial). Drainage from each lot will be self-contained with all flows directed to an extended detention basin (EDB) facility in the southwest corner of Lot 3.

Lot 1, Sub-basin A, is located in the northern portion of the site. Sub-basin A will produce flows of 1.6 cfs for the 5-year storm and 3.5 cfs for the 100-year storm. These flows will continue south and be intercepted by a proposed swale located along the property line. The flows will then travel west to a proposed type 'C' inlet at the southwest corner of the site. An 18" HDPE storm sewer will transport these flows into Lot 2.

Lot 2, Sub-basin B, is located in the center of the site. Sub-basin B will produce flows of 1.6 cfs for the 5-year storm and 3.5 cfs for the 100-year storm. As with Lot 1 the site flows will be intercepted by a swale located along the property line. These flows will be intercepted by a type 'C' inlet at the southwest corner of the lot. These flows will combine with the flows from Sub-basin A at DP1 to produce flows of 3.2 cfs for the 5-year storm and 7.0 cfs for the 100-year storm. An 18" HDPE storm sewer will transport these flows into the proposed EDB in Lot 3.

Lot 3, Sub-basin C, is located in the southern portion of the site. Sub-basin C will produce flows of 3.7 cfs and 8.3 cfs respectively. These flows will be intercepted by a proposed swale located along the south property line and into the proposed EDB. The combined flows into the basin at DP2 will be 6.5 cfs for the 5-year storm and 14.3 cfs for the 100-year storm.

The proposed 0.656 ac.ft. EDB will reduce the site flows into the existing 4' x 4' box culvert to 3.9 cfs for the 5-year storm and 5.3 cfs for the 100-year storm.

CONCRETE CHANNEL REPAIR

Approximately 120 lf of the existing concrete channel will need to be removed and replaced. The channel section is 6 feet wide and 7 feet deep. The new concrete channel section will be doweled into the concrete channel sections which remain.

WATER QUALITY AND DETENTION

Water quality for the site will be achieved within by 0.118 acre-feet of storage, 1.85 ft deep within the 0.656 ac. ft. extended detention basin (EDB). The remainder of the basin will provide the storage volume required for detention. The facility will have an 18" HDPE outlet pipe with a 12" restrictor plate located 6.5" above the pipe invert.

PRIVATE DRAINAGE FACILITIES

Item	Unit	Quantity	Unit Cost	Total Cost
18" HDPE FES	EA	1	\$450	\$ 450.00
18" HDPE	LF	400	\$45	\$ 18,000.00
Outlet Structure	EA	1	\$5,000	\$ 5,000.00
Emergency Spillway	EA	1	\$1,500	\$ 1,500.00
Type 'C' Inlet	EA	2	\$3,270	\$ 6,540.00
Concrete Channel	LF	120	\$150	<u>\$18,000.00</u>
			Sub-Total	\$49,490.00
			15% Contingency & Engineering	<u>\$ 7,423.50</u>
			TOTAL	\$56,913.50

DRAINAGE BASIN FEES

Based on a resolution, No. 16-336, passed by the Board of County Commissioners on September 29, 2016, drainage and bridge fees will only be assessed on the two (2) smaller lots in the replat. The area of the two (2) smaller lots is 1.96 acres.

The proposed development is located within the Sand Creek drainage basin. The 2018 drainage basin fee calculation is as follows:

Impervious Coverage	=	73.6%
Area Subject to Fee	=	0.736 x 1.96 acres = 1.443 acre
Sand Creek Basin Fee	=	\$17,197/acre
Drainage Basin Fee	=	\$17,197 x 1.443 = \$24,815
Sand Creek Bridge Fee	=	\$5,210
Bridge Fee	=	\$5,210 x 1.443 = \$7,518

CONCLUSION

The proposed development and subsequent lot developments follow the “Four Step Process” as mandated by the EPA as follows:

Step 1: Runoff has been reduced by disconnecting impervious areas where possible, eliminating “unnecessary” impervious areas and encouraging infiltration into suitable soils.

Step 2: All drainageways, ditches and channels have been stabilized by the following methods:

- Tributaries have been left in their relatively natural state where possible.
- New drainageways and swales have been stabilized with either riprap or erosion control fabric depending on the erosion potential.
- No new roadside ditches are proposed for the development.

Step 3: The proposed development will disturb approximately 4.5 acres, although the initial disturbance will only be 0.7 acres.

Step 4: The development of this project will not affect sensitive waters.

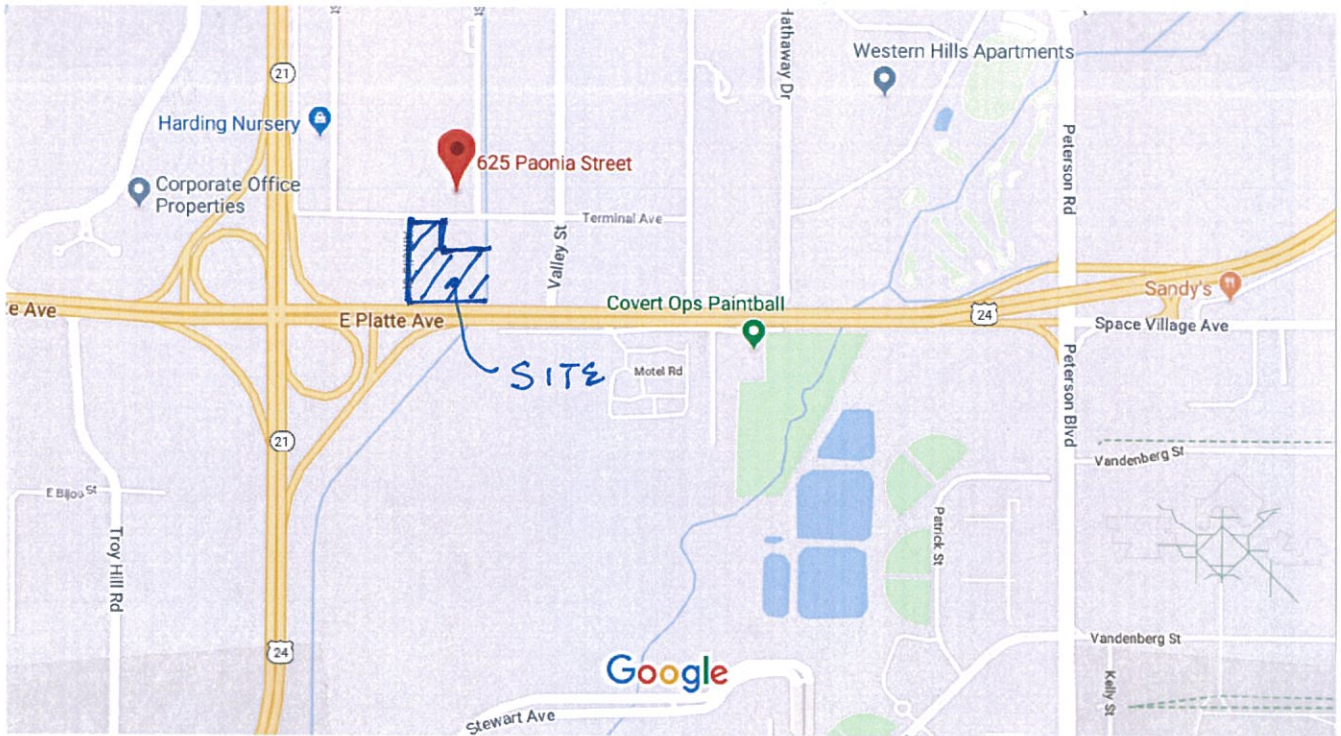
The development of this site will have little impact on downstream properties once the EDB is constructed.

REFERENCES

1. City of Colorado Springs and El Paso County (1994). *Drainage Criteria Manual Volume I* (DCM).
2. City of Colorado Springs and El Paso County (1994). *Drainage Criteria Manual Volume II* (DCM).
3. Soil Survey of El Paso County Area, Colorado by USDA, NRCS.
4. *El Paso County (January 2006) Engineering Criteria Manual*.
5. Urban Drainage and Flood Control District (June 2011). *Urban Storm Drainage Criteria Manual, Volume 1-3*.
6. Sand Creek Drainage Basin Planning Study (DBPS).
7. Preliminary/Final Drainage Plan and Report for the Appaloosa Hwy 24 Subdivision by Oliver E. Watts, Consulting Engineer, dated November, 2000.

APPENDIX A

MAPS

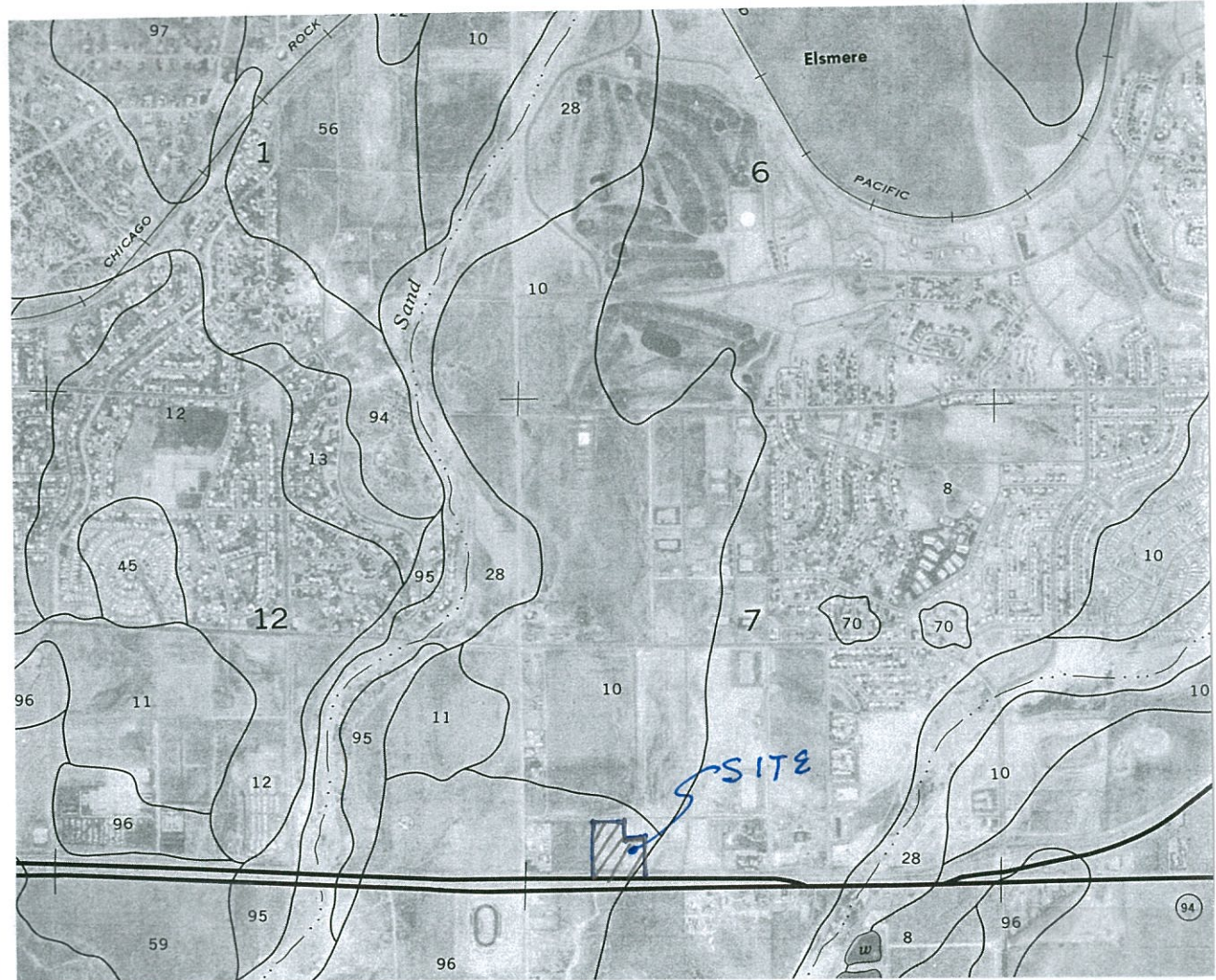


VICINITY MAP

N.T.S.

ADPCIVIL
ENGINEERING FOR THE FUTURE

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SOILS MAP
N.T.S.




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104°43'07"
38°50'37"

JOINS PANEL 0752

EL PASO COUNTY UNINCORPORATED AREAS 080059

- Legend**
-  1% annual chance (100-Year) Floodplain
 -  1% annual chance (100-Year) Floodway
 -  0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 754 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

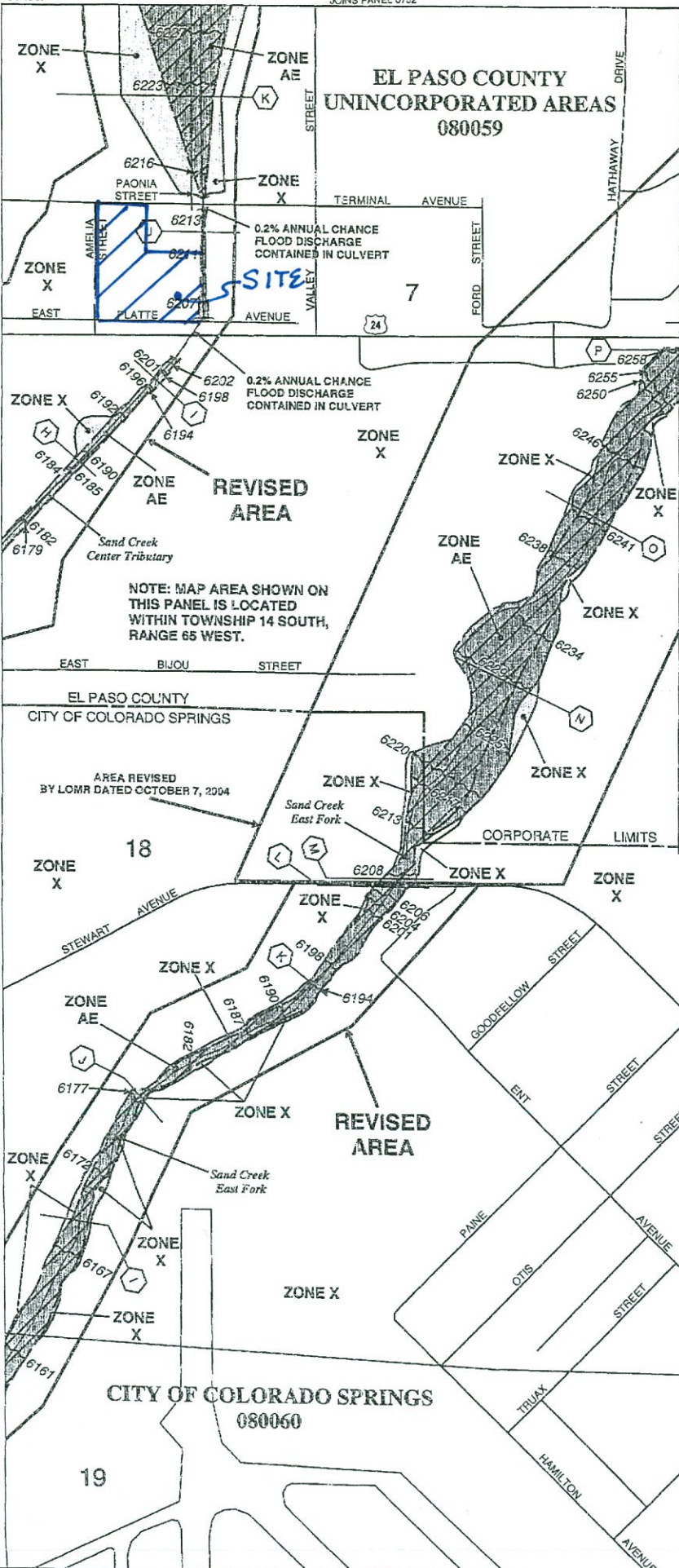
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX

COLORADO SPRINGS, CITY OF 08000 0754 F
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0754 F

MAP NUMBER
08041C0754 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST.

AREA REVISED BY LOMR DATED OCTOBER 7, 2004

EL PASO COUNTY
CITY OF COLORADO SPRINGS

CITY OF COLORADO SPRINGS
080060

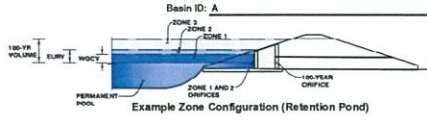
APPENDIX B

DESIGN CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Appaloosa Subdivision



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	4.58 acres
Watershed Length =	500 ft
Watershed Slope =	0.012 ft/ft
Watershed Imperviousness =	76.70% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Group C/D =	0.0% percent
Desired WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depth =	Denver - Capitol Building
Water Quality Capture Volume (WQCV) =	0.118 acre-foot
Excess Urban Runoff Volume (EURV) =	0.380 acre-foot
2-yr Runoff Volume (P1 = 1.19 in.) =	0.327 acre-foot
5-yr Runoff Volume (P1 = 1.5 in.) =	0.431 acre-foot
10-yr Runoff Volume (P1 = 1.75 in.) =	0.538 acre-foot
25-yr Runoff Volume (P1 = 2 in.) =	0.662 acre-foot
50-yr Runoff Volume (P1 = 2.25 in.) =	0.757 acre-foot
100-yr Runoff Volume (P1 = 2.52 in.) =	0.880 acre-foot
500-yr Runoff Volume (P1 = 3.01 in.) =	1.058 acre-foot
Approximate 2-yr Detention Volume =	0.307 acre-foot
Approximate 5-yr Detention Volume =	0.405 acre-foot
Approximate 10-yr Detention Volume =	0.506 acre-foot
Approximate 25-yr Detention Volume =	0.642 acre-foot
Approximate 50-yr Detention Volume =	0.764 acre-foot
Approximate 100-yr Detention Volume =	0.907 acre-foot

Optional User Override	1-hr Precipitation
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.01	inches

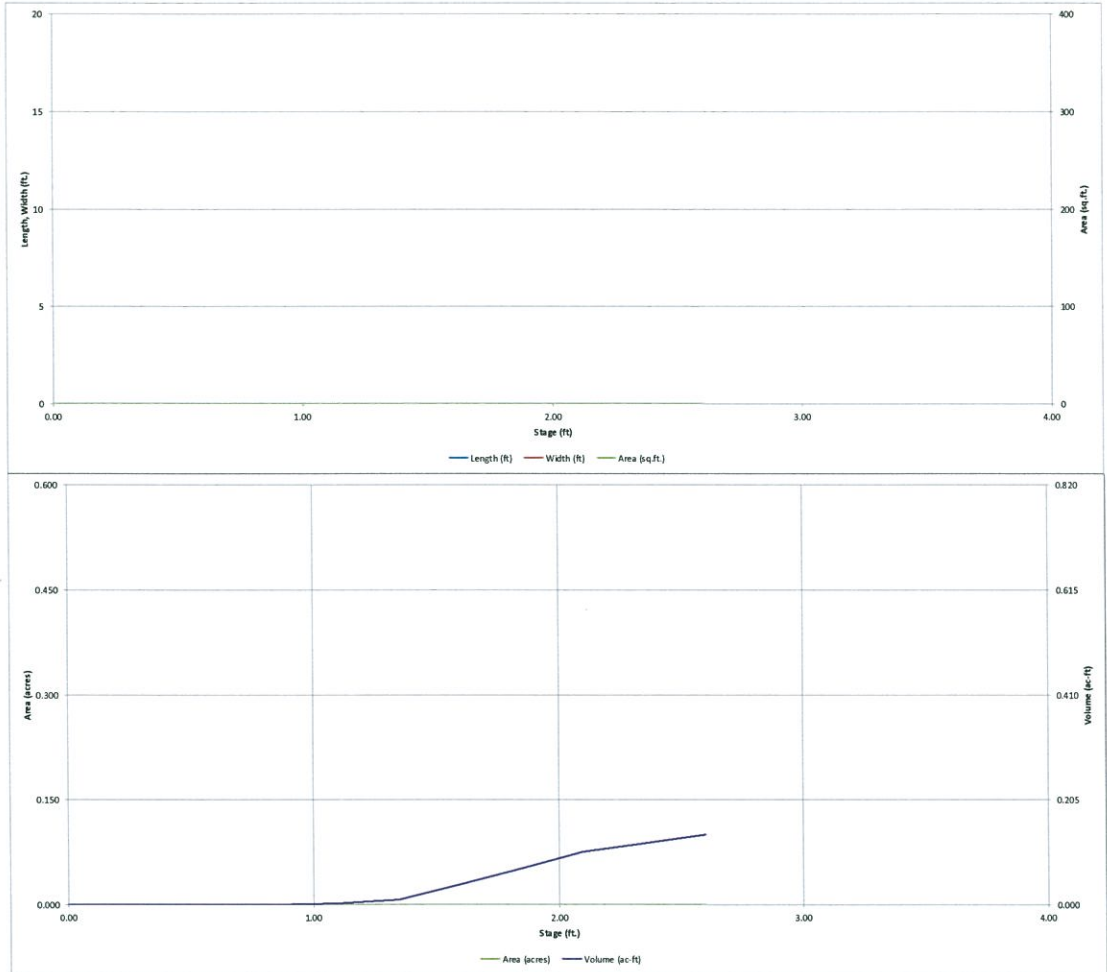
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.118	acre-foot
Zone 2 Volume (EURV - Zone 1) =	0.271	acre-foot
Zone 3 (100yr + 1/2 WQCV - Zones 1 & 2) =	0.267	acre-foot
Total Detention Basin Volume =	0.656	acre-foot
Initial Surcharge Volume (ISV) =	0	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{det}) =	5.00	ft
Depth of Trickle Channel (H _{trc}) =	0.50	ft
Slope of Trickle Channel (S _{trc}) =	0.001	ft/ft
Slopes of Main Basin in Sides (S _{mb}) =	3	H:V
Basin Length-to-Width Ratio (R _{mb}) =	2	
Initial Surcharge Area (A _{is}) =	0	ft ²
Surcharge Volume Length (L _{sv}) =	0.3	ft
Surcharge Volume Width (W _{sv}) =	0.3	ft
Depth of Basin Floor (H _{100yr}) =	0.10	ft
Length of Basin Floor (L _{100yr}) =	99.9	ft
Width of Basin Floor (W _{100yr}) =	50.0	ft
Area of Basin Floor (A _{100yr}) =	4,997	ft ²
Volume of Basin Floor (V _{100yr}) =	166	ft ³
Depth of Main Basin (H _{mb}) =	4.07	ft
Length of Main Basin (L _{mb}) =	124.4	ft
Width of Main Basin (W _{mb}) =	74.4	ft
Area of Main Basin (A _{mb}) =	9,258	ft ²
Volume of Main Basin (V _{mb}) =	28,588	ft ³
Calculated Total Basin Volume (V _{mb}) =	0.660	acre-foot

Depth Increment =	0.25	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	0.00									
ISV	0.33							0	0.000	
	0.50							0	0.000	
	0.75							0	0.000	
Floor	0.93							124	0.003	
	1.00							471	0.011	
	1.25							1,762	0.040	
	1.50							3,111	0.071	
	1.75							4,519	0.104	
Zone 1 (WQCV)	1.86							5,216	0.120	
	2.00							5,987	0.137	
	2.25							7,578	0.174	
	2.50							9,171	0.211	
	2.75		110.9	60.9	6,754	0.155	10,828	0.249		
	3.00		112.4	62.4	7,014	0.161	12,549	0.288		
	3.25		113.9	63.9	7,279	0.167	14,335	0.329		
	3.50		115.4	65.4	7,548	0.173	16,189	0.372		
Zone 2 (EURV)	3.61		116.0	66.1	7,668	0.176	17,025	0.391		
	3.75		116.9	66.9	7,821	0.180	18,110	0.416		
	4.00		118.4	68.4	8,009	0.186	20,100	0.461		
	4.25		119.9	69.9	8,382	0.192	22,160	0.509		
	4.50		121.4	71.4	8,669	0.199	24,291	0.558		
	4.75		122.9	72.9	8,960	0.206	26,464	0.608		
Z3 (100+1/2WQCV)	5.00		124.4	74.4	9,256	0.212	28,771	0.660		
	5.25		125.9	75.9	9,556	0.219	31,123	0.714		
	5.50		127.4	77.4	9,861	0.226	33,520	0.770		
	5.75		128.9	78.9	10,171	0.233	36,054	0.828		
	6.00		130.4	80.4	10,485	0.241	38,836	0.887		
	6.25		131.9	81.9	10,803	0.248	41,296	0.948		
	6.50		133.4	83.4	11,126	0.255	44,038	1.011		
	6.75		134.9	84.9	11,453	0.263	46,800	1.078		
	7.00		136.4	86.4	11,785	0.271	49,765	1.142		
	7.25		137.9	87.9	12,122	0.278	52,753	1.211		
	7.50		139.4	89.4	12,463	0.286	55,826	1.282		
	7.75		140.9	90.9	12,808	0.294	58,985	1.354		
	8.00		142.4	92.4	13,156	0.302	62,230	1.429		
	8.25		143.9	93.9	13,513	0.310	65,564	1.505		
	8.50		145.4	95.4	13,872	0.318	68,987	1.584		
	8.75		146.9	96.9	14,235	0.327	72,500	1.664		
	9.00		148.4	98.4	14,603	0.335	76,105	1.747		
	9.25		149.9	99.9	14,975	0.344	79,802	1.832		
	9.50		151.4	101.4	15,352	0.352	83,593	1.919		
	9.75		152.9	102.9	15,734	0.361	87,479	2.008		
	10.00		154.4	104.4	16,120	0.370	91,460	2.100		
	10.25		155.9	105.9	16,510	0.379	95,539	2.193		
	10.50		157.4	107.4	16,905	0.388	99,716	2.289		
	10.75		158.9	108.9	17,305	0.397	103,992	2.387		
	11.00		160.4	110.4	17,708	0.407	108,368	2.488		
	11.25		161.9	111.9	18,117	0.416	112,847	2.591		
	11.50		163.4	113.4	18,530	0.425	117,427	2.696		
	11.75		164.9	114.9	18,947	0.435	122,112	2.803		
	12.00		166.4	116.4	19,369	0.445	126,901	2.913		
	12.25		167.9	117.9	19,796	0.454	131,797	3.026		
	12.50		169.4	119.4	20,227	0.464	136,799	3.140		
	12.75		170.9	120.9	20,662	0.474	141,910	3.258		
	13.00		172.4	122.4	21,102	0.484	147,131	3.378		
	13.25		173.9	123.9	21,546	0.495	152,462	3.500		
	13.50		175.4	125.4	21,995	0.505	157,904	3.625		
	13.75		176.9	126.9	22,449	0.515	163,460	3.753		
	14.00		178.4	128.4	22,907	0.526	169,129	3.883		
	14.25		179.9	129.9	23,369	0.536	174,914	4.015		
	14.50		181.4	131.4	23,836	0.547	180,814	4.151		
	14.75		182.9	132.9	24,308	0.558	186,832	4.289		
	15.00		184.4	134.4	24,783	0.569	192,968	4.430		

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

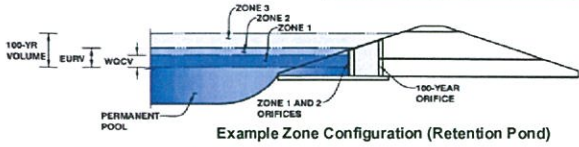
UD-Detention, Version 3.07 (February 2017)



Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: s Academy Business Ctr
Basin ID: A



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.85	0.118	Orifice Plate
Zone 2 (EURV)	3.60	0.271	Orifice Plate
100+1/2WQCV	4.98	0.267	Weir&Pipe (Restrict)
		0.656	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 5/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	0.31	0.31	0.31					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft ²
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	1.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	% grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _g =	1.50	N/A	feet
Over Flow Weir Slope Length =	2.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.87	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	2.80	N/A	ft ²
Overflow Grate Open Area w/ Debris =	1.40	N/A	ft ²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.58	N/A	ft ²
Outlet Orifice Centroid =	0.32	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.29	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

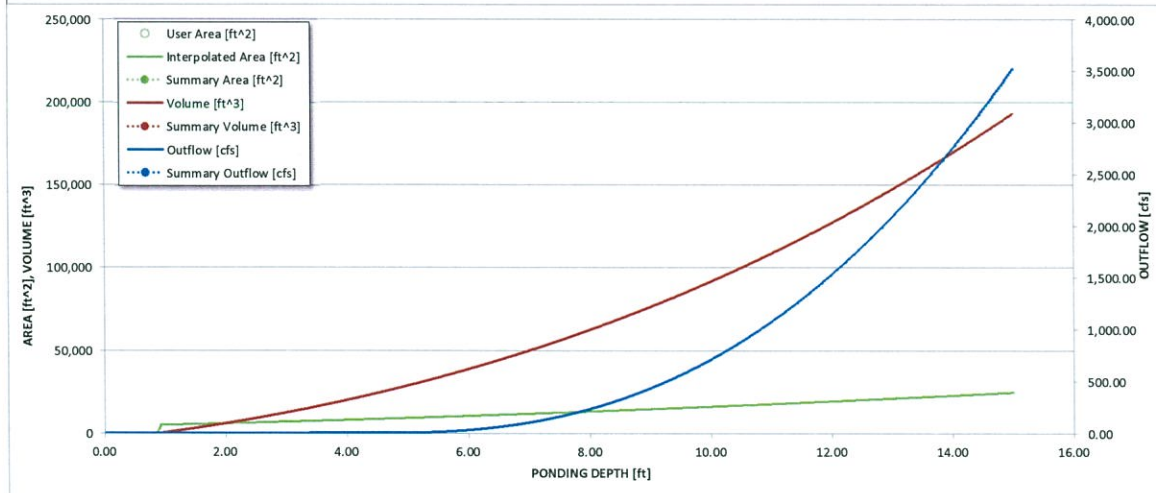
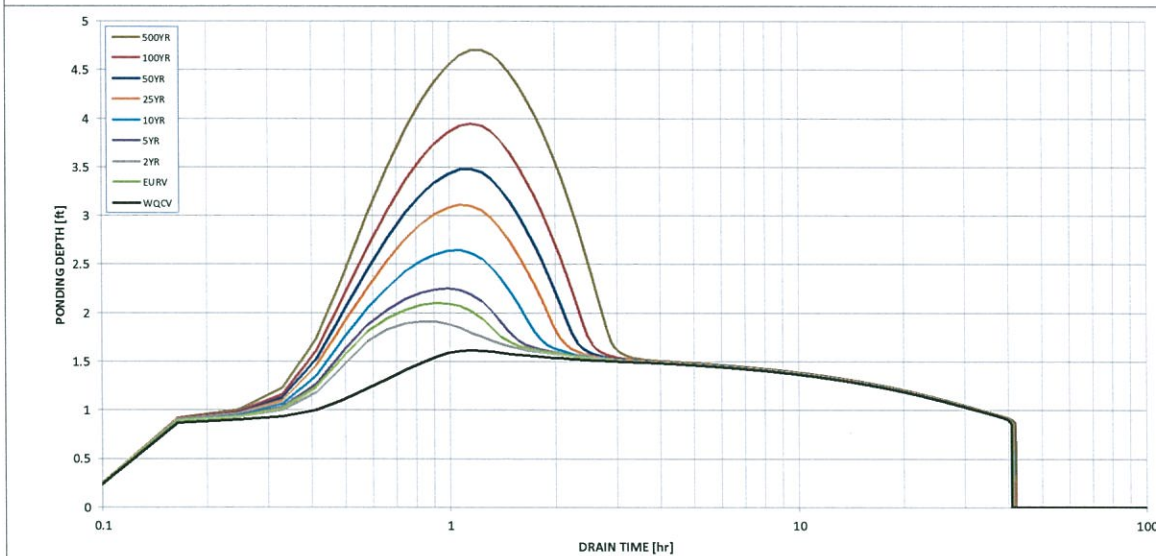
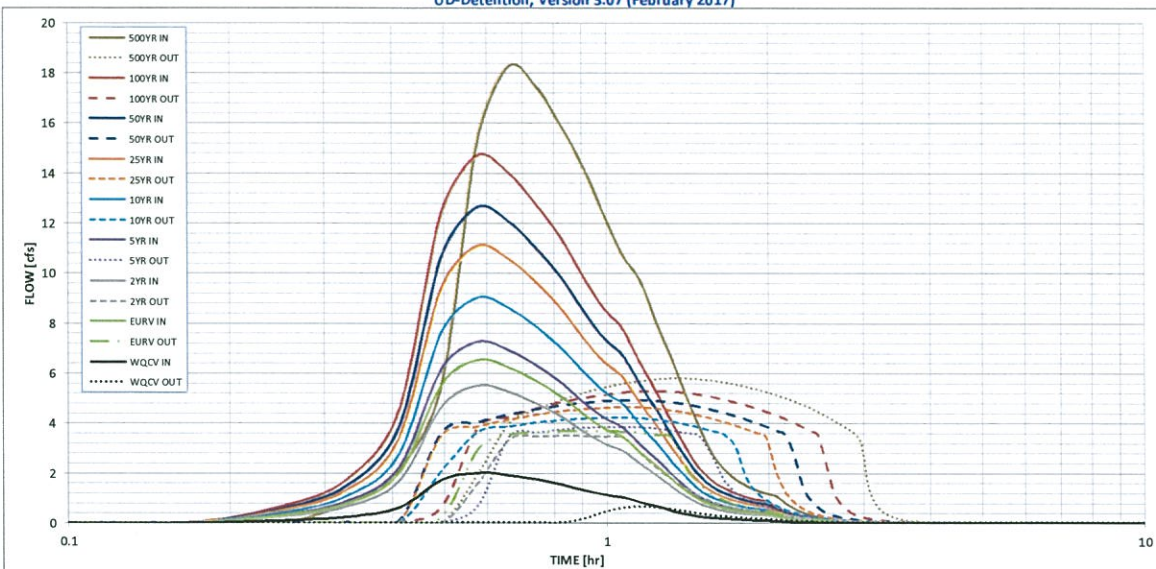
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.01
Calculated Runoff Volume (acre-ft) =	0.118	0.389	0.327	0.431	0.538	0.662	0.757	0.880	1.098
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.118	0.388	0.326	0.431	0.537	0.662	0.756	0.879	1.097
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.20	0.67	0.93	1.25	1.77
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.1	0.9	3.1	4.3	5.7	8.1
Peak Inflow Q (cfs) =	2.0	6.5	5.5	7.3	9.0	11.1	12.6	14.7	18.2
Peak Outflow Q (cfs) =	0.7	3.7	3.5	3.8	4.2	4.6	4.9	5.3	5.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	39.8	4.5	1.5	1.2	0.9	0.7
Structure Controlling Flow =	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	0.19	1.31	1.23	1.4	1.5	1.6	1.7	1.9	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	33	34	32	30	28	27	25	22
Time to Drain 99% of Inflow Volume (hours) =	40	38	39	38	38	37	36	36	34
Maximum Ponding Depth (ft) =	1.61	2.10	1.91	2.25	2.64	3.11	3.48	3.94	4.70
Area at Maximum Ponding Depth (acres) =	0.13	0.14	0.14	0.14	0.15	0.16	0.17	0.18	0.20
Maximum Volume Stored (acre-ft) =	0.087	0.151	0.127	0.173	0.232	0.304	0.366	0.450	0.598

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

APPENDIX C
DESIGN CHARTS

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

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

Figure 6-25. Estimate of Average Concentrated Shallow Flow

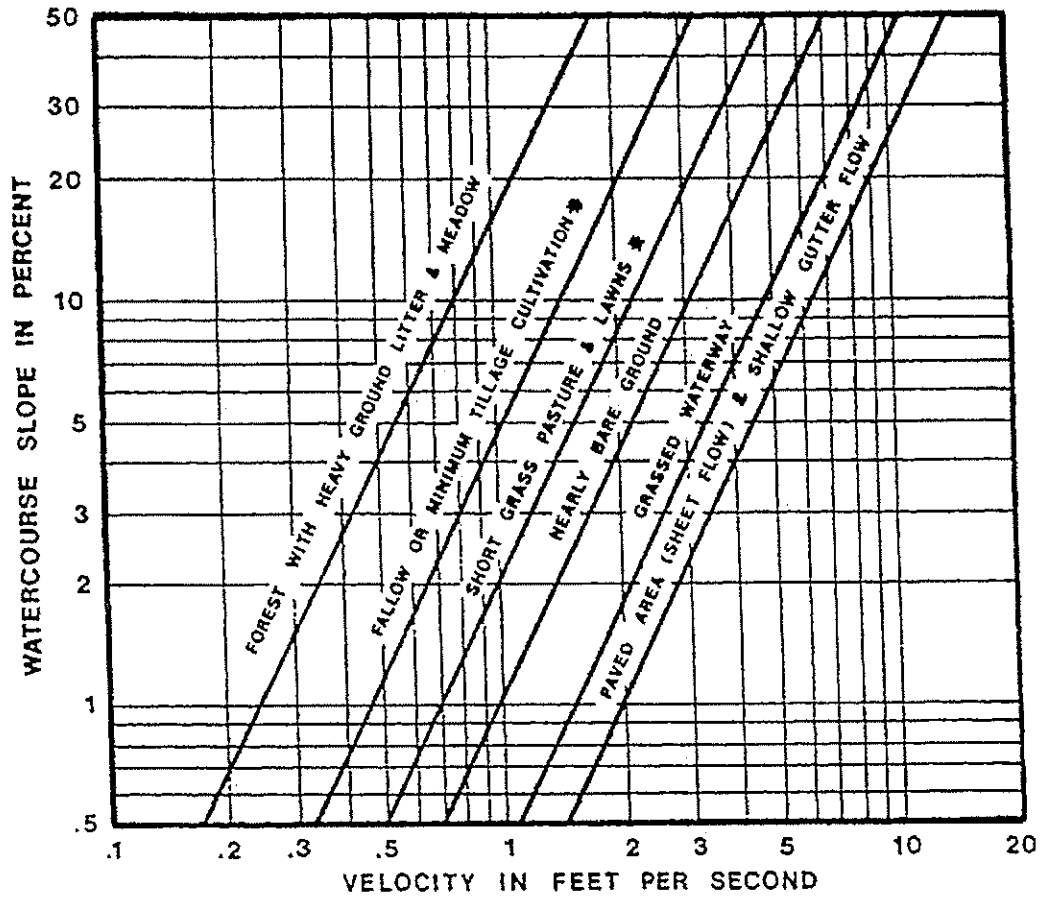
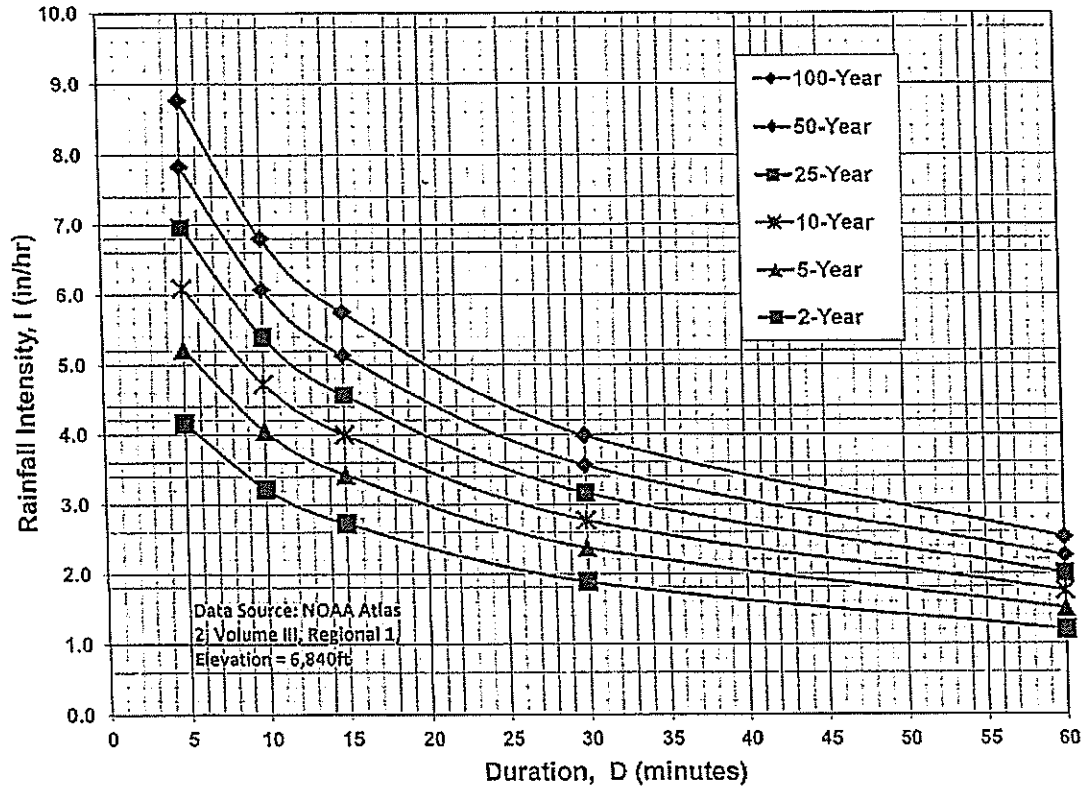


Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

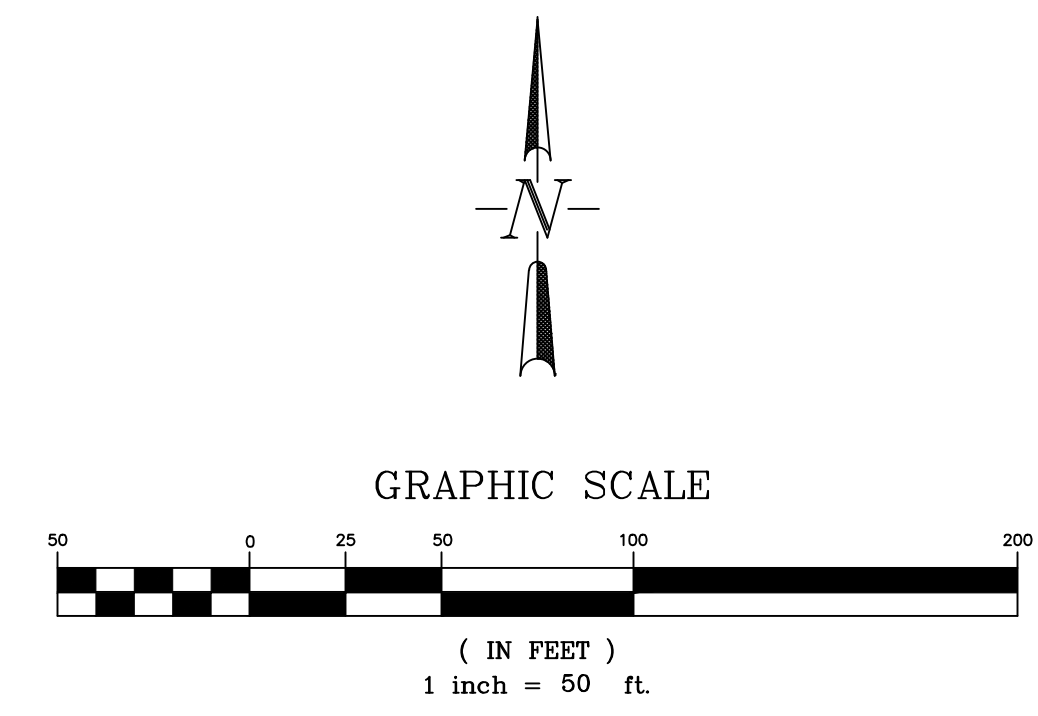
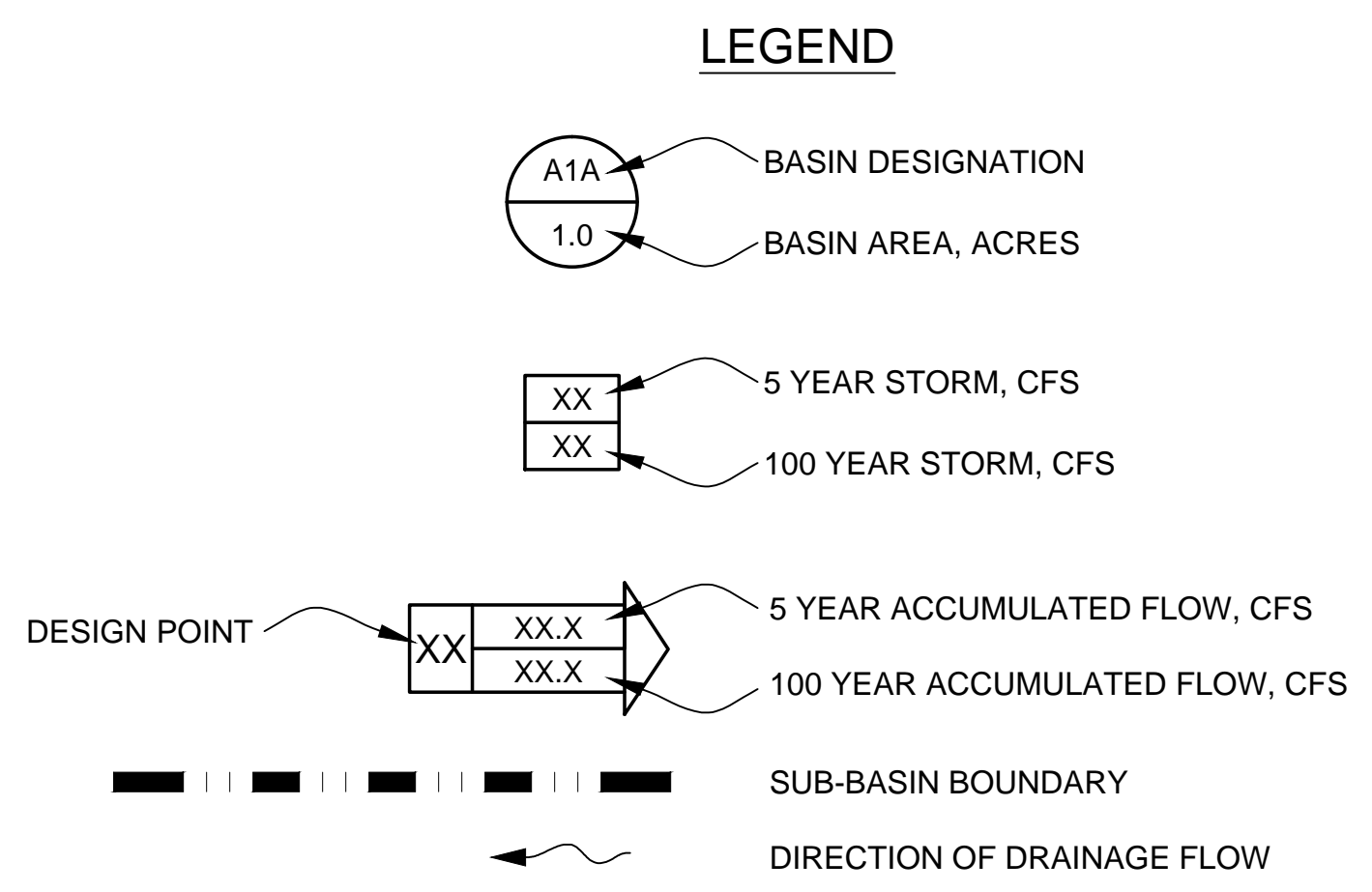
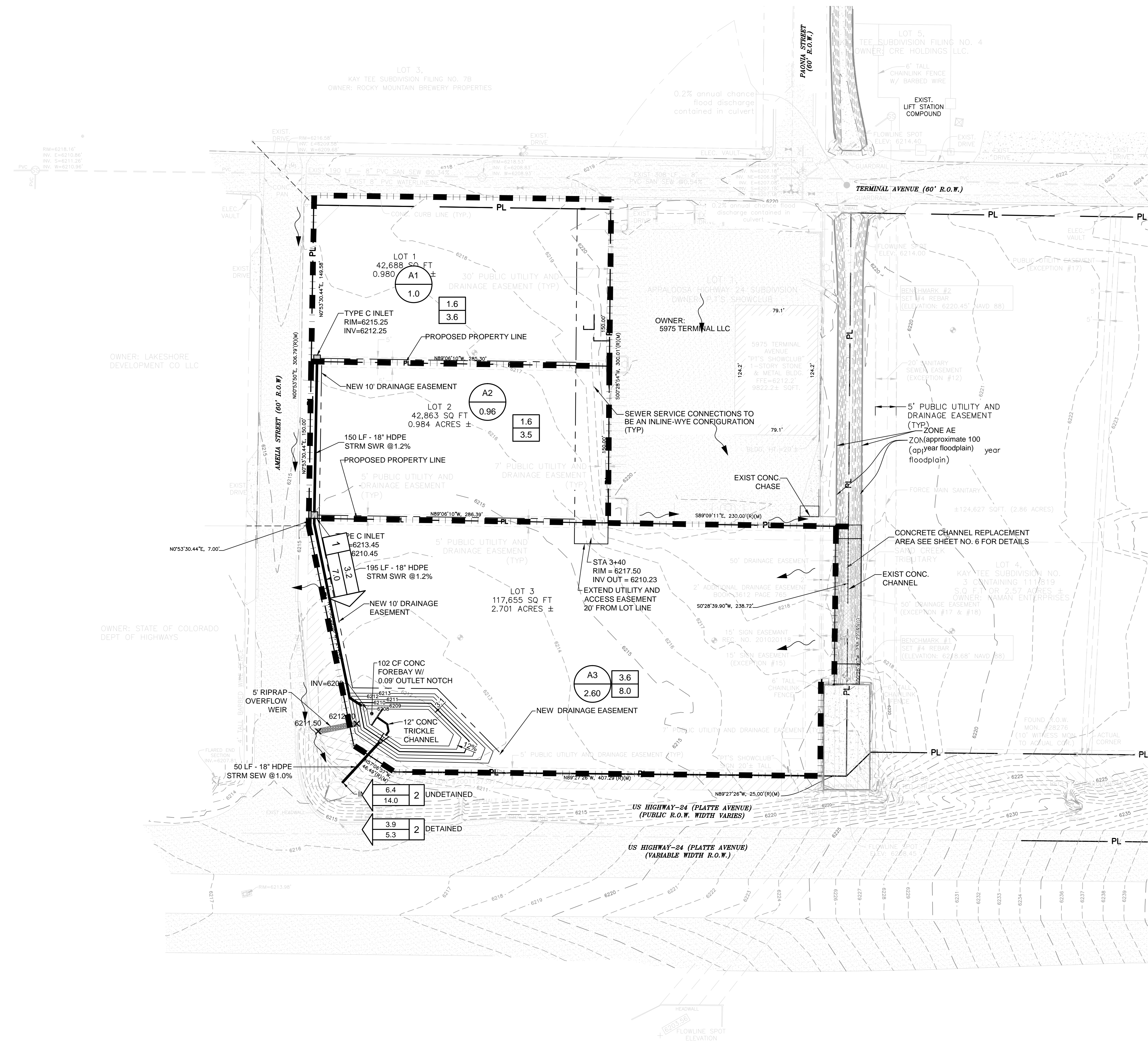
$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_5 = -1.50 \ln(D) + 7.583$$

$$I_2 = -1.19 \ln(D) + 6.035$$

Note: Values calculated by equations may not precisely duplicate values read from figure.

M:\LAND PROJECTS\2016\160504-Appaloosa Sub DWG\160504-Const.dwg Mike Wed, 06/06/18 10:39 AM



DESIGNED BY MAB	PROJECT ENGINEER MAB	PROJECT MANAGER MAB	SCALE: 1" = 50'
DATE: 04/16/18	JOB NO: 160504	CADD FILE NO: 160504-CADD	DRAWN BY: HJG
PREPARED BY:			
3520 Austin Bluffs Parkway Suite 102 Colorado Springs, CO 80918 (719) 266-5212 fax: (719) 266-5341			
NO.	DATE	REVISION	
APPALOOSA HIGHWAY 24 SUBDIVISION FILING NO. 2 COLORADO SPRINGS, COLORADO DRAINAGE PLAN			
SHEET			
1 of 1			

Drainage_v1-redline.pdf Markup Summary

dsdgrimm (1)

ADP Project No. 1:
May 16, 2018

This is the final drainage report completed for the Appaloosa Vacation and Replat (VR1813). Provide a drainage letter meeting the requirements in DCM Vol. 1 Section 4.5.

Subject: Engineer
Page Label: 1
Lock: Unlocked
Author: dsdgrimm
Date: 6/18/2019 2:33:57 PM
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This is the final drainage report completed for the Appaloosa Vacation and Replat (VR1813). Provide a drainage letter meeting the requirements in DCM Vol. 1 Section 4.5.