



Preliminary Drainage Report

Waterview North El Paso County, CO

Prepared for:

CRP Entitlements, LLC
31 N. Tejon Street, Suite 514
Colorado Springs, CO 80903
Contact: Charles Cothorn

Prepared by:

Kimley-Horn and Associates, Inc.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903
(719) 453-0180
Contact: John Heiberger, P.E.

Project #: 096955001

Prepared: July 15, 2021

Kimley»Horn



CERTIFICATION

ENGINEERS STATEMENT

This report and plan for the preliminary drainage design of Waterview North was prepared by me (or under my direct supervision) in accordance with the provisions of El Paso County Drainage Design and Technical Criteria for the owners thereof. I understand that El Paso County does not and will not assume liability for drainage facilities designed by others.

SIGNATURE (Affix Seal): _____
John Heiberger, Colorado P.E. No. 50096 Date

EL PASO COUNTY

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

Jennifer Irvine, P.E.
County Engineer / ECM Administrator

Date

Conditions:

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GENERAL LOCATION AND PROJECT DESCRIPTION

PURPOSE AND SCOPE OF STUDY

The purpose of this report is to outline the Preliminary Drainage Report (the “Preliminary Report”) for Waterview North (the “Project”) located on three parcels at the northeast corner of S. Powers Blvd and Bradley Rd (the “Site”), El Paso County, Colorado (the “County”).

This Preliminary Report identifies on-site and offsite drainage patterns, areas tributary to the site and proposes to safely route developed storm water to adequate outfalls at or less than historic flow rates. This Preliminary Drainage Report is intended to accompany the early grading permit application for the Project. A Final Drainage Report containing detailed proposed site stormwater infrastructure design will be submitted at a later date. The Project will be processed through El Paso County. Additional outside agency review or processing is not anticipated as part of the Project.

LOCATION

The Project is located on three parcels at the northeast corner of S. Powers Blvd and Bradley Rd (the “Site”), El Paso County, Colorado (the “County”). The Site is located within the Jimmy Camp Creek Basin which is mostly vacant land. The Site is surrounded by:

North: Peak Innovation Parkway, Lot 7 Colorado Springs Airport Filing No. 1D

South: Bradley Road

East: Colorado Centre Metro District, Lot 4 Colorado Centre Foreign Trade Zone & Business Park Filing No. 1

West: S. Powers Boulevard

DESCRIPTION OF PROPERTY

The proposed improvements consist of single and multi-family residential, industrial, and commercial uses within the Site. The Project will also include construction of internal roadways and utility infrastructure which will be detailed in the Final Drainage Report submitted at a later date.

The total Site is approximately 116.5 acres and consists of vacant land with native vegetation within the Jimmy Camp Creek Basin. The Site drains approximately from the northwest corner to the southeast corner at grades that vary from 5% to 15%.

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type A and B. The NRSC Soils map is provided in **Appendix A**.

There are no major irrigation facilities within the Site. The Site does not currently provide on-site water quality or detention for the Project area. There is no regional detention pond for the Project Site.

There is an existing gas main that runs along the east side of the property.

DRAINAGE BASINS AND SUBBASINS

MAJOR BASIN DESCRIPTIONS

The Project Site is a part of the *Amendment to the Master Drainage Development Plan for Waterview, Waterview North* prepared by Dakota Springs Engineering, dated February 2021 (the “MDDP Amendment”).

The Flood Insurance Rate Map (FIRM) 08041C0768G effective date December 7, 2018, by FEMA, indicates that the Site is located in Zone X (outside of the 500-year flood plain) and no portion of this Site is located within the 100-year floodplain. This panel is included in **Appendix A**.

SUBBASIN DESCRIPTIONS

The Site is located in the Jimmy Camp Creek watershed and generally slopes from northwest to southeast at approximately 5%-15%. Currently, the site consists of natural vegetation. The existing runoff from the Site is captured by existing storm sewer within S. Powers Boulevard and Bradley Road. The runoff then continues east and eventually outfalls to Jimmy Camp Creek.

Off-site basins sheet flow onto the Site from the north. The offsite flow is within two separate basins: The Big Johnson Basin and the Jimmy Camp Creek Basin. The offsite flows were analyzed within the Master Development Drainage Plan. A Pre-Development Basin Map from the MDDP Amendment is provided in **Appendix E** which shows the offsite basins.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

The Project follows the El Paso County Drainage Criteria Manual, Volumes 1 and 2 (the “CRITERIA”) and the Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3 (the “MANUAL”). Project area drainage is not significantly impacted by such constraints as utilities or existing development. Further detail regarding onsite drainage patterns is provided in the Drainage Facility Design section.

Hydrologic Criteria

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per the CRITERIA. The Rational Method was used for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the MANUAL by calculating weighted impervious values for each specific Site sub-basin. Full spectrum detention basins will be designed during the Final Drainage Report process. Temporary sediment basins were provided for the Site for the overlot grading construction associated with the Early Grading Permit. Temporary sediment basins were sized per the MANUAL fact sheet on sediment basins which is provided in **Appendix E**.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed Site was divided into six sub-basins. Each of these sub-basins sheet flows to a temporary sediment basin in the overlot graded condition. Hydrologic calculations are provided in Appendix B. A proposed conditions map is provided in Appendix D.

SPECIFIC DETAILS

Sub-Basin PA-1

Sub-basin PA-1 is 18.65 acres and is anticipated to be developed into a light industrial use. The runoff within this sub-basin will sheet flow to the temporary sediment basin 1. The 5-year and 100-year storm event runoffs are 36.58 cfs and 72.86 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into Jimmy Camp Creek. Additional details and final design calculations will be included in a final drainage report.

Sub-Basin PA-2

Sub-basin PA-2 is 23.14 acres and is anticipated to be developed into a commercial use. The runoff within this sub-basin will sheet flow to the temporary sediment basin 2. The 5-year and 100-year storm event runoffs are 96.90 cfs and 176.76 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into Jimmy Camp Creek. Additional details and final design calculations will be included in a final drainage report.

Sub-Basin PA-3

Sub-basin PA-3 is 16.57 acres and is anticipated to be developed into a residential use. The runoff within this sub-basin will sheet flow to temporary sediment basin 3. The 5-year and 100-year storm event runoffs are 69.36 cfs and 126.53 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into Jimmy Camp Creek. Additional details and final design calculations will be included in a final drainage report.

Sub-Basin PA4

Sub-basin PA-4 is 9.56 acres and is anticipated to be developed into a residential use. The runoff within this sub-basin will sheet flow to temporary sediment basin 4. The 5-year and 100-year storm event runoffs are 36.71 cfs and 66.97 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into Jimmy Camp Creek. Additional details and final design calculations will be included in a final drainage report.

Sub-Basin PA-5

Sub-basin PA-5 is 24.65 acres and is anticipated to be developed into a residential use. The runoff within this sub-basin will sheet flow to temporary sediment basin 5. The 5-year and 100-year storm event runoffs are 103.20 cfs and 188.26 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into Jimmy Camp Creek. Additional details and final design calculations will be included in a final drainage report.

Sub-Basin PA-6

Sub-basin PA-6 is 23.96 acres and is anticipated to be developed into a residential use. The runoff

within this sub-basin will sheet flow to temporary sediment basin 6. The 5-year and 100-year storm event runoffs are 39.09 cfs and 86.04 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into Jimmy Camp Creek. Additional details and final design calculations will be included in a final drainage report.

SUMMARY

COMPLIANCE WITH STANDARDS

The drainage design presented within this report for Waterview North conforms to the CRITERIA and MANUAL. Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments.

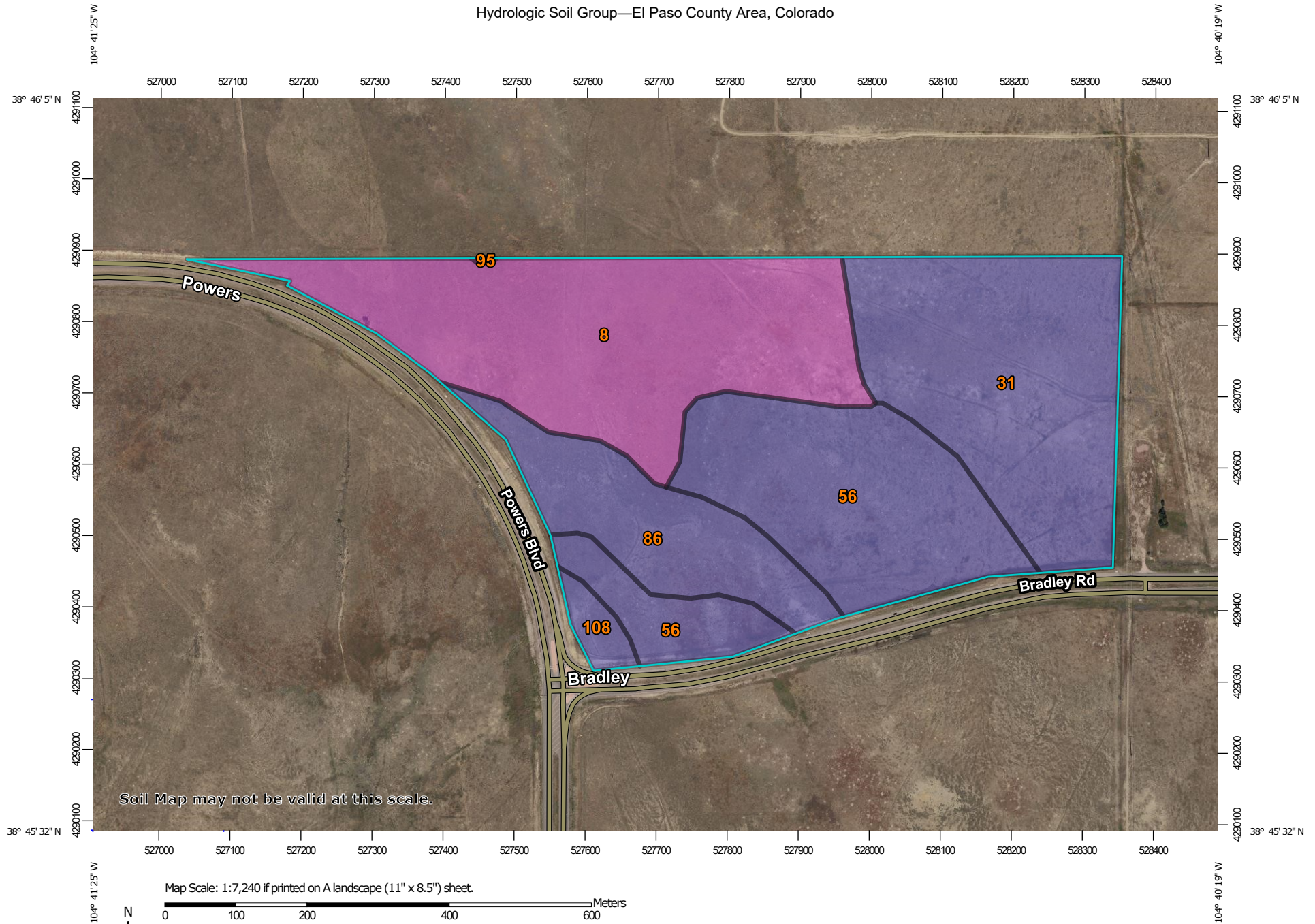
This report and findings are in general conformance with all previously approved reports and/or studies which include this Site. The proposed Project does not adversely impact the peak flows downstream within Jimmy Camp Creek.

REFERENCES

1. El Paso County Drainage Criteria Manual Volumes 1 and 2, May 2014.
2. Mile High Flood District Drainage Criteria Manual Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.
3. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0768G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).


APPENDIX A – SOILS MAP AND FEMA FIRM PANEL

Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines


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

Soil Rating Points






 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	38.3	33.1%
31	Fort Collins loam, 3 to 8 percent slopes	B	30.6	26.5%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	30.0	26.0%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	14.6	12.6%
95	Truckton loamy sand, 1 to 9 percent slopes	A	0.0	0.0%
108	Wiley silt loam, 3 to 9 percent slopes	B	2.0	1.7%
Totals for Area of Interest			115.6	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

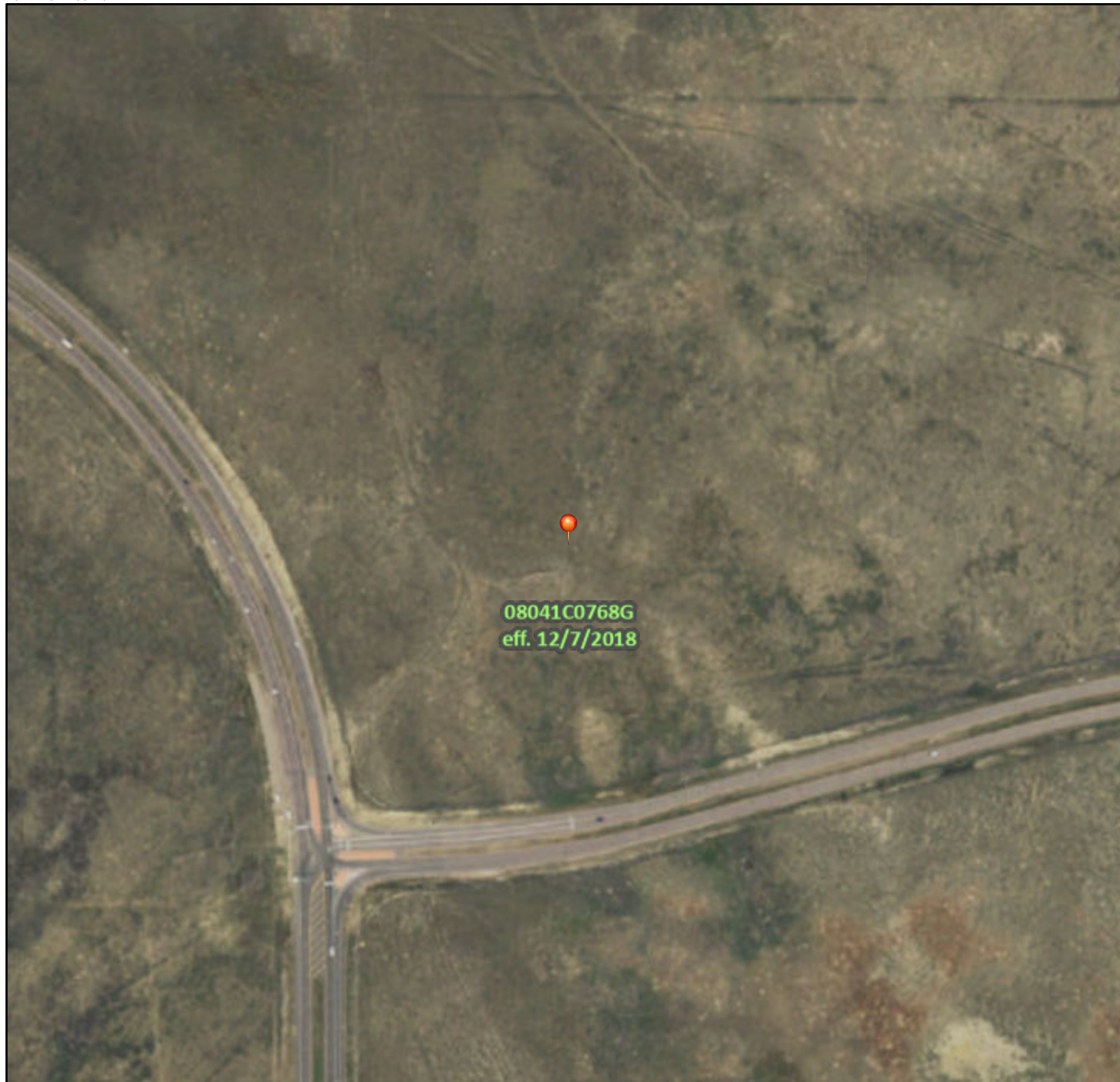
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette



104°41'8"W 38°46'1"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

104°40'31"W 38°45'33"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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 Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



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 **7/7/2021 at 3:45 PM** 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.

APPENDIX B – HYDROLOGIC CALCULATIONS

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

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_r) 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_r) 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.

IDF Equations:

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

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

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

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

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

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

Where:

I = Rainfall Intensity (in/hr)

D= Duration (minutes)

	<u>2-yr</u>	<u>5-yr</u>	<u>10-yr</u>	<u>100-yr</u>
P ₁ =	1.19	1.5	1.75	2.52

Time Intensity Frequency Tabulation

Time	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
5	4.12	5.17	6.03	6.89	7.75	8.68
10	3.29	4.13	4.82	5.51	6.19	6.93
15	2.81	3.52	4.11	4.69	5.28	5.91
30	1.99	2.48	2.89	3.31	3.72	4.16
60	1.16	1.44	1.68	1.92	2.16	2.42
120	0.34	0.40	0.47	0.54	0.60	0.67

*The Design Point Rainfall Values and Time Intensity Frequency Tabulation are found in Table 6-2 and Figure 6-5 respectively, of the Colorado Springs Drainage Criteria Manual, Volume 1

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	BASIN DESIGNATION	SOIL GROUP DESIGNATION	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
						C2	C5	C10	C100
PA-1	812,489	18.65	LIGHT INDUSTRIAL	A	80.0%	0.57	0.59	0.63	0.70
PA-2	1,008,140	23.14	COMMERCIAL	B	95.0%	0.79	0.81	0.83	0.88
PA-3	721,633	16.57	RESIDENTIAL	A	65.0%	0.79	0.81	0.83	0.88
PA-4	416,409	9.56	RESIDENTIAL	A	65.0%	0.79	0.81	0.83	0.88
PA-5	1,073,712	24.65	RESIDENTIAL	B	65.0%	0.79	0.81	0.83	0.88
PA-6	1,043,587	23.96	RESIDENTIAL	B	65.0%	0.41	0.45	0.49	0.59
TOTAL	5,075,970	116.53							

Waterview North - Drainage Report Proposed Runoff Calculations Time of Concentration																
SUB-BASIN DATA				INITIAL / OVERLAND TIME				TRAVEL TIME				T(c) CHECK (URBANIZED BASINS)				FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
PA-1	PA-1	812,489	18.65	0.59	100	1.2%	8.8	1170	1.2%	20.00	2.2	9.0	17.8	1270	17.1	17.1
PA-2	PA-2	1,008,140	23.14	0.81	100	6.3%	2.9	620	6.3%	20.00	5.0	2.1	5.0	720	14.0	5.0
PA-3	PA-3	721,633	16.57	0.81	100	7.9%	2.7	340	10.3%	20.00	6.4	0.9	5.0	440	12.4	5.0
PA-4	PA-4	416,409	9.56	0.81	100	7.9%	2.7	670	2.0%	20.00	2.8	3.9	6.6	770	14.3	6.6
PA-5	PA-5	1,073,712	24.65	0.81	100	18.6%	2.0	392	4.5%	20.00	4.2	1.5	5.0	492	12.7	5.0
PA-6	PA-6	1,043,587	23.96	0.45	100	1.9%	9.5	750	1.9%	20.00	2.8	4.5	14.0	850	14.7	14.0

Waterview North - Drainage Report Proposed Runoff Calculations (Rational Method Procedure) Design Storm 5 Year												
BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
PA-1	PA-1	18.65	0.59	17.1	11.00	3.32	36.58					
PA-2	PA-2	23.14	0.81	5.0	18.75	5.17	96.90					
PA-3	PA-3	16.57	0.81	5.0	13.42	5.17	69.36					
PA-4	PA-4	9.56	0.81	6.6	7.74	4.74	36.71					
PA-5	PA-5	24.65	0.81	5.0	19.97	5.17	103.20					
PA-6	PA-6	23.96	0.45	14.0	10.78	3.63	39.09					

Waterview North - Drainage Report Proposed Runoff Calculations (Rational Method Procedure) Design Storm 100 Year												
BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
PA-1	PA-1	18.65	0.70	17.1	13.06	5.58	72.86					
PA-2	PA-2	23.14	0.88	5.0	20.37	8.68	176.76					
PA-3	PA-3	16.57	0.88	5.0	14.58	8.68	126.53					
PA-4	PA-4	9.56	0.88	6.6	8.41	7.96	66.97					
PA-5	PA-5	24.65	0.88	5.0	21.69	8.68	188.26					
PA-6	PA-6	23.96	0.59	14.0	14.13	6.09	86.04					

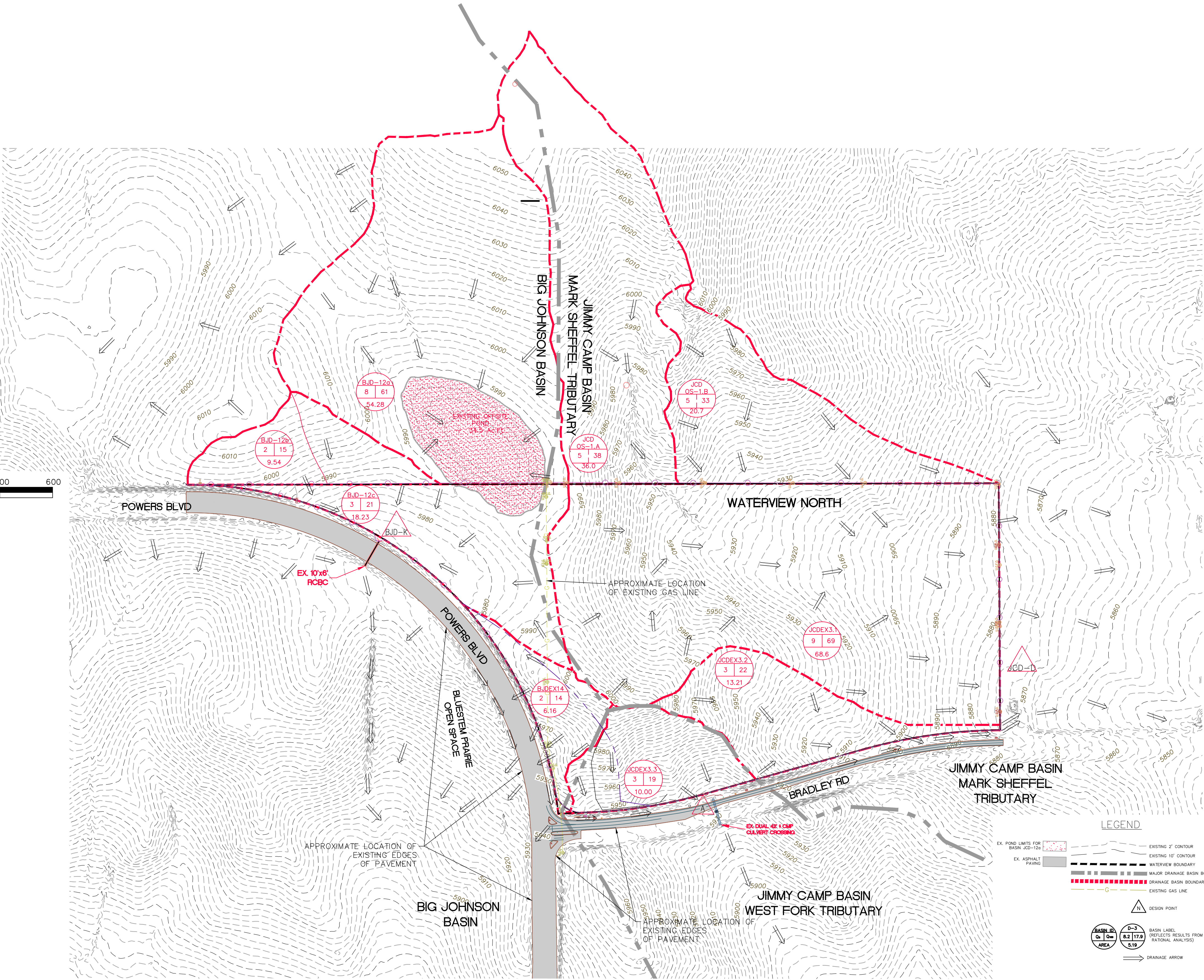
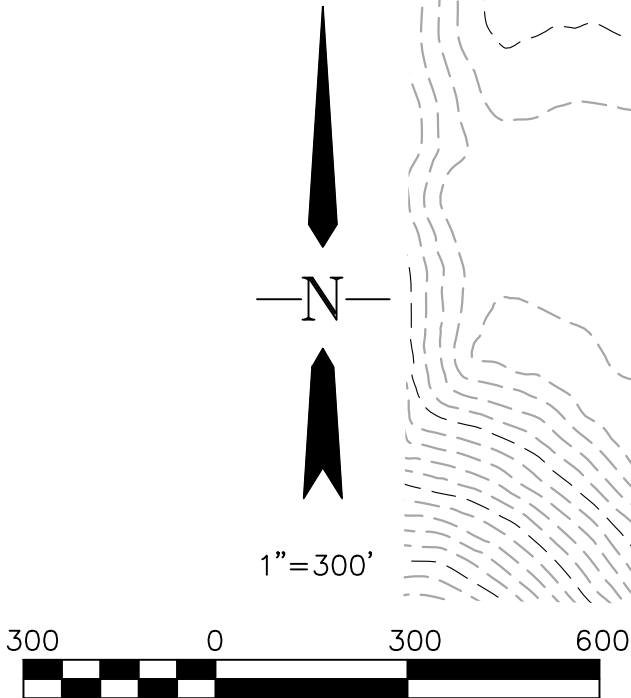
SUMMARY - PROPOSED RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
PA-1	PA-1	18.65	36.58	72.86	36.58	72.86
PA-2	PA-2	23.14	96.90	176.76	96.90	176.76
PA-3	PA-3	16.57	69.36	126.53	69.36	126.53
PA-4	PA-4	9.56	36.71	66.97	36.71	66.97
PA-5	PA-5	24.65	103.20	188.26	103.20	188.26
PA-6	PA-6	23.96	39.09	86.04	39.09	86.04

APPENDIX C – DRAINAGE EXHIBITS

PRE-DEVELOPMENT BASIN MAP

BASIN ID	BASIN AREA (Ac.)	DESIGN POINT	RATIONAL ANALYSIS RESULTS	
			Q _s (CFS)	Q ₁₀₀ (CFS)
BJD-12a	54.28		8	61
BJD-12b	9.54		2	15
BJD-12c	18.23		3	21
		BJD-K	4	31
JCD OS-1A	36.0		5	38
JCD OS-1B	20.7		5	33
JCDEX-3.1	68.6		9	69
JCDEX-3.2	13.21		3	22
		JCD-D	12	84
JCDEX-3.3	10.0		3	19
BJDEX14	6.16		2	14
		A	3	19
		A*	5	25

A* - MODELLED AS BASIN OS-1 IN THE FINAL DRAINAGE REPORT FOR FILING 1 OF TRAILS AT ASPEN RIDGE, APP'D ON FEBRUARY 13, 2020.



REVISIONS:		
NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: CEB DATE: 11-05-20
DRAWN BY: CEB DATE: 11-05-20
CHECKED BY: CKC DATE: 11-05-20

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1-800-922-1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES
GAS, ELECTRIC, WATER AND WASTEWATER

DSE Dakota Springs
Engineering

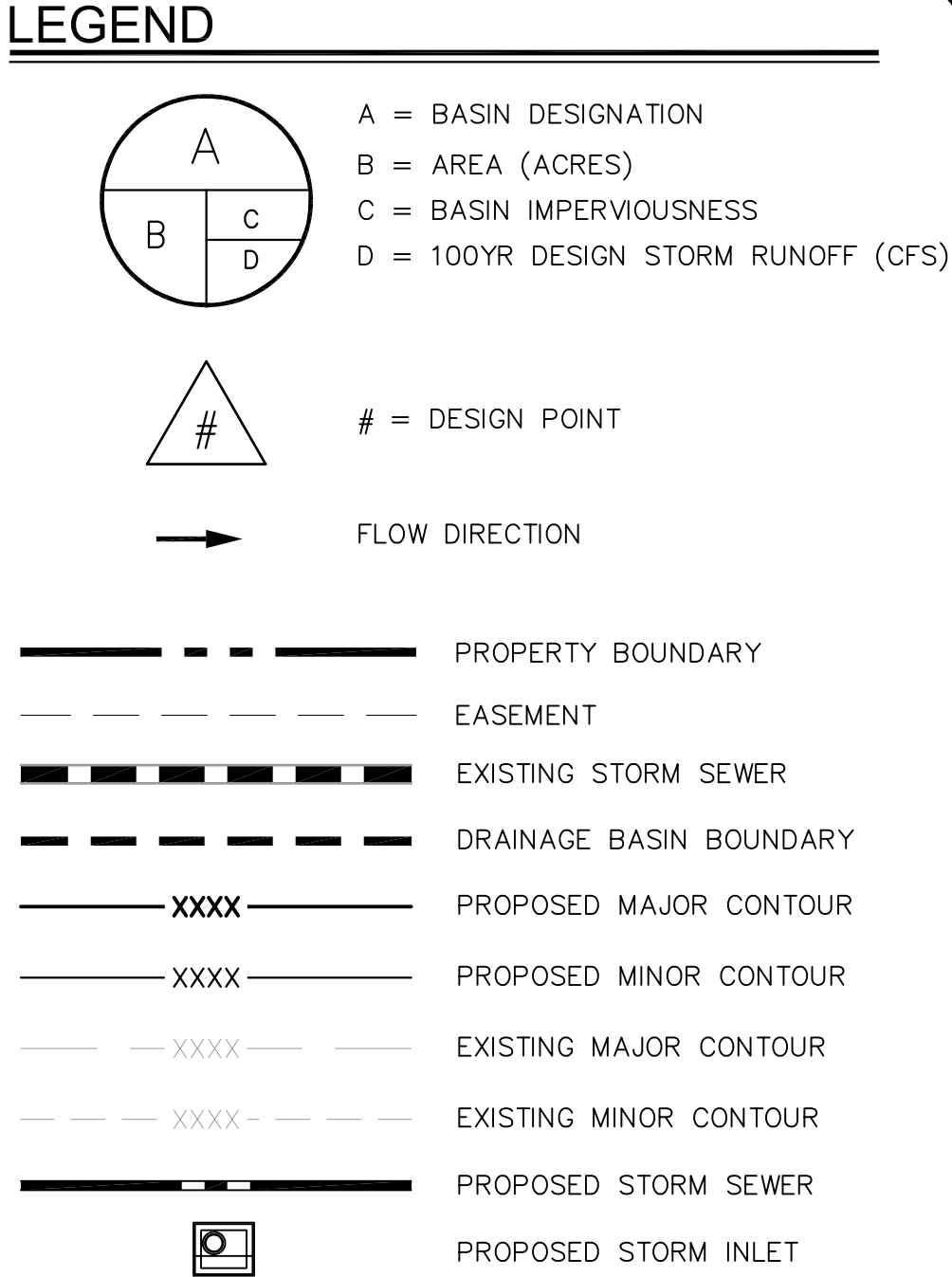
31 N. TEJON, SUITE 518
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT WATERVIEW NORTH

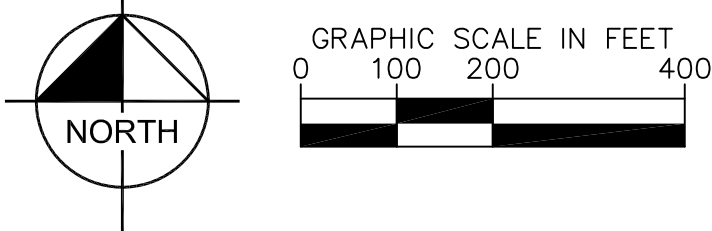
SHEET TITLE PRE-DEVELOPMENT BASIN MAP

FROM n/a TO n/a

JOB NO. 02-19-05 SHEET 2 OF 3



SUMMARY - PROPOSED RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
PA-1	PA-1	18.65	36.58	72.86	36.58	72.86
PA-2	PA-2	23.14	96.90	176.76	96.90	176.76
PA-3	PA-3	16.57	69.36	126.53	69.36	126.53
PA-4	PA-4	9.56	36.71	66.97	36.71	66.97
PA-5	PA-5	24.65	103.20	188.26	103.20	188.26
PA-6	PA-6	23.96	39.09	86.04	39.09	86.04



APPENDIX D – SEDIMENT BASIN FACT SHEET

Description

A sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. Sediment basins are designed to capture site runoff and slowly release it to allow time for settling of sediment prior to discharge. Sediment basins are often constructed in locations that will later be modified to serve as post-construction stormwater basins.



Photograph SB-1. Sediment basin at the toe of a slope. Photo courtesy of WWE.

Appropriate Uses

Most large construction sites (typically greater than 2 acres) will require one or more sediment basins for effective management of construction site runoff. On linear construction projects, sediment basins may be impractical; instead, sediment traps or other combinations of BMPs may be more appropriate.

Sediment basins should not be used as stand-alone sediment controls. Erosion and other sediment controls should also be implemented upstream.

When feasible, the sediment basin should be installed in the same location where a permanent post-construction detention pond will be located.

Design and Installation

The design procedure for a sediment basin includes these steps:

- **Basin Storage Volume:** Provide a storage volume of at least 3,600 cubic feet per acre of drainage area. To the extent practical, undisturbed and/or off-site areas should be diverted around sediment basins to prevent “clean” runoff from mixing with runoff from disturbed areas. For undisturbed areas (both on-site and off-site) that cannot be diverted around the sediment basin, provide a minimum of 500 ft³/acre of storage for undeveloped (but stable) off-site areas in addition to the 3,600 ft³/acre for disturbed areas. For stable, developed areas that cannot be diverted around the sediment basin, storage volume requirements are summarized in Table SB-1.
- **Basin Geometry:** Design basin with a minimum length-to-width ratio of 2:1 (L:W). If this cannot be achieved because of site space constraints, baffling may be required to extend the effective distance between the inflow point(s) and the outlet to minimize short-circuiting.
- **Dam Embankment:** It is recommended that embankment slopes be 4:1 (H:V) or flatter and no steeper than 3:1 (H:V) in any location.

Sediment Basins	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

- **Inflow Structure:** For concentrated flow entering the basin, provide energy dissipation at the point of inflow.

Table SB-1. Additional Volume Requirements for Undisturbed and Developed Tributary Areas Draining through Sediment Basins

Imperviousness (%)	Additional Storage Volume (ft³) Per Acre of Tributary Area
Undeveloped	500
10	800
20	1230
30	1600
40	2030
50	2470
60	2980
70	3560
80	4360
90	5300
100	6460

- **Outlet Works:** The outlet pipe shall extend through the embankment at a minimum slope of 0.5 percent. Outlet works can be designed using one of the following approaches:
 - **Riser Pipe (Simplified Detail):** Detail SB-1 provides a simplified design for basins treating no more than 15 acres.
 - **Orifice Plate or Riser Pipe:** Follow the design criteria for Full Spectrum Detention outlets in the EDB Fact Sheet provided in Chapter 4 of this manual for sizing of outlet perforations with an emptying time of approximately 72 hours. In lieu of the trash rack, pack uniformly sized 1½ - to 2-inch gravel in front of the plate or surrounding the riser pipe. This gravel will need to be cleaned out frequently during the construction period as sediment accumulates within it. The gravel pack will need to be removed and disposed of following construction to reclaim the basin for use as a permanent detention facility. If the basin will be used as a permanent extended detention basin for the site, a trash rack will need to be installed once contributing drainage areas have been stabilized and the gravel pack and accumulated sediment have been removed.
 - **Floating Skimmer:** If a floating skimmer is used, install it using manufacturer's recommendations. Illustration SB-1 provides an illustration of a Faircloth Skimmer Floating Outlet™, one of the more commonly used floating skimmer outlets. A skimmer should be designed to release the design volume in no less than 48 hours. The use of a floating skimmer outlet can increase the sediment capture efficiency of a basin significantly. A floating outlet continually decants cleanest water off the surface of the pond and releases cleaner water than would discharge from a perforated riser pipe or plate.

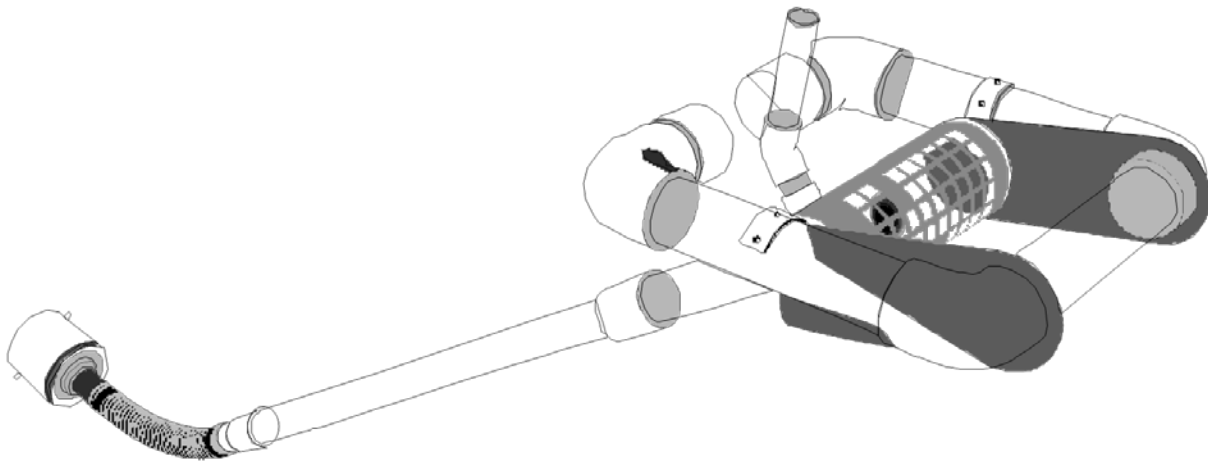


Illustration SB-1. Outlet structure for a temporary sediment basin - Faircloth Skimmer Floating Outlet. Illustration courtesy of J. W. Faircloth & Sons, Inc., FairclothSkimmer.com.

- **Outlet Protection and Spillway:** Consider all flow paths for runoff leaving the basin, including protection at the typical point of discharge as well as overtopping.
 - **Outlet Protection:** Outlet protection should be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway into which discharge occurs. This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.
 - **Emergency Spillway:** Provide a stabilized emergency overflow spillway for rainstorms that exceed the capacity of the sediment basin volume and its outlet. Protect basin embankments from erosion and overtopping. If the sediment basin will be converted to a permanent detention basin, design and construct the emergency spillway(s) as required for the permanent facility. If the sediment basin will not become a permanent detention basin, it may be possible to substitute a heavy polyvinyl membrane or properly bedded rock cover to line the spillway and downstream embankment, depending on the height, slope, and width of the embankments.

Maintenance and Removal

Maintenance activities include the following:

- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- Do not remove a sediment basin until the upstream area has been stabilized with vegetation.

Final disposition of the sediment basin depends on whether the basin will be converted to a permanent post-construction stormwater basin or whether the basin area will be returned to grade. For basins being converted to permanent detention basins, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. If the sediment basin is not to be used as a permanent detention facility, fill the excavated area with soil and stabilize with vegetation.

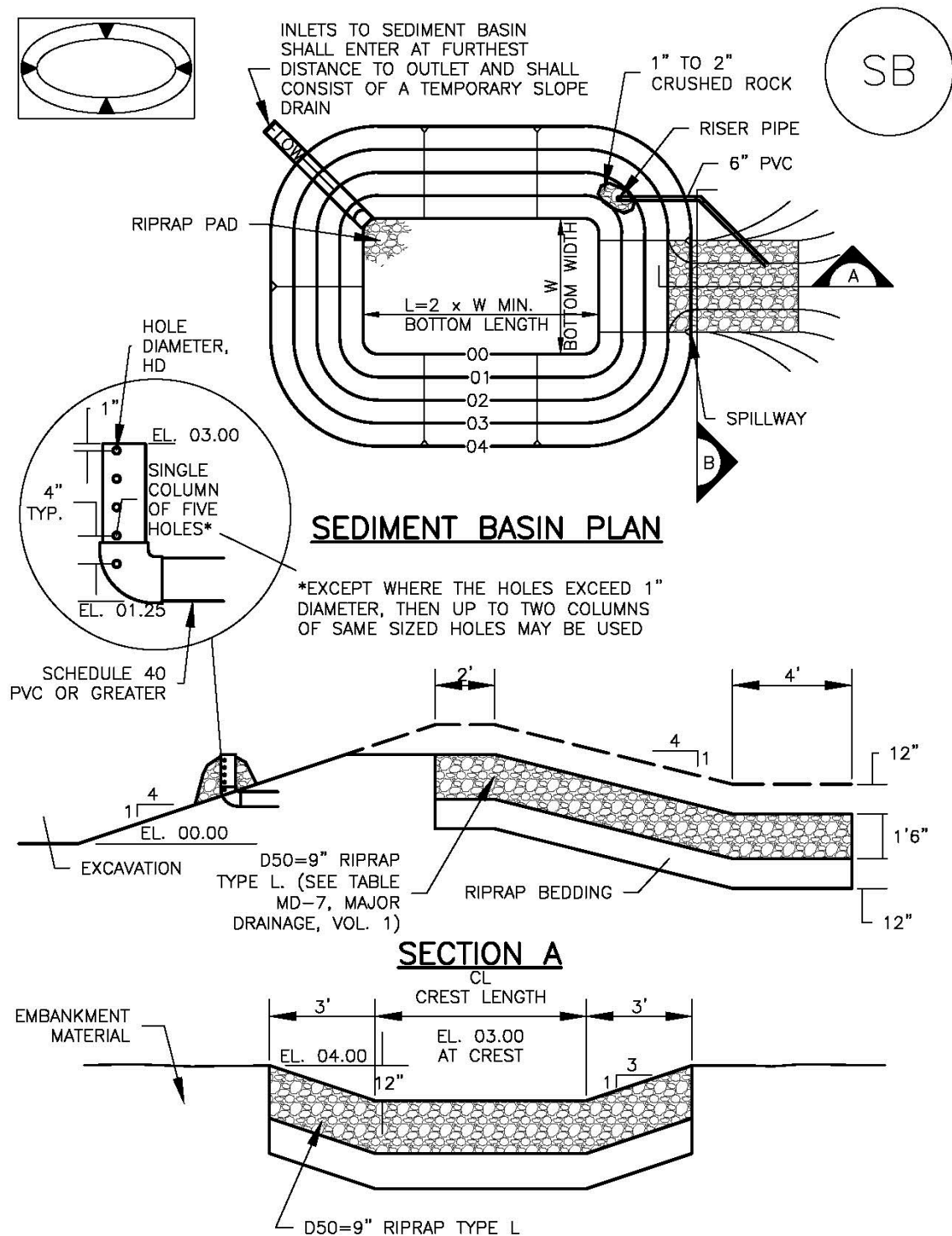


TABLE SB-1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/16
3	28	5	½
4	33 ½	6	9/8
5	38 ½	8	2 1/32
6	43	9	2 1/32
7	47 ¼	11	2 5/32
8	51	12	2 7/32
9	55	13	7/8
10	58 ¼	15	1 5/16
11	61	16	3 1/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 1/8
15	73 ¼	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

- SEE PLAN VIEW FOR:
 - LOCATION OF SEDIMENT BASIN.
 - TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
 - FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
 - FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.
- FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.
- SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND-DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.
- EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.
- EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.
- PIPE SCH 40 OR GREATER SHALL BE USED.
- THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).
5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.
6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.