PRELIMINARY & FINAL DRAINAGE REPORT

for

WIDEFIELD PK-8 SCHOOL

Widefield, CO

March 2019

PPR-18-026

Prepared for:

Widefield School District 3
1820 Main St.
Colorado Springs, CO 80911
Contact: Dennis Neal
(719) 391-3530

Prepared by:

Drexel, Barrell & Co.
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Colorado Springs, CO 80905
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(719) 260-0887

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PRELIMINARY DRAINAGE REPORT
for
WIDEFIELD PK-8 SCHOOL
Widefield, Colorado

1.0 CERTIFICATION STATEMENTS

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 El Paso 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 omission on my part in preparing this report.

COLORADO REGISTERED TIM D. McCONNELL 33797 PROFESSIONAL ENGINEER

3-27-19

Tim D. McConnell, P.E. Date
Colorado P.E. License No. 33797
For and on Behalf of Drexel, Barrell & Co.

DEVELOPER'S STATEMENT

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

Business Name: Widefield School District 3

By: 3/26/19
Dennis Neal Date

Title: Chief Operations Officer
Address: 1820 Main St.
Colorado Springs, CO 80911

EL PASO COUNTY

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

Approved
by Jeff Rice
El Paso County Planning and Community Development
on behalf of Elizabeth Nijkamp, Engineering Review Manager
08/21/2019 3:11:49 PM

For the County Engineer Date
CONDITIONS:

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Widefield PK-8 School project at Lorson Ranch. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location

The site is located at the northeast corner of Fontaine Blvd. and Lamprey Road - the SW 1/4 of Section 13, Township 15 S, Range 65 W of the 6th P.M., El Paso County, Colorado.

The site is bound on the west and north by Lamprey Road, the south by Fontaine Blvd. and on the east by an undeveloped lot to be developed as residential in the future. Also to the east of the site is a utility easement/open space.

Site Conditions

The site is approximately 25.1 acres in size and is proposed as school site use. The site is currently undeveloped and is covered with native grass and vegetation. It is gently sloping from east to west.

This proposed school site calls for a two story building with approx. 81,000 sf footprint, a track and field, associated parking, drive aisles, sidewalks, landscaping and utilities. Public access is provided off of Fontaine Blvd. and bus access is off of Lamprey Dr.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is underlain by Manzanst clay loam, a type 'C' hydrologic soil and by Razor-Midway complex, a type 'D' hydrologic soil. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C1000 F (March 17, 1997) the project site is within a designated Zone X area described as "areas determined to be outside 500-year

floodplain". A firmette map is included in the appendix.

4.0 PROPOSED HYDROLOGY (RATIONAL METHOD) & HYDRAULIC SUMMARY

For the purposes of site specific analysis, the project site has been divided into several grouped drainage basins as shown on the proposed drainage plan. Thirty four (34) Design Points have been analyzed for sizing of the drainage facilities.

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals. Urban Drainage UD-Detention, UD-Inlet and Flowmaster were also used to identify pond and storm system sizing (see appendix for calculations). See below for a summary runoff table.

Rational Method Runoff Summary

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A0	0.42	0.8	2.3
A1	1.18	1.0	4.9
A2	0.45	1.0	2.3
A3	0.15	0.1	0.5
A4	1.72	0.9	5.3
A5	0.38	0.3	1.4
A6	0.36	1.1	2.4
A7	0.21	0.9	1.7
A8	0.13	0.2	0.6
A9	0.24	0.7	1.6
A10	0.66	2.3	4.6
A11	0.54	0.8	2.8
A12	0.85	2.5	5.3
A13	0.08	0.1	0.3
A14	0.17	0.3	1.0
A15	0.12	0.4	0.8
A16	0.17	0.4	1.1
A17	1.62	0.8	4.9
A18	1.09	1.3	4.1
A19	3.13	2.8	13.9
A20	0.33	1.4	2.8
A21	0.38	1.7	3.2
A22	0.93	0.6	3.6
B1	2.91	1.9	9.6
B2	0.72	3.2	6.2

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
DP-0	0.42	0.8	2.3
DP-1	1.60	1.7	7.0
DP-2	0.45	1.0	2.3
DP-3	0.15	1.8	6.5
DP-4	1.72	0.9	5.3
DP-5	3.50	2.6	11.4
DP-6	0.36	1.1	2.4
DP-7	4.07	4.0	14.2
DP-8	0.21	0.9	1.7
DP-9	4.41	4.7	15.7
DP-10	0.24	0.7	1.6
DP-11	5.31	6.8	19.9
DP-12	0.54	0.8	2.8
DP-13	1.39	3.2	7.8
DP-14	1.47	2.9	7.4
DP-15	1.64	3.2	8.1
DP-16	0.12	0.4	0.8
DP-17	1.76	3.5	8.7
DP-18	1.93	3.8	9.4
DP-19	1.62	0.8	4.9
DP-20	8.86	10.6	32.2
DP-21	9.95	11.7	35.6
DP-22	3.13	2.8	13.9
DP-23	3.46	4.1	16.4
DP-24	3.84	5.6	19.4

B3	0.69	3.1	5.9
B4	0.77	1.6	4.3
B5	1.56	0.8	4.7
C1	1.31	0.9	5.4
C2	2.09	1.5	8.0
C3	0.84	0.6	3.3

DP-25	14.72	16.0	51.4
DP-26	2.91	1.9	9.6
DP-27	0.72	3.2	6.2
DP-28	1.41	6.1	11.7
DP-29	2.18	7.2	15.0
DP-30	1.56	0.8	4.7
DP-31	16.28	1.1	29.8
DP-32	1.31	0.9	5.4
DP-33	2.09	1.5	8.0
DP-34	0.84	0.6	3.3

A-group basins represent flows that are captured by the pond proposed Full Spectrum EDB and outfall via a 24" pipe.

DP-0 is located at the proposed area inlet in Basin A0. The flows leave this inlet via a 15" storm pipe. This design point captures all of the flows from Basin A0.

DP-1 is located at the proposed area inlet in Basin A1. The flows leave this inlet via a 15" storm pipe. This design point captures all of the flows from Basin A0 and A1.

DP-2 is located at the proposed area inlet in Basin A2. The flows leave this inlet via a 12" storm pipe. This design point captures all of the flows from Basin A2.

DP-3 is located at the proposed area inlet in Basin A3. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basins A0, A1, A2 and A3.

DP-4 is located at the proposed area inlet in Basin A4. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basin A4.

DP-5 is located at the proposed 18"x18" wye in Basin A5. The flows leave this wye via an 18" storm pipe. This design point reflects all of the flows from Basins A0, A1, A2, A3, A4 and A5.

DP-6 is located at the proposed area inlet in Basin A6. The flows leave this inlet via a 12" storm pipe. This design point reflects all of the flows from Basin A6.

DP-7 is located at the proposed area inlet in Basin A7. The flows leave this inlet via a 24" storm pipe. This design point reflects all of the flows from Basins A0, A1, A2, A3, A4, A5 and A6.

DP-8 is located at the proposed at-grade Type 16 inlet in Basin A7. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basin A7.

DP-9 is located at the proposed area inlet in Basin A8. The flows leave this inlet via a 24" storm pipe. This design point reflects all of the flows from Basins A0, A1, A2, A3, A4, A5, A6, A7 and A8.

DP-10 is located at the proposed at-grade Type 16 inlet in Basin A9. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basin A9.

DP-11 is located at the proposed sump Type R inlet in Basin A10. The flows leave this manhole via a 24" storm pipe. This design point reflects all of the flows from Basins A0, A1, A2, A3, A4, A5, A6, A7, A8, A9 and A10.

DP-12 is located at the proposed area inlet in Basin A11. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basin A11.

DP-13 is located at the proposed area inlet in Basin A12. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basins A11 and A12.

DP-14 is located at the proposed area inlet in Basin A13. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basins A11, A12 and A13.

DP-15 is located where the underground drain connects to the storm pipe in Basin A14. The flows leave via an 18" storm pipe. This design point reflects all of the flows from Basins A11, A12, A13 and A14.

DP-16 is located at the proposed roof drains in Basin A15. The flows from the roof drains connect to the 18" storm pipe. This design point reflects all of the flows from Basin A15.

DP-17 is located at the pipe junction where the roof drains from DP-16 connects to the 18" storm pipe. The flows leave this junction via an 18" storm pipe. This design point reflects all of the flows from Basins A11, A12, A13, A14 and A15.

DP-18 is located where the underground drain connects to the storm pipe in Basin A16. The flows leave via an 18" storm pipe. This design point reflects all of the flows from Basins A11, A12, A13, A14, A15 and A16.

DP-19 is located where the perimeter drain around the east side of the track outfalls to connect to the storm system in Basin A17. The flows leave via a 12" storm pipe. This design point reflects all of the flows from Basin A17.

DP-20 is located at the proposed manhole in Basin A18. The flows leave this manhole via a 30" storm pipe. This design point reflects all of the flows from Basins A0 through A17.

DP-21 is located at the proposed area inlet in Basin A18. The flows leave this inlet via a 30" storm pipe that discharges into the pond. This design point reflects all of the flows from Basins A0 through A18.

DP-22 is located at the proposed flared end section in Basin A19. The flows leave via an 18" storm pipe. This design point reflects all of the flows from Basin A19.

DP-23 is located at the proposed at-grade Type 16 inlet in Basin A20. The flows leave this inlet via a 24" storm pipe. This design point reflects all of the flows from Basins A19 and A20. A Type 16 (combination) inlet detail has been included in the Appendix.

DP-24 is located at the proposed at-grade Type 16 inlet in Basin A21. The flows leave this inlet via a 24" storm pipe that discharges into the pond. This design point reflects all of the flows from Basins A19, A20 and A21.

Pond backflow is accommodated for in the two inlets at DP-23 and DP-24. The flowline elevations for these 2 inlets is higher than the 100-yr elevation of the pond.

DP-25 is located at the bottom of the proposed Full Spectrum EDB pond in Basin A22. The flows leave the pond via an outlet structure and a 24" storm pipe. This design point reflects all of the flows from all "A" basins.

B-group basins represent flows that are captured by the proposed on-site storm system, but not directed to the pond.

DP-26 is located at the proposed at-grade double Type R inlet in Basin B1. The flows leave this inlet via a 24" storm pipe that connects to the existing storm system in Fontaine Blvd., which carries the flows to the west. This design point reflects all of the flows from Basin B1.

DP-27 is located at the proposed at-grade Type R inlet in Basin B2. The flows leave this inlet via an 18" storm pipe. This design point reflects all of the flows from Basin B2.

DP-28 is located at the proposed sump Type R inlet in Basin B3. The flows leave this inlet via a 24" storm pipe. This design point reflects all of the flows from Basins B2 and B3.

DP-29 is located at the proposed at-grade Type R inlet in Basin B4. The flows leave this inlet via a 24" storm pipe that connects to the existing storm system in Fontaine Blvd., which carries the flows to the west. This design point reflects all of the flows from Basins B2, B3 and B4.

DP-30 is located where the perimeter drain around the west side of the track outfalls to connect to the storm system in Basin B5. The flows leave via a 12" storm pipe. This design point reflects all of the flows from Basin B5.

C-group basins represent flows that leave the project site and are captured by existing curb and gutter in either Fontaine Blvd. or Lamprey Dr. and then carried to inlets in the existing storm system.

DP-31 is located at the proposed manhole in Basin C1. The manhole connects to the existing storm sewer system that will carry the flows to the west to a pond that has accounted for these flows. This design point reflects all of the flows from all "A" Basins and from Basin B5.

DP-32 is located at the existing inlet in Lamprey Dr. adjacent to Basin C1. The inlet was designed to handle the flows from the existing project it is a part of as well as from our Basin C1. DP-32 reflects all of the flows leaving the project site from Basin C1.

DP-33 is located at the existing inlet in Lamprey Dr. adjacent to Basin C2. The inlet was designed to handle the flows from the existing project it is a part of as well as from our

Basin C2. DP-33 reflects all of the flows leaving the project site from Basin C2.

DP-34 is located at the existing inlet in Fontaine Blvd. adjacent to Basin C3. The inlet was designed to handle the flows from the existing project it is a part of as well as from our Basin C3. DP-34 reflects all of the flows leaving the project site from Basin C3.

5.0 PROPOSED DETENTION/WATER QUALITY FACILITIES

The proposed on-site pond is a 2.6 ac-ft extended detention basin (EDB) located at the northwest end of the project site. Although it does not capture flows from the entire site, it has been oversized by using impervious coverage and the area of the entire site. The required pond volume when using the entire site area for 100-yr detention is 1.594 acre-feet. The actual pond volume is 2.592 acre-feet. It will capture then release the flows at a reduced flow rate into a proposed 24" pipe, which connects to the existing storm sewer system and continues to the west. In accordance with El Paso County criteria, a modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period. A spillway has been placed on the north side of the pond. In the event that water overtops the spillway, it will flow to the curb in Lamprey Dr. then continue to the southwest to the existing storm sewer system where it is then carried to an existing downstream pond in Lorson Ranch.

According to the "Final Drainage Plan for Lorson Ranch East Filing No. 1," by Core Engineering Group, their pond C5 was designed to accommodate the flows from the school site for water quality. A pond on the school site is "required to detain runoff to existing flow rates to several storm outfall points provided on Lamprey Drive and Fontaine Boulevard." The proposed EDB on this school project is so oversized, it more than meets these requirements and reduced the overall site release rates to less than the historic condition. See Final Drainage Plan for Lorson Ranch East Filing No. 1 for full drainage analysis.

Calculations are provided in the appendix for the on-site pond, forebay volumes, micropool surface area, outlet structure, discharge pipe and spillway.

Private maintenance agreements and O&M manuals will be established for this pond as required by the County.

6.0 FOUR-STEP PROCESS

This project conforms to the City of Colorado Springs/El Paso County Four Step Process. The process focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

1. ***Employ Runoff Reduction Practices:*** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.

2. ***Implement BMP's that provide a Water Quality Capture Volume with slow release:*** Runoff from this project will be treated through capture and slow release of the WQCV in a permanent Extended Detention Basin facility designed per current City of Colorado Springs/El Paso County drainage criteria.

3. ***Stabilize Drainage Ways:*** Flows from this project are not directly released into any drainage ways. They are released into the existing storm sewer system at a rate less than the historical rate, so there will be no adverse effects on the existing drainage ways.

4. ***Implement Site Specific and Other Source Control BMP's:*** A site specific storm water quality and erosion control plan and narrative will be submitted and approved by El Paso County Engineering prior to any disturbance within the project area. Details such as site specific source control construction BMP's as well as permanent BMP's will be detailed in this plan and narrative to protect receiving waters.

7.0 GEOTECHNICAL HAZARDS

In accordance with geotechnical recommendations, the project design is intended to direct runoff away from structures, and into the receiving storm sewer system and water quality/detention basins. This will be accomplished by a variety of means, i.e. curb and gutter and storm sewer.

8.0 DRAINAGE/BRIDGE FEES

The project lies within the Jimmy Camp Creek Drainage Basin.

The percent imperviousness for this subdivision is calculated as follows:

Project site imperviousness = 34.0%

25.27 Acres at 34.0% Impervious = 8.6 Impervious Acres

The following calculations are based on the 2018 drainage/bridge fees for the Jimmy Camp Creek Drainage Basin:

Drainage Fee
$17,197 x 8.6 Impervious Ac = $147,894.20

Bridge Fee
$804 x 8.6 Impervious Ac. = $6,914.40

Surety
$7,285 x 8.6 Impervious Ac. = $62,651.00

Fees will be paid by the Widefield School District #3.

9.0 CONCLUSIONS

The new Widefield PK-8 school project has been designed in accordance with El Paso County criteria. The EDB/water quality pond has been designed to limit the release of storm runoff. This development will not negatively impact the downstream facilities.

10.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs "Drainage Criteria Manual", 2016.

2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised April 2008.

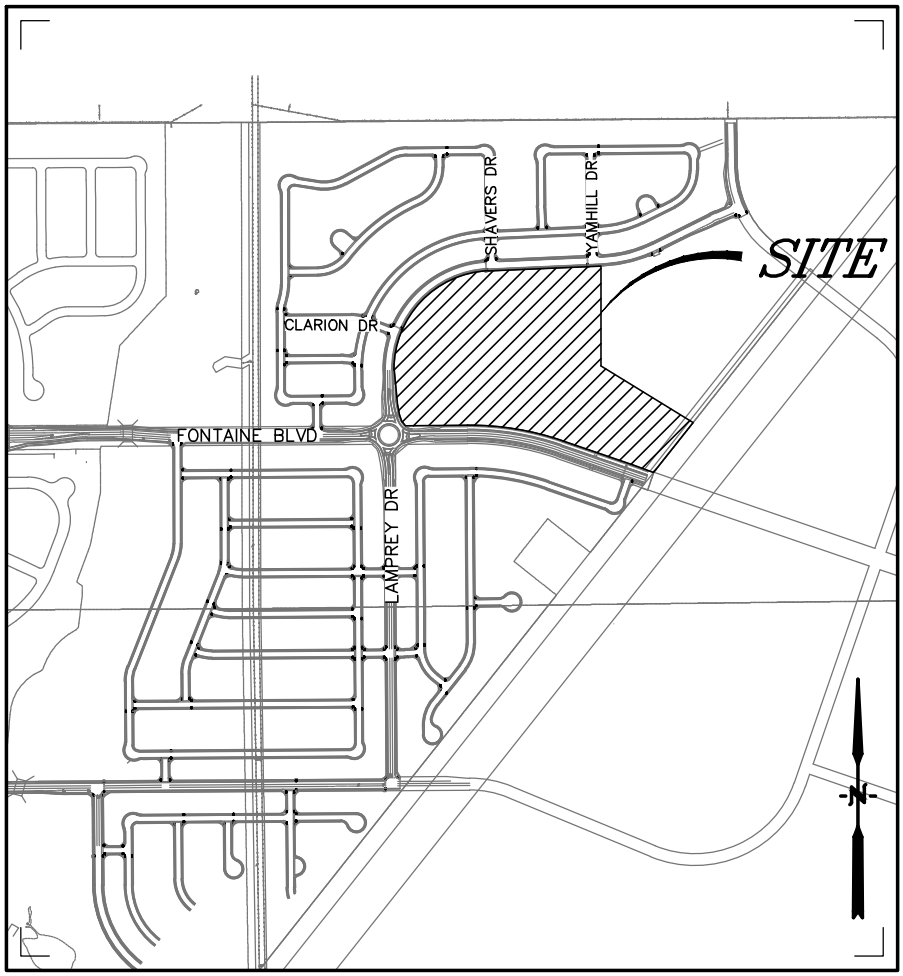
3. Soil Survey for Colorado Springs and El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

4. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 1997.

5. Geotechnical Engineering Report. Prepared by Terracon Consultants, Inc, February 7, 2018.

6. "Final Drainage Plan Lorson Ranch East Filing No. 1," prepared by Core Engineering Group, LLC, July 2, 2018.

APPENDIX



Vicinity Map
Not to scale

NEW WIDEFIELD PK–8 SCHOOL
WIDEFIELD, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

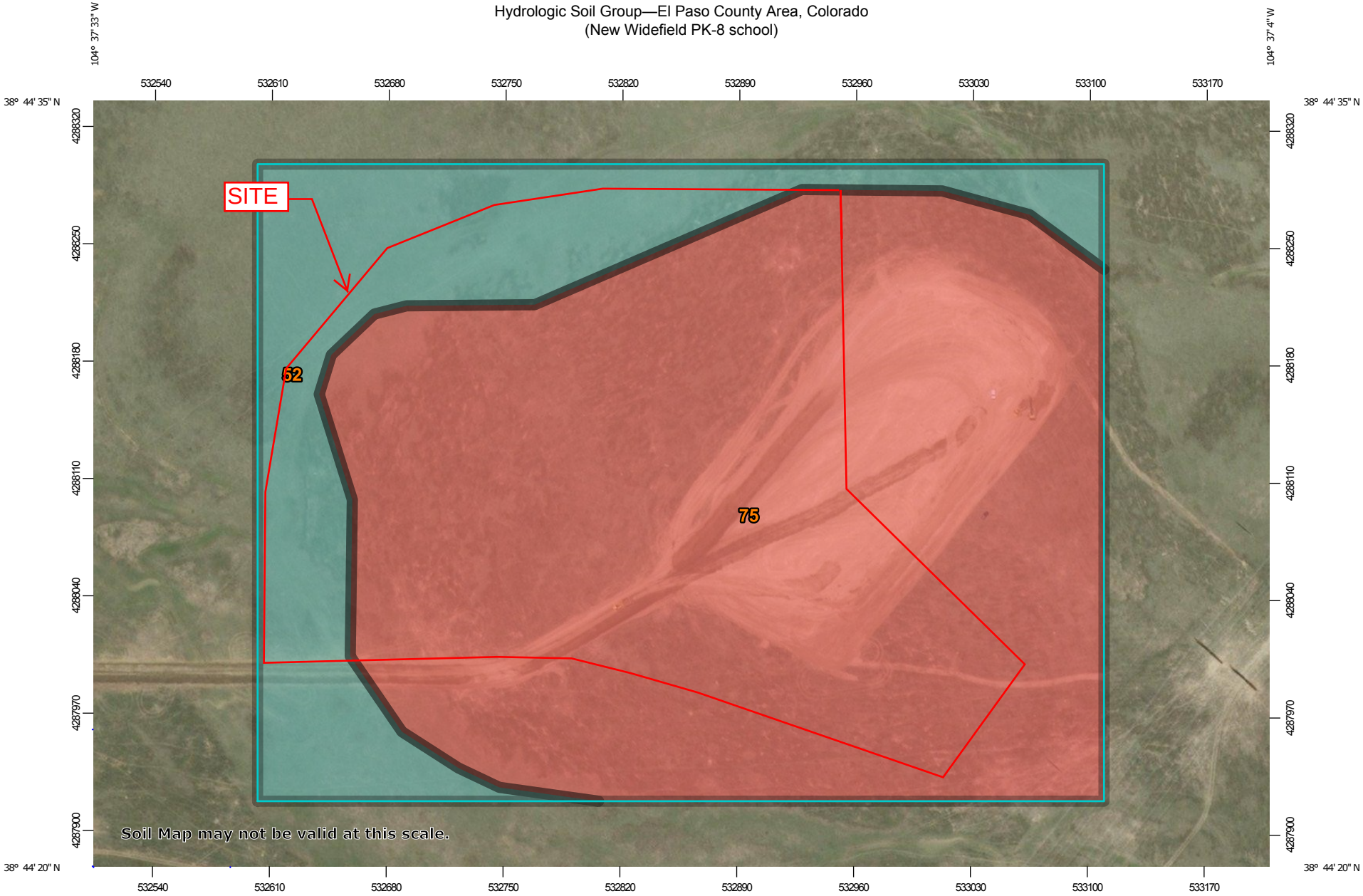
DATE:

JOB NO: **21126–00CSCV**

DWG. NO. **VMAP**

SHEET 1 OF 1

Hydrologic Soil Group—El Paso County Area, Colorado
(New Widefield PK-8 school)



Map Scale: 1:3,220 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil 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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: Nov 7, 2015—Mar 9, 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
52	Manzanst clay loam, 0 to 3 percent slopes	C	11.4	23.8%
75	Razor-Midway complex	D	36.4	76.2%
Totals for Area of Interest			**47.8**	**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.

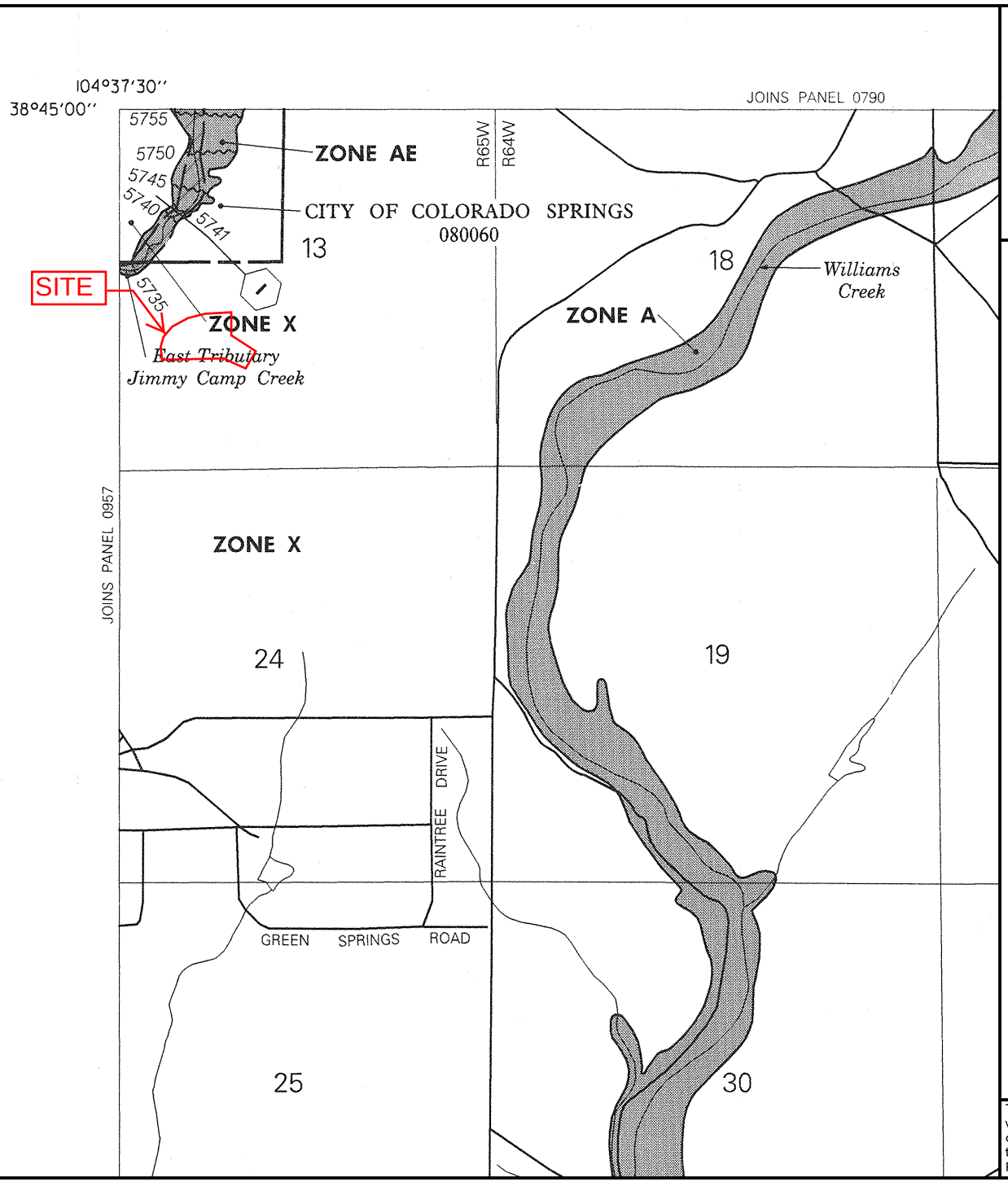
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

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



APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 1000 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	1000	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1000	F

MAP NUMBER
08041C1000 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

PROJECT INFORMATION								
PROJECT:	Widefield PK-8 School							
PROJECT NO:	21126-00							
DESIGN BY:	SBN							Drexel, Barrell & Co.
REV. BY:	TDM							
AGENCY:	City of Colorado Springs							
REPORT TYPE:	Final							
DATE:	3/12/2019							
Soil Type: C								
				C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn					0.15		0.50	0
Roof					0.75		0.83	90
Asphalt/Sidewalk					0.90		0.96	100
*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"								
PROPOSED								

SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
		ACRE	**C2**	**C5**	**C10**	**C100**	
A0	Landscape/Lawn	0.25		0.15		0.50	0
	Roof	0.17		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.39		0.63	36%
TOTAL A0		0.42					
A1	Landscape/Lawn	1.12		0.15		0.50	0
	Roof	0.06		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.18		0.52	5%
TOTAL A1		1.18					
A2	Landscape/Lawn	0.12		0.15		0.50	0
	Roof	0.33		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.59		0.74	66%
TOTAL A2		0.45					
A3	Landscape/Lawn	0.15		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL A3		0.15					
A4	Landscape/Lawn	1.70		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.02		0.90		0.96	100
	WEIGHTED AVERAGE			0.16		0.51	1%
TOTAL A4		1.72					
A5	Landscape/Lawn	0.35		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.03		0.90		0.96	100
	WEIGHTED AVERAGE			0.21		0.54	8%
TOTAL A5		0.38					
A6	Landscape/Lawn	0.07		0.15		0.50	0
	Roof	0.29		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.63		0.77	73%
TOTAL A6		0.36					
A7	Landscape/Lawn	0.00		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.21		0.90		0.96	100
	WEIGHTED AVERAGE			0.90		0.96	100%
TOTAL A7		0.21					

A8	Landscape/Lawn	0.10		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.03		0.90		0.96	100
	WEIGHTED AVERAGE			0.32		0.61	23%
TOTAL A8		0.13					
A9	Landscape/Lawn	0.07		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.17		0.90		0.96	100
	WEIGHTED AVERAGE			0.68		0.83	71%
TOTAL A9		0.24					
A10	Landscape/Lawn	0.07		0.15		0.50	0
	Roof	0.45		0.75		0.83	90
	Asphalt/Sidewalk	0.14		0.90		0.96	100
	WEIGHTED AVERAGE			0.72		0.82	83%
TOTAL A10		0.66					
A11	Landscape/Lawn	0.42		0.15		0.50	0
	Roof	0.12		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.28		0.57	20%
TOTAL A11		0.54					
A12	Landscape/Lawn	0.17		0.15		0.50	0
	Roof	0.60		0.75		0.83	90
	Asphalt/Sidewalk	0.08		0.90		0.96	100
	WEIGHTED AVERAGE			0.64		0.78	73%
TOTAL A12		0.85					
A13	Landscape/Lawn	0.07		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.01		0.90		0.96	100
	WEIGHTED AVERAGE			0.24		0.56	13%
TOTAL A13		0.08					
A14	Landscape/Lawn	0.11		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.06		0.90		0.96	100
	WEIGHTED AVERAGE			0.41		0.66	35%
TOTAL A14		0.17					
A15	Landscape/Lawn	0.00		0.15		0.50	0
	Roof	0.12		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.75		0.83	90%
TOTAL A15		0.12					
A16	Landscape/Lawn	0.10		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.07		0.90		0.96	100
	WEIGHTED AVERAGE			0.46		0.69	41%
TOTAL A16		0.17					
A17	Landscape/Lawn	1.62		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL A17		1.62					
A18	Landscape/Lawn	0.81		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.28		0.90		0.96	100
	WEIGHTED AVERAGE			0.34		0.62	26%
TOTAL A18		1.09					

A19	Landscape/Lawn	2.97		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.16		0.90		0.96	100
	WEIGHTED AVERAGE			0.19		0.52	5%
TOTAL A19		3.13					
A20	Landscape/Lawn	0.03		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.30		0.90		0.96	100
	WEIGHTED AVERAGE			0.83		0.92	91%
TOTAL A20		0.33					
A21	Landscape/Lawn	0.02		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.36		0.90		0.96	100
	WEIGHTED AVERAGE			0.86		0.94	95%
TOTAL A21		0.38					
A22	Landscape/Lawn	0.93		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL A22		0.93					
B1	Landscape/Lawn	2.78		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.13		0.90		0.96	100
	WEIGHTED AVERAGE			0.18		0.52	4%
TOTAL B1		2.91					
B2	Landscape/Lawn	0.03		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.69		0.90		0.96	100
	WEIGHTED AVERAGE			0.87		0.94	96%
TOTAL B2		0.72					
B3	Landscape/Lawn	0.03		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.66		0.90		0.96	100
	WEIGHTED AVERAGE			0.87		0.94	96%
TOTAL B3		0.69					
B4	Landscape/Lawn	0.46		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.31		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.69	40%
TOTAL B4		0.77					
B5	Landscape/Lawn	1.56		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL B5		1.56					
C1	Landscape/Lawn	1.31		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C1		1.31					
C2	Landscape/Lawn	2.05		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.04		0.90		0.96	100
	WEIGHTED AVERAGE			0.16		0.51	2%
TOTAL C2		2.09					
C3	Landscape/Lawn	0.84		0.15		0.50	0
	Roof	0.00		0.75		0.83	90
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C3		0.84					
TOTAL SITE		26.20		0.31		0.59	21.7%

PROJECT INFORMATION

PROJECT:	Widefield PK-8 School
PROJECT NO:	21126-00
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	City of Colorado Springs
REPORT TYPE:	Final
DATE:	3/12/2019

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)				TRAVEL TIME (t_t)					PIPE TRAVEL TIME (t_p)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	LENGTH	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t_c	t_c	Min
A0	DP-0	0.39	0.63	0.42	100	15	15.0	5.4	100	1	1.0	3.1	0.5					5.9	5	5.9
A1		0.18	0.52	1.18	75	12.3	16.4	5.9	425	6	1.4	3.7	1.9					7.8	5	7.8
	DP-1	0.24	0.55	1.60														7.8	5	7.8
A2	DP-2	0.59	0.74	0.45	80	1.6	2.0	6.8	30	0.6	2.0	4.8	0.1					6.9	5	6.9
A3		0.15	0.50	0.15	75	1	1.3	14.0	10	0.1	1.0	3.1	0.1					14.0	5	14.0
	DP-3	0.28	0.57	1.78														14.0	5	14.0
A4	DP-4	0.16	0.51	1.72	100	2	2.0	14.0	340	6.5	1.9	4.4	1.3					15.3	5	15.3
	DP-5	0.22	0.54	3.50										100	1.0	4.8	0.3	15.6	5	15.6
A5		0.21	0.54	0.38	80	1.6	2.0	11.8	10	0.2	2.0	4.4	0.0					11.9	5	11.9
A6	DP-6	0.63	0.77	0.36	70	1.4	2.0	5.8	55	1.1	2.0	4.8	0.2					6.0	5	6.0
	DP-7	0.29	0.58	4.07										50	1.5	7.2	0.1	15.7	5	15.7
A7	DP-8	0.90	0.96	0.21	100	2.8	2.8	2.7	70	1.1	1.6	7.4	0.2					2.8	5	5.0
A8		0.32	0.61	0.13	55	1.2	2.2	8.3	10	0.2	2.0	4.4	0.0					8.3	5	8.3
	DP-9	0.32	0.60	4.41										125	0.8	5.2	0.4	16.1	5	16.1
A9	DP-10	0.68	0.83	0.24	100	1.2	1.2	7.4	180	4.3	2.4	9.1	0.3					7.7	5	7.7
A10		0.72	0.82	0.66	100	2	2.0	5.7	230	5	2.2	5.0	0.8					6.4	5	6.4
	DP-11	0.39	0.64	5.31										170	2.1	8.5	0.3	16.5	5	16.5
A11	DP-12	0.28	0.57	0.54	50	12	24.0	3.7	180	3.6	2.0	4.4	0.7					4.4	5	5.0
A12		0.64	0.78	0.85	100	2	2.0	6.8	185	3.7	2.0	4.8	0.6					7.4	5	7.4
	DP-13	0.50	0.70	1.39														7.4	5	7.4
A13		0.24	0.56	0.08	50	0.7	1.4	10.1	10	0.1	1.0	3.1	0.1					10.2	5	10.2
	DP-14	0.49	0.69	1.47														10.2	5	10.2
A14		0.41	0.66	0.17	25	0.3	1.2	6.0	70	0.7	1.0	3.4	0.3					6.4	5	6.4
	DP-15	0.48	0.69	1.64										75	1.0	4.8	0.3	10.4	5	10.4
A15	DP-16	0.75	0.83	0.12	60	0.3	2.0	4.0										4.0	5	5.0
	DP-17	0.50	0.70	1.76										130	0.9	4.6	0.5	10.9	5	10.9

A16		0.46	0.69	0.17	15	0.2	1.3	4.2	70	0.7	1.0	3.4	0.3					4.6	5	5.0
	DP-18	0.50	0.70	1.93										115	0.5	4.1	0.5	11.4	5	11.4
A17	DP-19	0.15	0.50	1.62	95	2.2	2.3	13.1	355	1.9	0.5	2.4	2.5					15.6	5	15.6
	DP-20	0.37	0.63	8.86										165	1.0	6.8	0.4	16.9	5	16.9
A18		0.34	0.62	1.09	100	1	1.0	14.2	205	3	1.5	3.8	0.9					15.1	5	15.1
	DP-21	0.37	0.62	9.95										215	1.8	9.1	0.4	17.3	5	17.3
A19	DP-22	0.19	0.52	3.13	50	12	24.0	4.2	570	11.2	2.0	4.4	2.2					6.3	5	6.3
A20		0.83	0.92	0.33	45	0.9	2.0	2.7	260	9.5	3.7	11.3	0.4					3.1	5	5.0
	DP-23	0.25	0.56	3.46										40	1.3	5.5	0.1	6.5	5	6.5
A21		0.86	0.94	0.38	55	1.1	2.0	2.6	275	9.2	3.3	10.6	0.4					3.1	5	5.0
	DP-24	0.31	0.60	3.84										35	1.9	8.1	0.1	6.5	5	6.5
A22		0.15	0.50	0.93	100	10.5	10.5	8.1	195	2	1.0	5.9	0.6					8.7	5	8.7
	DP-25	0.34	0.61	14.72										130	13.4	24.9	0.1	17.3	5	17.3
B1	DP-26	0.18	0.52	2.91	100	8.8	8.8	8.3	385	13	3.4	5.7	1.1					9.4	5	9.4
B2	DP-27	0.87	0.94	0.72	10	0.1	1.0	1.4	365	6.5	1.8	7.8	0.8					2.1	5	5.0
B3		0.87	0.94	0.69	100	2.9	2.9	3.1	260	5.4	2.1	8.5	0.5					3.6	5	5.0
	DP-28	0.87	0.94	1.41										230	1.5	5.9	0.6	5.6	5	5.6
B4		0.45	0.69	0.77	95	4.4	4.6	7.1	225	7.5	3.3	10.6	0.4					7.4	5	7.4
	DP-29	0.72	0.85	2.18														7.4	5	7.4
B5	DP-30	0.15	0.50	1.56	95	2.2	2.3	13.1	340	1.6	0.5	2.4	2.4					15.5	5	15.5
	DP-31	0.32	0.60	16.28										345	1.0	6.8	0.8	18.2	5	18.2
C1	DP-32	0.15	0.50	1.31	45	4	8.9	5.8	575	8	1.4	6.9	1.4					7.1	5	7.1
C2	DP-33	0.16	0.51	2.09	100	7	7.0	9.1	1120	18	1.6	7.4	2.5					11.7	5	11.7
C3	DP-34	0.15	0.50	0.84	100	2	2.0	14.1	320	19.8	6.2	7.7	0.7	170	1.2	6.4	0.4	15.2	5	15.2

PROJECT INFORMATION

PROJECT:	Widefield PK-8 School
PROJECT NO:	21126-00
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	City of Colorado Springs
REPORT TYPE:	Final
DATE:	3/12/2019

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED RUNOFF 5 YR STORM P1= **1.50**

			DIRECT RUNOFF					PIPE SIZING			
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	n	Slope (ft/ft)	Calculated Pipe Dia	Used Pipe
A0	DP-0	0.42	0.39	5.9	0.17	4.88	0.8				
A1		1.18	0.18	7.7	0.21	4.50	1.0				
	DP-1	1.60	0.24	7.8	0.38	4.48	1.7				
A2	DP-2	0.45	0.59	11.2	0.27	3.93	1.0				
A3		0.15	0.15	14.0	0.02	3.57	0.1				
	DP-3	1.78	0.28	14.0	0.50	3.57	1.8				
A4	DP-4	1.72	0.16	15.3	0.27	3.43	0.9				
	DP-5	3.50	0.22	15.6	0.77	3.40	2.6				
A5		0.38	0.21	11.2	0.08	3.92	0.3				
A6	DP-6	0.36	0.63	6.0	0.23	4.86	1.1				
	DP-7	4.07	0.29	15.9	1.19	3.37	4.0				
A7	DP-8	0.21	0.90	7.1	0.19	4.61	0.9				
A8		0.13	0.32	8.3	0.04	4.38	0.2				
	DP-9	4.41	0.32	16.3	1.42	3.33	4.7				
A9	DP-10	0.24	0.68	7.7	0.16	4.50	0.7				
A10		0.66	0.72	6.4	0.47	4.76	2.3				
	DP-11	5.31	0.39	16.6	2.06	3.30	6.8				
A11	DP-12	0.54	0.28	5.0	0.15	5.10	0.8				
A12		0.85	0.64	7.5	0.55	4.54	2.5				
	DP-13	1.39	0.50	7.5	0.70	4.54	3.2				
A13		0.08	0.24	10.2	0.02	4.08	0.1				
	DP-14	1.47	0.49	10.2	0.72	4.08	2.9				
A14		0.17	0.41	6.4	0.07	4.78	0.3				
	DP-15	1.64	0.48	10.4	0.79	4.04	3.2				
A15	DP-16	0.12	0.75	7.6	0.09	4.53	0.4				
	DP-17	1.76	0.50	10.7	0.88	4.00	3.5				
A16		0.17	0.46	5.0	0.08	5.10	0.4				
	DP-18	1.93	0.50	11.2	0.96	3.93	3.8				
A17	DP-19	1.62	0.15	15.6	0.24	3.40	0.8				
	DP-20	8.86	0.37	17.0	3.26	3.27	10.6				
A18		1.09	0.34	15.8	0.37	3.38	1.3				
	DP-21	9.95	0.37	17.5	3.63	3.22	11.7				
A19	DP-22	3.13	0.19	6.3	0.59	4.78	2.8				
A20		0.33	0.83	5.0	0.27	5.10	1.4				

	DP-23	3.46	0.25	6.5	0.86	4.76	4.1				
A21		0.38	0.86	5.0	0.33	5.10	1.7				
	DP-24	3.84	0.31	6.5	1.19	4.74	5.6				
A22		0.93	0.15	8.7	0.14	4.32	0.6				
	DP-25	14.72	0.34	17.6	4.97	3.21	16.0				
Pond Release							0.3				
B1	DP-26	2.91	0.18	13.9	0.53	3.58	1.9				
B2	DP-27	0.72	0.87	5.0	0.63	5.10	3.2				
B3		0.69	0.87	5.0	0.60	5.10	3.1				
	DP-28	1.41	0.87	5.6	1.22	4.94	6.1				
B4		0.77	0.45	7.4	0.35	4.55	1.6				
	DP-29	2.18	0.72	7.4	1.57	4.55	7.2				
B5	DP-30	1.56	0.15	15.5	0.23	3.41	0.8				
	DP-31						1.1				
C1	DP-32	1.31	0.15	7.1	0.20	4.61	0.9				
C2	DP-33	2.09	0.16	9.2	0.34	4.24	1.5				
C3	DP-34	0.84	0.15	8.4	0.13	4.37	0.6				

PROJECT INFORMATION

PROJECT:	Widefield PK-8 School
PROJECT NO:	21126-00
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	City of Colorado Springs
REPORT TYPE:	Final
DATE:	3/12/2019

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

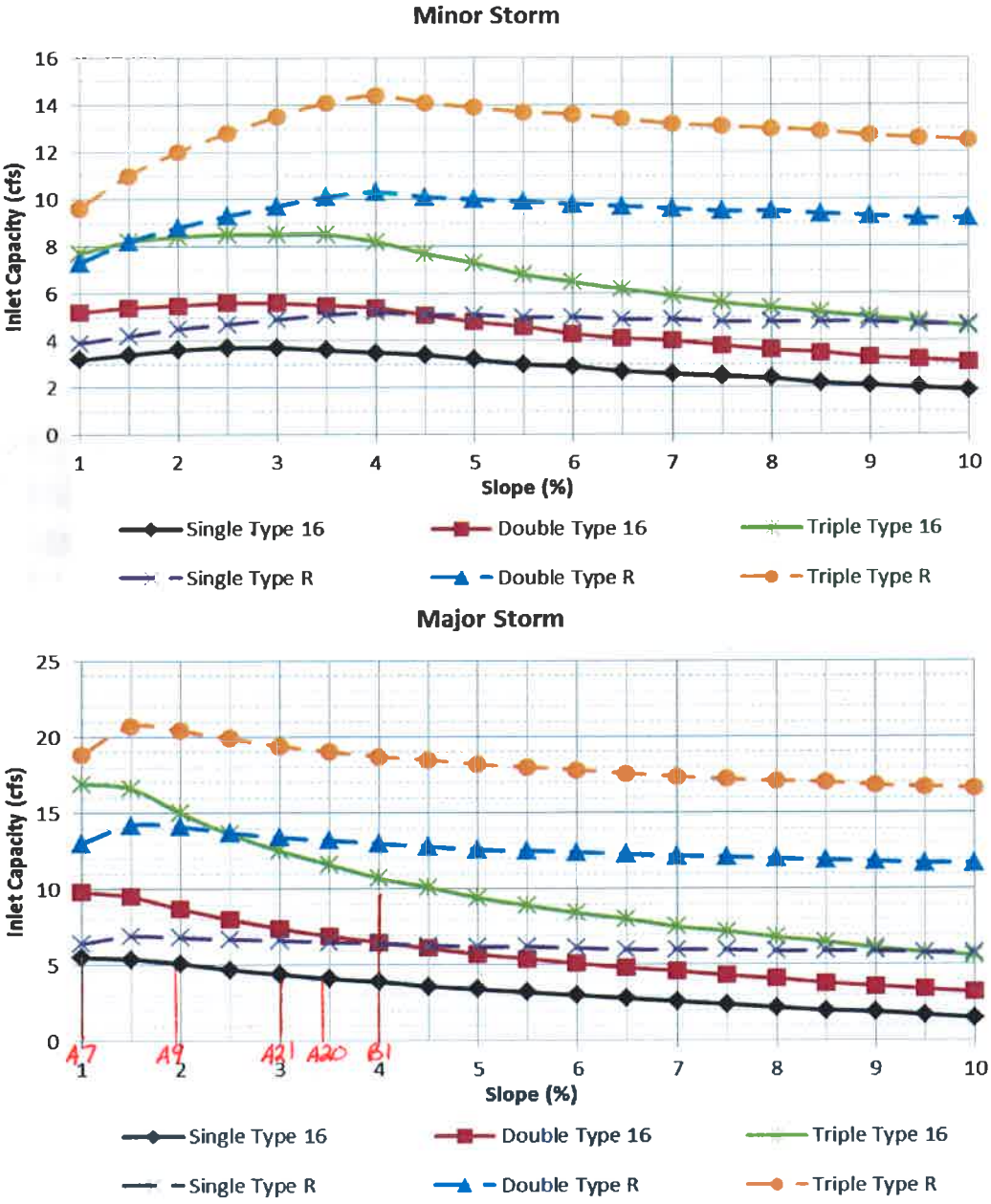
PROPOSED RUNOFF 100 YR STORM P1= **2.67**

			DIRECT RUNOFF					PIPE SIZING			
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	n	Slope (ft/ft)	Calculated Pipe Dia (ft)	Used Pipe (in)
A0	DP-0	0.42	0.63	5.9	0.27	8.69	2.3	0.016	0.005	1.19	15"
A1		1.18	0.52	7.7	0.61	8.00	4.9				
	DP-1	1.60	0.55	7.8	0.88	7.98	7.0	0.016	0.01	1.32	15"
A2	DP-2	0.45	0.74	11.2	0.33	6.99	2.3	0.016	0.012	0.89	12"
A3		0.15	0.50	14.0	0.08	6.35	0.5				
	DP-3	1.78	0.57	14.0	1.02	6.35	6.5	0.016	0.005	1.65	18"
A4	DP-4	1.72	0.51	15.3	0.87	6.11	5.3	0.016	0.005	1.43	18"
	DP-5	3.50	0.54	15.6	1.89	6.05	11.4	0.016	0.01	1.71	18"
A5		0.38	0.54	11.2	0.20	6.98	1.4				
A6	DP-6	0.36	0.77	6.0	0.28	8.66	2.4	0.016	0.01	0.93	12"
	DP-7	4.07	0.58	15.9	2.37	6.01	14.2	0.016	0.008	1.93	24"
A7	DP-8	0.21	0.96	7.1	0.20	8.21	1.7	0.016	0.005	0.93	18"
A8		0.13	0.61	8.3	0.08	7.80	0.6				
	DP-9	4.41	0.60	16.3	2.65	5.94	15.7	0.016	0.021	1.69	24"
A9	DP-10	0.24	0.83	7.7	0.20	8.01	1.6	0.016	0.005	0.91	18"
A10		0.66	0.82	6.4	0.54	8.48	4.6				
	DP-11	5.31	0.64	16.6	3.39	5.88	19.9	0.016	0.01	2.11	24"
A11	DP-12	0.54	0.57	5.0	0.31	9.09	2.8	0.016	0.005	1.32	15"
A12		0.85	0.78	7.5	0.66	8.08	5.3				
	DP-13	1.39	0.70	7.5	0.97	8.08	7.8	0.016	0.005	1.74	18"
A13		0.08	0.56	10.2	0.04	7.25	0.3				
	DP-14	1.47	0.69	10.2	1.01	7.25	7.4	0.016	0.01	1.49	18"
A14		0.17	0.66	6.4	0.11	8.50	1.0				
	DP-15	1.64	0.69	10.4	1.13	7.18	8.1	0.016	0.009	1.57	18"
A15	DP-16	0.12	0.83	7.6	0.10	8.06	0.8	0.016	0.005	0.93	12"
	DP-17	1.76	0.70	10.7	1.23	7.12	8.7	0.016	0.005	1.85	18"
A16		0.17	0.69	5.0	0.12	9.09	1.1				
	DP-18	1.93	0.70	11.2	1.34	7.00	9.4	0.016	0.015	1.54	18"
A17	DP-19	1.62	0.50	15.6	0.81	6.06	4.9	0.016	0.005	1.39	12"
	DP-20	8.86	0.63	17.0	5.54	5.81	32.2	0.016	0.018	2.28	30"
A18		1.09	0.62	15.8	0.67	6.02	4.1				
	DP-21	9.95	0.62	17.5	6.21	5.73	35.6	0.016	0.134	1.63	30"
A19	DP-22	3.13	0.52	6.3	1.64	8.51	13.9	0.016	0.013	1.71	18"
A20		0.33	0.92	5.0	0.30	9.09	2.8				

	DP-23	3.46	0.56	6.5	1.94	8.46	16.4	0.016	0.019	1.68	18"
A21		0.38	0.94	5.0	0.36	9.09	3.2				
	DP-24	3.84	0.60	6.5	2.30	8.44	19.4	0.016	0.078	1.36	24"
A22		0.93	0.50	8.7	0.47	7.69	3.6				
	DP-25	14.72	0.61	17.6	8.98	5.72	51.4				
Pond Release							25.1	0.016	0.0225	1.93	24"
B1	DP-26	2.91	0.52	13.9	1.51	6.37	9.6	0.016	0.04	1.21	24"
B2	DP-27	0.72	0.94	5.0	0.68	9.09	6.2	0.016	0.015	1.23	18"
B3		0.69	0.94	5.0	0.65	9.09	5.9				
	DP-28	1.41	0.94	5.6	1.33	8.80	11.7	0.016	0.04	1.30	24"
B4		0.77	0.69	7.4	0.53	8.10	4.3				
	DP-29	2.18	0.85	7.4	1.85	8.10	15.0	0.016	0.04	1.43	24"
B5	DP-30	1.56	0.50	15.5	0.78	6.08	4.7	0.016	0.085	0.80	12"
	DP-31						29.8	0.016	0.02	2.48	30"
C1	DP-32	1.31	0.50	7.1	0.66	8.21	5.4				
C2	DP-33	2.09	0.51	9.2	1.06	7.54	8.0				
C3	DP-34	0.84	0.50	8.4	0.42	7.79	3.3				

Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical

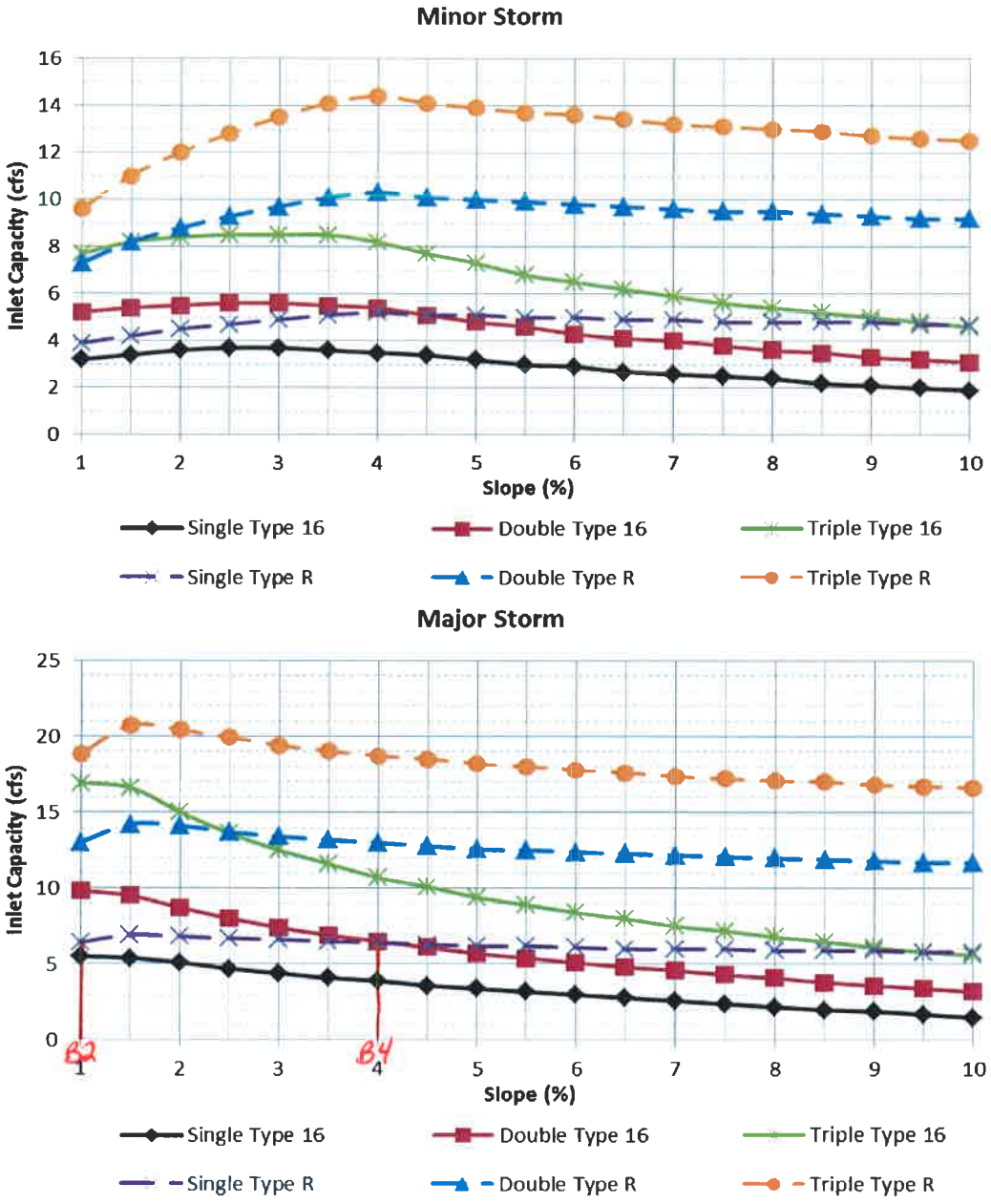


A7: Q_{100} = 1.7 cfs → Single Type 16
A9: Q_{100} = 1.6 cfs → Single Type 16
A20: Q_{100} = 2.3 cfs → Single Type 16
A21: Q_{100} = 2.7 cfs → Single Type 16
B1: Q_{100} = 9.6 cfs → double Type R

The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

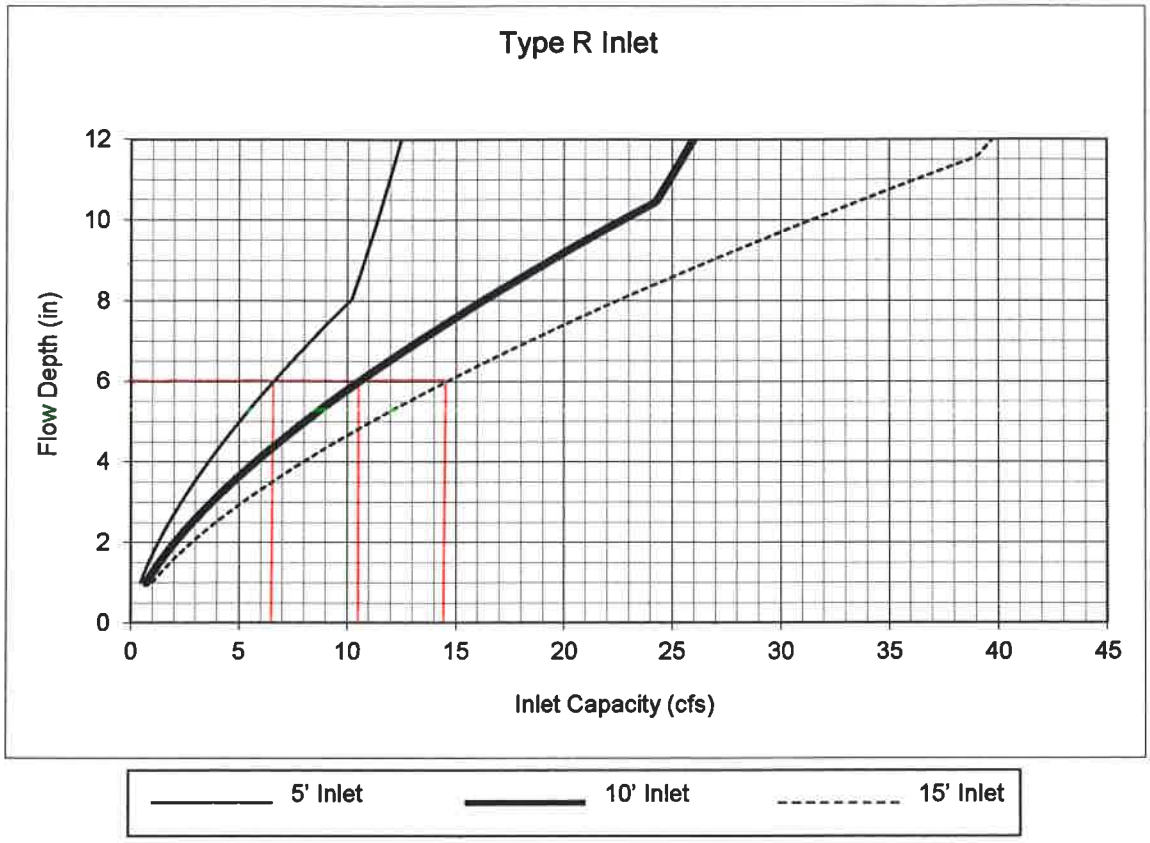
Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical



B2: Q100 = 6.2 cfs → Single Type R
B4: Q100 = 4.3 cfs → Single Type R

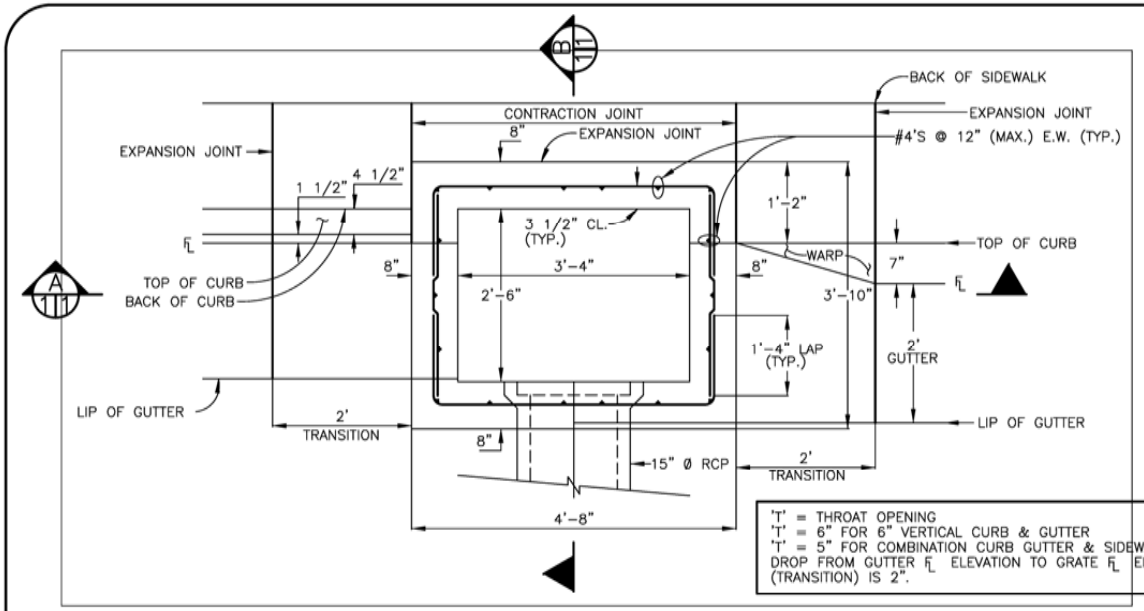
The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



A10: Q_{100} = 4.6 cfs → 5' inlet
B3: Q_{100} = 5.9 cfs → 5' inlet

Notes:
1. The standard inlet parameters must apply to use this chart.

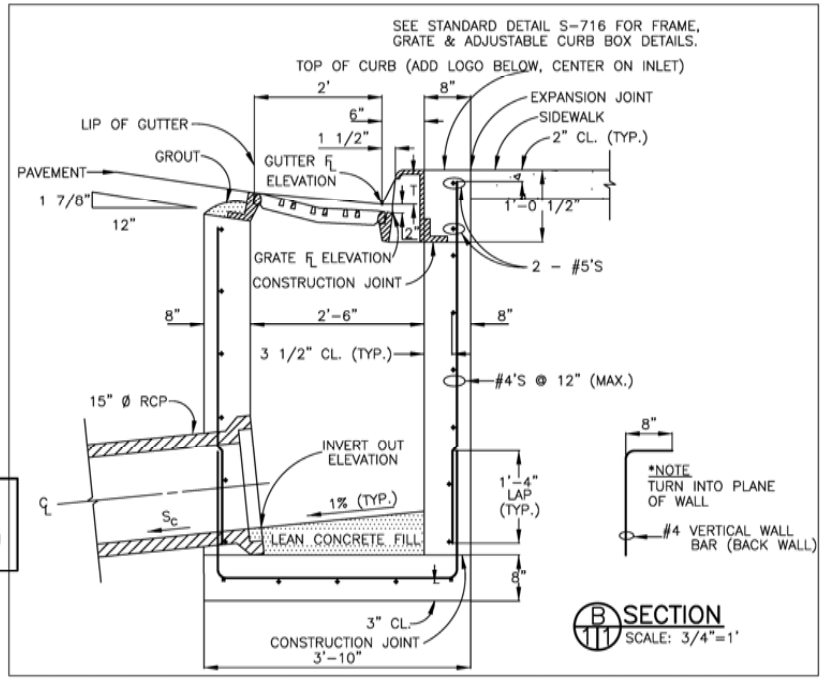


'T' = THROAT OPENING
'T' = 6" FOR 6" VERTICAL CURB & GUTTER
'T' = 5" FOR COMBINATION CURB GUTTER & SIDEWALK
DROP FROM GUTTER ℄ ELEVATION TO GRATE ℄ ELEVATION (TRANSITION) IS 2".

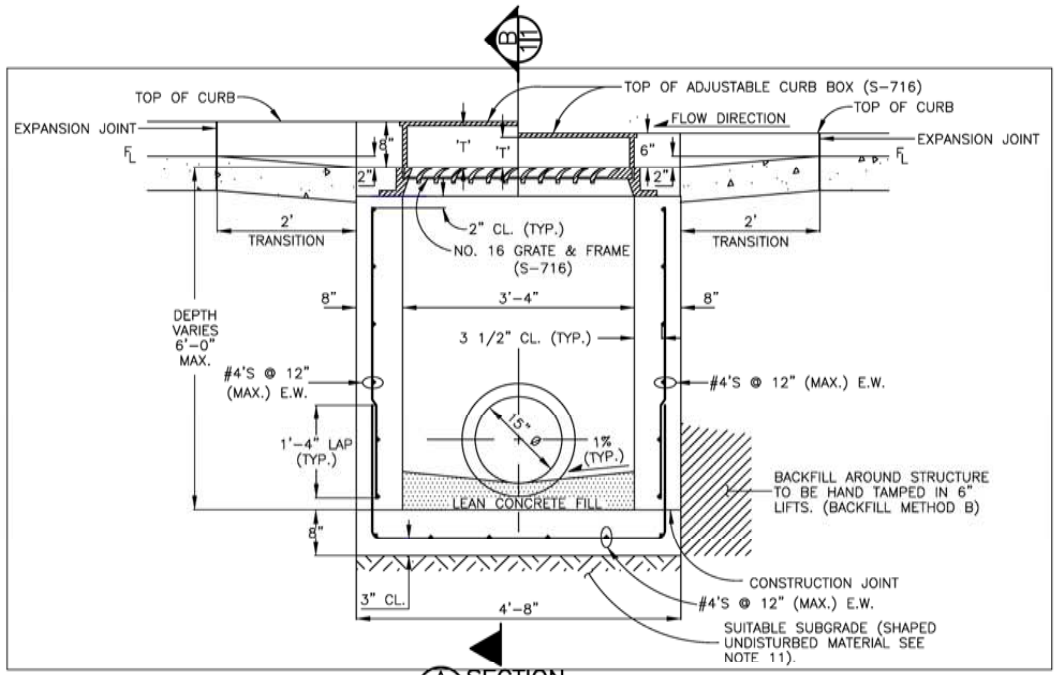
VERTICAL CURB & GUTTER

PLAN VIEW
SCALE: 3/4"=1'

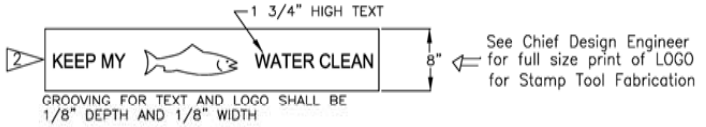
COMB. CURB, GUTTER & SIDEWALK



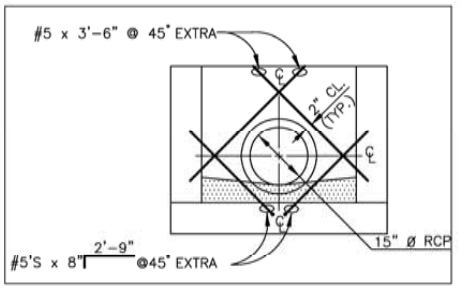
B 1/1 SECTION
SCALE: 3/4"=1'



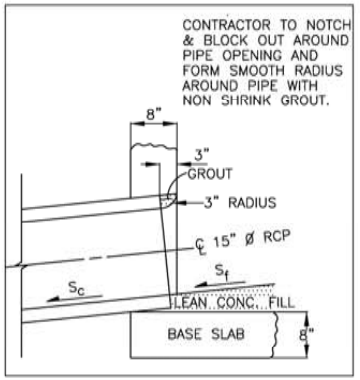
A 1/1 SECTION
SCALE: 3/4"=1'



DETAIL FISH LOGO
NO SCALE



REBAR PLACEMENT
DETAIL AROUND CONNECTOR
SCALE: 1/2"=1'



DETAIL CONNECTOR OUTLET
SCALE: 3/4"=1' (OPTIONAL)

NOTE:
SEE DETAIL SPECIFICATIONS SECTION 11.04 STORM INLETS FOR MORE INFORMATION. USE OF THIS DETAIL WITHOUT SPECIFICATIONS SHALL BE CONSIDERED NON-COMPLIANT.

NOTES:
1. FOR PAYMENT PURPOSES, INLET STRUCTURES SHALL ALSO INCLUDE 2'-0" CURB & GUTTER TRANSITION SECTION AT EACH END OF INLET PLUS SIDEWALK SECTIONS WHERE REQUIRED BEHIND INLET STRUCTURE AND TRANSITION SECTIONS.
2. FLOOR SLOPE MAY BE POURED MONOLITHIC WITH BASE.
3. S_C = SLOPE OF CONNECTOR = 1% MIN.
4. UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS OR OTHERWISE APPROVED, ALL #16 INLETS SHALL BE CONSTRUCTED WITH AN ADJUSTABLE C.I. CURB BOX (S-716).
5. DESIGN CONDITIONS FOR INLET ALLOWS DEPTHS OF 6' (MAX.). FOR INLETS MORE THAN 6 FEET IN DEPTH, SHOP DRAWINGS AND DESIGN ANALYSIS SHALL BE SUBMITTED FOR APPROVAL.
6. ALL REINFORCING STEEL SHALL BE ASTM, A-615, GRADE 60 DEFORMED BARS. DIAMETER OF BEND MEASURED ON THE INSIDE OF THE BAR SHALL BE A MINIMUM OF 6 BAR DIAMETER.
7. ALL WORK SHALL CONFORM TO AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", FIFTEENTH EDITION, 1992.
8. CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 4000 PSI.
9. SUB-GRADE SHALL BE A GRADATION EQUAL TO CLASS B BEDDING COMPACTED TO 95% MAXIMUM DRY DENSITY. AASHTO DESIGNATION T-180.
10. NO FORMWORK SHALL REMAIN INSIDE STRUCTURE WHEN COMPLETE.
11. SUB-GRADE SHALL BE SHAPED UNDISTURBED MATERIAL OR OVEREXCAVATED AND BACKFILLED WITH CLASS B BEDDING MATERIAL, COMPACTED PER WMD SPECIFICATIONS.
12. SPLICING OF REINFORCING STEEL SHALL BE PERMITTED ONLY WHERE DETAILED IN DRAWINGS.
13. INLET WALLS SHALL BE FORMED BOTH INSIDE AND OUTSIDE. CASTING OF SIDEWALLS AGAINST EARTH IS NOT PERMITTED.
14. LEAN CONCRETE FILL TO BE f'_c = 2000 PSI.

REVISED		
	BY	DATE
1	E.M.K.	4/10/96
2	I.J.	3/29/99

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
WASTEWATER MANAGEMENT DIVISION

STANDARD DETAILS
SINGLE NO. 16 OPEN THROAT INLET
ADJUSTABLE CURB BOX

ISSUE DATE	DRAWN BY E.M.K.	SHEET NO. 1	DRAWING NO.
6/94	CHECKED BY I.J.	OF 1 SHEETS	S-616.1

FILENAME: C:\DRAWINGS\MASSTAND\S616-1.DWG, 4/11/99

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

User Input

Calculated cells

				Designer:	**SBN**
				Company:	**Drexel Barrell**
***Design Storm: 1-Hour Rain Depth	WQCV Event	0.53	inches	**Date:**	**March 12, 2019**
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	**Project:**	**CSPD Sand Creek Substation**
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	**Location:**	
Optional User Defined Storm	CUHP				
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52			
Max Intensity for Optional User Defined Storm	2.51496				

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**EDB Wtrshd**														
Receiving Pervious Area Soil Type	Clay Loam														
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	15.190														
Directly Connected Impervious Area (DCIA, acres)	3.000														
Unconnected Impervious Area (UIA, acres)	2.160														
Receiving Pervious Area (RPA, acres)	0.000														
Separate Pervious Area (SPA, acres)	10.030														
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C														

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	15.190														
Directly Connected Impervious Area (DCIA, %)	19.7%														
Unconnected Impervious Area (UIA, %)	14.2%														
Receiving Pervious Area (RPA, %)	0.0%														
Separate Pervious Area (SPA, %)	66.0%														
A_R (RPA / UIA)	0.000														
I_a Check	1.000														
f / I for WQCV Event:	0.5														
f / I for 5-Year Event:	0.2														
f / I for 100-Year Event:	0.1														
f / I for Optional User Defined Storm CUHP:	0.12														
IRF for WQCV Event:	1.00														
IRF for 5-Year Event:	1.00														
IRF for 100-Year Event:	1.00														
IRF for Optional User Defined Storm CUHP:	1.00														
Total Site Imperviousness: I_{total}	34.0%														
Effective Imperviousness for WQCV Event:	34.0%														
Effective Imperviousness for 5-Year Event:	34.0%														
Effective Imperviousness for 100-Year Event:	34.0%														
Effective Imperviousness for Optional User Defined Storm CUHP:	34.0%														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
100-Year Event CREDIT**: Reduce Detention By:	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
User Defined CUHP CREDIT: Reduce Detention By:	0.0%														

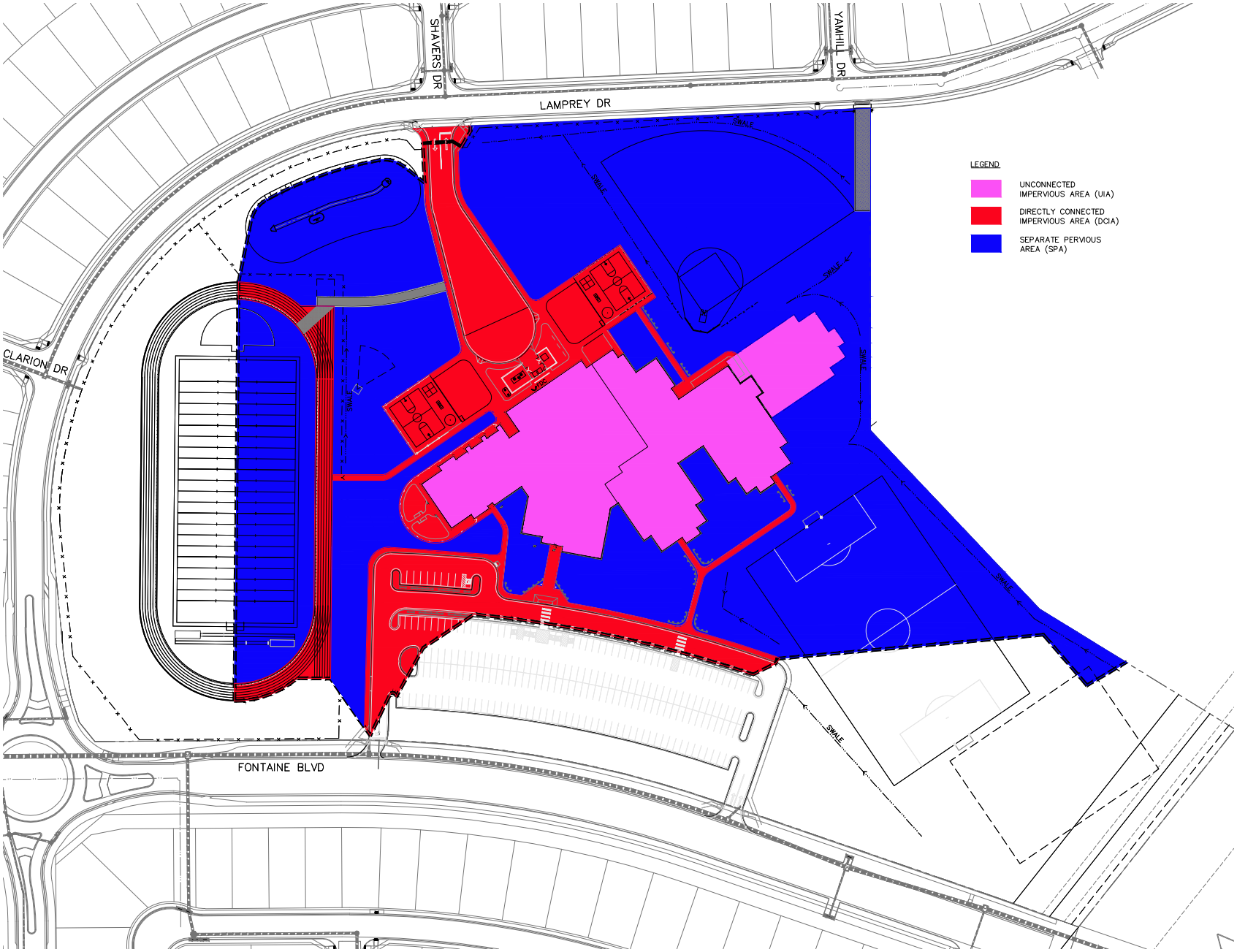
Total Site Imperviousness:	**34.0%**
Total Site Effective Imperviousness for WQCV Event:	**34.0%**
Total Site Effective Imperviousness for 5-Year Event:	**34.0%**
Total Site Effective Imperviousness for 100-Year Event:	**34.0%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	**34.0%**

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

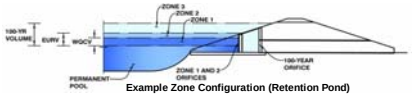

SHAVERS DR
YAMHILL DR
LAMPREY DR
CLARION DR
FONTAINE BLVD
SWALE
LEGEND
UNCONNECTED IMPERVIOUS AREA (UIA)
DIRECTLY CONNECTED IMPERVIOUS AREA (DCIA)
SEPARATE PERVIOUS AREA (SPA)

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Widefield PK-8 school

Basin ID:



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	15.19	acres
Watershed Length =	1,120	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	34.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	0.207	acre-feet
Excess Urban Runoff Volume (EURV) =	0.474	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.437	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.704	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.979	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.490	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	1.857	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.320	acre-feet
500-yr Runoff Volume (P1 = 3.49 in.) =	3.581	acre-feet
Approximate 2-yr Detention Volume =	0.410	acre-feet
Approximate 5-yr Detention Volume =	0.664	acre-feet
Approximate 10-yr Detention Volume =	0.765	acre-feet
Approximate 25-yr Detention Volume =	0.851	acre-feet
Approximate 50-yr Detention Volume =	0.889	acre-feet
Approximate 100-yr Detention Volume =	1.070	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.49	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.207	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.267	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.596	acre-feet
Total Detention Basin Volume =	1.070	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

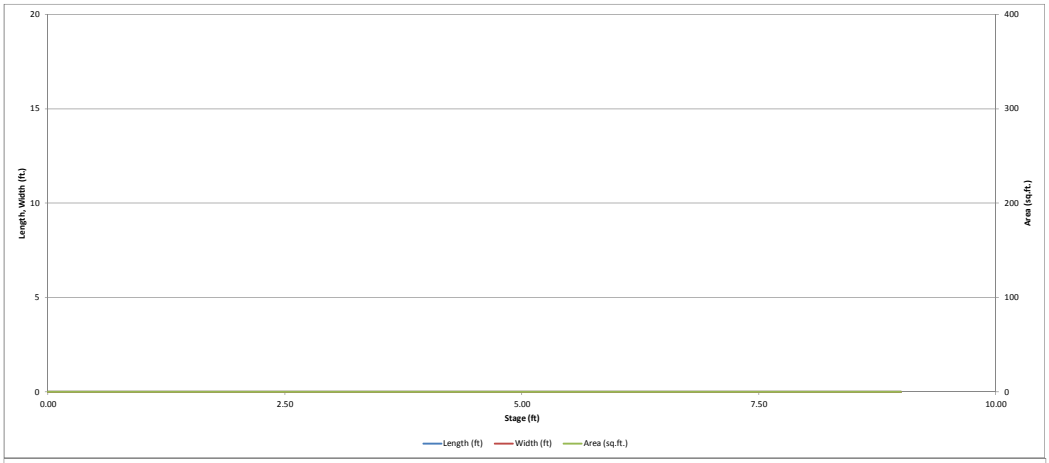
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

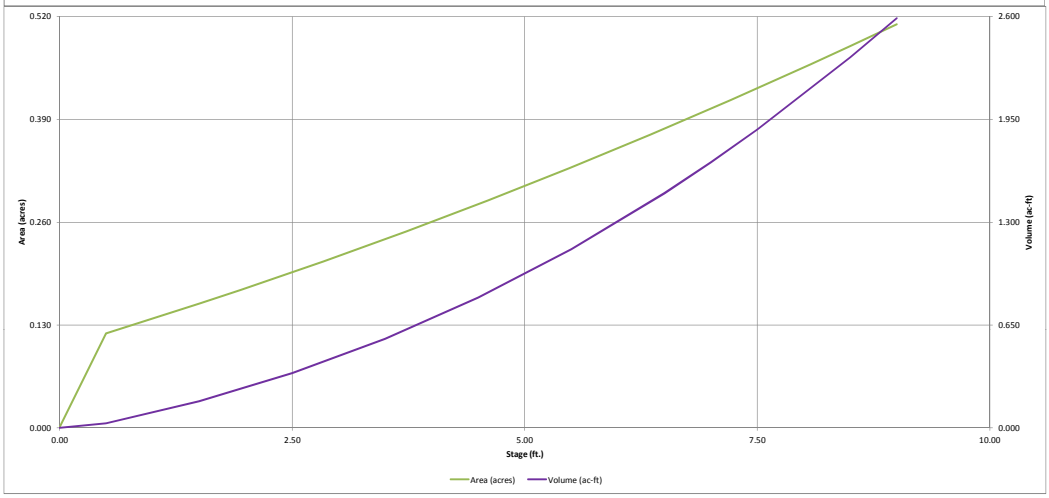
Depth Increment = 1 ft

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	--	--	--	41	0.001		
5735	--	0.50	--	--	--	5,207	0.120	1,260	0.029
5736	--	1.50	--	--	--	6,834	0.157	7,264	0.167
5737	--	2.50	--	--	--	8,562	0.197	15,030	0.345
5738	--	3.50	--	--	--	10,390	0.239	24,506	0.563
5739	--	4.50	--	--	--	12,319	0.283	35,861	0.823
5740	--	5.50	--	--	--	14,348	0.329	49,194	1.129
5741	--	6.50	--	--	--	16,478	0.378	64,607	1.483
5741.5-Spillway	--	7.00	--	--	--	17,581	0.404	73,122	1.679
5742	--	7.50	--	--	--	18,708	0.429	82,194	1.887
5743	--	8.50	--	--	--	21,040	0.483	102,068	2.343
5743.5-Embkmnt	--	9.00	--	--	--	22,243	0.511	112,889	2.592

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



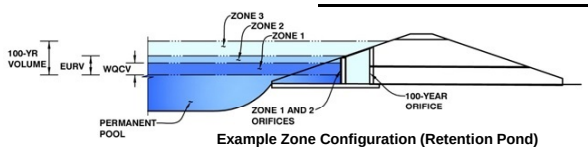


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.74	0.207	Orifice Plate
Zone 2 (EURV)	3.12	0.267	Orifice Plate
Zone 3 (100-year)	5.32	0.596	Weir&Pipe (Circular)
		1.070	Total

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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 =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.313E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.84	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	15.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.89	sq. inches (diameter = 1-9/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.28	2.56					
Orifice Area (sq. inches)	1.89	1.89	1.89					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.75	N/A	feet
Overflow Weir Front Edge Length =	3.91	N/A	feet	Over Flow Weir Slope Length =	3.91	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	3.41	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	3.91	N/A	feet	Overflow Grate Open Area w/o Debris =	10.70	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.35	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Circular	Not Selected			Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft^2
Circular Orifice Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.88	feet
Spillway Crest Length =	12.00	feet	Stage at Top of Freeboard =	8.88	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.50	acres
Freeboard above Max Water Surface =	1.00	feet			

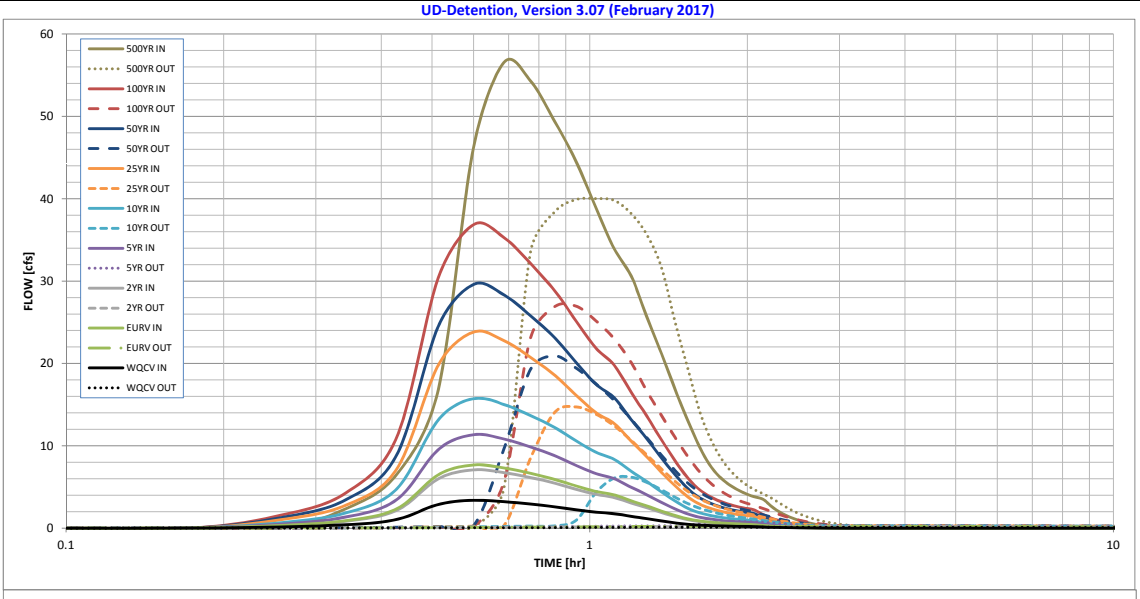
Calculated Parameters for Spillway

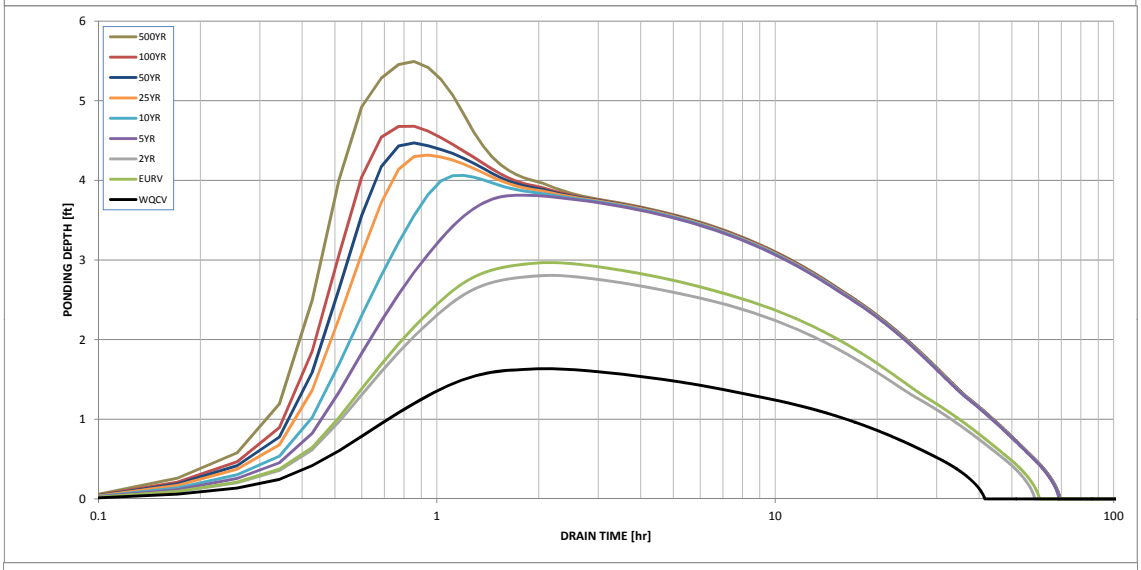
Routed Hydrograph Results

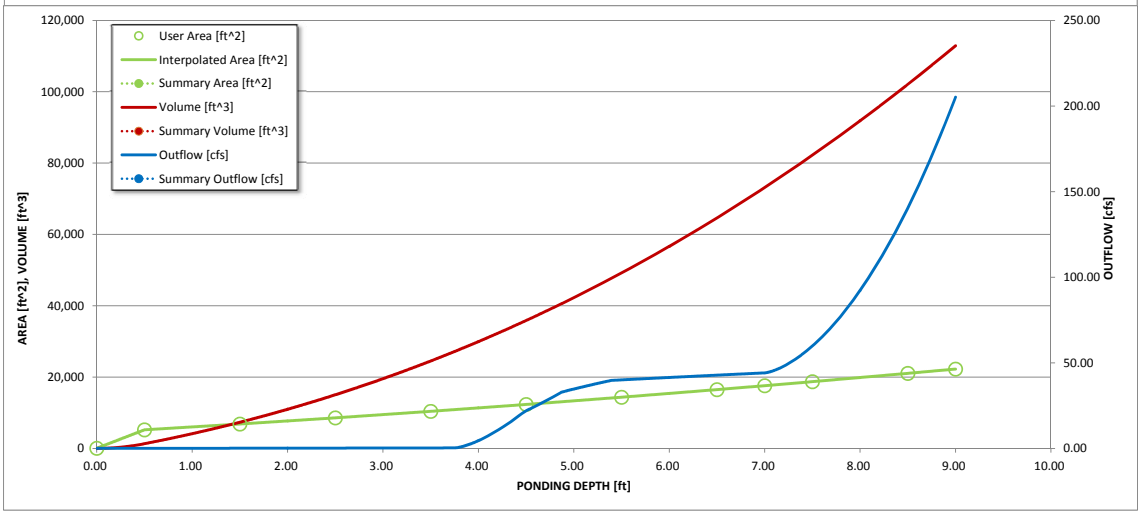
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.49
Calculated Runoff Volume (acre-ft) =	0.207	0.474	0.437	0.704	0.979	1.490	1.857	2.320	3.581
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.206	0.473	0.437	0.703	0.978	1.488	1.855	2.317	3.577
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.12	0.33	0.76	1.01	1.32	2.12
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	1.8	5.0	11.6	15.3	20.0	32.2
Peak Inflow Q (cfs) =	3.4	7.7	7.1	11.3	15.7	23.8	29.6	36.9	56.5
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.8	6.2	14.7	20.9	27.0	40.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	1.3	1.3	1.4	1.3	1.2
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.5	1.4	1.9	2.5	3.7
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	54	53	61	58	55	52	49	42
Time to Drain 99% of Inflow Volume (hours) =	**40**	58	56	65	64	63	62	60	57
Maximum Ponding Depth (ft) =	1.63	2.97	2.81	3.81	4.06	4.32	4.47	4.68	5.49
Area at Maximum Ponding Depth (acres) =	0.16	0.22	0.21	0.25	0.26	0.27	0.28	0.29	0.33
Maximum Volume Stored (acre-ft) =	0.189	0.440	0.406	0.639	0.703	0.770	0.812	0.872	1.126

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			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename: _____

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.14 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:10:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:15:25	0.15	0.34	0.32	0.50	0.69	1.03	1.27	1.58	2.37
0.972	0:20:34	0.41	0.92	0.85	1.35	1.87	2.81	3.48	4.32	6.56
	0:25:42	1.05	2.36	2.18	3.47	4.79	7.21	8.94	11.09	16.84
	0:30:50	2.89	6.49	6.00	9.55	13.17	19.80	24.53	30.42	46.18
	0:35:59	3.38	7.67	7.09	11.34	15.72	23.80	29.59	36.86	56.54
	0:41:07	3.21	7.32	6.76	10.83	15.02	22.77	28.33	35.31	54.30
	0:46:16	2.92	6.66	6.15	9.86	13.67	20.73	25.79	32.14	49.41
	0:51:24	2.59	5.94	5.48	8.81	12.24	18.59	23.14	28.88	44.50
	0:56:32	2.22	5.12	4.72	7.61	10.59	16.13	20.11	25.14	38.88
	1:01:41	1.94	4.46	4.12	6.63	9.22	14.02	17.47	21.87	33.92
	1:06:49	1.76	4.04	3.73	6.01	8.36	12.71	15.84	19.81	30.65
	1:11:58	1.43	3.32	3.06	4.96	6.92	10.57	13.20	16.53	25.65
	1:17:06	1.16	2.71	2.49	4.05	5.68	8.70	10.88	13.65	21.24
	1:22:14	0.87	2.08	1.91	3.13	4.40	6.79	8.52	10.73	16.79
	1:27:23	0.64	1.54	1.41	2.33	3.30	5.14	6.49	8.20	12.94
	1:32:31	0.47	1.12	1.03	1.69	2.39	3.76	4.76	6.05	9.64
	1:37:40	0.37	0.87	0.80	1.31	1.84	2.87	3.62	4.58	7.24
	1:42:48	0.30	0.71	0.66	1.07	1.51	2.34	2.95	3.72	5.84
	1:47:56	0.26	0.61	0.56	0.91	1.28	1.98	2.49	3.14	4.92
	1:53:05	0.23	0.53	0.49	0.80	1.12	1.73	2.18	2.74	4.28
	1:58:13	0.21	0.48	0.44	0.72	1.01	1.56	1.95	2.45	3.83
	2:03:22	0.19	0.44	0.41	0.66	0.93	1.43	1.79	2.25	3.51
	2:08:30	0.14	0.33	0.30	0.49	0.68	1.05	1.32	1.66	2.61
	2:13:38	0.10	0.24	0.22	0.36	0.50	0.77	0.96	1.21	1.89
	2:18:47	0.07	0.18	0.16	0.26	0.37	0.57	0.71	0.89	1.40
	2:23:55	0.05	0.13	0.12	0.19	0.27	0.42	0.53	0.66	1.04
	2:29:04	0.04	0.09	0.08	0.14	0.19	0.30	0.38	0.48	0.76
	2:34:12	0.03	0.06	0.06	0.10	0.14	0.21	0.27	0.34	0.54
	2:39:20	0.02	0.05	0.04	0.07	0.10	0.16	0.20	0.25	0.40
	2:44:29	0.01	0.03	0.03	0.05	0.07	0.11	0.13	0.17	0.28
	2:49:37	0.01	0.02	0.02	0.03	0.04	0.07	0.08	0.11	0.18
	2:54:46	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.06	0.10
	2:59:54	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04
	3:05:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	3:10:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:41:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:46:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:51:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:56:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:01:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:06:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:11:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:17:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:32:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:42:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:47:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:58:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:03:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:23:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:28:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:34:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:39:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:44:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:49:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:54:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:59:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:04:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:10:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Widefield PK-8 school - Forebay volumes

Forebay = 3% of WQCV = $0.03 \times 0.207 = 0.0062$ ac-ft

$Q_{in\ east} = 18.4$ cfs

$Q_{in\ south} = 37.7$ cfs

$Q_{total} = 56.1$ cfs

$$\frac{18.4 \text{ cfs}}{56.1 \text{ cfs}} = \frac{x \text{ ac-ft}}{0.0062 \text{ ac-ft}}$$

$x = 0.0020$ ac-ft
$= 88.6$ ft^3 ← East forebay volume

$$\frac{37.7 \text{ cfs}}{56.1 \text{ cfs}} = \frac{x \text{ ac-ft}}{0.0062 \text{ ac-ft}}$$

$x = 0.0042$ ac-ft
$= 181.5$ ft^3 ← South forebay volume

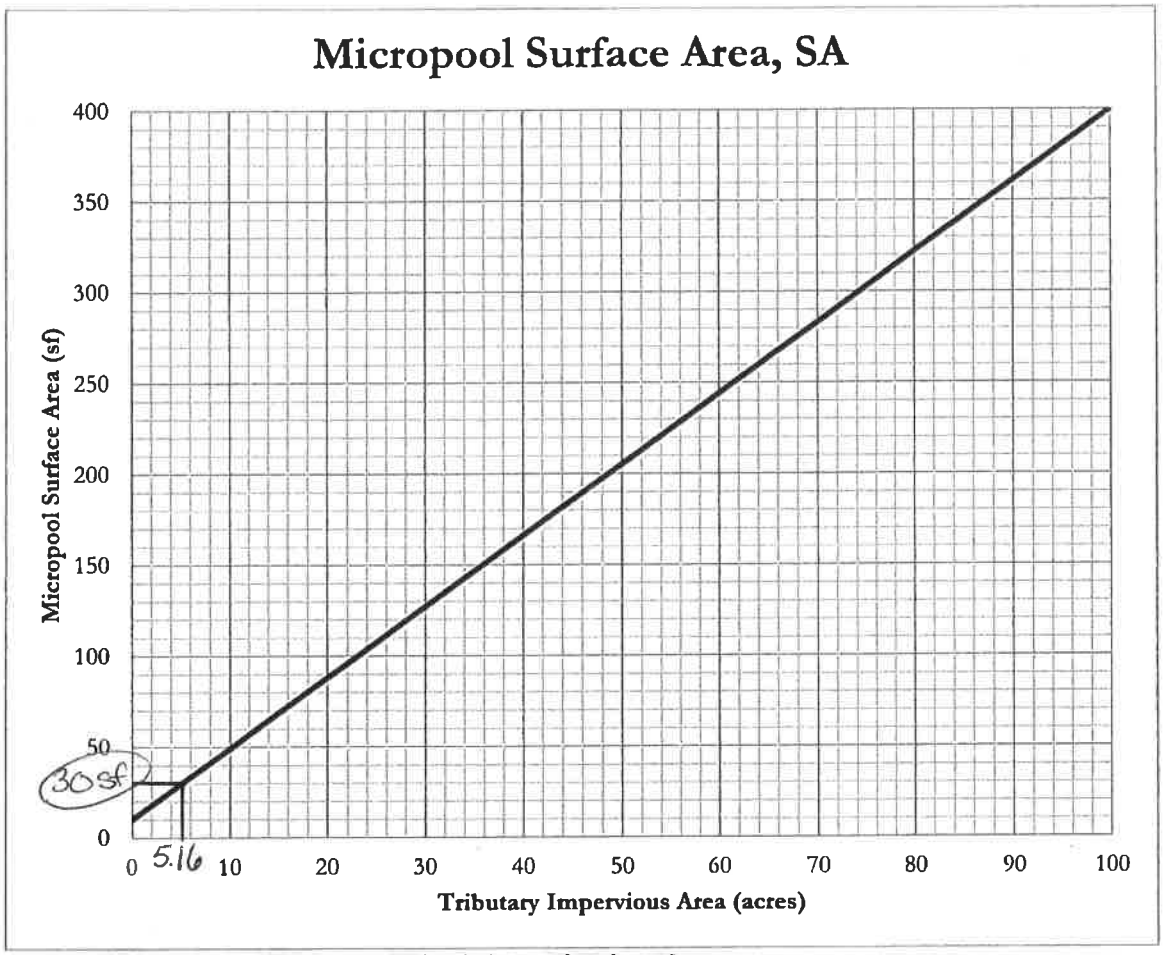


Figure 1 – Micropool surface area (SA) determination chart

The tributary impervious area is the effective number of impervious acres that will be treated by the extended detention basin (EDB). It is calculated by multiplying the tributary area to be treated by the impervious fraction of that area.

$$TIA = I \times A$$

$\frac{34}{100} \times 15.19 = 5.16$ ac

TIA = Tributary impervious area (acres)
I = Imperviousness (fraction)
A = Tributary catchment area upstream (acres)

For EDBs with tributary impervious areas greater than 100 acres, the micropool surface area is 400 sf. The initial surcharge depth (ISD) is defined as the depth of the initial surcharge volume (ISV). The surface area determined using Figure 1 assumes an ISD of 4 inches. The initial surcharge volume is thus calculated by multiplying the micropool surface area by 4 inches.

$$ISV = SA \times 4\ inches$$

ISV = Initial surcharge volume (cf)
SA = Surface area (from Figure 1, sf)

FOREBAY VOLUME

V=3% x WQCV

WQCV=	0.207	ac-ft
V=	0.0062	ac-ft

FOREBAY RELEASE NOTCH WIDTH - EAST

$Q=CLH^{2/3}$

Q_{100}=	18.4	cfs
2% of Q=	0.37	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	2	in

FOREBAY RELEASE NOTCH WIDTH - SOUTH

$Q=CLH^{2/3}$

Q_{100}=	37.7	cfs
2% of Q=	0.75	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	3	in

COLORADO
Division of Water Resources
Department of Natural Resources
www.water.state.co.us P 303.866.3581

NON-JURISDICTIONAL WATER IMPOUNDMENT STRUCTURE[1]

This notice is required per Section 37-87-125, C.R.S. (1998) and
must be submitted to the Division Engineer's Office a minimum of 45 days prior to construction.

OWNER INFORMATION

Name: Widefield School District 3 Telephone/E-Mail: (719) 391-3530 / neald@wsd3.org

Address: 1820 Main St. (Street / P.O. Box/ Rural Route) Colorado Springs (City) CO (State) 80911 (Zip Code)

Responsible Person: Dennis Neal Telephone/E-Mail: (719) 391-3530 / neald@wsd3.org

Address: 1820 Main St. (Street / P.O. Box/ Rural Route) Colorado Springs (City) CO (State) 80911 (Zip Code)

Contractor: Nunn Construction Telephone/E-Mail: (719) 599-7710 / ebivens@nunnconstruction.com

STRUCTURE INFORMATION

Name of Dam: Widefield PK-8 school drainage facility Water Division: 2 Water District: 10

Location: *(Provide Section, Township, Range, **and** GPS Point taken at crest of dam above streamline/outlet)*

- Section: 13, Township: 15, Range: 65, 6th P.M.
- Northing 405,949.35 meters, Easting 990,600.62 meters *(Datum should be UTM, NAD 83)*

Dam Dimensions:

- Vertical Height[2]: 7 ft., Length: 180 ft., Crest Width: 5 ft., Slopes: U/S: 4:1 (H:1V), D/S 4:1 (H:1V)

Reservoir:

- Surface Area[1]: 0.40 acres, Capacity[1]: 1.679 acre-feet, Drainage Area*: 25.26 acres
  **(If drainage area is unknown leave blank and a spillway size will be assigned):*

Emergency Spillway: *(See Table 1, Spillway Sizing Guidelines)*

- Bottom Width: 23 ft., Side Slopes: 4:1 H:1V, Freeboard[3]: 1 ft

Outlet Conduit Type: RCP pipe, Size: 30 inches, Location: West end of EDB

Stream Name or Water Source[4]: Widefield PK-8 school Proposed Water Use: none/stormwater detention

Water Court Case **or** WDID : n/a
(Water District Identification Number)

Signature of Owner 3/13/18 Date

Office Use Only

DIVISION ENGINEER'S REQUIREMENTS:

Bill W. Tyner 9-12-2018
Signature of Division Engineer Date

Dam I.D. 100522

[1] A "Non-Jurisdictional Structure" is a dam creating a reservoir with a capacity of 100 acre-feet or less *and* a surface area of 20 acres or less *and* a vertical height (footnote 2) of 10 feet or less. Non-jurisdictional size dams are regulated and subject to the authority of the State Engineer consistent with sections 37-87-102 and 37-87-105 C.R.S.

[2] "Vertical Height" is measured from the elevation of the lowest point of the natural surface of the ground or the invert of the outlet conduit (whichever is lower) where that point occurs along the longitudinal centerline of the dam up to the crest of the emergency spillway of the dam.

[3] "Freeboard" is the vertical distance from the bottom of spillway to the crest of the dam. Minimum Freeboard is 3 feet.

[4] If construction in reservoir intercepts groundwater, a well permit is required. (Well permit applications can be found at www.water.state.co.us)

DWR (11/16)

LEGEND

- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR — 5750 —
- EX. INTERMEDIATE CONTOUR
- EX. INDEX CONTOUR ----5750----
- PROPOSED STORM SEWER
- PROPOSED INLET
- PROPOSED FLARED END SECTION
- PROPOSED SITE LIGHTING
- PROPOSED PEDESTRIAN LIGHTING
- EX. MANHOLE
- EX. STORM SEWER
- BASIN BOUNDARY
- FLOW DIRECTION
- DESIGN POINT 1

A1 — BASIN
AREA (ACRE) — 1.18 2.3 — Q5 (cfs) / Q100 (cfs)

N

50 20 0 50 100
SCALE: 1"=50'

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
DP-0	0.42	0.8	2.3
DP-1	1.60	1.7	7.0
DP-2	0.45	1.0	2.3
DP-3	0.15	1.8	6.5
DP-4	1.72	0.9	5.3
DP-5	3.50	2.6	11.4
DP-6	0.36	1.1	2.4
DP-7	4.07	4.0	14.2
DP-8	0.21	0.9	1.7
DP-9	4.41	4.7	15.7
DP-10	0.24	0.7	1.6
DP-11	5.31	6.8	19.9
DP-12	0.54	0.8	2.8
DP-13	1.39	3.2	7.8
DP-14	1.47	2.9	7.4
DP-15	1.64	3.2	8.1
DP-16	0.12	0.4	0.8
DP-17	1.76	3.5	8.7
DP-18	1.93	3.8	9.4
DP-19	1.62	0.8	4.9
DP-20	8.86	10.6	32.2
DP-21	9.95	11.7	35.6
DP-22	3.13	2.8	13.9
DP-23	3.46	4.1	16.4
DP-24	3.84	5.6	19.4
DP-25	14.72	16.0	51.4
DP-26	2.91	1.9	9.6
DP-27	0.72	3.2	6.2
DP-28	1.41	6.1	11.7
DP-29	2.18	7.2	15.0
DP-30	1.56	0.8	4.7
DP-31	16.28	1.1	29.8
DP-32	1.31	0.9	5.4
DP-33	2.09	1.5	8.0
DP-34	0.84	0.6	3.3

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New Widefield PK-8 School

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Widefield School District 3
1820 Main Street
Colorado Springs, CO 80911

WIDEFIELD SCHOOL DISTRICT 3
PRIDE. TRADITION. INNOVATION.

COLORADO REGISTERED T.D. McCONNELL 37797 7-3-18 PROFESSIONAL ENGINEER

Construction Documents

Drawn:	SBN
Checked:	TDM
Issued:	03 July 2018
Revised:	

DRAINAGE MAP

PROPOSED DRAINAGE MAP

DR-PR

Project No. 17.001
The LKA Partners Incorporated

SHEET 1 OF 30