



**PRELIMINARY DRAINAGE REPORT  
FOR  
FRONT RANGE – MIDWAY SOLAR PROJECT  
EL PASO COUNTY, CO  
(WSEO 17-001)**

**PREPARED FOR:**

TRADEWIND ENERGY, INC.  
FRONT RANGE – MIDWAY SOLAR  
16105 W. 113<sup>TH</sup> STREET SUITE 105  
LENEXA, KS 66219  
PHONE: (913) 888-9463  
CONTACT: SCOTT ZIEMETZ

**PREPARED BY:**

CORE CONSULTANTS, INC.  
1950 W. LITTLETON BOULEVARD, SUITE 109  
LITTLETON, CO 80120  
PHONE: 303-703-4444  
CONTACT: DAVID BACCI  
CORE PROJECT NUMBER: 17-012

FEBRUARY 26, 2018

**APPROVAL BLOCKS**

**I. DESIGN ENGINEER'S STATEMENT:**

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

\_\_\_\_\_  
David Bacci, P.E. #42104



\_\_\_\_\_  
Date

**II. OWNER/DEVELOPER'S STATEMENT:**

I, the developer, have read and will comply with all the requirements specified in this Drainage Report and Plan.

*Dave Tadarola*

\_\_\_\_\_  
Development Manager

**III. EL PASO COUNTY STATEMENT:**

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



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**TABLE OF CONTENTS**

	<b><u>PAGE</u></b>
<b><u>PHASE II DRAINAGE REPORT</u></b>	
I. GENERAL LOCATION AND DESCRIPTION .....	4
A. SITE LOCATION.....	4
B. DESCRIPTION OF PROPERTY.....	4
II. DRAINAGE BASINS AND SUB-BASINS .....	4
A. MAJOR DRAINAGE BASINS .....	4
B. MINOR DRAINAGE BASINS .....	5 - 6
III. DRAINAGE DESIGN CRITERIA .....	6
A. REGULATIONS .....	6
B. DRAINAGE STUDIES, MASTER PLANS, SITE CONSTRAINTS .....	6
C. HYDROLOGY .....	7
D. HYDRAULICS.....	7
E. WATER QUALITY ENHANCEMENT .....	7
IV. STORMWATER MANAGEMENT FACILITY DESIGN.....	7
A. STORMWATER CONVEYANCE FACILITIES.....	7
B. STORMWATER STORAGE FACILITIES.....	7
C. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES .....	8
D. FLOODPLAIN MODIFICATION .....	8
E. ADDITIONAL PERMITTING REQUIREMENTS.....	8
F. GENERAL .....	8
V. REFERENCES .....	8



## LIST OF APPENDICES

### **APPENDIX A – HYDROLOGIC CALCULATIONS**

VICINITY MAP  
FIRM MAP  
SCS SOILS MAPS  
PERCENT IMPERVIOUS CALCULATIONS  
RUNOFF COEFFICIENT CALCULATIONS  
TIME OF CONCENTRATION CALCULATIONS  
RATIONAL METHOD CALCULATIONS FOR DETERMINING 2 AND 100-YEAR RUNOFF RATES  
CUHP CALCULATIONS  
EXTENDED DETENTION BASIN CALCULATIONS  
DRAINAGE PLAN



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## **I. GENERAL LOCATION AND DESCRIPTION**

### **A. SITE LOCATION**

This Final Drainage Report provides remediation for changes in the drainage patterns resulting from the development of the proposed Front Range – Midway Solar Project. The Project would consist of a 100 megawatt (MW) distributed generation photovoltaic solar facility that would encompass approximately 1,085 acres in El Paso County (EPC), Colorado. The Project is located west of Interstate-25 (I-25) approximately 20 miles south of downtown Colorado Springs on private and county owned lands. The Project is bound on the west by county lands and by dispersed residential development to the northwest and southwest, by rangeland to the north, by a gravel pit to the east, and by the Midway Waste Management Landfill to the south. Other facilities in the near vicinity include the Pikes Peak International Raceway approximately 1.5 miles to the north and the Fort Carson Military Reservation approximately one mile to the west. The Mountain States Telephone compound is also located within the project area. Front Range - Midway Solar Project is located in Section 20, Township 17 South, Range 65 West of the 6<sup>th</sup> Principal Meridian, El Paso County, Colorado. A vicinity map for the site can be found in Appendix A.

### **B. DESCRIPTION OF PROPERTY**

The project area is flat to gently rolling, at elevations ranging from approximately 5,360 to 5,520 feet. The site has naturally occurring slopes ranging from 2 to 10 percent and is covered with native grass and very few deciduous trees. Surface runoff is to the north, south and east. Runoff from the northern portion of the site flows north into two separate conveyances. After merging into one conveyance, these flows continue east under I25 through a series of bridges and eventually into Fountain Creek. Flows from the southeast portion of the site flow east under I25 through an existing box culvert and continue east into Fountain Creek. Flows from the southwest portion of the site flow south into Sand Creek then under I25 through a series of bridges and continue into Fountain Creek which flows to the south along the east side of I-25 to Pueblo where it joins the Arkansas River. The proposed improvements to the site consist of a 100 megawatt (MW) photovoltaic solar array, distribution poles, a meteorological station, inverters, site access roads, and other necessary ancillary features. The soils vary throughout the site and include mainly Wilid Silt Loam, (Hydrologic soil group C), Fort Loam (Hydrologic soil group C), Kim Loam (Hydrologic soil group B) and Schamber Razor (Hydrologic soil group A). A soils map has been provided and can be found in Appendix A.

## **II. DRAINAGE BASINS AND SUB-BASINS**

### **A. MAJOR DRAINAGE BASINS**

The existing drainage patterns for the major basin will follow the historic patterns. Front Range – Midway Solar site will drain east and cross under I25 in 3 locations

eventually outfalling into Fountain Creek. Fountain Creek flows to the south along the east side of I-25 and is part of the Arkansas River basin

The site falls within Zone X, as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 08041C1155F, 08041C1160F, 08041C1170F, and 08041C1165F. A copy of the FIRM map can be found in Appendix A.

## **B. MINOR DRAINAGE BASINS**

Minor Drainage Basins for Front Range – Midway Solar Project have been delineated per the preliminary layout of the solar arrays. Layout of the arrays and access roads may change during the preliminary development of the site. Overall, the proposed drainage patterns for the sub-basins will follow the historic patterns prior to development. For sub-basins within the site, runoff will drain to the north, south and east.

Basin (A1) will flow north to a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the northeast into an east-flowing conveyance and through a series of bridges under I25 to Fountain Creek.

Basin (A2) will flow southeast to a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff overland to the northeast and into an east-flowing conveyance then through a series of bridges under I25 to Fountain Creek.

Basin (A3) will flow to the east and will be collected in an existing Extended Detention Basin. Flowrates or flow patterns within this basin will not be affected by this development.

Basin (A4) will flow to the south and eventually into Sand Creek. Flowrates or flow patterns within this basin will not be affected by this development.

Basin (A5) will flow southeast to a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff overland to the south into Sand Creek. Sand Creek crosses I25 through a series of bridges and flows into Fountain Creek.

Basin (A6) flows east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek.

---

Basin (A7) flows northeast into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek.

Basin (A8) will flow to the northeast into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek.

Basin (A9) will flow to the northeast into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff overland to the east through a series of bridges under I25 to Fountain Creek.

Basin (A10) will flow to the east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic flowrate to the southeast into a conveyance that continues east under I25 through an existing box culvert eventually flowing into Fountain Creek.

Basin (A11) will flow to the east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic flowrate to the southeast into a conveyance that continues east under I25 through an existing box culvert eventually flowing into Fountain Creek.

Basin (A12) flows east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek

The developed minor basins will include pole mounted solar arrays with native ground beneath and 3" thick gravel access roads constructed of  $\frac{3}{4}$ " gravel on top of 12" re-compacted soil. The development will slightly increase the imperviousness of the site due to the addition of gravel roads. Extended Detention Basins have been designed to mitigate the increase in runoff. A total of 9 extended detention basins will be designed during the construction document design phase. The extended detention basins will be privately owned and maintained.

### **III. DRAINAGE DESIGN CRITERIA**

#### **A. REGULATIONS**

This Final Drainage Report is in accordance with El Paso County Drainage Criteria Manual and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual*. These manuals were used as a basis of design for the site. All applicable tables, figures, and charts from the referenced reports and criteria manuals used in the drainage design of the site can be found in

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Appendix B. The report will analyze the minor (5-year) and major (100-year) storm events.

**B. DRAINAGE STUDIES, MASTER PLANS, AND SITE CONSTRAINTS**

There are no previous drainage studies, master plans or site constraints for this development.

**C. HYDROLOGY**

A combination of the Rational Method and the Colorado Urban Hydrograph Procedure (CUHP) was used to determine the flow rates for various basins within the site. Basins Larger than 160 acres were evaluated using CUHP. The rational method was used for all other basins. The sub-basins were delineated based on the existing topography for the project. Flow rates for each basin can be found in Appendix A. Stormwater Management Model (SWMM) is typically used in conjunction with CUHP when the routing of extended detention basins, channels and/or storm networks as necessary. Because this site is located at the top of a basin; each basin flows into its own extended detention basin or separate concentrated point. Because of this, no routing is required and SWMM was not used. The impervious panels are going to be pole mounted with the ground underneath them to remain vegetated. The gravel access roads will be constructed to slow surface flows and promote infiltration back into the ground. As a result, there will be very slight increase in runoff once the development is constructed.

The intensity-frequency curves used in the Rational Method calculations were taken from the El Paso County Drainage Criteria Manual. All drainage facilities were analyzed and designed for both the minor (5-year) and major (100-year) storm events. Time of concentration calculations were used to determine the rainfall intensity. The development of the site will slightly increase the imperviousness of the site; therefore, detention will be required in various locations for the development. These calculations also can be found in Appendix A.

**D. HYDRAULICS**

Hydraulic calculations for street and inlet capacity will not be necessary for this development.

**E. WATER QUALITY ENHANCEMENT**

Water quality measures within the extended detention basins will be required and will be designed during the construction design process. The design will employ the Four-Step process for selecting structural BMP's as described in the El Paso Drainage Criteria Manual.

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#### **IV. STORMWATER MANAGEMENT FACILITY DESIGN**

##### **A. STORMWATER CONVEYANCE FACILITIES**

The general concept for the drainage design is to maintain the historic drainage patterns and release rates for the site. By doing this, it reduces the impact to the existing channels and ultimately Fountain Creek and Sand Creek. No public infrastructure is proposed within this site.

##### **B. STORMWATER STORAGE FACILITIES**

Extended Detention Basins for the site will be required. Basins A1-A2 and A5-A12 will have Extended Detention Basins within their respective basins. Extended Detention Basins will be designed per the El Paso County Drainage Criteria Manual and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual*. Extended Detention Basin calculations can be found in Appendix A.

##### **C. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES**

Water quality measures within the extended detention basins will be required. Outlet structures, micro pools and essential components of the outlet structures will be designed per the El Paso County Drainage Criteria Manual and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual*. Outlet structure calculations can be found in Appendix A.

##### **D. FLOODPLAIN MODIFICATION**

There will be no modification to the floodplain.

##### **E. ADDITIONAL PERMITTING REQUIREMENTS**

No additional permitting will be required for this site.

##### **F. GENERAL**

All applicable tables, figures, and charts from the referenced reports and criteria manuals used in the drainage design of the site can be found in Appendix B. The site is not going to be platted at this time therefore no drainage fees are due.



**REFERENCES**

- A. El Paso County Drainage Criteria Manual, Volumes 1 and 2.
- B. Drainage Criteria Manual, Volumes 1, 2, & 3, Urban Drainage and Flood Control District, June 2001, Revised June 2004.



## APPENDIX A

### HYDROLOGIC CALCULATIONS

VICINITY MAP

FIRM MAP

SOILS MAP

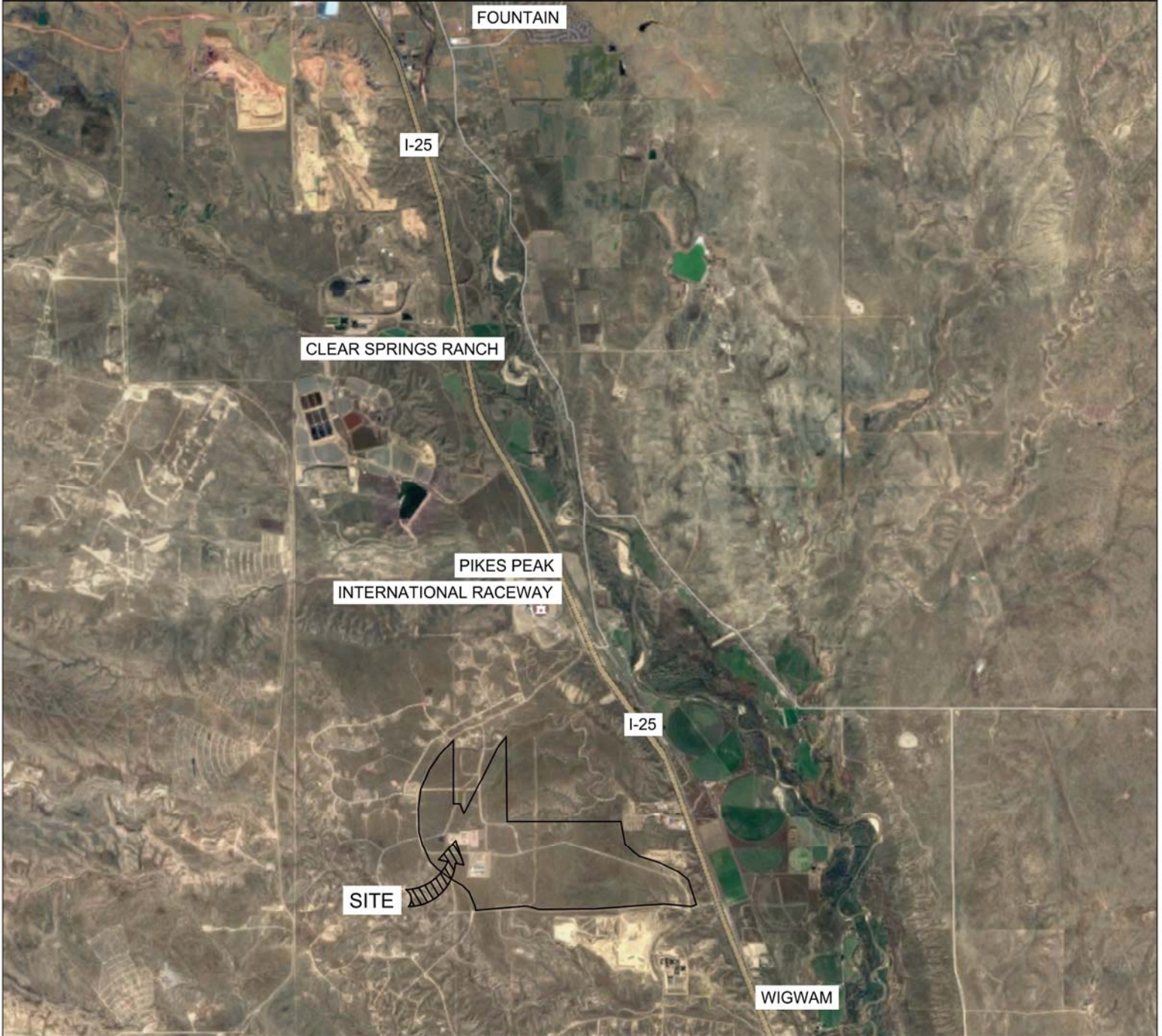
CIA CALCULATIONS

CUHP CALCULATIONS

EXTENDED DETENTION BASIN CALCULATIONS

DRAINAGE PLAN





PROJECT: FRONT RANGE - MIDWAY SOLAR  
VICINITY MAP  
DATE: 07/21/2017



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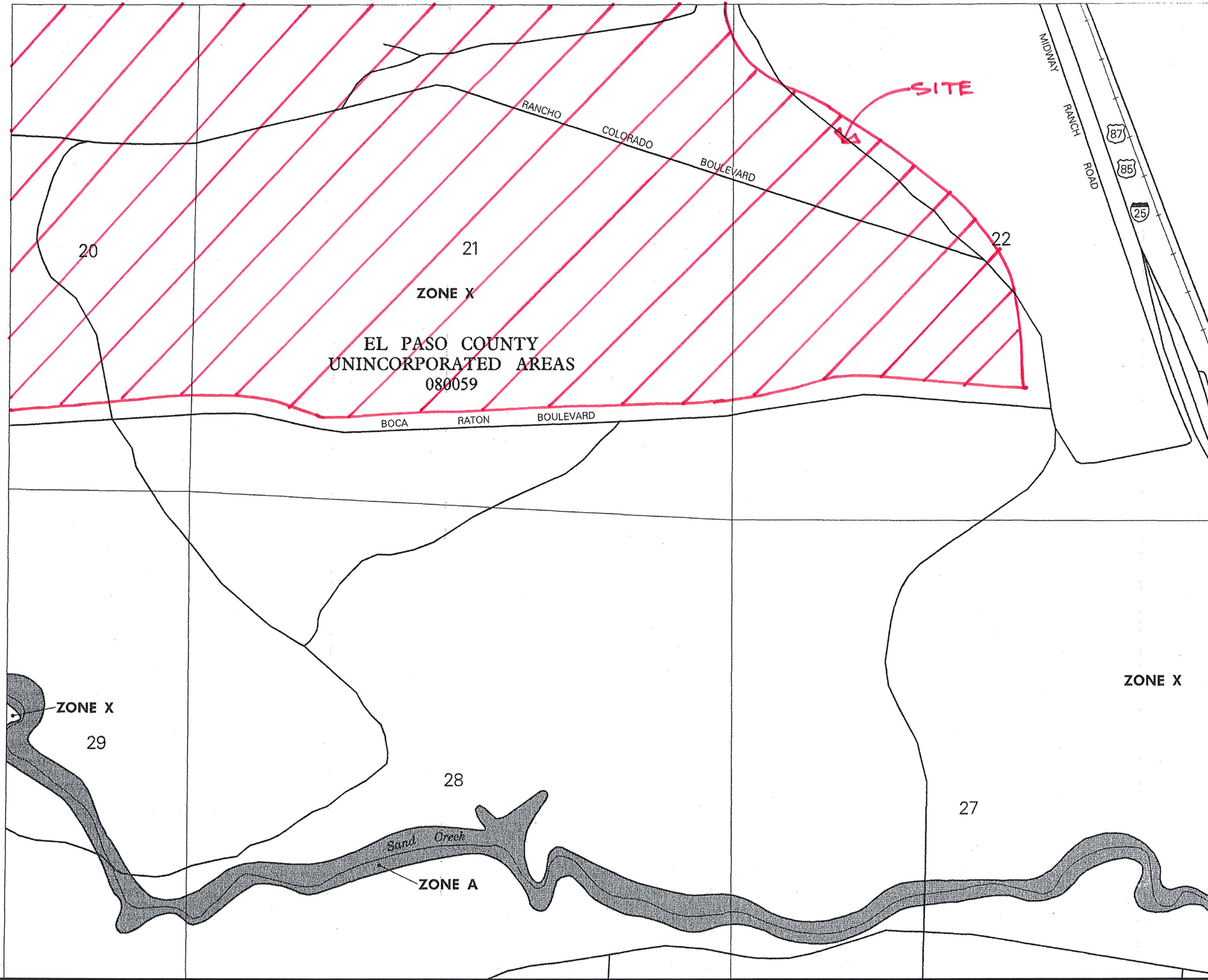


104°41'15"  
38°33'45"

JOINS PANEL 1160



APPROXIMATE SCALE IN FEET  
1000 0 1000



**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM  
FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY,  
COLORADO AND  
INCORPORATED AREAS**

**PANEL 1170 OF 1300**  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1170	F

**MAP NUMBER  
08041C1170 F**

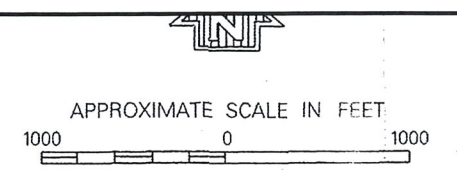
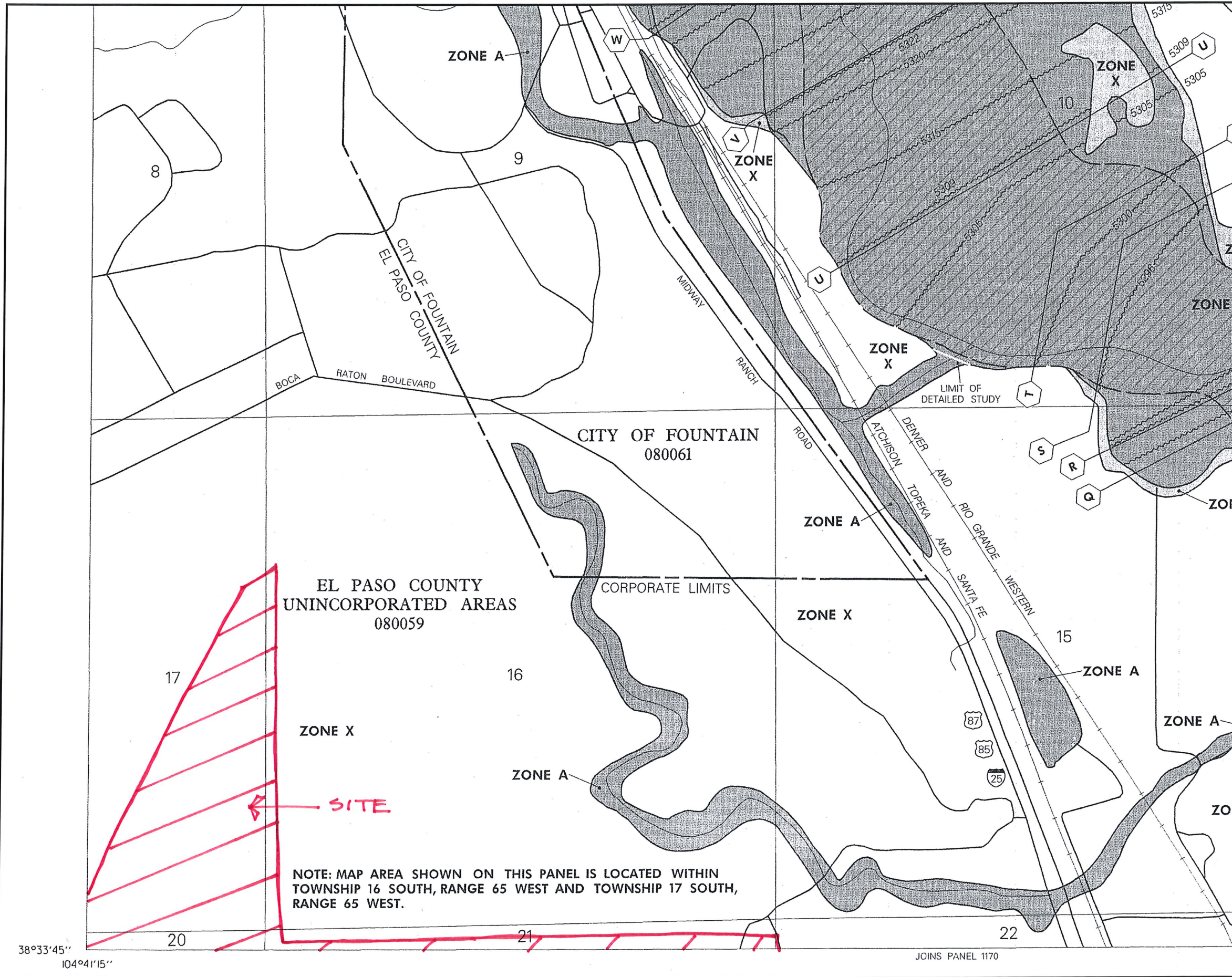
**EFFECTIVE DATE:  
MARCH 17, 1997**



Federal Emergency Management Agency

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





**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM  
FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY,  
COLORADO AND  
INCORPORATED AREAS**

**PANEL 1160 OF 1300**  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1160	F
FOUNTAIN, CITY OF	080061	1160	F

**MAP NUMBER  
08041C1160 F**

**EFFECTIVE DATE:  
MARCH 17, 1997**



Federal Emergency Management Agency

EL PASO COUNTY  
UNINCORPORATED AREAS  
080059

CITY OF FOUNTAIN  
080061

ZONE X

ZONE X

ZONE A

ZONE A

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN  
TOWNSHIP 16 SOUTH, RANGE 65 WEST AND TOWNSHIP 17 SOUTH,  
RANGE 65 WEST.

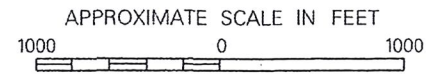
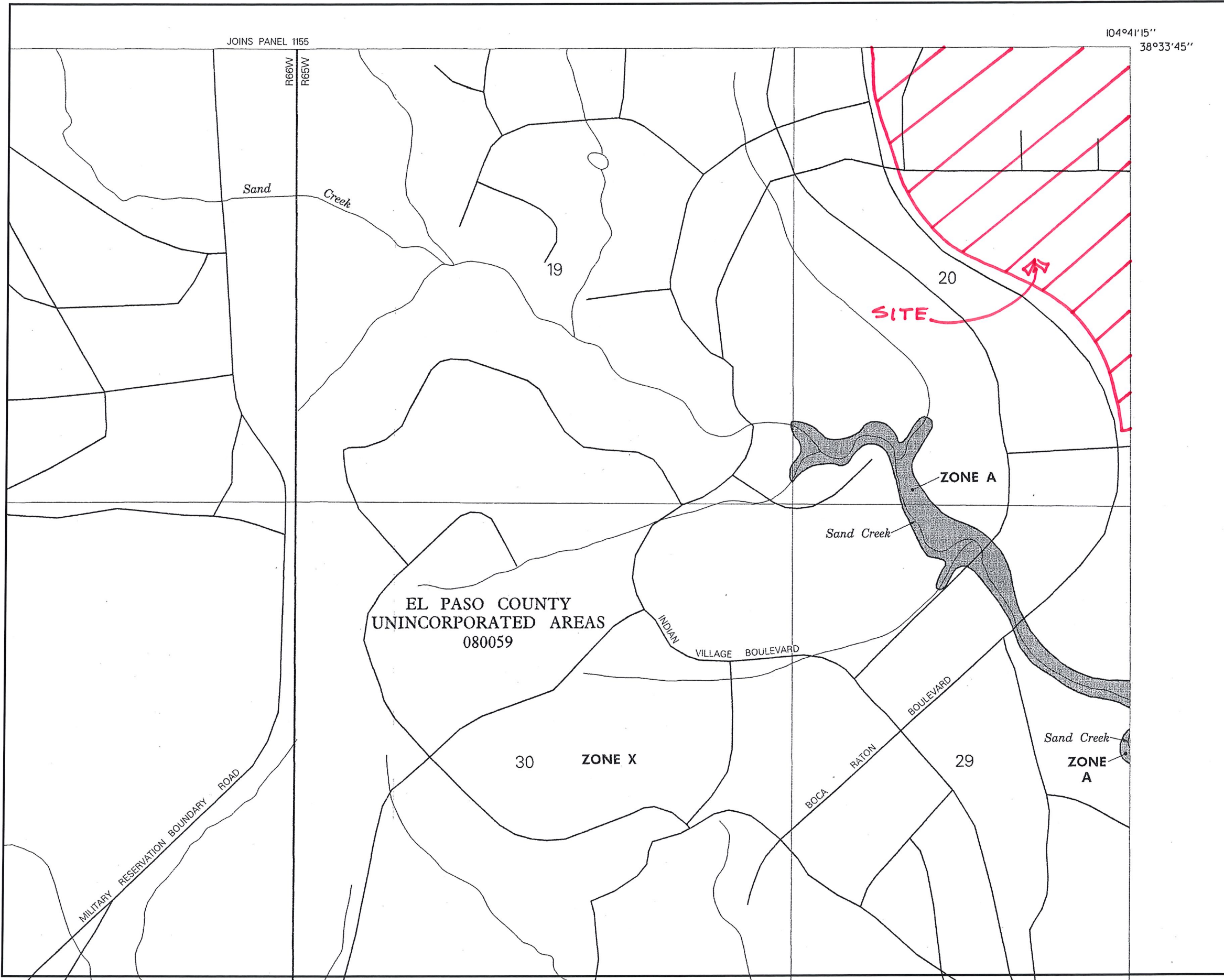
← SITE

38°33'45"  
104°41'15"

JOINS PANEL 1170

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





**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM FLOOD INSURANCE RATE MAP**

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 1165 OF 1300  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:	NUMBER	PANEL	SUFFIX
COMMUNITY			
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1165	F

MAP NUMBER  
08041C1165 F

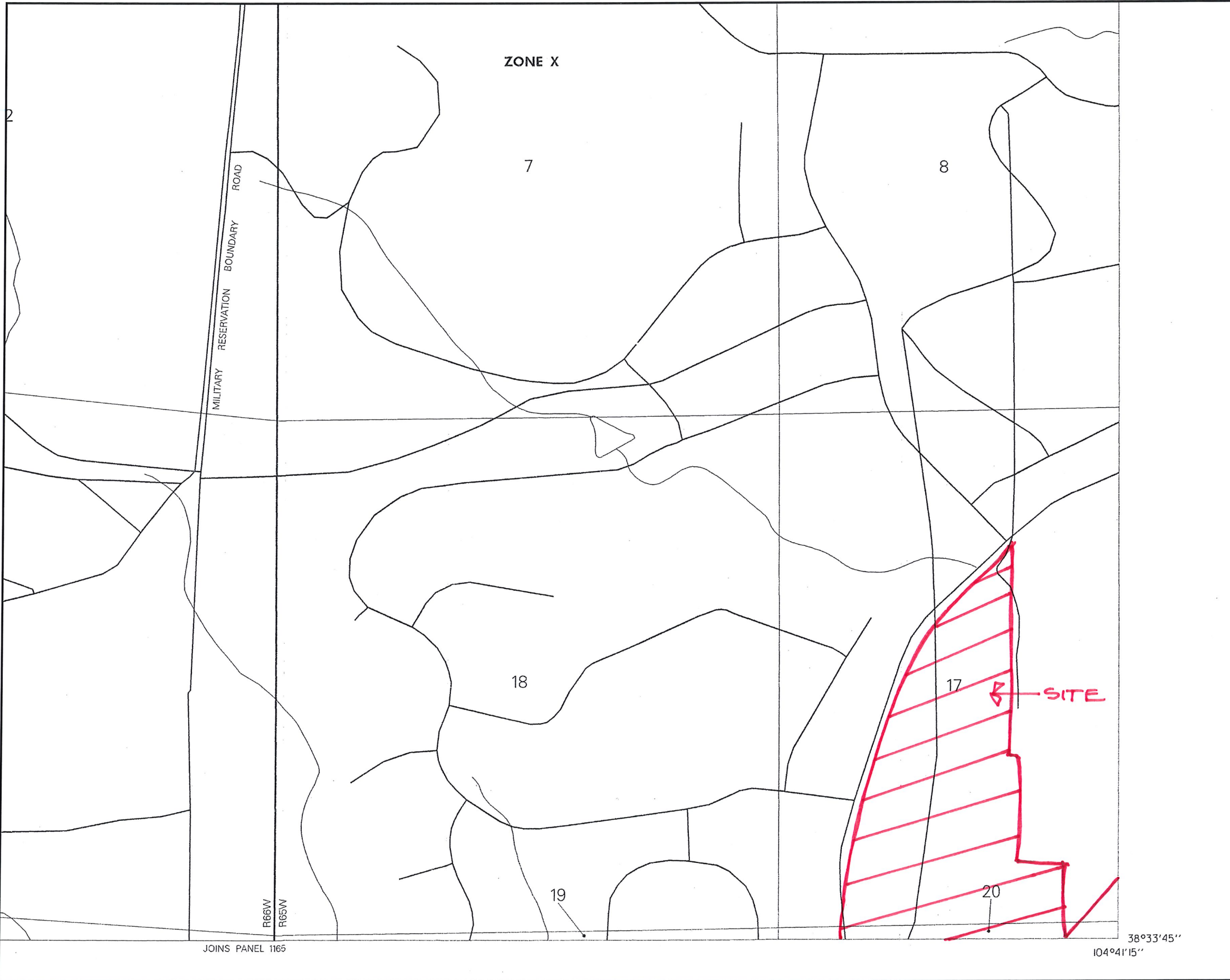
EFFECTIVE DATE:  
MARCH 17, 1997



Federal Emergency Management Agency

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





APPROXIMATE SCALE IN FEET  
 1000 0 1000

**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM  
 FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY,  
 COLORADO AND  
 INCORPORATED AREAS**

**PANEL 1155 OF 1300**  
 (SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY UNINCORPORATED AREAS	080059	1:55	F
FOUNTAIN, CITY OF	083061	1:55	F

**MAP NUMBER  
 08041C1155 F**

**EFFECTIVE DATE:  
 MARCH 17, 1997**

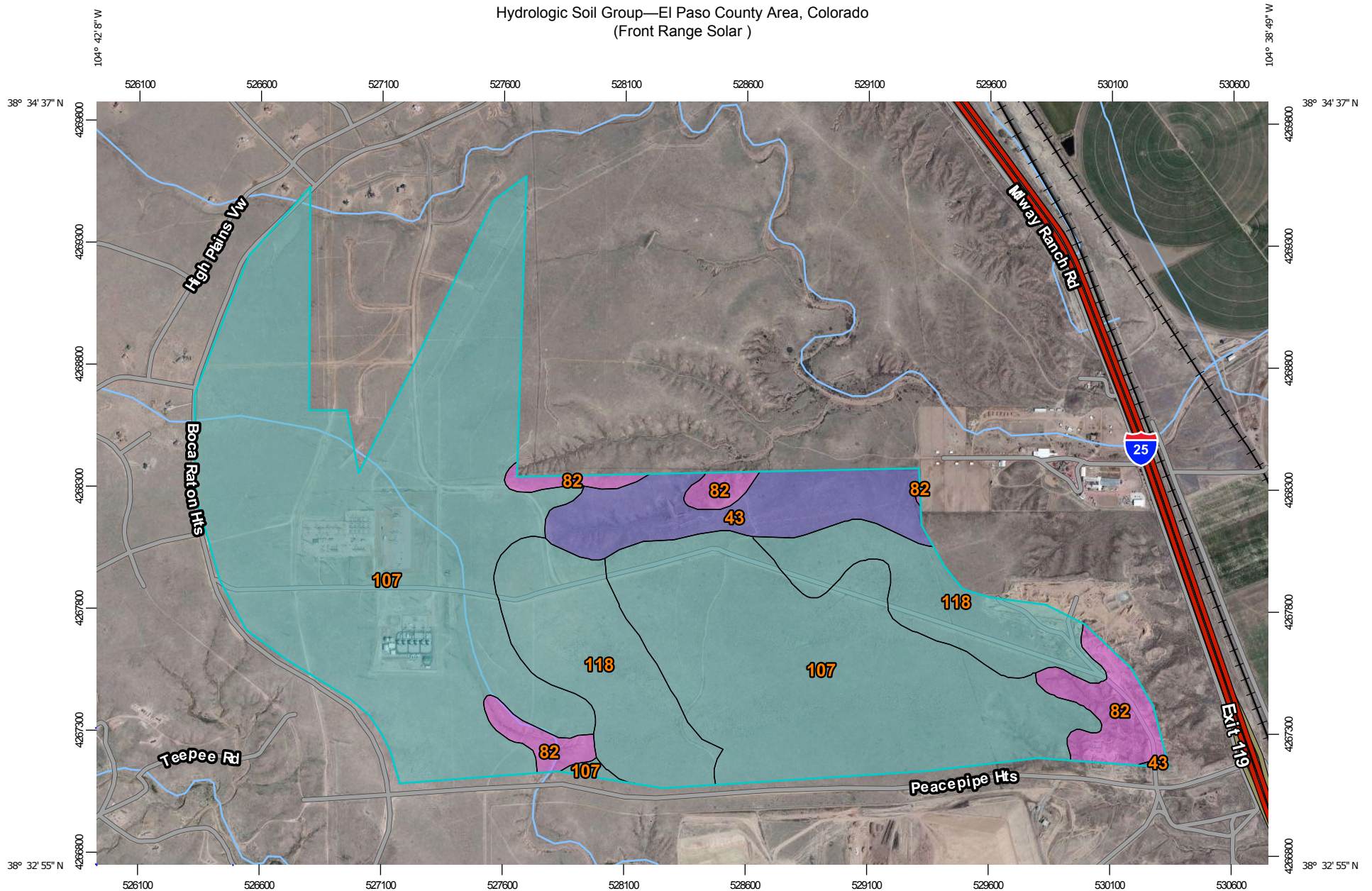


Federal Emergency Management Agency

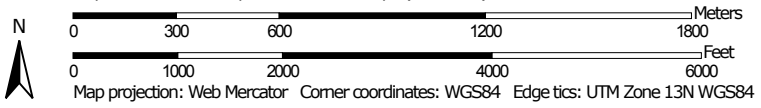
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program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



Hydrologic Soil Group—El Paso County Area, Colorado  
(Front Range Solar )




Map Scale: 1:22,000 if printed on A landscape (11" x 8.5") sheet.



Hydrologic Soil Group—El Paso County Area, Colorado  
(Front Range Solar )

**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.

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 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
43	Kim loam, 1 to 8 percent slopes	B	88.1	7.4%
82	Schamber-Razor complex, 8 to 50 percent slopes	A	65.6	5.5%
107	Willid silt loam, 0 to 3 percent slopes	C	841.7	70.5%
118	Fort loam, 1 to 5 percent slopes, cool	C	198.6	16.6%
<b>Totals for Area of Interest</b>			<b>1,194.0</b>	<b>100.0%</b>

## 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



# FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

## COMPOSITE BASIN - WEIGHTED "C" CALCULATIONS

-REFERENCE UDFCD Vol.1 RUNOFF Table 6-3

	Residential				Lawns						Total Area	Percent Impervious
	Single Family			Multi-Unit (attached)	Roof	Gravel Road	Substation	Clay Soil		Historic		
	0.25 acres	3 DU's/Ac 3,0000 sf 2 story	5 DU's/Ac 3,000 sf 2 story					2-7% Slope	>7% Slope			
% Imperv.	45.00%	48.00%	63.00%	75.00%	90.00%	80.00%	40.00%	2.00%	2.00%	2.00%		
BASIN	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area		
A1	0.00					1.47				27.87	29.34	5.9%
A2	0.00					2.89	2.07			72.37	77.33	5.9%
A3	0.00					0.00				106.70	106.70	2.0%
A4	0.00					0.00				31.31	31.31	2.0%
A6	0.00					1.77				46.21	47.98	4.9%
A7	0.00					1.77				57.91	59.68	4.3%
A8	0.00					1.76				86.05	87.81	3.6%
A9	0.00					1.37				31.49	32.86	5.3%
A12	0.00					0.57				10.40	10.97	6.1%
<b>TOTAL</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>19.62</b>	<b>2.07</b>	<b>0.00</b>	<b>0.00</b>	<b>913.76</b>	<b>935.45</b>	<b>3.7%</b>

# FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

## COMPOSITE DEVELOPED BASIN -WEIGHTED "C" CALCULATIONS

-REFERENCE EL PASO COUNTY DRAINAGE CRITERIA MANUAL

$$C = \frac{\sum_{i=1}^n C_i A_i}{A_t}$$

Eq 5-2  
El Paso County DCM

"C"  
Frequency

10		100		
A&B	C&D	A&B	C&D	
0.15	0.25	0.2	0.3	Historic
0.8	0.8	0.85	0.85	Gravel
0.5	0.6	0.6	0.7	Substation

Basin ID	% Imperv.	i	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A1	5.9%	0.06	A	0.02	0.02	0.18	0.23	29.34	29.34	0.03	0.08	0.28	0.33
			B	0.03	0.04	0.18	0.23						
			C or D	0.03	0.08	0.28	0.33						
A2	5.9%	0.06	A	0.02	0.02	0.18	0.24	77.33	77.33	0.03	0.08	0.28	0.33
			B	0.03	0.04	0.18	0.24						
			C or D	0.03	0.08	0.28	0.33						
A3	2.0%	0.02	A	0.01	0.01	0.15	0.20	106.70	106.70	0.01	0.05	0.25	0.30
			B	0.01	0.01	0.15	0.20						
			C or D	0.01	0.05	0.25	0.30						
A4	2.0%	0.02	A	0.01	0.01	0.15	0.20	31.31	31.31	0.01	0.05	0.25	0.30
			B	0.01	0.01	0.15	0.20						
			C or D	0.01	0.05	0.25	0.30						
A6	4.9%	0.05	A	0.02	0.02	0.17	0.22	47.98	47.98	0.03	0.07	0.27	0.32
			B	0.02	0.03	0.17	0.22						
			C or D	0.03	0.07	0.27	0.32						

Basin ID	% Imperv.	<i>i</i>	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A7	4.3%	0.04	A	0.01	0.02	0.17	0.22	59.68	59.68	0.02	0.07	0.27	0.32
			B	0.02	0.03	0.17	0.22						
			C or D	0.02	0.07	0.27	0.32						
A8	3.6%	0.04	A	0.01	0.01	0.16	0.21	87.81	87.81	0.02	0.06	0.26	0.31
			B	0.02	0.02	0.16	0.21						
			C or D	0.02	0.06	0.26	0.31						
A9	5.3%	0.05	A	0.02	0.02	0.18	0.23	32.86	32.86	0.03	0.08	0.27	0.32
			B	0.03	0.03	0.18	0.23						
			C or D	0.03	0.08	0.27	0.32						
A12	6.1%	0.06	A	0.02	0.02	0.18	0.23	29.34	29.34	0.04	0.08	0.28	0.33
			B	0.03	0.04	0.18	0.23						
			C or D	0.04	0.08	0.28	0.33						

# FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

$T_c = 1.87 (1.1 - C_{10})L^{0.5}s^{-0.33}$  (El Paso County DCM Vol. 1)

Prepared By: GMV

## TIME OF CONCENTRATION CALCULATIONS

-REFERENCE UDFCD Vol.1 Section 2.4

NRCS Conveyance factors, K -REFERENCE UDFCD Vol.1 RUNOFF Table 6-2

SF-2	Heavy Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
	Tillage/field	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

SUB-BASIN DATA			INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)		FINAL T(c)	
DRAIN BASIN	AREA ac.	C(10)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	% IMPER-VIOUS	USDCM Eq. 6-5	min.
A1	29.34	0.28	300	1.0%	26.6	1009	2.8%	7.00	1.2	14.0	40.6	5.9%		40.6
A2	77.33	0.28	300	1.3%	24.2	2086	0.7%	7.00	0.6	57.9	82.1	5.9%		82.1
A3	106.70	0.25	300	2.0%	21.9	2874	1.5%	7.00	0.9	53.2	75.1	2.0%		75.1
A4	31.31	0.25	300	1.7%	23.3	3634	1.2%	7.00	0.8	75.7	99.0	2.0%		99.0
A6	47.98	0.27	300	1.3%	24.4	1578	1.8%	7.00	0.9	29.2	53.6	4.9%		53.6
A7	59.68	0.27	300	2.7%	19.5	2169	2.2%	7.00	1.0	36.2	55.7	4.3%		55.7
A8	87.81	0.26	300	1.7%	23.0	3108	1.9%	7.00	1.0	51.8	74.8	3.6%		74.8
A9	32.86	0.27	300	2.7%	19.4	1597	3.6%	7.00	1.3	20.5	39.9	5.3%		39.9
A12	10.97	0.28	300	2.3%	20.1	196	4.6%	7.00	1.5	2.2	22.3	6.1%		22.3

**FRONT RANGE - MIDWAY SOLAR**

CORE Project #: 17-012

Prepared By: GMV

**RATIONAL METHOD PEAK RUNOFF**

**10-YR STORM**

SF-3

Rainfall Depth-Duration-Frequency (1-hr) = 1.55

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF				TOTAL RUNOFF				REMARKS
DESIGN POINT	DRAIN BASIN	AREA ac.	10yr RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A	I in/hr	Q cfs	
1	A1	29.34	0.28	40.6	8.14	2.02	16.5					
2	A2	77.33	0.28	82.1	21.65	1.26	27.3					
3	A3	106.70	0.25	75.1	26.68	1.34	35.8					
4	A4	31.31	0.25	99.0	7.83	1.11	8.7					
6	A6	47.98	0.27	53.6	12.97	1.69	21.9					
7	A7	59.68	0.27	55.7	15.89	1.65	26.2					
8	A8	87.81	0.26	74.8	22.92	1.35	30.9					
9	A9	32.86	0.27	39.9	8.97	2.04	18.3					
12	A12	10.97	0.28	22.3	3.06	2.88	8.8					

# FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

## RATIONAL METHOD PEAK RUNOFF

### 100-YR STORM

SF-3

Rainfall Depth-Duration-Frequency (1-hr) = 2.58

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF				TOTAL RUNOFF				REMARKS
DESIGN POINT	DRAIN BASIN	AREA ac.	100yr RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A	I in/hr	Q cfs	
1	A1	29.34	0.33	40.6	9.61	3.37	32.3					
2	A2	77.33	0.33	82.1	25.62	2.10	53.8					
3	A3	106.70	0.30	75.1	32.01	2.24	71.6					
4	A4	31.31	0.30	99.0	9.39	1.84	17.3					
6	A6	47.98	0.32	53.6	15.37	2.81	43.2					
7	A7	59.68	0.32	55.7	18.88	2.74	51.7					
8	A8	87.81	0.31	74.8	27.31	2.24	61.2					
9	A9	32.86	0.32	39.9	10.61	3.40	36.1					
12	A12	10.97	0.33	22.3	3.61	4.79	17.3					

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Existing 2 Yr.**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Existing 2 Yr	0.157	0.255	58.4	12.93	30.3	9.14	21.6	160	722,867	0.05	38,675	50.0	8	38,680	0.04
A10	Existing 2 Yr	0.157	0.277	81.7	18.91	42.5	13.36	31.5	151	955,935	0.05	51,145	65.0	8	51,135	0.03
A11	Existing 2 Yr	0.157	0.264	78.6	17.46	40.9	12.34	29.1	134	813,146	0.05	43,505	60.0	7	43,502	0.03

**Summary of CUHP Input Parameters (Version 2.0.0) - Existing 2 Yr.**

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A5	A5	2	0.311	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.53
A10	A10	2	0.411	0.856	1.692	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.53
A11	A11	2	0.350	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.53



**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Existing 100 Yr**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Existing 100 Yr	0.156	0.253	58.3	12.85	30.3	9.08	21.4	160	722,867	1.84	1,329,393	60.0	243	1,329,567	1.22
A10	Existing 100 Yr	0.156	0.276	81.7	18.79	42.5	13.28	31.3	151	955,935	1.84	1,758,017	70.0	250	1,757,673	0.95
A11	Existing 100 Yr	0.156	0.263	78.6	17.35	40.9	12.26	28.9	134	813,146	1.84	1,495,420	70.0	219	1,495,317	0.98

**Summary of CUHP Input Parameters (Version 2.0.0) - Existing 100 Yr.**

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A5	A5	100	0.311	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A10	A10	100	0.411	0.856	1.692	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A11	A11	100	0.350	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Proposed 2 Yr.**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Proposed 2 Yr.	0.154	0.250	58.3	12.70	30.3	8.98	21.2	160	722,867	0.06	44,815	50.0	9	44,822	0.05
A10	Proposed 2 Yr.	0.153	0.270	81.6	18.43	42.4	13.02	30.7	151	955,935	0.07	62,244	60.0	9	62,228	0.04
A11	Proposed 2 Yr.	0.152	0.256	78.5	16.96	40.8	11.99	28.3	134	813,146	0.07	54,219	60.0	8	54,216	0.04

**Summary of CUHP Input Parameters (Version 2.0.0) - Proposed 2 Yr.**

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A5	A5	2	0.311	0.479	1.072	0.014	3.1	0.35	0.05	3.00	0.50	0.0018	0.00	0.06	0.03	2.38
A10	A10	2	0.411	0.856	1.692	0.019	3.5	0.35	0.05	3.00	0.50	0.0018	0.00	0.07	0.04	2.70
A11	A11	2	0.350	0.785	1.525	0.019	3.7	0.35	0.05	3.00	0.50	0.0018	0.00	0.07	0.04	2.85

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Proposed 100 Yr.**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Proposed 100 Yr.	0.156	0.253	58.3	12.85	30.3	9.08	21.4	160	722,867	1.84	1,329,393	60.0	243	1,329,567	1.22
A10	Proposed 100 Yr.	0.156	0.276	81.7	18.79	42.5	13.28	31.3	151	955,935	1.84	1,758,017	70.0	250	1,757,673	0.95
A11	Proposed 100 Yr.	0.156	0.263	78.6	17.35	40.9	12.26	28.9	134	813,146	1.84	1,495,420	70.0	219	1,495,317	0.98

**Summary of CUHP Input Parameters (Version 2.0.0) - Proposed 100 Yr.**

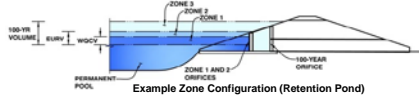
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A5	A5	100	0.311	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A10	A10	100	0.411	0.856	1.692	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A11	A11	100	0.350	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81

## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A1**



Example Zone Configuration (Retention Pond)

### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>
Watershed Area =	29.34 acres
Watershed Length =	2,200 ft
Watershed Slope =	0.030 ft/ft
Watershed Imperviousness =	5.90% 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 =	User Input
Water Quality Capture Volume (WQCV) =	0.103 acre-feet
Excess Urban Runoff Volume (EURV) =	0.138 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.116 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.345 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	3.650 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.109 acre-feet
Approximate 5-yr Detention Volume =	0.331 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	0.852 acre-feet

Optional User Override  
1-hr Precipitation

1.19	inches
1.50	inches
	inches
	inches
	inches
2.52	inches

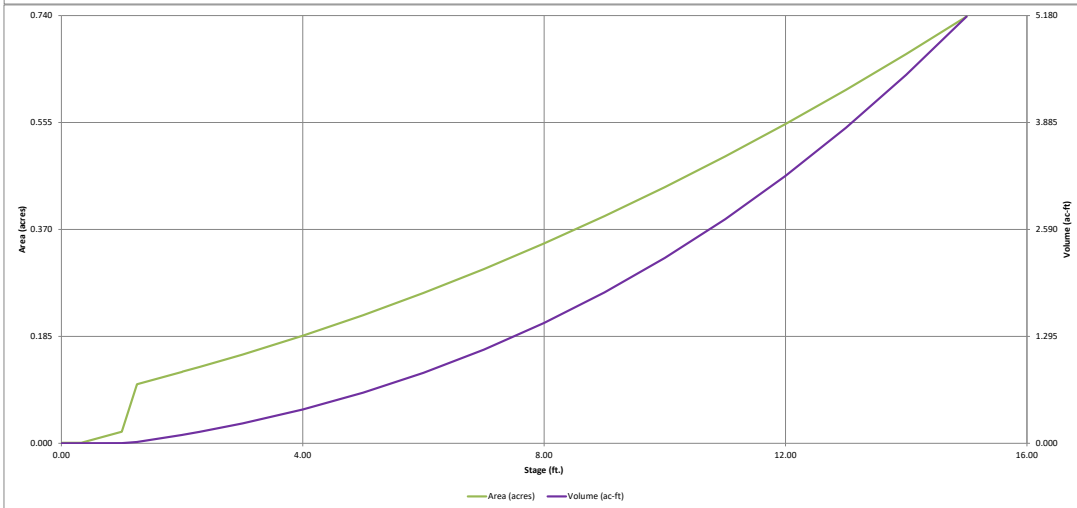
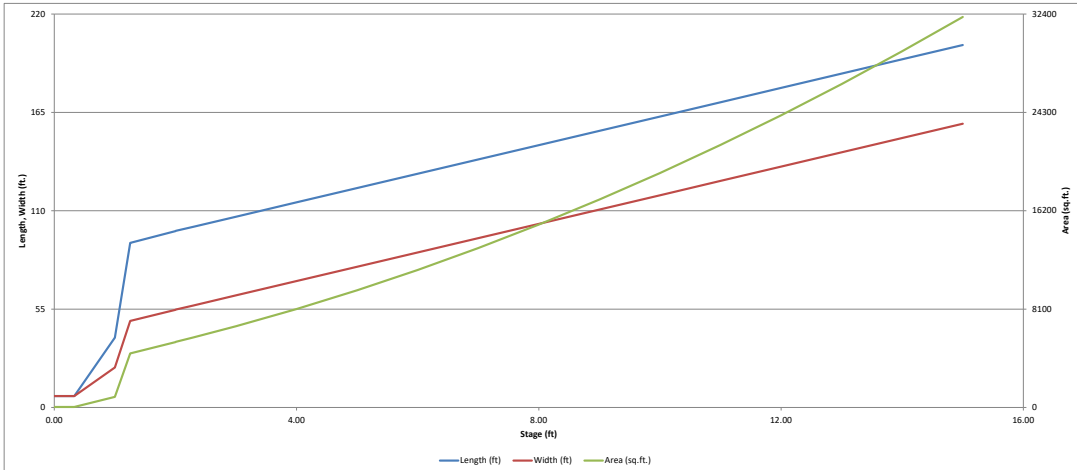
### Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.035	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.714	acre-feet
Total Detention Basin Volume =	0.852	acre-feet
Initial Surcharge Volume (ISV) =	13	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	41	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	6.4	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	6.4	ft
Depth of Basin Floor (H <sub>100yr</sub> ) =	0.42	ft
Length of Basin Floor (L <sub>100yr</sub> ) =	92.7	ft
Width of Basin Floor (W <sub>100yr</sub> ) =	48.7	ft
Area of Basin Floor (A <sub>100yr</sub> ) =	4,515	ft <sup>2</sup>
Volume of Basin Floor (V <sub>100yr</sub> ) =	703	ft <sup>3</sup>
Depth of Main Basin (H <sub>main</sub> ) =	4.75	ft
Length of Main Basin (L <sub>main</sub> ) =	130.7	ft
Width of Main Basin (W <sub>main</sub> ) =	86.7	ft
Area of Main Basin (A <sub>main</sub> ) =	11,328	ft <sup>2</sup>
Volume of Main Basin (V <sub>main</sub> ) =	36,384	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	0.852	acre-feet

Depth Increment = 1 ft									
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		6.4	6.4	41		0.001		
ISV	0.33		6.4	6.4	41		0.001	13	0.000
	1.00		39.0	22.4	873		0.020	93	0.002
Floor	1.25		92.1	48.4	4,454		0.102	726	0.017
	2.00		96.6	54.6	5,384		0.124	4,383	0.101
Zone 1 (WQCV)	2.01		96.8	54.8	5,408		0.124	4,490	0.103
Zone 2 (EURV)	2.29		101.0	57.0	5,757		0.132	6,053	0.139
	3.00		106.7	62.7	6,687		0.154	10,467	0.240
	4.00		114.7	70.7	8,106		0.186	17,853	0.410
	5.00		122.7	78.7	9,653		0.222	26,721	0.613
Zone 3 (100-year)	6.00		130.7	86.7	11,328		0.260	37,201	0.854
	7.00		138.7	94.7	13,131		0.301	49,419	1.135
	8.00		146.7	102.7	15,061		0.346	63,505	1.458
	9.00		154.7	110.7	17,120		0.393	79,585	1.827
	10.00		162.7	118.7	19,307		0.443	97,788	2.245
	11.00		170.7	126.7	21,622		0.496	118,242	2.714
	12.00		178.7	134.7	24,065		0.552	141,075	3.239
	13.00		186.7	142.7	26,636		0.611	166,415	3.820
	14.00		194.7	150.7	29,335		0.673	194,390	4.463
	15.00		202.7	158.7	32,162		0.738	225,128	5.168

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

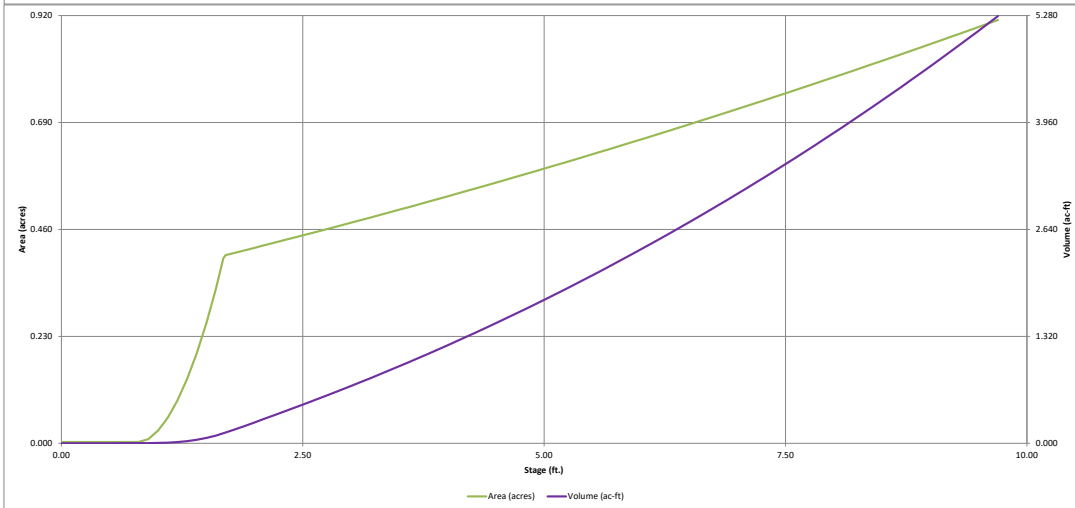
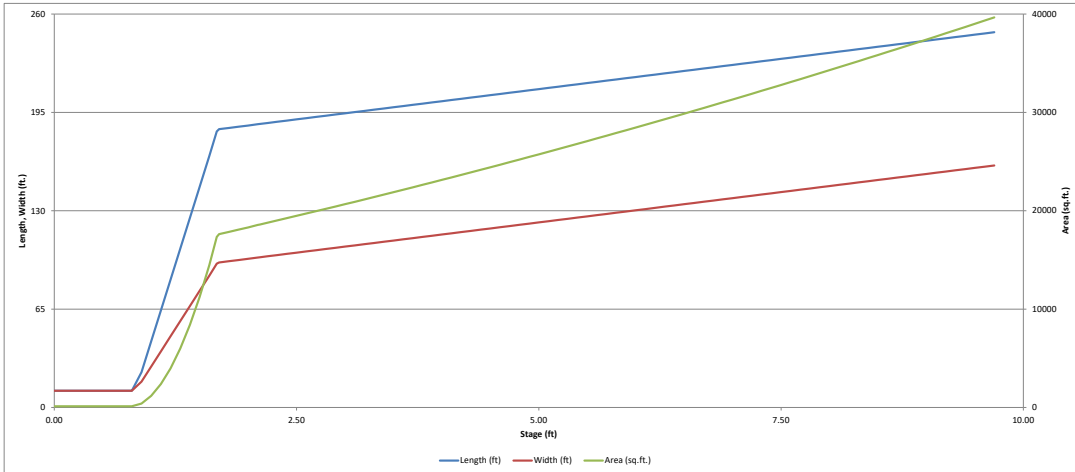






**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

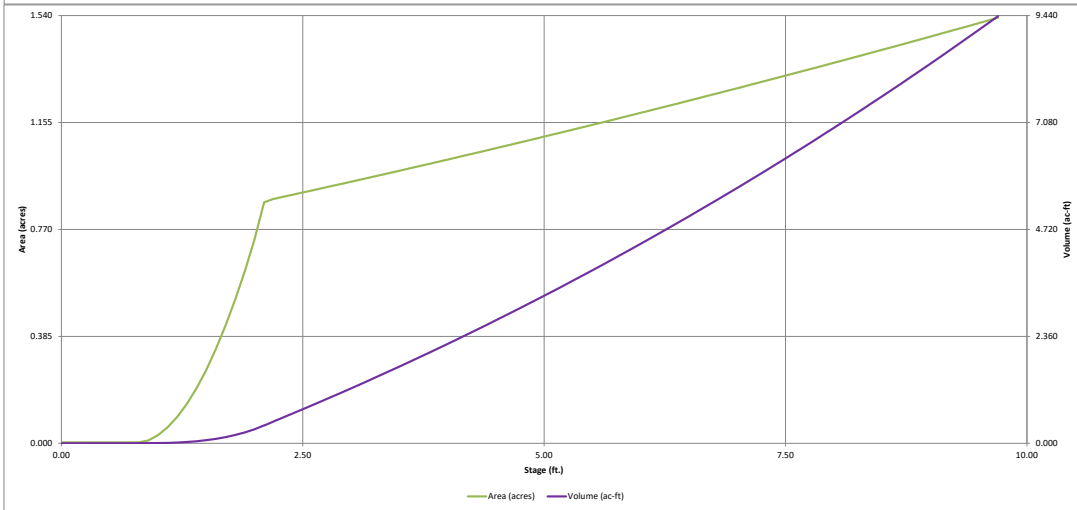
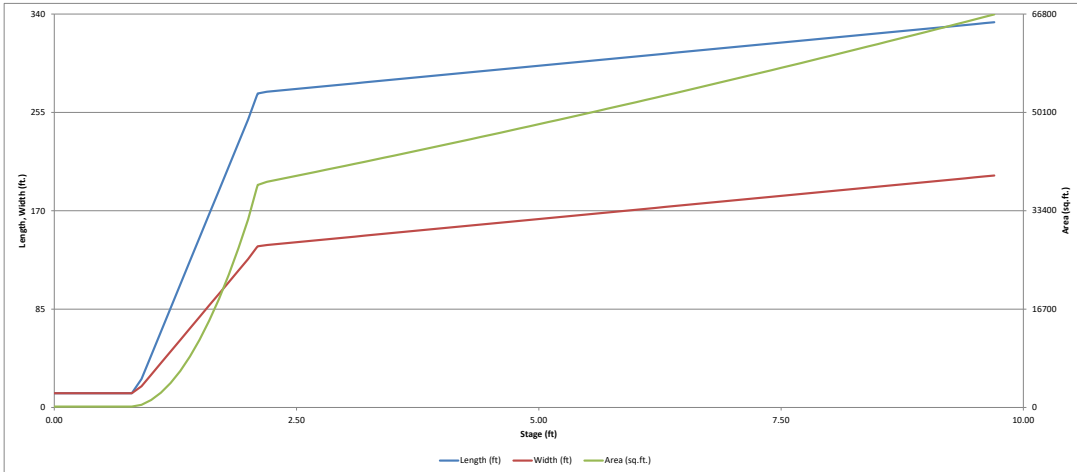
UD-Detention, Version 3.07 (February 2017)





**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

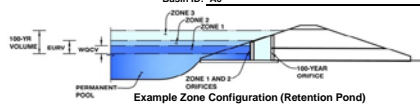
UD-Detention, Version 3.07 (February 2017)



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A6**



### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>
Watershed Area =	47.98 acres
Watershed Length =	1,777 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	3.50% percent
Percentage Hydrologic Soil Group A =	5.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	95.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.103 acre-feet
Excess Urban Runoff Volume (EURV) =	0.127 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.103 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.405 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	5.636 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.096 acre-feet
Approximate 5-yr Detention Volume =	0.392 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	1.092 acre-feet

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	1.19 inches
	1.50 inches
	2.52 inches

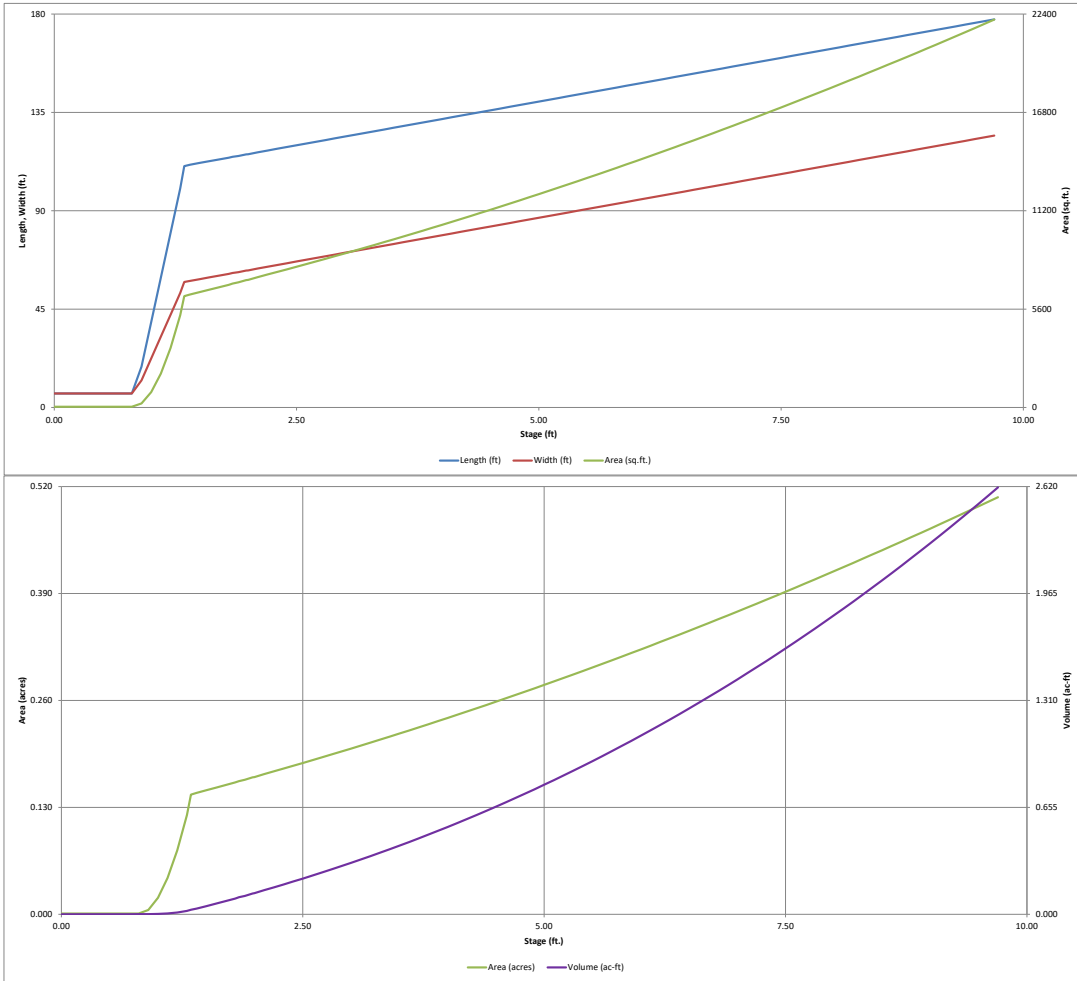
### Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.103 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.023 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.965 acre-feet
Total Detention Basin Volume =	1.092 acre-feet
Initial Surcharge Volume (ISV) =	14 ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2
Initial Surcharge Area (A <sub>ISV</sub> ) =	41 ft <sup>2</sup>
Surcharge Volume Length (L <sub>SV</sub> ) =	6.4 ft
Surcharge Volume Width (W <sub>SV</sub> ) =	6.4 ft
Depth of Basin Floor (H <sub>100</sub> ) =	0.51 ft
Length of Basin Floor (L <sub>100</sub> ) =	110.7 ft
Width of Basin Floor (W <sub>100</sub> ) =	57.5 ft
Area of Basin Floor (A <sub>100</sub> ) =	6,367 ft <sup>2</sup>
Volume of Basin Floor (V <sub>100</sub> ) =	1,179 ft <sup>3</sup>
Depth of Main Basin (H <sub>main</sub> ) =	4.66 ft
Length of Main Basin (L <sub>main</sub> ) =	148.0 ft
Width of Main Basin (W <sub>main</sub> ) =	94.8 ft
Area of Main Basin (A <sub>main</sub> ) =	14,025 ft <sup>2</sup>
Volume of Main Basin (V <sub>main</sub> ) =	46,342 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	1,092 acre-feet

Depth Increment = 0.1 ft										
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (ft <sup>2</sup> )	Volume (ft <sup>3</sup> )	Volume (ac-ft)	
<b>Top of Micropool</b>	0.00		6.4	6.4	41		0.001			
<b>ISV</b>	0.33		6.4	6.4	41		0.001	13	0.000	
	0.40		6.4	6.4	41		0.001	16	0.000	
	0.50		6.4	6.4	41		0.001	20	0.000	
	0.60		6.4	6.4	41		0.001	24	0.001	
	0.70		6.4	6.4	41		0.001	28	0.001	
	0.80		6.4	6.4	41		0.001	32	0.001	
	0.90		18.6	12.4	231		0.005	41	0.001	
	1.00		39.0	22.4	875		0.020	93	0.002	
	1.10		59.4	32.4	1,926		0.044	230	0.005	
	1.20		79.8	42.4	3,385		0.078	492	0.011	
	1.30		100.2	52.4	5,253		0.121	921	0.021	
<b>Floor</b>	1.34		110.4	57.4	6,340		0.146	1,210	0.028	
	1.40		111.1	57.9	6,433		0.148	1,530	0.035	
	1.50		111.9	58.7	6,568		0.151	2,180	0.050	
	1.60		112.7	59.5	6,706		0.154	2,844	0.065	
	1.70		113.5	60.3	6,844		0.157	3,521	0.081	
	1.80		114.3	61.1	6,984		0.160	4,212	0.097	
<b>Zone 1 (WQC)</b>	1.84		114.7	61.5	7,054		0.162	4,563	0.105	
	1.90		115.1	61.9	7,125		0.164	4,918	0.113	
<b>Zone 2 (EURV)</b>	1.98		115.8	62.6	7,253		0.166	5,565	0.128	
	2.00		115.9	62.7	7,267		0.167	5,637	0.129	
	2.10		116.8	63.6	7,425		0.170	6,445	0.148	
	2.20		117.6	64.4	7,570		0.174	7,195	0.165	
	2.30		118.4	65.2	7,716		0.177	7,959	0.183	
	2.40		119.2	66.0	7,863		0.181	8,738	0.201	
	2.50		120.0	66.8	8,012		0.184	9,532	0.219	
	2.60		120.8	67.6	8,162		0.187	10,341	0.237	
	2.70		121.6	68.4	8,313		0.191	11,165	0.256	
	2.80		122.4	69.2	8,466		0.194	12,004	0.276	
	2.90		123.2	70.0	8,620		0.198	12,858	0.295	
	3.00		124.0	70.8	8,775		0.201	13,728	0.315	
	3.10		124.8	71.6	8,932		0.205	14,613	0.335	
	3.20		125.6	72.4	9,089		0.209	15,514	0.356	
	3.30		126.4	73.2	9,248		0.212	16,431	0.377	
	3.40		127.2	74.0	9,409		0.216	17,364	0.399	
	3.50		128.0	74.8	9,570		0.220	18,313	0.420	
	3.60		128.8	75.6	9,733		0.223	19,278	0.443	
	3.70		129.6	76.4	9,897		0.227	20,259	0.465	
	3.80		130.4	77.2	10,062		0.231	21,257	0.488	
	3.90		131.2	78.0	10,229		0.235	22,272	0.511	
	4.00		132.0	78.8	10,397		0.239	23,303	0.535	
	4.10		132.8	79.6	10,566		0.243	24,351	0.559	
	4.20		133.6	80.4	10,737		0.246	25,416	0.583	
	4.30		134.4	81.2	10,909		0.250	26,499	0.608	
	4.40		135.2	82.0	11,082		0.254	27,598	0.634	
	4.50		136.0	82.8	11,256		0.258	28,715	0.659	
	4.60		136.8	83.6	11,432		0.262	29,849	0.685	
	4.70		137.6	84.4	11,609		0.266	31,001	0.712	
	4.80		138.4	85.2	11,787		0.271	32,171	0.739	
	4.90		139.2	86.0	11,966		0.275	33,359	0.766	
	5.00		140.0	86.8	12,147		0.279	34,564	0.793	
	5.10		140.8	87.6	12,329		0.283	35,788	0.822	
	5.20		141.6	88.4	12,512		0.287	37,030	0.850	
	5.30		142.4	89.2	12,697		0.291	38,291	0.879	
	5.40		143.2	90.0	12,883		0.296	39,570	0.908	
	5.50		144.0	90.8	13,070		0.300	40,867	0.938	
	5.60		144.8	91.6	13,259		0.304	42,184	0.968	
	5.70		145.6	92.4	13,448		0.309	43,519	0.999	
	5.80		146.4	93.2	13,639		0.313	44,874	1.030	
	5.90		147.2	94.0	13,832		0.318	46,247	1.062	
	6.00		148.0	94.8	14,025		0.322	47,640	1.094	
<b>Zone 3 (100-year)</b>	6.10		148.8	95.6	14,220		0.326	49,052	1.126	
	6.20		149.6	96.4	14,416		0.331	50,484	1.159	
	6.30		150.4	97.2	14,613		0.335	51,935	1.192	
	6.40		151.2	98.0	14,812		0.340	53,407	1.226	
	6.50		152.0	98.8	15,012		0.345	54,898	1.260	
	6.60		152.8	99.6	15,213		0.349	56,409	1.295	
	6.70		153.6	100.4	15,416		0.354	57,941	1.330	
	6.80		154.4	101.2	15,620		0.359	59,492	1.366	
	6.90		155.2	102.0	15,825		0.363	61,065	1.402	
	7.00		156.0	102.8	16,031		0.368	62,657	1.438	
	7.10		156.8	103.6	16,239		0.373	64,271	1.475	
	7.20		157.6	104.4	16,448		0.378	65,905	1.513	
	7.30		158.4	105.2	16,658		0.382	67,560	1.551	
	7.40		159.2	106.0	16,869		0.387	69,237	1.589	
	7.50		160.0	106.8	17,082		0.392	70,934	1.628	
	7.60		160.8	107.6	17,296		0.397	72,653	1.668	
	7.70		161.6	108.4	17,511		0.402	74,394	1.708	
	7.80		162.4	109.2	17,728		0.407	76,156	1.748	
	7.90		163.2	110.0	17,946		0.412	77,939	1.789	
	8.00		164.0	110.8	18,165		0.417	79,745	1.831	
	8.10		164.8	111.6	18,386		0.422	81,572	1.873	
	8.20		165.6	112.4	18,607		0.427	83,422	1.915	
	8.30		166.4	113.2	18,830		0.432	85,294	1.958	
	8.40		167.2	114.0	19,055		0.437	87,189	2.002	
	8.50		168.0	114.8	19,280		0.443	89,105	2.046	
	8.60		168.8	115.6	19,507		0.448	91,044	2.090	
	8.70		169.6	116.4	19,735		0.453	93,006	2.135	
	8.80		170.4	117.2	19,964		0.458	94,991	2.181	
	8.90		171.2	118.0	20,195		0.464	96,999	2.227	
	9.00		172.0	118.8	20,427		0.469	99,030	2.273	
	9.10		172.8	119.6	20,660		0.474	101,084	2.321	
	9.20		173.6	120.4	20,895		0.480	103,162	2.368	
	9.30		174.4	121.2	21,131		0.485	105,263	2.417	
	9.40		175.2	122.0	21,368		0.491	107,388	2.465	
	9.50		176.0	122.8	21,606		0.496	109,537	2.515	
	9.60		176.8	123.6	21,846		0.502	111,710	2.565	
	9.70		177.6	124.4	22,087		0.507	113,906	2.615	

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

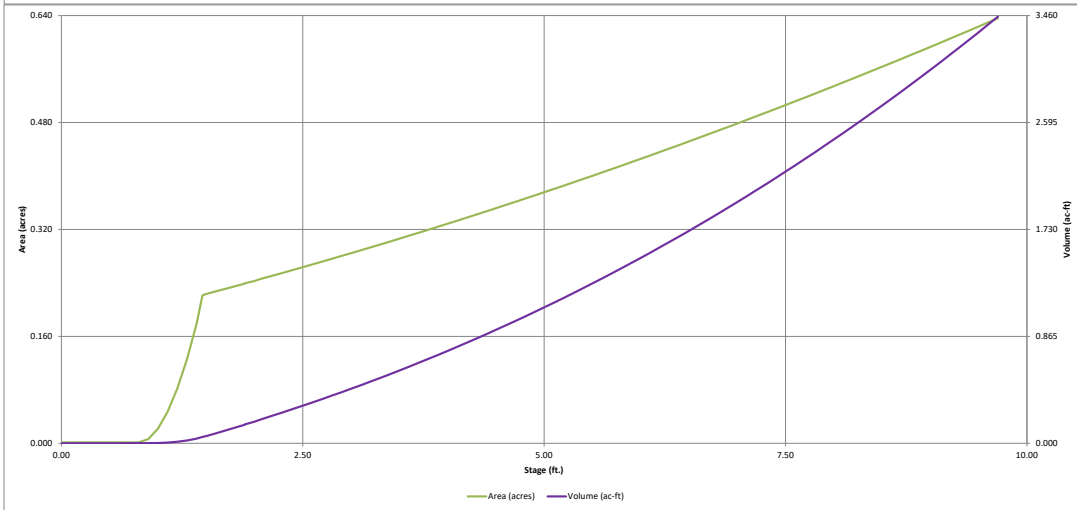
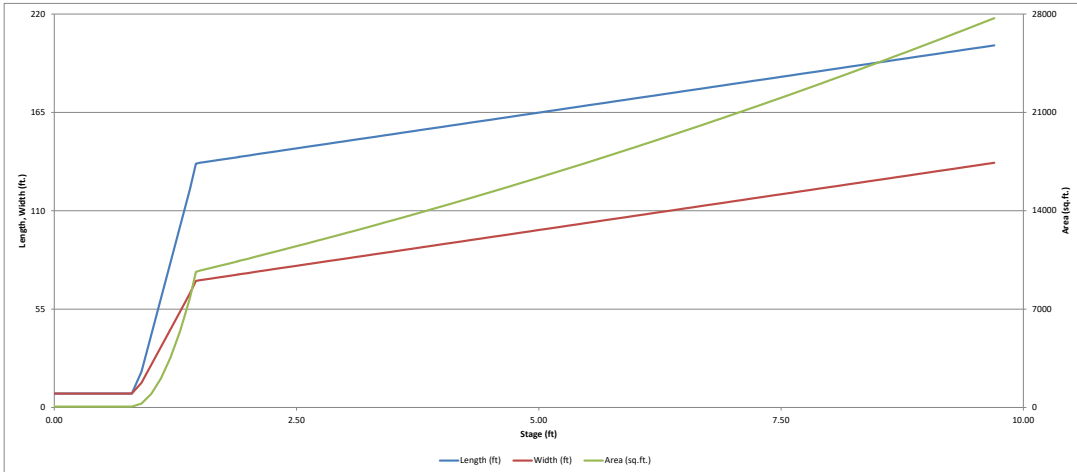
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**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

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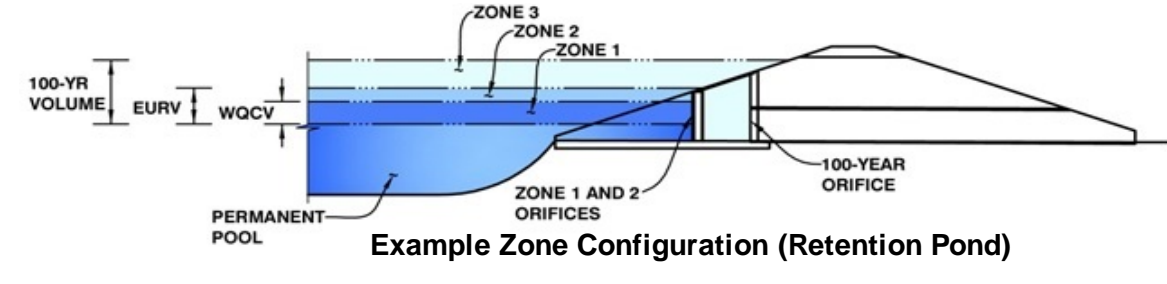


**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A8**



**Required Volume Calculation**

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	87.81	acres
Watershed Length =	2,421	ft
Watershed Slope =	0.024	ft/ft
Watershed Imperviousness =	3.90%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.210	acre-feet
Excess Urban Runoff Volume (EURV) =	0.264	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.218	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.816	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	10.745	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.203	acre-feet
Approximate 5-yr Detention Volume =	0.788	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	2.136	acre-feet

<b>Optional User Override</b>	
<b>1-hr Precipitation</b>	
	1.19 inches
	1.50 inches
	2.52 inches

**Stage-Storage Calculation**

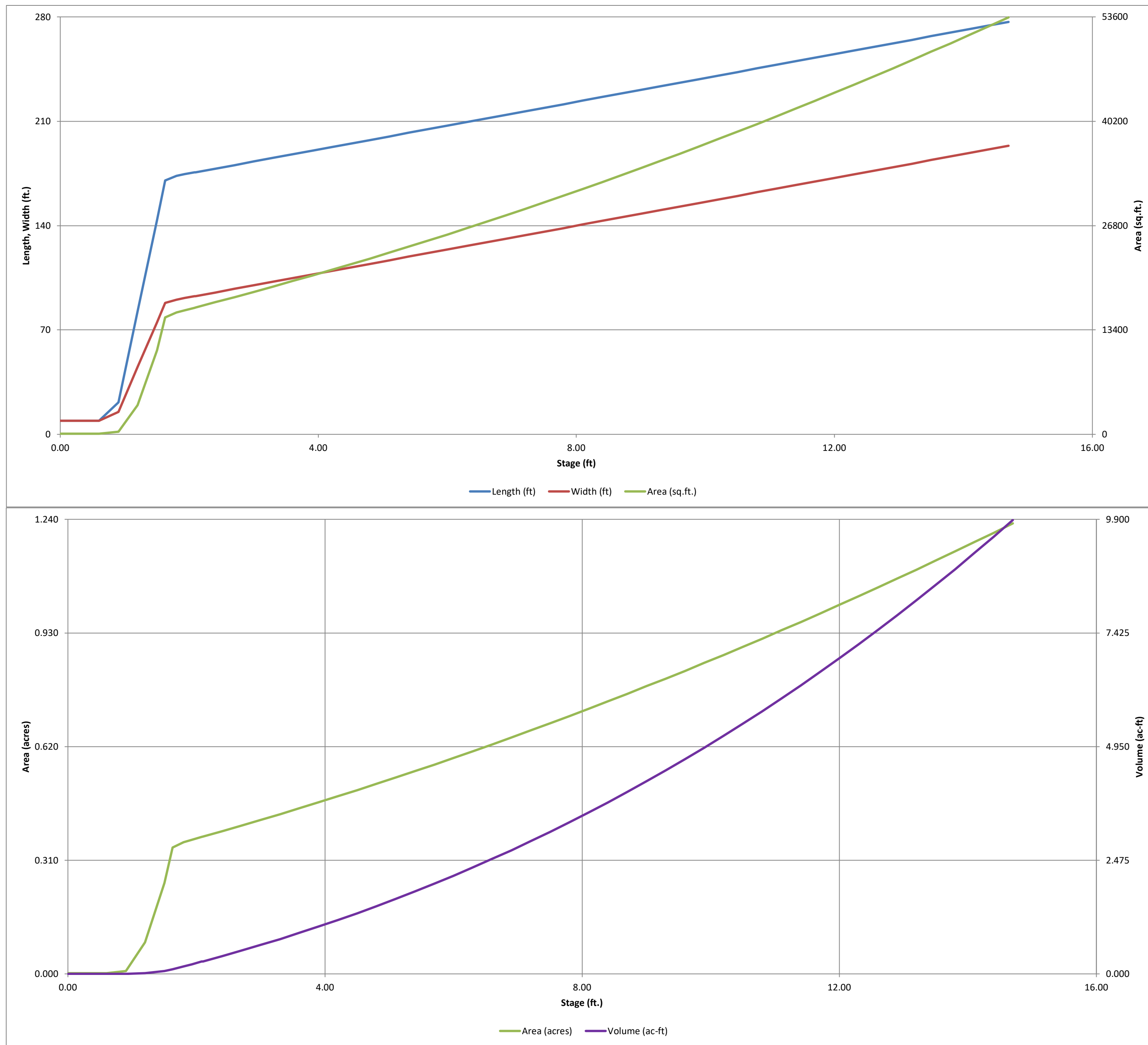
Zone 1 Volume (WQCV) =	0.210	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.054	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.871	acre-feet
Total Detention Basin Volume =	2.136	acre-feet
Initial Surcharge Volume (ISV) =	27	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	83	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	9.1	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	9.1	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.80	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	172.0	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	89.0	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	15,306	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	4,397	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.37	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	207.0	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	123.9	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	25,657	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	88,563	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	2,136	acre-feet

Depth Increment = 0.3 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		9.1	9.1	83		0.002		
<b>ISV</b>	0.33		9.1	9.1	83		0.002	27	0.001
	0.60		9.1	9.1	83		0.002	49	0.001
	0.90		21.4	15.1	323		0.007	80	0.002
	1.20		82.6	45.1	3,724		0.085	596	0.014
	1.50		143.8	75.1	10,798		0.248	2,682	0.062
<b>Floor</b>	1.63		170.3	88.1	15,003		0.344	4,352	0.100
	1.80		173.3	90.3	15,645		0.359	6,980	0.160
<b>Zone 1 (WQCV)</b>	1.93		174.4	91.4	15,941		0.366	9,191	0.211
<b>Zone 2 (EURV)</b>	2.08		175.6	92.6	16,262		0.373	11,606	0.266
	2.10	User Input	175.8	92.7	16,305		0.374	11,931	0.274
	2.40		178.2	95.1	16,955		0.389	16,920	0.388
	2.70		180.6	97.5	17,617		0.404	22,105	0.507
	3.00		183.0	99.9	18,290		0.420	27,491	0.631
	3.30		185.4	102.3	18,975		0.436	33,080	0.759
	3.60		187.8	104.7	19,671		0.452	38,877	0.892
	3.90		190.2	107.1	20,379		0.468	44,884	1.030
	4.20		192.6	109.5	21,098		0.484	51,106	1.173
	4.50		195.0	111.9	21,829		0.501	57,544	1.321
	4.80		197.4	114.3	22,572		0.518	64,204	1.474
	5.10		199.8	116.7	23,326		0.535	71,088	1.632
	5.40		202.2	119.1	24,091		0.553	78,201	1.795
	5.70		204.6	121.5	24,868		0.571	85,544	1.964
<b>Zone 3 (100-year)</b>	6.00		207.0	123.9	25,657		0.589	93,123	2.138
	6.30		209.4	126.3	26,457		0.607	100,939	2.317
	6.60		211.8	128.7	27,268		0.626	108,998	2.502
	6.90		214.2	131.1	28,091		0.645	117,301	2.693
	7.20		216.6	133.5	28,926		0.664	125,854	2.889
	7.50		219.0	135.9	29,772		0.683	134,658	3.091
	7.80		221.4	138.3	30,629		0.703	143,718	3.299
	8.10		223.8	140.7	31,499		0.723	153,037	3.513
	8.40		226.2	143.1	32,379		0.743	162,618	3.733
	8.70		228.6	145.5	33,271		0.764	172,466	3.959
	9.00		231.0	147.9	34,175		0.785	182,582	4.192
	9.30		233.4	150.3	35,090		0.806	192,972	4.430
	9.60		235.8	152.7	36,017		0.827	203,638	4.675
	9.90		238.2	155.1	36,955		0.848	214,583	4.926
	10.20		240.6	157.5	37,905		0.870	225,812	5.184
	10.50		243.0	159.9	38,867		0.892	237,328	5.448
	10.80		245.4	162.3	39,839		0.915	249,133	5.719
	11.10		247.8	164.7	40,824		0.937	261,232	5.997
	11.40		250.2	167.1	41,820		0.960	273,628	6.282
	11.70		252.6	169.5	42,827		0.983	286,325	6.573
	12.00		255.0	171.9	43,846		1.007	299,326	6.872
	12.30		257.4	174.3	44,876		1.030	312,634	7.177
	12.60		259.8	176.7	45,918		1.054	326,253	7.490
	12.90		262.2	179.1	46,972		1.078	340,186	7.810
	13.20		264.6	181.5	48,037		1.103	354,437	8.137
	13.50		267.0	183.9	49,113		1.127	369,009	8.471
	13.80		269.4	186.3	50,201		1.152	383,906	8.813
	14.10		271.8	188.7	51,301		1.178	399,131	9.163
	14.40		274.2	191.1	52,412		1.203	414,688	9.520
	14.70		276.6	193.5	53,534		1.229	430,579	9.885

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

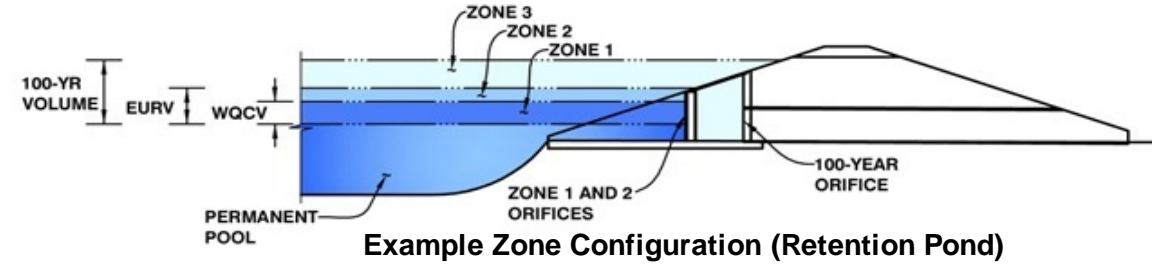


## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A9**



Example Zone Configuration (Retention Pond)

### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	32.86	acres
Watershed Length =	1,854	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	5.20%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.103	acre-feet
Excess Urban Runoff Volume (EURV) =	0.135	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.113	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.358	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.064	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.105	acre-feet
Approximate 5-yr Detention Volume =	0.344	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.903	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

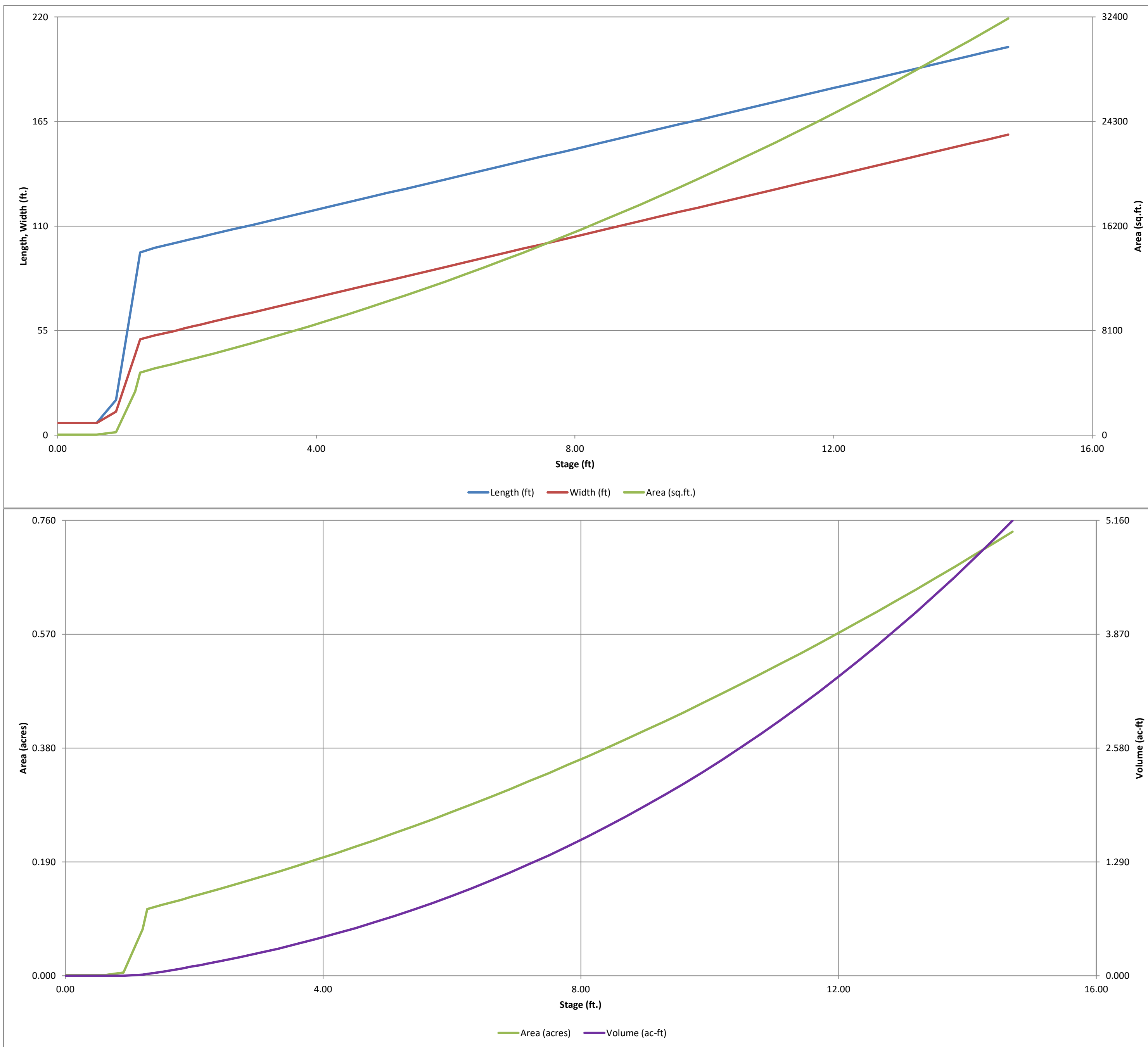
### Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.032	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.768	acre-feet
Total Detention Basin Volume =	0.903	acre-feet
Initial Surcharge Volume (ISV) =	13	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	41	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	6.4	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	6.4	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.44	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	96.7	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	50.7	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	4,903	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	796	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.73	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	134.6	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	88.5	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	11,907	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	38,526	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>0.903</b>	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Depth Increment = 0.3 ft									
<b>Top of Micropool</b>	0.00		6.4	6.4	41		0.001		
<b>ISV</b>	0.33		6.4	6.4	41		0.001	13	0.000
	0.60		6.4	6.4	41		0.001	24	0.001
	0.90		18.6	12.4	230		0.005	41	0.001
	1.20		79.8	42.4	3,382		0.078	491	0.011
<b>Floor</b>	1.27		96.1	50.4	4,843		0.111	818	0.019
	1.50		98.5	52.4	5,161		0.118	1,925	0.044
	1.80		100.9	54.8	5,529		0.127	3,528	0.081
<b>Zone 1 (WQCV)</b>	1.96		102.2	56.2	5,743		0.132	4,486	0.103
	2.10		103.4	57.3	5,922		0.136	5,303	0.122
<b>Zone 2 (EURV)</b>	2.20		104.2	58.1	6,051		0.139	5,901	0.135
	2.40		105.8	59.7	6,313		0.145	7,138	0.164
	2.70		108.2	62.1	6,716		0.154	9,092	0.209
	3.00		110.6	64.5	7,130		0.164	11,168	0.256
	3.30		113.0	66.9	7,556		0.173	13,371	0.307
	3.60		115.4	69.3	7,993		0.184	15,703	0.360
	3.90		117.8	71.7	8,442		0.194	18,168	0.417
	4.20		120.2	74.1	8,903		0.204	20,770	0.477
	4.50		122.6	76.5	9,375		0.215	23,511	0.540
	4.80		125.0	78.9	9,858		0.226	26,396	0.606
	5.10		127.4	81.3	10,353		0.238	29,427	0.676
	5.40		129.8	83.7	10,860		0.249	32,609	0.749
	5.70		132.2	86.1	11,378		0.261	35,944	0.825
<b>Zone 3 (100-year)</b>	6.00		134.6	88.5	11,907		0.273	39,437	0.905
	6.30		137.0	90.9	12,449		0.286	43,090	0.989
	6.60		139.4	93.3	13,001		0.298	46,907	1.077
	6.90		141.8	95.7	13,565		0.311	50,892	1.168
	7.20		144.2	98.1	14,141		0.325	55,047	1.264
	7.50		146.6	100.5	14,728		0.338	59,377	1.363
	7.80		149.0	102.9	15,327		0.352	63,885	1.467
	8.10		151.4	105.3	15,937		0.366	68,575	1.574
	8.40		153.8	107.7	16,559		0.380	73,449	1.686
	8.70		156.2	110.1	17,192		0.395	78,511	1.802
	9.00		158.6	112.5	17,837		0.409	83,765	1.923
	9.30		161.0	114.9	18,493		0.425	89,214	2.048
	9.60		163.4	117.3	19,161		0.440	94,862	2.178
	9.90		165.8	119.7	19,840		0.455	100,712	2.312
	10.20		168.2	122.1	20,531		0.471	106,767	2.451
	10.50		170.6	124.5	21,233		0.487	113,032	2.595
	10.80		173.0	126.9	21,947		0.504	119,508	2.744
	11.10		175.4	129.3	22,673		0.520	126,201	2.897
	11.40		177.8	131.7	23,410		0.537	133,113	3.056
	11.70		180.2	134.1	24,158		0.555	140,248	3.220
	12.00		182.6	136.5	24,918		0.572	147,609	3.389
	12.30		185.0	138.9	25,689		0.590	155,200	3.563
	12.60		187.4	141.3	26,472		0.608	163,024	3.743
	12.90		189.8	143.7	27,267		0.626	171,085	3.928
	13.20		192.2	146.1	28,073		0.644	179,385	4.118
	13.50		194.6	148.5	28,891		0.663	187,929	4.314
	13.80		197.0	150.9	29,720		0.682	196,721	4.516
	14.10		199.4	153.3	30,560		0.702	205,762	4.724
	14.40		201.8	155.7	31,412		0.721	215,058	4.937
	14.70		204.2	158.1	32,276		0.741	224,611	5.156

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



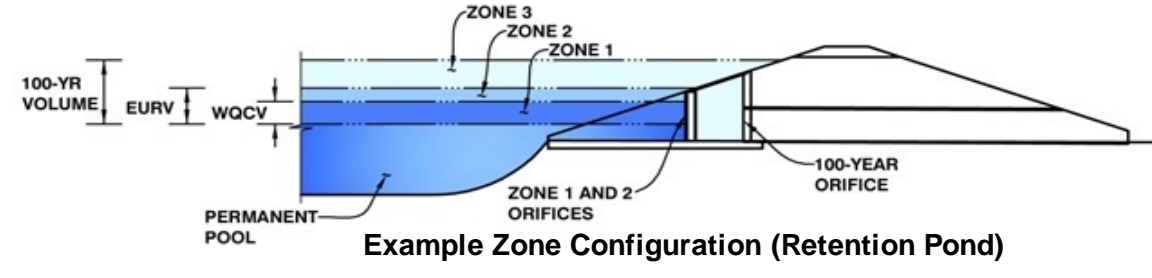


## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A10**



### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	263.34	acres
Watershed Length =	7.992	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	3.50%	percent
Percentage Hydrologic Soil Group A =	5.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	95.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.568	acre-feet
Excess Urban Runoff Volume (EURV) =	0.695	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.565	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.225	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	30.934	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.526	acre-feet
Approximate 5-yr Detention Volume =	2.150	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.991	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

### Stage-Storage Calculation

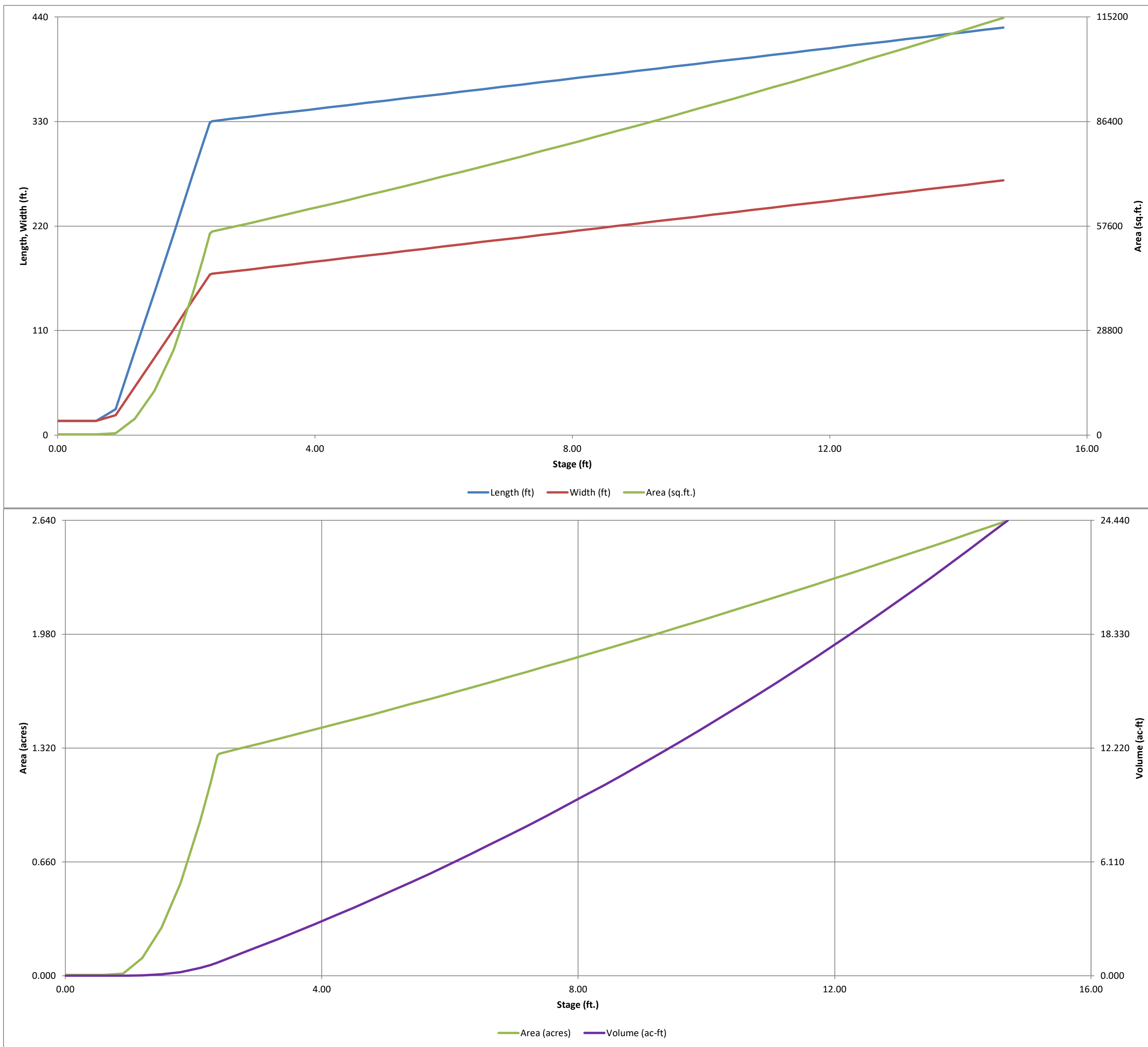
Zone 1 Volume (WQCV) =	0.568	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.297	acre-feet
Total Detention Basin Volume =	5.991	acre-feet
Initial Surcharge Volume (ISV) =	74	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	225	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	15.0	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	15.0	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	1.54	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	330.1	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	169.5	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	55,951	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	30,753	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	3.63	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	359.1	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	198.5	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	71,281	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	230,060	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	5,992	acre-feet

Depth Increment = 0.3 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		15.0	15.0	225		0.005		
<b>ISV</b>	0.33		15.0	15.0	225		0.005	72	0.002
	0.60		15.0	15.0	225		0.005	133	0.003
	0.90		27.2	21.0	572		0.013	210	0.005
	1.20		88.4	51.0	4,510		0.104	880	0.020
	1.50		149.6	81.0	12,120		0.278	3,283	0.075
	1.80		210.8	111.0	23,402		0.537	8,520	0.196
	2.10		274.1	142.0	38,918		0.893	18,078	0.415
<b>Zone 1 (WQCV)</b>	2.26		306.7	158.0	48,460		1.112	25,054	0.575
<b>Zone 2 (EURV)</b>	2.37		329.2	169.0	55,627		1.277	30,775	0.706
<b>Floor</b>	2.37		329.2	169.0	55,627		1.277	30,775	0.706
	2.40		330.3	169.7	56,051		1.287	32,453	0.745
	2.70		332.7	172.1	57,257		1.314	49,449	1.135
	3.00		335.1	174.5	58,474		1.342	66,808	1.534
	3.30		337.5	176.9	59,703		1.371	84,535	1.941
	3.60		339.9	179.3	60,944		1.399	102,631	2.356
	3.90		342.3	181.7	62,196		1.428	121,102	2.780
	4.20		344.7	184.1	63,459		1.457	139,950	3.213
	4.50		347.1	186.5	64,734		1.486	159,178	3.654
	4.80		349.5	188.9	66,020		1.516	178,791	4.104
	5.10		351.9	191.3	67,318		1.545	198,792	4.564
	5.40		354.3	193.7	68,628		1.575	219,183	5.032
	5.70		356.7	196.1	69,949		1.606	239,970	5.509
<b>Zone 3 (100-year)</b>	6.00		359.1	198.5	71,281		1.636	261,154	5.995
	6.30		361.5	200.9	72,625		1.667	282,739	6.491
	6.60		363.9	203.3	73,981		1.698	304,730	6.996
	6.90		366.3	205.7	75,348		1.730	327,129	7.510
	7.20		368.7	208.1	76,727		1.761	349,940	8.034
	7.50		371.1	210.5	78,117		1.793	373,166	8.567
	7.80		373.5	212.9	79,518		1.825	396,811	9.110
	8.10		375.9	215.3	80,931		1.858	420,878	9.662
	8.40		378.3	217.7	82,356		1.891	445,371	10.224
	8.70		380.7	220.1	83,792		1.924	470,293	10.796
	9.00		383.1	222.5	85,240		1.957	495,648	11.379
	9.30		385.5	224.9	86,699		1.990	521,438	11.971
	9.60		387.9	227.3	88,170		2.024	547,668	12.573
	9.90		390.3	229.7	89,652		2.058	574,342	13.185
	10.20		392.7	232.1	91,146		2.092	601,461	13.808
	10.50		395.1	234.5	92,651		2.127	629,030	14.441
	10.80		397.5	236.9	94,168		2.162	657,053	15.084
	11.10		399.9	239.3	95,697		2.197	685,532	15.738
	11.40		402.3	241.7	97,237		2.232	714,472	16.402
	11.70		404.7	244.1	98,788		2.268	743,876	17.077
	12.00		407.1	246.5	100,351		2.304	773,746	17.763
	12.30		409.5	248.9	101,925		2.340	804,087	18.459
	12.60		411.9	251.3	103,511		2.376	834,902	19.167
	12.90		414.3	253.7	105,109		2.413	866,195	19.885
	13.20		416.7	256.1	106,718		2.450	897,969	20.615
	13.50		419.1	258.5	108,338		2.487	930,227	21.355
	13.80		421.5	260.9	109,970		2.525	962,973	22.107
	14.10		423.9	263.3	111,614		2.562	996,210	22.870
	14.40		426.3	265.7	113,269		2.600	1,029,942	23.644
	14.70		428.7	268.1	114,936		2.639	1,064,173	24.430

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

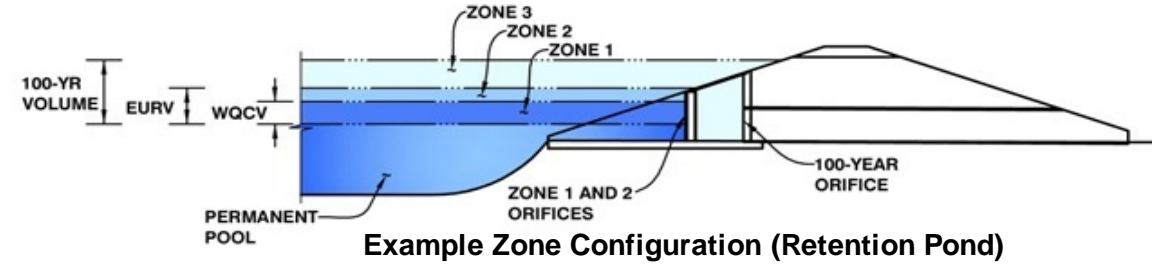


## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A11**



### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	224.01	acres
Watershed Length =	8,048	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	3.70%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.509	acre-feet
Excess Urban Runoff Volume (EURV) =	0.637	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.523	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.028	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	27.367	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.488	acre-feet
Approximate 5-yr Detention Volume =	1.959	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.329	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
	2.52	inches

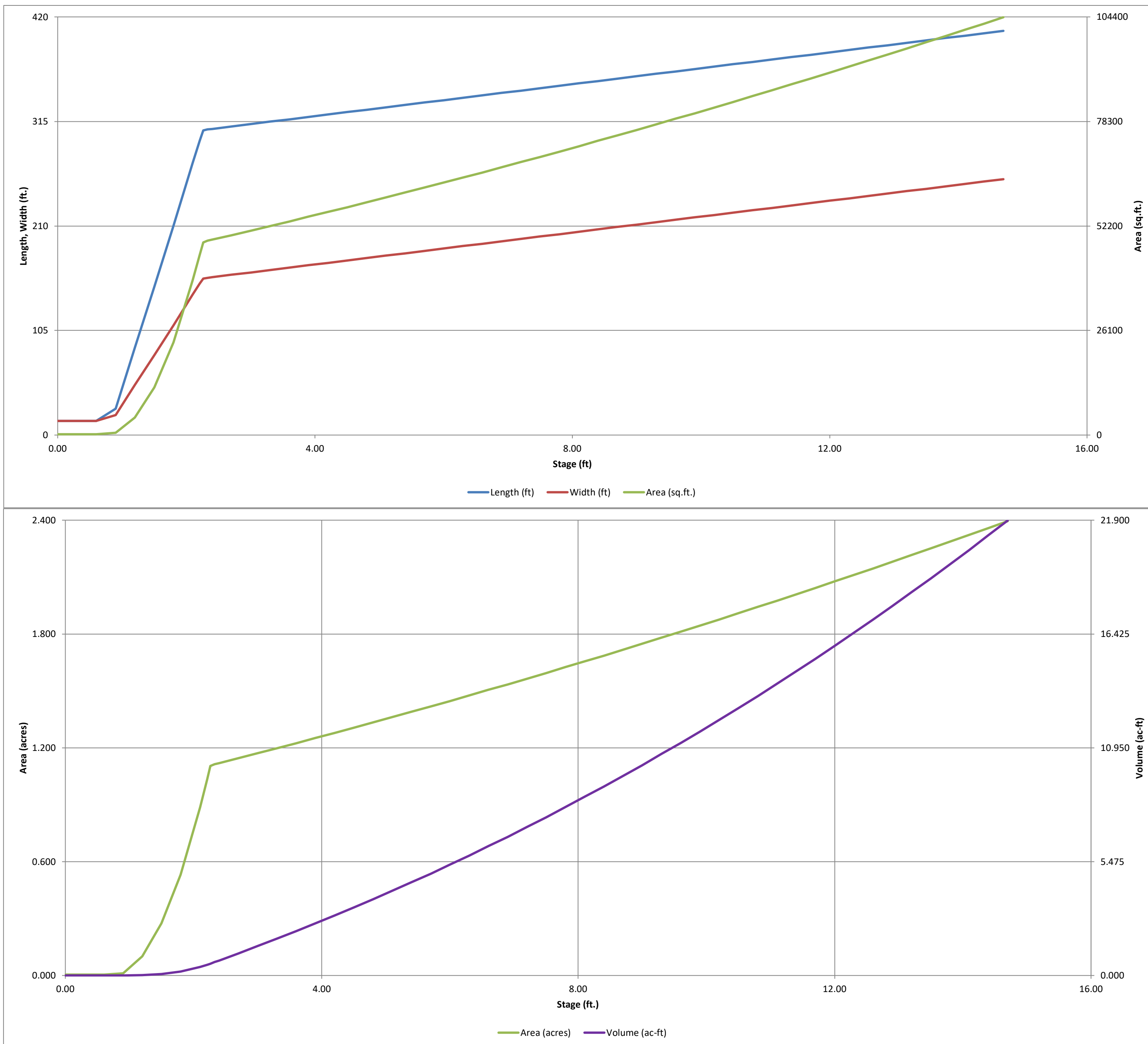
### Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.509	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.692	acre-feet
Total Detention Basin Volume =	5.329	acre-feet
Initial Surcharge Volume (ISV) =	67	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	202	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	14.2	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	14.2	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	1.43	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	306.5	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	157.5	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	48,260	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	24,633	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	3.74	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	336.4	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	187.4	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	63,025	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	207,340	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	5.329	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		14.2	14.2	202		0.005		
ISV	0.33		14.2	14.2	202		0.005	65	0.001
	0.60		14.2	14.2	202		0.005	119	0.003
	0.90		26.4	20.2	534		0.012	189	0.004
	1.20		87.6	50.2	4,400		0.101	837	0.019
	1.50		148.8	80.2	11,937		0.274	3,196	0.073
	1.80		210.0	110.2	23,146		0.531	8,366	0.192
	2.10		273.3	141.2	38,587		0.886	17,834	0.409
Zone 1 (WQCV)	2.21		295.7	152.2	45,009		1.033	22,427	0.515
Floor	2.26		305.9	157.2	48,091		1.104	24,754	0.568
Zone 2 (EURV)	2.33		307.0	158.0	48,510		1.114	28,140	0.646
	2.40		307.6	158.6	48,771		1.120	31,545	0.724
	2.70		310.0	161.0	49,895		1.145	46,344	1.064
	3.00		312.4	163.4	51,031		1.172	61,483	1.411
	3.30		314.8	165.8	52,179		1.198	76,964	1.767
	3.60		317.2	168.2	53,338		1.224	92,791	2.130
	3.90		319.6	170.6	54,508		1.251	108,968	2.502
	4.20		322.0	173.0	55,691		1.278	125,498	2.881
	4.50		324.4	175.4	56,884		1.306	142,383	3.269
	4.80		326.8	177.8	58,089		1.334	159,629	3.665
	5.10		329.2	180.2	59,306		1.361	177,238	4.069
	5.40		331.6	182.6	60,534		1.390	195,214	4.481
	5.70		334.0	185.0	61,774		1.418	213,560	4.903
Zone 3 (100-year)	6.00		336.4	187.4	63,025		1.447	232,279	5.332
	6.30		338.8	189.8	64,288		1.476	251,376	5.771
	6.60		341.2	192.2	65,562		1.505	270,853	6.218
	6.90		343.6	194.6	66,848		1.535	290,714	6.674
	7.20		346.0	197.0	68,145		1.564	310,963	7.139
	7.50		348.4	199.4	69,454		1.594	331,602	7.613
	7.80		350.8	201.8	70,774		1.625	352,636	8.095
	8.10		353.2	204.2	72,106		1.655	374,068	8.587
	8.40		355.6	206.6	73,449		1.686	395,901	9.089
	8.70		358.0	209.0	74,804		1.717	418,139	9.599
	9.00		360.4	211.4	76,171		1.749	440,785	10.119
	9.30		362.8	213.8	77,549		1.780	463,842	10.648
	9.60		365.2	216.2	78,938		1.812	487,315	11.187
	9.90		367.6	218.6	80,339		1.844	511,206	11.736
	10.20		370.0	221.0	81,752		1.877	535,520	12.294
	10.50		372.4	223.4	83,176		1.909	560,258	12.862
	10.80		374.8	225.8	84,611		1.942	585,426	13.440
	11.10		377.2	228.2	86,058		1.976	611,026	14.027
	11.40		379.6	230.6	87,517		2.009	637,062	14.625
	11.70		382.0	233.0	88,987		2.043	663,537	15.233
	12.00		384.4	235.4	90,468		2.077	690,455	15.851
	12.30		386.8	237.8	91,962		2.111	717,820	16.479
	12.60		389.2	240.2	93,466		2.146	745,633	17.117
	12.90		391.6	242.6	94,982		2.180	773,900	17.766
	13.20		394.0	245.0	96,510		2.216	802,624	18.426
	13.50		396.4	247.4	98,049		2.251	831,808	19.096
	13.80		398.8	249.8	99,600		2.287	861,455	19.776
	14.10		401.2	252.2	101,162		2.322	891,569	20.468
	14.40		403.6	254.6	102,736		2.358	922,153	21.170
	14.70		406.0	257.0	104,321		2.395	953,211	21.883

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



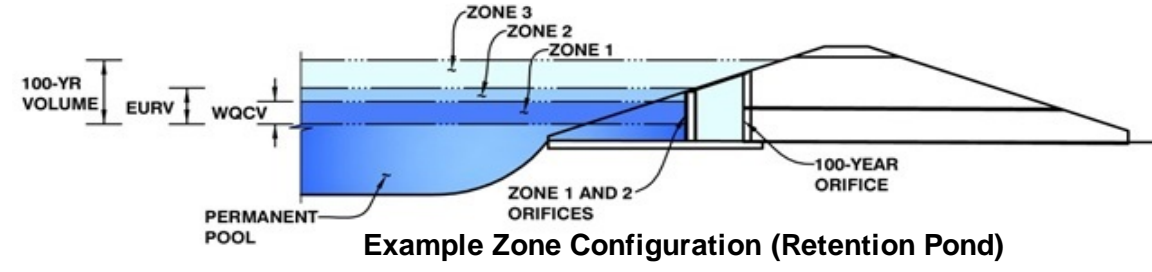


**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A12**



**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	10.97	acres
Watershed Length =	444	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	6.70%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.043	acre-feet
Excess Urban Runoff Volume (EURV) =	0.059	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.050	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.140	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.373	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.047	acre-feet
Approximate 5-yr Detention Volume =	0.134	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.337	acre-feet

Note: L / W Ratio < 1  
L / W Ratio = 0.4

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

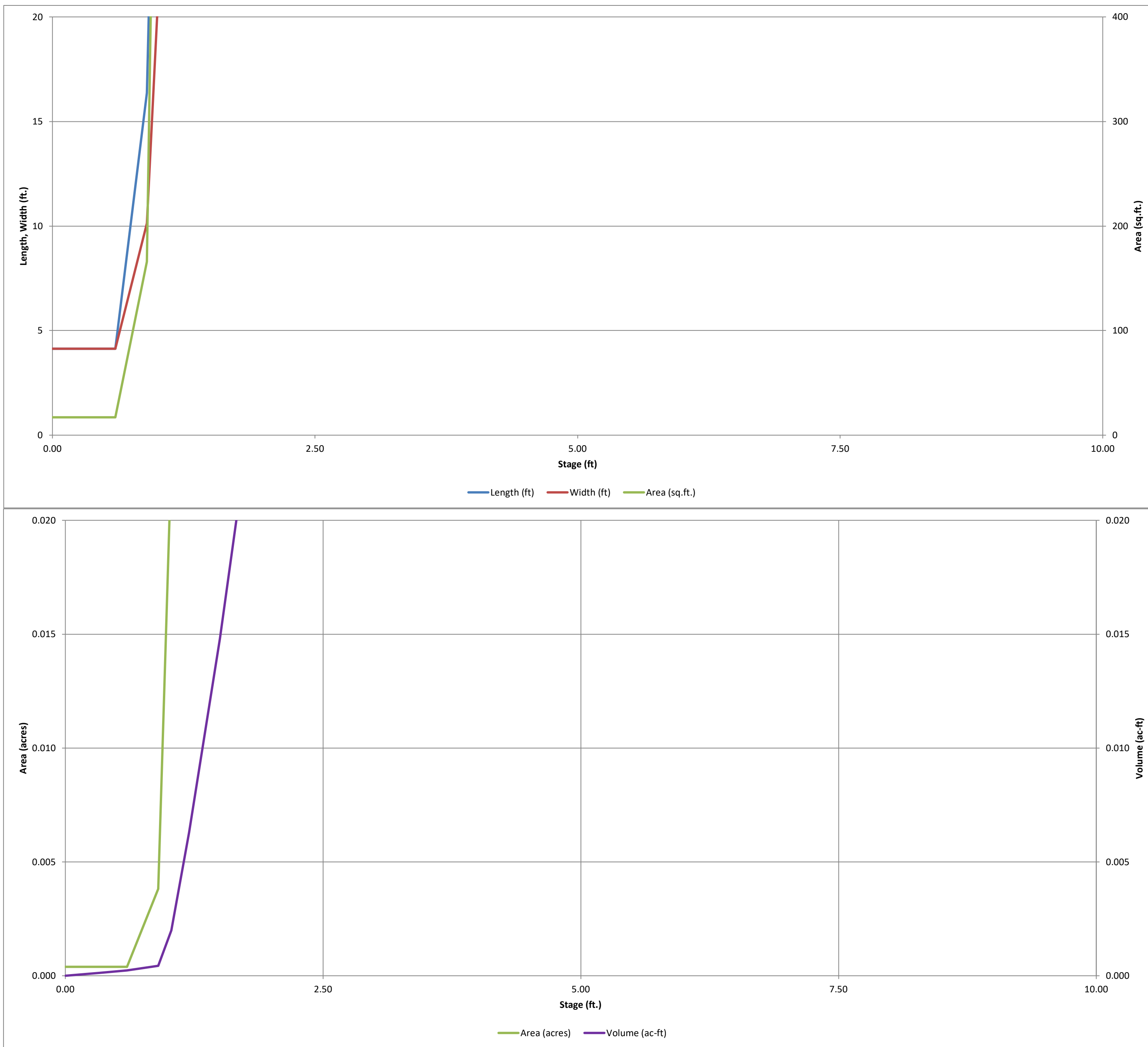
**Stage-Storage Calculation**

Zone 1 Volume (WQCV) =	0.043	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.016	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.278	acre-feet
Total Detention Basin Volume =	0.337	acre-feet
Initial Surcharge Volume (ISV) =	6	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	17	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	4.1	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	4.1	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.20	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	44.4	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	23.9	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	1,059	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	80	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.97	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	84.2	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	63.6	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	5,357	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	14,583	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	0.337	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		4.1	4.1	17		0.000		
ISV	0.33		4.1	4.1	17		0.000	5	0.000
	0.60		4.1	4.1	17		0.000	10	0.000
Floor	0.90		16.4	10.1	166		0.004	19	0.000
	1.03		42.9	23.1	992		0.023	87	0.002
Zone 1 (WQCV)	1.20		45.7	25.2	1,150		0.026	274	0.006
	1.50		48.1	27.6	1,325		0.030	645	0.015
	1.80		50.5	30.0	1,513		0.035	1,070	0.025
	2.10		53.0	32.4	1,718		0.039	1,571	0.036
	2.28		54.4	33.9	1,843		0.042	1,891	0.043
Zone 2 (EURV)	2.40	User Input	55.4	34.8	1,929		0.044	2,118	0.049
	2.63		57.2	36.7	2,099		0.048	2,581	0.059
	2.70		57.8	37.2	2,151		0.049	2,729	0.063
	3.00		60.2	39.6	2,385		0.055	3,410	0.078
	3.30		62.6	42.0	2,630		0.060	4,162	0.096
Zone 3 (100-year)	3.60		65.0	44.4	2,887		0.066	4,989	0.115
	3.90		67.4	46.8	3,156		0.072	5,895	0.135
	4.20		69.8	49.2	3,436		0.079	6,884	0.158
	4.50		72.2	51.6	3,727		0.086	7,958	0.183
	4.80		74.6	54.0	4,030		0.093	9,121	0.209
	5.10		77.0	56.4	4,344		0.100	10,377	0.238
	5.40		79.4	58.8	4,670		0.107	11,729	0.269
	5.70		81.8	61.2	5,008		0.115	13,180	0.303
	6.00		84.2	63.6	5,345		0.123	14,681	0.337
	6.30		86.6	66.0	5,717		0.131	16,395	0.376
6.60		89.0	68.4	6,089		0.140	18,166	0.417	
6.90		91.4	70.8	6,473		0.149	20,050	0.460	
7.20		93.8	73.2	6,868		0.158	22,050	0.506	
7.50		96.2	75.6	7,274		0.167	24,171	0.555	
7.80		98.6	78.0	7,692		0.177	26,416	0.606	
8.10		101.0	80.4	8,122		0.186	28,788	0.661	
8.40		103.4	82.8	8,563		0.197	31,291	0.718	
8.70		105.8	85.2	9,016		0.207	33,927	0.779	
9.00		108.2	87.6	9,480		0.218	36,701	0.843	
9.30		110.6	90.0	9,956		0.229	39,616	0.909	
9.60		113.0	92.4	10,443		0.240	42,676	0.980	
9.90		115.4	94.8	10,942		0.251	45,883	1.053	
10.20		117.8	97.2	11,452		0.263	49,242	1.130	
10.50		120.2	99.6	11,974		0.275	52,756	1.211	
10.80		122.6	102.0	12,507		0.287	56,427	1.295	
11.10		125.0	104.4	13,052		0.300	60,261	1.383	
11.40		127.4	106.8	13,608		0.312	64,260	1.475	
11.70		129.8	109.2	14,176		0.325	68,427	1.571	
12.00		132.2	111.6	14,755		0.339	72,766	1.670	
12.30		134.6	114.0	15,346		0.352	77,281	1.774	
12.60		137.0	116.4	15,949		0.366	81,975	1.882	
12.90		139.4	118.8	16,563		0.380	86,852	1.994	
13.20		141.8	121.2	17,188		0.395	91,914	2.110	
13.50		144.2	123.6	17,825		0.409	97,166	2.231	
13.80		146.6	126.0	18,474		0.424	102,610	2.356	
14.10		149.0	128.4	19,134		0.439	108,251	2.485	
14.40		151.4	130.8	19,805		0.455	114,092	2.619	
14.70		153.8	133.2	20,488		0.470	120,135	2.758	

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

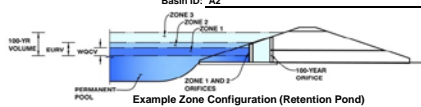
UD-Detention, Version 3.07 (February 2017)



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A2**



Example Zone Configuration (Retention Pond)

### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>
Watershed Area =	77.33 acres
Watershed Length =	2,282 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	6.80% 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 =	User Input
Water Quality Capture Volume (WQCV) =	0.308 acre-feet
Excess Urban Runoff Volume (EURV) =	0.424 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.360 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.995 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	9.689 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.336 acre-feet
Approximate 5-yr Detention Volume =	0.953 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	2.390 acre-feet

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	2.52 inches

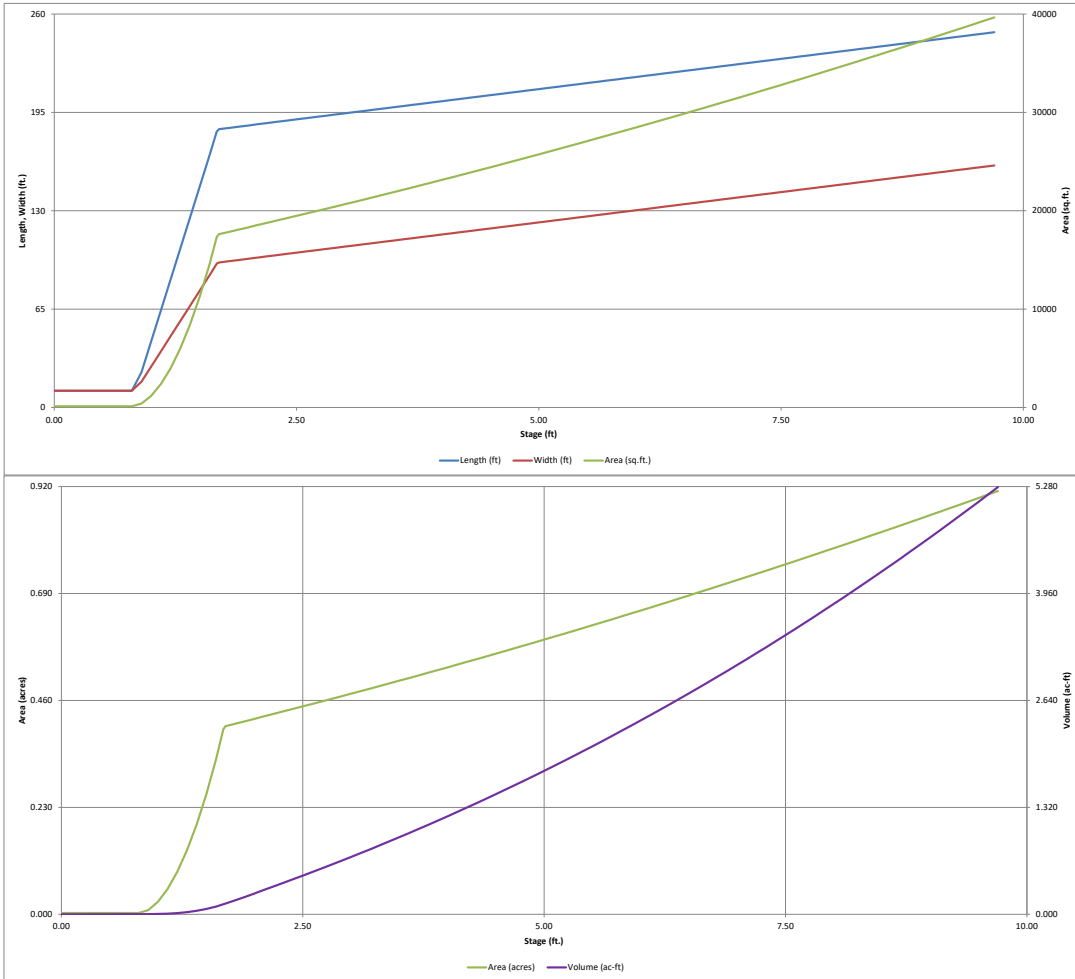
### Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.308 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.116 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.966 acre-feet
Total Detention Basin Volume =	2.390 acre-feet
Initial Surcharge Volume (ISV) =	40 ft³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LB</sub> ) =	2
Initial Surcharge Area (A <sub>ISV</sub> ) =	122 ft²
Surcharge Volume Length (L <sub>ISV</sub> ) =	11.0 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	11.0 ft
Depth of Basin Floor (H <sub>100yr</sub> ) =	0.85 ft
Length of Basin Floor (L <sub>100yr</sub> ) =	183.8 ft
Width of Basin Floor (W <sub>100yr</sub> ) =	95.7 ft
Area of Basin Floor (A <sub>100yr</sub> ) =	17,598 ft²
Volume of Basin Floor (V <sub>100yr</sub> ) =	5,416 ft³
Depth of Main Basin (H <sub>main</sub> ) =	4.32 ft
Length of Main Basin (L <sub>main</sub> ) =	218.4 ft
Width of Main Basin (W <sub>main</sub> ) =	130.3 ft
Area of Main Basin (A <sub>main</sub> ) =	28,462 ft²
Volume of Main Basin (V <sub>main</sub> ) =	98,625 ft³
Calculated Total Basin Volume (V <sub>total</sub> ) =	2,391 acre-feet

Depth Increment =	0.1	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (ft²)	Volume (ft³)	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		11.0	11.0	122		0.003		
<b>ISV</b>	0.33		11.0	11.0	122		0.003	39	0.001
	0.40		11.0	11.0	122		0.003	48	0.001
	0.50		11.0	11.0	122		0.003	60	0.001
	0.60		11.0	11.0	122		0.003	72	0.002
	0.70		11.0	11.0	122		0.003	84	0.002
	0.80		11.0	11.0	122		0.003	96	0.002
	0.90		23.3	17.0	397		0.009	116	0.003
	1.00		43.7	27.0	1,182		0.027	192	0.004
	1.10		64.1	37.0	2,374		0.055	366	0.008
	1.20		84.5	47.0	3,975		0.091	680	0.016
	1.30		104.9	57.0	5,984		0.137	1,175	0.027
	1.40		125.3	67.0	8,400		0.193	1,890	0.043
	1.50		145.7	77.0	11,225		0.258	2,868	0.066
	1.60		166.1	87.0	14,457		0.332	4,149	0.095
<b>Floor</b>	1.68		182.4	95.0	17,337		0.398	5,419	0.124
	1.70		183.9	95.8	17,627		0.405	5,770	0.132
	1.80		184.7	96.6	17,852		0.410	7,544	0.173
	1.90		185.5	97.4	18,077		0.415	9,340	0.214
	2.00		186.3	98.2	18,304		0.420	11,159	0.256
	2.10		187.2	99.1	18,556		0.426	13,187	0.303
<b>Zone 1 (WQCV)</b>	2.12		187.4	99.3	18,601		0.427	13,558	0.311
	2.20		188.0	99.9	18,785		0.431	15,054	0.346
	2.30		188.8	100.7	19,016		0.437	16,944	0.389
<b>Zone 2 (EURV)</b>	2.39		189.5	101.4	19,225		0.441	18,665	0.428
	2.40		189.6	101.5	19,249		0.442	18,857	0.433
	2.50		190.4	102.3	19,482		0.447	20,793	0.477
	2.60		191.2	103.1	19,717		0.453	22,753	0.522
	2.70		192.0	103.9	19,953		0.458	24,737	0.568
	2.80		192.8	104.7	20,190		0.464	26,744	0.614
	2.90		193.6	105.5	20,429		0.469	28,775	0.661
	3.00		194.4	106.3	20,669		0.474	30,830	0.708
	3.10		195.2	107.1	20,910		0.480	32,909	0.755
	3.20		196.0	107.9	21,153		0.486	35,012	0.804
	3.30		196.8	108.7	21,396		0.491	37,139	0.853
	3.40		197.6	109.5	21,642		0.497	39,291	0.902
	3.50		198.4	110.3	21,888		0.502	41,468	0.952
	3.60		199.2	111.1	22,135		0.508	43,669	1.003
	3.70		200.0	111.9	22,384		0.514	45,895	1.054
	3.80		200.8	112.7	22,635		0.520	48,146	1.105
	3.90		201.6	113.5	22,886		0.525	50,422	1.158
	4.00		202.4	114.3	23,139		0.531	52,723	1.210
	4.10		203.2	115.1	23,393		0.537	55,050	1.264
	4.20		204.0	115.9	23,648		0.543	57,402	1.318
	4.30		204.8	116.7	23,905		0.549	59,779	1.372
	4.40		205.6	117.5	24,162		0.555	62,183	1.428
	4.50		206.4	118.3	24,422		0.561	64,612	1.483
	4.60		207.2	119.1	24,682		0.567	67,067	1.540
	4.70		208.0	119.9	24,944		0.573	69,548	1.597
	4.80		208.8	120.7	25,207		0.579	72,056	1.654
	4.90		209.6	121.5	25,471		0.585	74,590	1.712
	5.00		210.4	122.3	25,736		0.591	77,150	1.771
	5.10		211.2	123.1	26,003		0.597	79,737	1.831
	5.20		212.0	123.9	26,271		0.603	82,351	1.891
	5.30		212.8	124.7	26,541		0.609	84,991	1.951
	5.40		213.6	125.5	26,811		0.616	87,659	2.012
	5.50		214.4	126.3	27,083		0.622	90,354	2.074
	5.60		215.2	127.1	27,357		0.628	93,076	2.137
	5.70		216.0	127.9	27,631		0.634	95,825	2.200
	5.80		216.8	128.7	27,907		0.641	98,602	2.264
<b>Zone 3 (100-year)</b>	5.90		217.6	129.5	28,184		0.647	101,406	2.328
	6.00		218.4	130.3	28,462		0.653	104,239	2.393
	6.10		219.2	131.1	28,742		0.660	107,099	2.459
	6.20		220.0	131.9	29,023		0.666	109,987	2.525
	6.30		220.8	132.7	29,305		0.673	112,904	2.592
	6.40		221.6	133.5	29,588		0.679	115,848	2.660
	6.50		222.4	134.3	29,873		0.686	118,821	2.728
	6.60		223.2	135.1	30,159		0.692	121,823	2.797
	6.70		224.0	135.9	30,446		0.699	124,853	2.866
	6.80		224.8	136.7	30,735		0.706	127,912	2.936
	6.90		225.6	137.5	31,025		0.712	131,000	3.007
	7.00		226.4	138.3	31,316		0.719	134,117	3.079
	7.10		227.2	139.1	31,608		0.726	137,263	3.151
	7.20		228.0	139.9	31,902		0.732	140,439	3.224
	7.30		228.8	140.7	32,197		0.739	143,644	3.298
	7.40		229.6	141.5	32,493		0.746	146,878	3.372
	7.50		230.4	142.3	32,791		0.753	150,143	3.447
	7.60		231.2	143.1	33,090		0.760	153,437	3.522
	7.70		232.0	143.9	33,390		0.767	156,761	3.599
	7.80		232.8	144.7	33,691		0.773	160,115	3.676
	7.90		233.6	145.5	33,994		0.780	163,499	3.753
	8.00		234.4	146.3	34,298		0.787	166,913	3.832
	8.10		235.2	147.1	34,603		0.794	170,359	3.911
	8.20		236.0	147.9	34,910		0.801	173,834	3.991
	8.30		236.8	148.7	35,217		0.808	177,340	4.071
	8.40		237.6	149.5	35,526		0.816	180,878	4.152
	8.50		238.4	150.3	35,837		0.823	184,446	4.234
	8.60		239.2	151.1	36,148		0.830	188,045	4.317
	8.70		240.0	151.9	36,461		0.837	191,675	4.400
	8.80		240.8	152.7	36,775		0.844	195,337	4.484
	8.90		241.6	153.5	37,091		0.851	199,031	4.569
	9.00		242.4	154.3	37,408		0.859	202,756	4.655
	9.10		243.2	155.1	37,726		0.866	206,512	4.741
	9.20		244.0	155.9	38,045		0.873	210,300	4.828
	9.30		244.8	156.7	38,365		0.881	214,121	4.916
	9.40		245.6	157.5	38,687		0.888	217,974	5.004
	9.50		246.4	158.3	39,010		0.896	221,859	5.093
	9.60		247.2	159.1	39,335		0.903	225,776	5.183
	9.70		248.0	159.9	39,661		0.910	229,726	5.274

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)



**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

Project: Front Range - Midway Solar  
Basin ID: A5



**Required Volume Calculation**

Selected BMP Type =	EOD	
Watershed Area =	199.14 acres	
Watershed Length =	4.884 ft	
Watershed Slope =	0.014 ft/ft	
Watershed Imperviousness =	3.10% 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 WQC Drain Time =	40.0 hours	
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQC) =	0.383 acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.468 acre-feet	1.19 inches
2-yr Runoff Volume (P1 = 1.19 in.) =	0.381 acre-feet	1.50 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.655 acre-feet	inches
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet	inches
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet	inches
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	24.208 acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet	inches
Approximate 2-yr Detention Volume =	0.355 acre-feet	
Approximate 5-yr Detention Volume =	1.604 acre-feet	
Approximate 10-yr Detention Volume =	0.000 acre-feet	
Approximate 25-yr Detention Volume =	0.000 acre-feet	
Approximate 50-yr Detention Volume =	0.000 acre-feet	
Approximate 100-yr Detention Volume =	4.400 acre-feet	

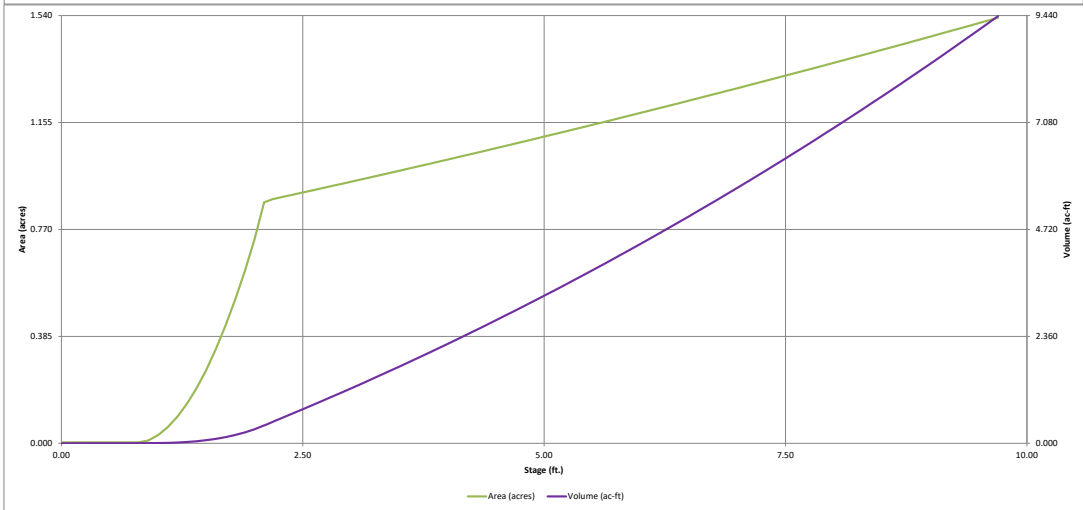
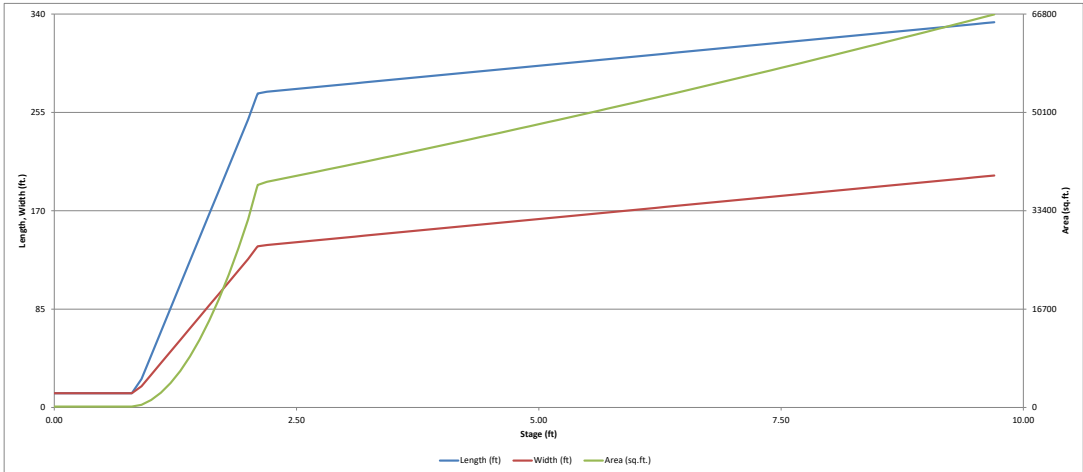
**Stage-Storage Calculation**

Zone 1 Volume (WQC) =	0.383 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.085 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.933 acre-feet
Total Detention Basin Volume =	4.400 acre-feet
Initial Surcharge Volume (ISV) =	50 ft³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2
Initial Surcharge Area (A <sub>ISV</sub> ) =	152 ft²
Surcharge Volume Length (L <sub>SV</sub> ) =	12.3 ft
Surcharge Volume Width (W <sub>SV</sub> ) =	12.3 ft
Depth of Basin Floor (H <sub>100</sub> ) =	1.27 ft
Length of Basin Floor (L <sub>100</sub> ) =	272.2 ft
Width of Basin Floor (W <sub>100</sub> ) =	139.7 ft
Area of Basin Floor (A <sub>100</sub> ) =	38,019 ft²
Volume of Basin Floor (V <sub>100</sub> ) =	17,227 ft³
Depth of Main Basin (H <sub>main</sub> ) =	3.90 ft
Length of Main Basin (L <sub>main</sub> ) =	303.3 ft
Width of Main Basin (W <sub>main</sub> ) =	170.9 ft
Area of Main Basin (A <sub>main</sub> ) =	51,828 ft²
Volume of Main Basin (V <sub>main</sub> ) =	174,339 ft³
Calculated Total Basin Volume (V <sub>total</sub> ) =	4,401 acre-feet

Depth Increment = 0.1 ft		Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (ft²)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	0.00		12.3	12.3	152		0.003		
ISV	0.33		12.3	12.3	152		0.003	49	0.001
	0.40		12.3	12.3	152		0.003	59	0.001
	0.50		12.3	12.3	152		0.003	74	0.002
	0.60		12.3	12.3	152		0.003	89	0.002
	0.70		12.3	12.3	152		0.003	105	0.002
	0.80		12.3	12.3	152		0.003	120	0.003
	0.90		24.6	18.3	450		0.010	143	0.003
	1.00		45.0	28.3	1,273		0.029	226	0.005
	1.10		65.4	38.3	2,504		0.057	411	0.009
	1.20		85.8	48.3	4,143		0.095	740	0.017
	1.30		106.2	58.3	6,190		0.142	1,253	0.029
	1.40		126.6	68.3	8,645		0.198	1,992	0.046
	1.50		147.0	78.3	11,508		0.264	2,996	0.069
	1.60		167.4	88.3	14,779		0.339	4,307	0.099
	1.70		187.8	98.3	18,458		0.424	5,965	0.137
	1.80		208.2	108.3	22,545		0.518	8,012	0.184
	1.90		228.6	118.3	27,040		0.621	10,488	0.241
	2.00		249.0	128.3	31,943		0.733	13,434	0.308
Zone 1 (WQC)	2.09		269.4	138.3	37,254		0.855	16,890	0.388
	2.10		271.4	139.3	37,808		0.868	17,266	0.396
Floor	2.10		271.4	139.3	37,808		0.868	17,266	0.396
Zone 2 (EURV)	2.19		272.9	140.4	38,304		0.879	20,698	0.475
	2.20		272.9	140.5	38,337		0.880	21,082	0.484
	2.30		273.7	141.3	38,668		0.888	24,932	0.572
	2.40		274.5	142.1	39,001		0.895	28,815	0.662
	2.50		275.3	142.9	39,335		0.903	32,732	0.751
	2.60		276.1	143.7	39,670		0.911	36,682	0.842
	2.70		276.9	144.5	40,006		0.918	40,666	0.934
	2.80		277.7	145.3	40,344		0.926	44,684	1.026
	2.90		278.5	146.1	40,683		0.934	48,735	1.119
	3.00		279.3	146.9	41,023		0.942	52,820	1.213
	3.10		280.1	147.7	41,365		0.950	56,940	1.307
	3.20		280.9	148.5	41,708		0.957	61,093	1.403
	3.30		281.7	149.3	42,052		0.965	65,281	1.499
	3.40		282.5	150.1	42,398		0.973	69,504	1.596
	3.50		283.3	150.9	42,744		0.981	73,761	1.693
	3.60		284.1	151.7	43,092		0.989	78,053	1.792
	3.70		284.9	152.5	43,442		0.997	82,379	1.891
	3.80		285.7	153.3	43,792		1.005	86,741	1.991
	3.90		286.5	154.1	44,144		1.013	91,138	2.092
	4.00		287.3	154.9	44,497		1.022	95,570	2.194
	4.10		288.1	155.7	44,851		1.030	100,037	2.297
	4.20		288.9	156.5	45,207		1.038	104,540	2.400
	4.30		289.7	157.3	45,564		1.046	109,079	2.504
	4.40		290.5	158.1	45,922		1.054	113,653	2.609
	4.50		291.3	158.9	46,282		1.062	118,263	2.715
	4.60		292.1	159.7	46,643		1.071	122,910	2.822
	4.70		292.9	160.5	47,005		1.079	127,592	2.929
	4.80		293.7	161.3	47,368		1.087	132,311	3.037
	4.90		294.5	162.1	47,733		1.096	137,066	3.147
	5.00		295.3	162.9	48,099		1.104	141,857	3.257
	5.10		296.1	163.7	48,466		1.113	146,685	3.367
	5.20		296.9	164.5	48,834		1.121	151,550	3.479
	5.30		297.7	165.3	49,204		1.130	156,452	3.592
	5.40		298.5	166.1	49,575		1.138	161,391	3.705
	5.50		299.3	166.9	49,947		1.147	166,367	3.819
	5.60		300.1	167.7	50,321		1.155	171,381	3.934
	5.70		300.9	168.5	50,696		1.164	176,432	4.050
	5.80		301.7	169.3	51,072		1.172	181,520	4.167
Zone 3 (100-year)	5.90		302.5	170.1	51,449		1.181	186,646	4.285
	6.00		303.3	170.9	51,828		1.180	191,810	4.403
	6.10		304.1	171.7	52,208		1.189	197,012	4.523
	6.20		304.9	172.5	52,589		1.207	202,252	4.643
	6.30		305.7	173.3	52,972		1.216	207,530	4.764
	6.40		306.5	174.1	53,356		1.225	212,846	4.886
	6.50		307.3	174.9	53,741		1.234	218,201	5.009
	6.60		308.1	175.7	54,127		1.243	223,594	5.133
	6.70		308.9	176.5	54,515		1.251	229,026	5.258
	6.80		309.7	177.3	54,904		1.260	234,497	5.383
	6.90		310.5	178.1	55,294		1.269	240,007	5.510
	7.00		311.3	178.9	55,686		1.278	245,556	5.637
	7.10		312.1	179.7	56,079		1.287	251,144	5.765
	7.20		312.9	180.5	56,473		1.296	256,772	5.895
	7.30		313.7	181.3	56,868		1.306	262,439	6.025
	7.40		314.5	182.1	57,265		1.315	268,146	6.156
	7.50		315.3	182.9	57,663		1.324	273,892	6.288
	7.60		316.1	183.7	58,062		1.333	279,678	6.421
	7.70		316.9	184.5	58,462		1.342	285,504	6.554
	7.80		317.7	185.3	58,864		1.351	291,371	6.689
	7.90		318.5	186.1	59,267		1.361	297,277	6.825
	8.00		319.3	186.9	59,671		1.370	303,224	6.961
	8.10		320.1	187.7	60,077		1.379	309,212	7.099
	8.20		320.9	188.5	60,484		1.389	315,240	7.237
	8.30		321.7	189.3	60,892		1.398	321,308	7.376
	8.40		322.5	190.1	61,301		1.407	327,418	7.516
	8.50		323.3	190.9	61,712		1.417	333,569	7.658
	8.60		324.1	191.7	62,124		1.426	339,760	7.800
	8.70		324.9	192.5	62,537		1.436	345,994	7.943
	8.80		325.7	193.3	62,952		1.445	352,269	8.087
	8.90		326.5	194.1	63,368		1.455	358,584	8.232
	9.00		327.3	194.9	63,785		1.464	364,942	8.378
	9.10		328.1	195.7	64,203		1.474	371,341	8.525
	9.20		328.9	196.5	64,623		1.484	377,782	8.673
	9.30		329.7	197.3	65,044		1.493	384,266	8.822
	9.40		330.5	198.1	65,466		1.503	390,791	8.971
	9.50		331.3	198.9	65,890		1.513	397,359	9.122
	9.60		332.1	199.7	66,315		1.522	403,969	9.274
	9.70		332.9	200.5	66,741		1.532	410,622	9.427

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

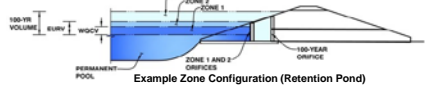
UD-Detention, Version 3.07 (February 2017)



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A6**



Example Zone Configuration (Retention Pond)

**Required Volume Calculation**

Selected BMP Type =	<b>EDB</b>
Watershed Area =	47.98 acres
Watershed Length =	1,777 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	3.50% percent
Percentage Hydrologic Soil Group A =	5.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	95.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQCv) =	0.103 acre-feet
Excess Urban Runoff Volume (EURV) =	0.127 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.103 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.405 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	5.636 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.096 acre-feet
Approximate 5-yr Detention Volume =	0.392 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	1.092 acre-feet

<b>Optional User Override 1-hr Precipitation</b>	
1.19	inches
1.50	inches
2.52	inches

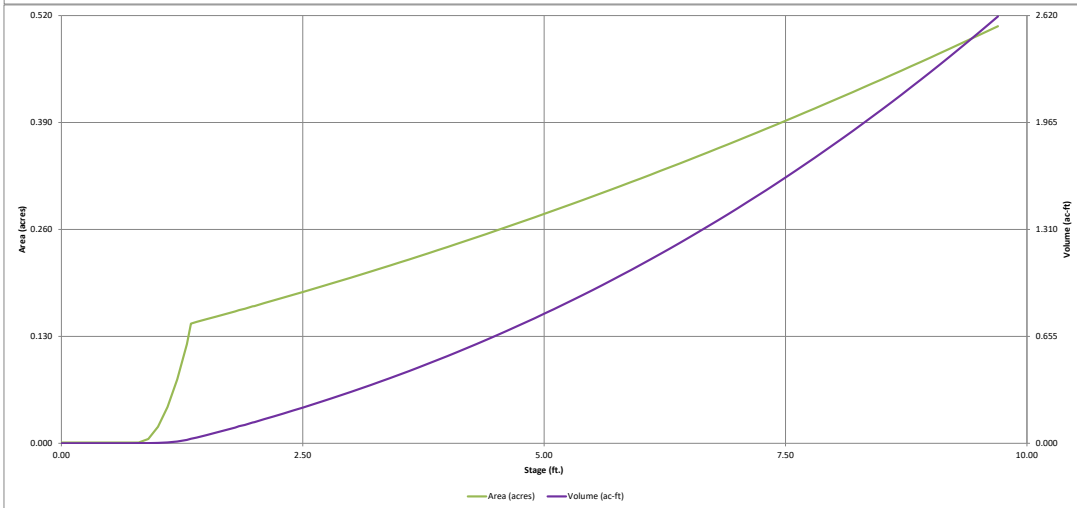
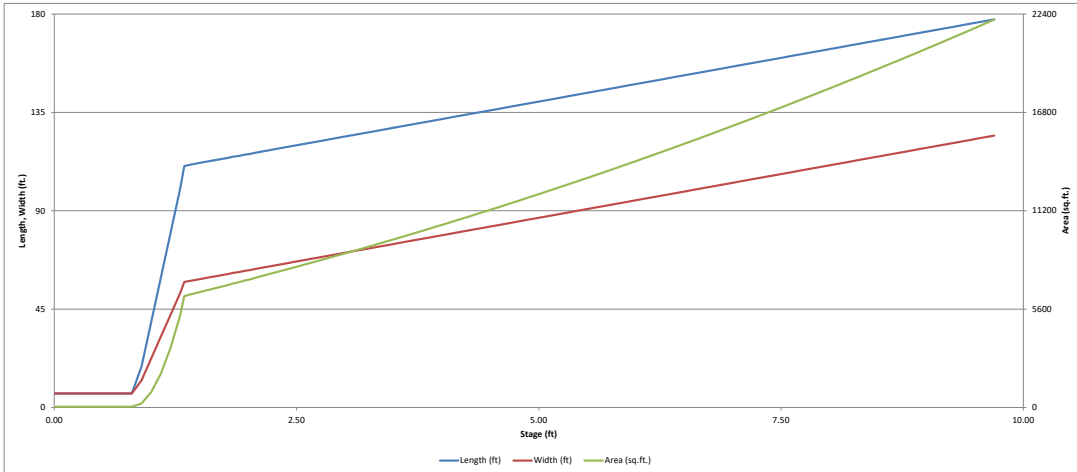
**Stage-Storage Calculation**

Zone 1 Volume (WQCv) =	0.103 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.023 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.965 acre-feet
Total Detention Basin Volume =	1.092 acre-feet
Initial Surcharge Volume (ISV) =	14 ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2
Initial Surcharge Area (A <sub>ISV</sub> ) =	41 ft <sup>2</sup>
Surcharge Volume Length (L <sub>SV</sub> ) =	6.4 ft
Surcharge Volume Width (W <sub>SV</sub> ) =	6.4 ft
Depth of Basin Floor (H <sub>100D</sub> ) =	0.51 ft
Length of Basin Floor (W <sub>100D</sub> ) =	110.7 ft
Width of Basin Floor (W <sub>100D</sub> ) =	57.5 ft
Area of Basin Floor (A <sub>100D</sub> ) =	6,367 ft <sup>2</sup>
Volume of Basin Floor (V <sub>100D</sub> ) =	1,179 ft <sup>3</sup>
Depth of Main Basin (H <sub>main</sub> ) =	4.66 ft
Length of Main Basin (L <sub>main</sub> ) =	148.0 ft
Width of Main Basin (W <sub>main</sub> ) =	94.8 ft
Area of Main Basin (A <sub>main</sub> ) =	14,025 ft <sup>2</sup>
Volume of Main Basin (V <sub>main</sub> ) =	46,342 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	1.092 acre-feet

Depth Increment =		0.1		ft					
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (ft <sup>2</sup> )	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>									
<b>ISV</b>									
	0.00		6.4	6.4	41		0.001		
	0.33		6.4	6.4	41		0.001	13	0.000
	0.40		6.4	6.4	41		0.001	16	0.000
	0.50		6.4	6.4	41		0.001	20	0.000
	0.60		6.4	6.4	41		0.001	24	0.001
	0.70		6.4	6.4	41		0.001	28	0.001
	0.80		6.4	6.4	41		0.001	32	0.001
	0.90		18.6	12.4	231		0.005	41	0.001
	1.00		39.0	22.4	875		0.020	93	0.002
	1.10		59.4	32.4	1,926		0.044	230	0.005
	1.20		79.8	42.4	3,385		0.078	492	0.011
	1.30		100.2	52.4	5,253		0.121	921	0.021
<b>Floor</b>									
	1.34		110.4	57.4	6,340		0.146	1,210	0.028
	1.40		111.1	57.9	6,433		0.148	1,530	0.035
	1.50		111.9	58.7	6,568		0.151	2,180	0.050
	1.60		112.7	59.5	6,706		0.154	2,844	0.065
	1.70		113.5	60.3	6,844		0.157	3,621	0.081
	1.80		114.3	61.1	6,984		0.160	4,212	0.097
<b>Zone 1 (WQCv)</b>									
	1.84		114.7	61.5	7,054		0.162	4,563	0.105
	1.90		115.1	61.9	7,125		0.164	4,918	0.113
<b>Zone 2 (EURV)</b>									
	1.98		115.8	62.6	7,253		0.166	5,565	0.128
	2.00		115.9	62.7	7,267		0.167	5,637	0.129
	2.10		116.8	63.6	7,425		0.170	6,445	0.148
	2.20		117.6	64.4	7,570		0.174	7,195	0.165
	2.30		118.4	65.2	7,716		0.177	7,959	0.183
	2.40		119.2	66.0	7,863		0.181	8,738	0.201
	2.50		120.0	66.8	8,012		0.184	9,532	0.219
	2.60		120.8	67.6	8,162		0.187	10,341	0.237
	2.70		121.6	68.4	8,313		0.191	11,165	0.256
	2.80		122.4	69.2	8,466		0.194	12,004	0.276
	2.90		123.2	70.0	8,620		0.198	12,858	0.295
	3.00		124.0	70.8	8,775		0.201	13,728	0.315
	3.10		124.8	71.6	8,932		0.205	14,613	0.335
	3.20		125.6	72.4	9,089		0.209	15,514	0.356
	3.30		126.4	73.2	9,248		0.212	16,431	0.377
	3.40		127.2	74.0	9,409		0.216	17,364	0.399
	3.50		128.0	74.8	9,570		0.220	18,313	0.420
	3.60		128.8	75.6	9,733		0.223	19,278	0.443
	3.70		129.6	76.4	9,897		0.227	20,259	0.465
	3.80		130.4	77.2	10,062		0.231	21,257	0.488
	3.90		131.2	78.0	10,229		0.235	22,272	0.511
	4.00		132.0	78.8	10,397		0.239	23,303	0.535
	4.10		132.8	79.6	10,566		0.243	24,351	0.559
	4.20		133.6	80.4	10,737		0.246	25,416	0.583
	4.30		134.4	81.2	10,909		0.250	26,499	0.608
	4.40		135.2	82.0	11,082		0.254	27,598	0.634
	4.50		136.0	82.8	11,256		0.258	28,715	0.659
	4.60		136.8	83.6	11,432		0.262	29,849	0.685
	4.70		137.6	84.4	11,609		0.266	31,001	0.712
	4.80		138.4	85.2	11,787		0.271	32,171	0.739
	4.90		139.2	86.0	11,966		0.275	33,359	0.766
	5.00		140.0	86.8	12,147		0.279	34,564	0.793
	5.10		140.8	87.6	12,329		0.283	35,788	0.822
	5.20		141.6	88.4	12,512		0.287	37,030	0.850
	5.30		142.4	89.2	12,697		0.291	38,291	0.879
	5.40		143.2	90.0	12,883		0.296	39,570	0.908
	5.50		144.0	90.8	13,070		0.300	40,867	0.938
	5.60		144.8	91.6	13,259		0.304	42,184	0.968
	5.70		145.6	92.4	13,448		0.309	43,519	0.999
	5.80		146.4	93.2	13,639		0.313	44,874	1.030
	5.90		147.2	94.0	13,832		0.318	46,247	1.062
<b>Zone 3 (100-year)</b>									
	6.00		148.0	94.8	14,025		0.322	47,640	1.094
	6.10		148.8	95.6	14,220		0.326	49,052	1.126
	6.20		149.6	96.4	14,416		0.331	50,484	1.159
	6.30		150.4	97.2	14,613		0.335	51,935	1.192
	6.40		151.2	98.0	14,812		0.340	53,407	1.226
	6.50		152.0	98.8	15,012		0.345	54,898	1.260
	6.60		152.8	99.6	15,213		0.349	56,409	1.295
	6.70		153.6	100.4	15,416		0.354	57,941	1.330
	6.80		154.4	101.2	15,620		0.359	59,492	1.366
	6.90		155.2	102.0	15,825		0.363	61,065	1.402
	7.00		156.0	102.8	16,031		0.368	62,657	1.438
	7.10		156.8	103.6	16,239		0.373	64,271	1.475
	7.20		157.6	104.4	16,448		0.378	65,905	1.513
	7.30		158.4	105.2	16,658		0.382	67,560	1.551
	7.40		159.2	106.0	16,869		0.387	69,237	1.589
	7.50		160.0	106.8	17,082		0.392	70,934	1.628
	7.60		160.8	107.6	17,296		0.397	72,653	1.668
	7.70		161.6	108.4	17,511		0.402	74,394	1.708
	7.80		162.4	109.2	17,728		0.407	76,156	1.748
	7.90		163.2	110.0	17,946		0.412	77,939	1.789
	8.00		164.0	110.8	18,165		0.417	79,745	1.831
	8.10		164.8	111.6	18,386		0.422	81,572	1.873
	8.20		165.6	112.4	18,607		0.427	83,422	1.915
	8.30		166.4	113.2	18,830		0.432	85,294	1.958
	8.40		167.2	114.0	19,055		0.437	87,189	2.002
	8.50		168.0	114.8	19,280		0.443	89,105	2.046
	8.60		168.8	115.6	19,507		0.448	91,044	2.090
	8.70		169.6	116.4	19,735		0.453	93,006	2.135
	8.80		170.4	117.2	19,964		0.458	94,991	2.181
	8.90		171.2	118.0	20,195		0.464	96,999	2.227
	9.00		172.0	118.8	20,427		0.469	99,030	2.273
	9.10		172.8	119.6	20,660		0.474	101,084	2.321
	9.20		173.6	120.4	20,895		0.480	103,162	2.368
	9.30		174.4	121.2	21,131		0.485	105,263	2.417
	9.40		175.2	122.0	21,368		0.491	107,388	2.465
	9.50		176.0	122.8	21,606		0.496	109,537	2.515
	9.60		176.8	123.6	21,846		0.502	111,710	2.565
	9.70		177.6	124.4	22,087		0.507	113,906	2.615

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

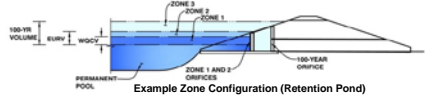




## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A7**



Example Zone Configuration (Retention Pond)

### Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	59.68 acres
Watershed Length =	2,133 ft
Watershed Slope =	0.013 ft/ft
Watershed Imperviousness =	4.20% 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 WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.153 acre-feet
Excess Urban Runoff Volume (EURV) =	0.195 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.161 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.577 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	7.321 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.150 acre-feet
Approximate 5-yr Detention Volume =	0.556 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	1.498 acre-feet

Optional User Override	1-hr Precipitation
	1.19 inches
	1.50 inches
	2.52 inches

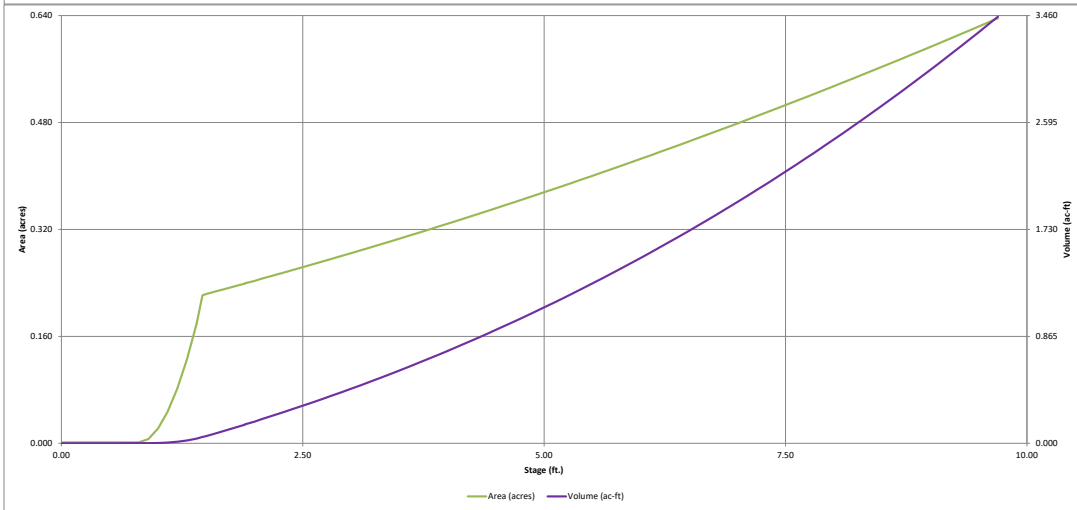
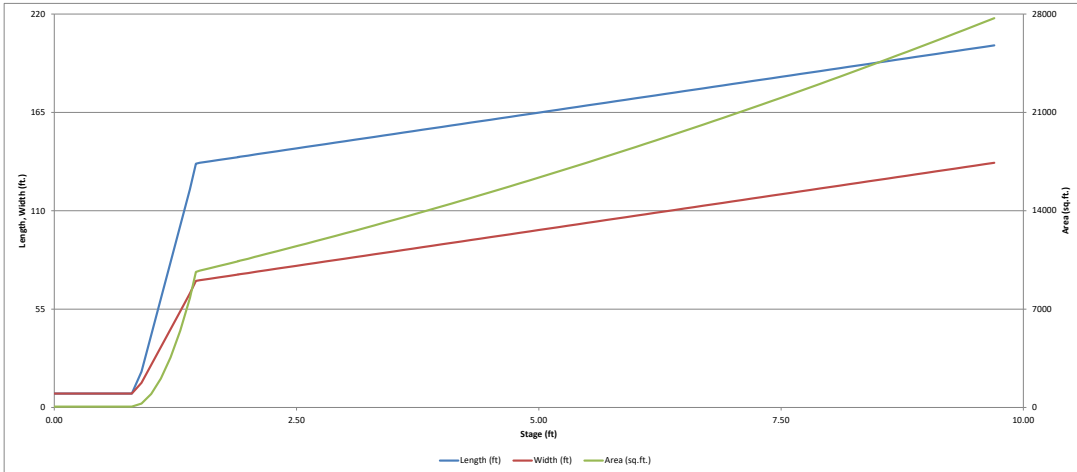
### Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.153 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.042 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.303 acre-feet
Total Detention Basin Volume =	1.498 acre-feet
Initial Surcharge Volume (ISV) =	20 ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>BL</sub> ) =	2
Initial Surcharge Area (A <sub>ISV</sub> ) =	61 ft <sup>2</sup>
Surcharge Volume Length (L <sub>SV</sub> ) =	7.8 ft
Surcharge Volume Width (W <sub>SV</sub> ) =	7.8 ft
Depth of Basin Floor (H <sub>100yr</sub> ) =	0.63 ft
Length of Basin Floor (L <sub>100yr</sub> ) =	136.6 ft
Width of Basin Floor (W <sub>100yr</sub> ) =	70.9 ft
Area of Basin Floor (A <sub>100yr</sub> ) =	9,687 ft <sup>2</sup>
Volume of Basin Floor (V <sub>100yr</sub> ) =	2,213 ft <sup>3</sup>
Depth of Main Basin (H <sub>main</sub> ) =	4.54 ft
Length of Main Basin (L <sub>main</sub> ) =	172.9 ft
Width of Main Basin (W <sub>main</sub> ) =	107.2 ft
Area of Main Basin (A <sub>main</sub> ) =	18,539 ft <sup>2</sup>
Volume of Main Basin (V <sub>main</sub> ) =	62,975 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	1,498 acre-feet

Depth Increment =		0.1		ft					
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (ft <sup>2</sup> )	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		7.8	7.8	61		0.001		
ISV	0.33		7.8	7.8	61		0.001	19	0.000
	0.40		7.8	7.8	61		0.001	24	0.001
	0.50		7.8	7.8	61		0.001	30	0.001
	0.60		7.8	7.8	61		0.001	36	0.001
	0.70		7.8	7.8	61		0.001	42	0.001
	0.80		7.8	7.8	61		0.001	48	0.001
	0.90		20.0	13.8	276		0.006	60	0.001
	1.00		40.4	23.8	961		0.022	118	0.003
	1.10		60.8	33.8	2,054		0.047	265	0.006
	1.20		81.2	43.8	3,556		0.082	543	0.012
	1.30		101.6	53.8	5,465		0.125	990	0.023
	1.40		122.0	63.8	7,782		0.179	1,649	0.038
Floor	1.46		136.3	70.8	9,647		0.221	2,258	0.052
	1.50		136.8	71.1	9,734		0.223	2,549	0.059
	1.60		137.6	71.9	9,901		0.227	3,631	0.081
	1.70		138.4	72.7	10,069		0.231	4,629	0.104
	1.80		139.2	73.5	10,239		0.235	5,545	0.127
	1.90		140.0	74.3	10,410		0.239	6,577	0.151
Zone 1 (WQC)	1.90		140.1	74.4	10,427		0.239	6,681	0.153
	2.00		140.8	75.1	10,582		0.243	7,627	0.175
Zone 2 (EURV)	2.07		141.5	75.8	10,721		0.246	8,479	0.195
	2.10		141.7	76.0	10,773		0.247	8,801	0.202
	2.20		142.5	76.8	10,948		0.251	9,887	0.227
	2.30		143.3	77.6	11,124		0.255	10,991	0.252
	2.40		144.1	78.4	11,301		0.259	12,112	0.278
	2.50		144.9	79.2	11,480		0.264	13,251	0.304
	2.60		145.7	80.0	11,660		0.268	14,408	0.331
	2.70		146.5	80.8	11,841		0.272	15,583	0.358
	2.80		147.3	81.6	12,023		0.276	16,776	0.385
	2.90		148.1	82.4	12,207		0.280	17,988	0.413
	3.00		148.9	83.2	12,392		0.284	19,218	0.441
	3.10		149.7	84.0	12,578		0.289	20,466	0.470
	3.20		150.5	84.8	12,766		0.293	21,733	0.499
	3.30		151.3	85.6	12,955		0.297	23,019	0.528
	3.40		152.1	86.4	13,145		0.302	24,324	0.558
	3.50		152.9	87.2	13,337		0.306	25,648	0.589
	3.60		153.7	88.0	13,529		0.311	26,991	0.620
	3.70		154.5	88.8	13,723		0.315	28,354	0.651
	3.80		155.3	89.6	13,919		0.320	29,736	0.683
	3.90		156.1	90.4	14,115		0.324	31,138	0.715
	4.00		156.9	91.2	14,313		0.329	32,560	0.747
	4.10		157.7	92.0	14,512		0.333	34,001	0.781
	4.20		158.5	92.8	14,713		0.338	35,462	0.814
	4.30		159.3	93.6	14,914		0.342	36,943	0.848
	4.40		160.1	94.4	15,117		0.347	38,445	0.883
	4.50		160.9	95.2	15,322		0.352	39,967	0.918
	4.60		161.7	96.0	15,527		0.356	41,509	0.953
	4.70		162.5	96.8	15,734		0.361	43,072	0.989
	4.80		163.3	97.6	15,942		0.366	44,656	1.025
	4.90		164.1	98.4	16,151		0.371	46,261	1.062
	5.00		164.9	99.2	16,362		0.376	47,887	1.099
	5.10		165.7	100.0	16,574		0.380	49,533	1.137
	5.20		166.5	100.8	16,787		0.385	51,201	1.175
	5.30		167.3	101.6	17,002		0.390	52,891	1.214
	5.40		168.1	102.4	17,218		0.395	54,602	1.253
	5.50		168.9	103.2	17,435		0.400	56,334	1.293
	5.60		169.7	104.0	17,653		0.405	58,089	1.334
	5.70		170.5	104.8	17,873		0.410	59,865	1.374
	5.80		171.3	105.6	18,093		0.415	61,663	1.416
	5.90		172.1	106.4	18,316		0.420	63,484	1.457
	6.00		172.9	107.2	18,539		0.426	65,326	1.500
Zone 3 (100-year)	6.10		173.7	108.0	18,764		0.431	67,192	1.543
	6.20		174.5	108.8	18,990		0.436	69,079	1.586
	6.30		175.3	109.6	19,217		0.441	70,990	1.630
	6.40		176.1	110.4	19,446		0.446	72,923	1.674
	6.50		176.9	111.2	19,676		0.452	74,879	1.719
	6.60		177.7	112.0	19,907		0.457	76,858	1.764
	6.70		178.5	112.8	20,139		0.462	78,860	1.810
	6.80		179.3	113.6	20,373		0.468	80,886	1.857
	6.90		180.1	114.4	20,608		0.473	82,935	1.904
	7.00		180.9	115.2	20,844		0.479	85,007	1.951
	7.10		181.7	116.0	21,082		0.484	87,104	2.000
	7.20		182.5	116.8	21,320		0.489	89,224	2.048
	7.30		183.3	117.6	21,560		0.495	91,368	2.098
	7.40		184.1	118.4	21,802		0.501	93,536	2.147
	7.50		184.9	119.2	22,045		0.506	95,728	2.198
	7.60		185.7	120.0	22,288		0.512	97,945	2.249
	7.70		186.5	120.8	22,534		0.517	100,186	2.300
	7.80		187.3	121.6	22,780		0.523	102,452	2.352
	7.90		188.1	122.4	23,028		0.529	104,742	2.405
	8.00		188.9	123.2	23,277		0.534	107,057	2.458
	8.10		189.7	124.0	23,527		0.540	109,397	2.511
	8.20		190.5	124.8	23,779		0.546	111,763	2.566
	8.30		191.3	125.6	24,032		0.552	114,153	2.621
	8.40		192.1	126.4	24,286		0.558	116,569	2.676
	8.50		192.9	127.2	24,541		0.563	119,010	2.732
	8.60		193.7	128.0	24,798		0.569	121,477	2.789
	8.70		194.5	128.8	25,056		0.575	123,970	2.846
	8.80		195.3	129.6	25,316		0.581	126,489	2.904
	8.90		196.1	130.4	25,576		0.587	129,033	2.962
	9.00		196.9	131.2	25,838		0.593	131,604	3.021
	9.10		197.7	132.0	26,101		0.599	134,201	3.081
	9.20		198.5	132.8	26,366		0.605	136,824	3.141
	9.30		199.3	133.6	26,631		0.611	139,474	3.202
	9.40		200.1	134.4	26,898		0.617	142,151	3.263
	9.50		200.9	135.2	27,166		0.624	144,854	3.325
	9.60		201.7	136.0	27,436		0.630	147,584	3.388
	9.70		202.5	136.8	27,707		0.636	150,341	3.451

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

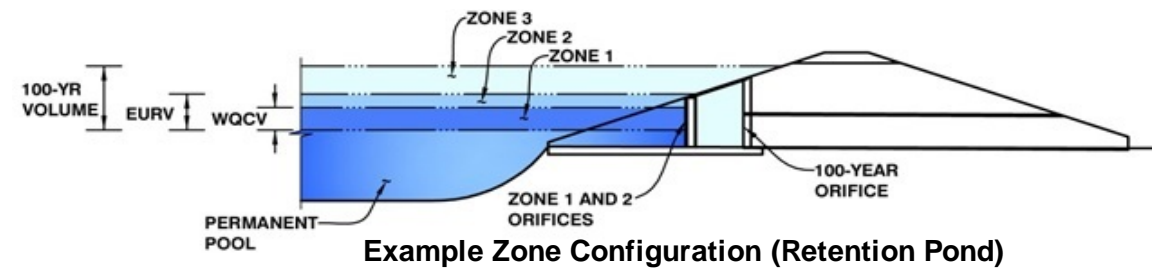
UD-Detention, Version 3.07 (February 2017)



**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A8**



**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	87.81	acres
Watershed Length =	2,421	ft
Watershed Slope =	0.024	ft/ft
Watershed Imperviousness =	3.90%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.210	acre-feet
Excess Urban Runoff Volume (EURV) =	0.264	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.218	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.816	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	10.745	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.203	acre-feet
Approximate 5-yr Detention Volume =	0.788	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	2.136	acre-feet

<b>Optional User Override</b>	
<b>1-hr Precipitation</b>	
	1.19 inches
	1.50 inches
	inches
	inches
	inches
	2.52 inches
	inches

**Stage-Storage Calculation**

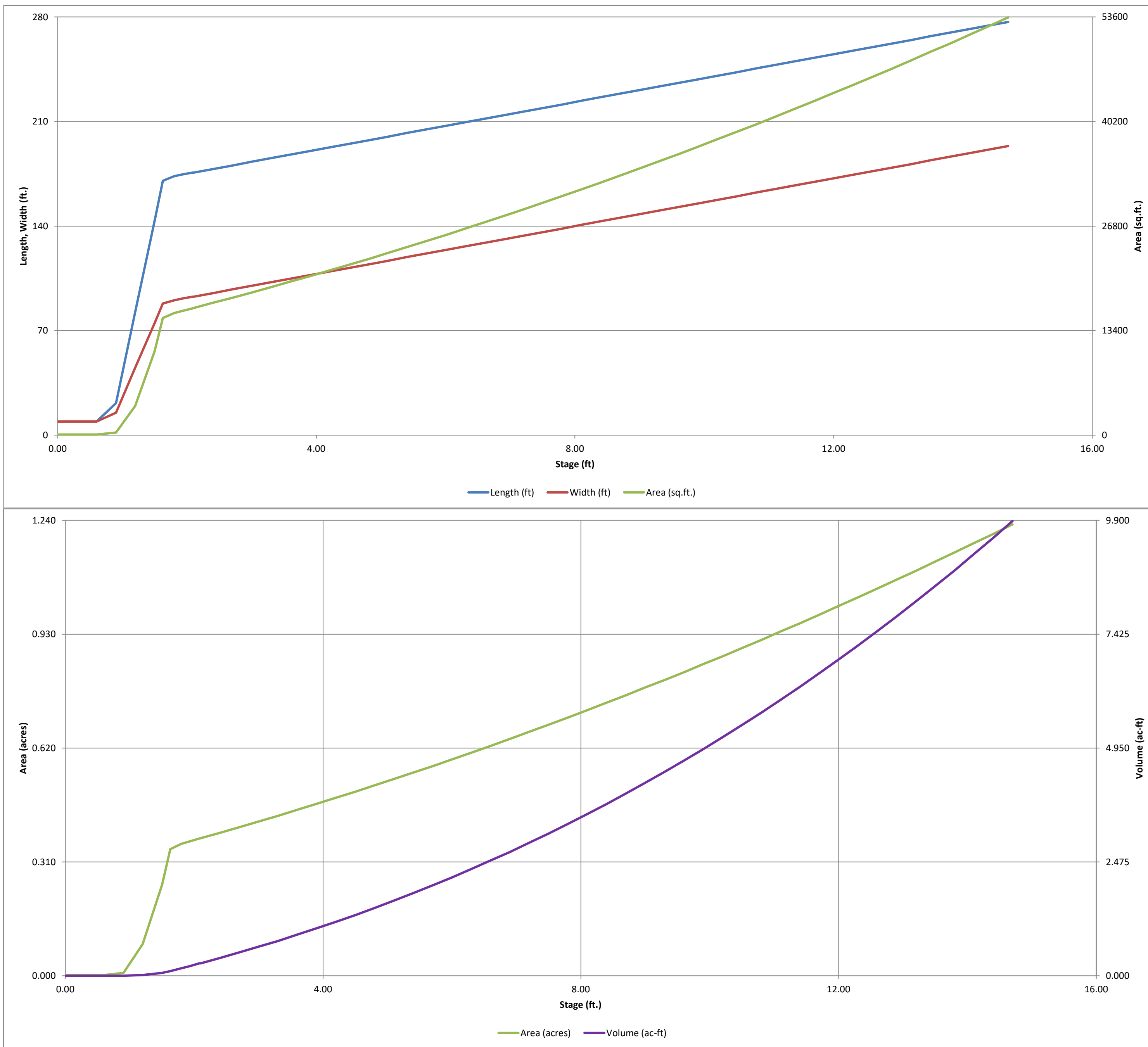
Zone 1 Volume (WQCV) =	0.210	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.054	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.871	acre-feet
Total Detention Basin Volume =	2.136	acre-feet
Initial Surcharge Volume (ISV) =	27	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	83	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	9.1	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	9.1	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.80	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	172.0	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	89.0	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	15,306	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	4,397	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.37	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	207.0	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	123.9	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	25,657	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	88,563	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	2,136	acre-feet

Depth Increment = 0.3 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		9.1	9.1	83		0.002		
<b>ISV</b>	0.33		9.1	9.1	83		0.002	27	0.001
	0.60		9.1	9.1	83		0.002	49	0.001
	0.90		21.4	15.1	323		0.007	80	0.002
	1.20		82.6	45.1	3,724		0.085	596	0.014
	1.50		143.8	75.1	10,798		0.248	2,682	0.062
<b>Floor</b>	1.63		170.3	88.1	15,003		0.344	4,352	0.100
	1.80		173.3	90.3	15,645		0.359	6,980	0.160
<b>Zone 1 (WQCV)</b>	1.93		174.4	91.4	15,941		0.366	9,191	0.211
<b>Zone 2 (EURV)</b>	2.08		175.6	92.6	16,262		0.373	11,606	0.266
	2.10		175.8	92.7	16,305		0.374	11,931	0.274
	2.40		178.2	95.1	16,955		0.389	16,920	0.388
	2.70		180.6	97.5	17,617		0.404	22,105	0.507
	3.00		183.0	99.9	18,290		0.420	27,491	0.631
	3.30		185.4	102.3	18,975		0.436	33,080	0.759
	3.60		187.8	104.7	19,671		0.452	38,877	0.892
	3.90		190.2	107.1	20,379		0.468	44,884	1.030
	4.20		192.6	109.5	21,098		0.484	51,106	1.173
	4.50		195.0	111.9	21,829		0.501	57,544	1.321
	4.80		197.4	114.3	22,572		0.518	64,204	1.474
	5.10		199.8	116.7	23,326		0.535	71,088	1.632
	5.40		202.2	119.1	24,091		0.553	78,201	1.795
	5.70		204.6	121.5	24,868		0.571	85,544	1.964
<b>Zone 3 (100-year)</b>	6.00		207.0	123.9	25,657		0.589	93,123	2.138
	6.30		209.4	126.3	26,457		0.607	100,939	2.317
	6.60		211.8	128.7	27,268		0.626	108,998	2.502
	6.90		214.2	131.1	28,091		0.645	117,301	2.693
	7.20		216.6	133.5	28,926		0.664	125,854	2.889
	7.50		219.0	135.9	29,772		0.683	134,658	3.091
	7.80		221.4	138.3	30,629		0.703	143,718	3.299
	8.10		223.8	140.7	31,499		0.723	153,037	3.513
	8.40		226.2	143.1	32,379		0.743	162,618	3.733
	8.70		228.6	145.5	33,271		0.764	172,466	3.959
	9.00		231.0	147.9	34,175		0.785	182,582	4.192
	9.30		233.4	150.3	35,090		0.806	192,972	4.430
	9.60		235.8	152.7	36,017		0.827	203,638	4.675
	9.90		238.2	155.1	36,955		0.848	214,583	4.926
	10.20		240.6	157.5	37,905		0.870	225,812	5.184
	10.50		243.0	159.9	38,867		0.892	237,328	5.448
	10.80		245.4	162.3	39,839		0.915	249,133	5.719
	11.10		247.8	164.7	40,824		0.937	261,232	5.997
	11.40		250.2	167.1	41,820		0.960	273,628	6.282
	11.70		252.6	169.5	42,827		0.983	286,325	6.573
	12.00		255.0	171.9	43,846		1.007	299,326	6.872
	12.30		257.4	174.3	44,876		1.030	312,634	7.177
	12.60		259.8	176.7	45,918		1.054	326,253	7.490
	12.90		262.2	179.1	46,972		1.078	340,186	7.810
	13.20		264.6	181.5	48,037		1.103	354,437	8.137
	13.50		267.0	183.9	49,113		1.127	369,009	8.471
	13.80		269.4	186.3	50,201		1.152	383,906	8.813
	14.10		271.8	188.7	51,301		1.178	399,131	9.163
	14.40		274.2	191.1	52,412		1.203	414,688	9.520
	14.70		276.6	193.5	53,534		1.229	430,579	9.885

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

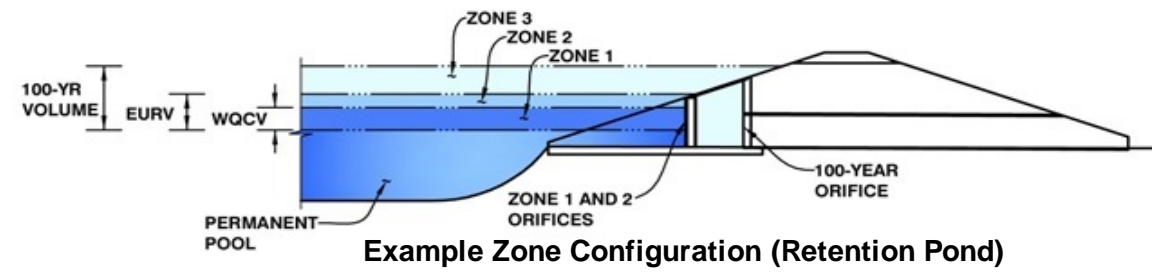
UD-Detention, Version 3.07 (February 2017)



## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A9**



### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	32.86	acres
Watershed Length =	1,854	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	5.20%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.103	acre-feet
Excess Urban Runoff Volume (EURV) =	0.135	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.113	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.358	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.064	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.105	acre-feet
Approximate 5-yr Detention Volume =	0.344	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.903	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

### Stage-Storage Calculation

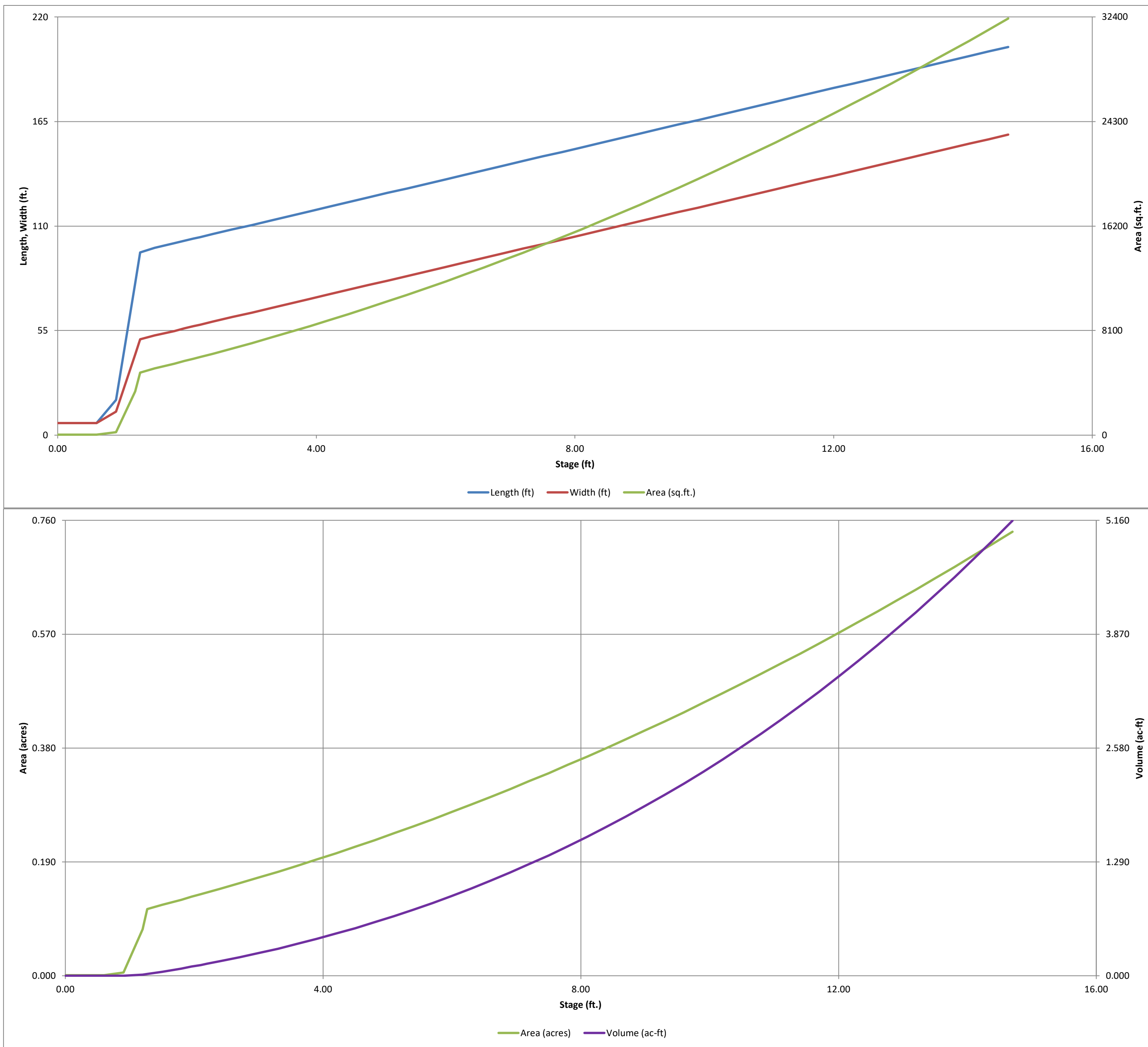
Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.032	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.768	acre-feet
Total Detention Basin Volume =	0.903	acre-feet
Initial Surcharge Volume (ISV) =	13	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	41	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	6.4	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	6.4	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.44	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	96.7	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	50.7	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	4,903	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	796	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.73	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	134.6	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	88.5	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	11,907	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	38,526	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>0.903</b>	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Depth Increment = 0.3 ft									
<b>Top of Micropool</b>	0.00		6.4	6.4	41		0.001		
<b>ISV</b>	0.33		6.4	6.4	41		0.001	13	0.000
	0.60		6.4	6.4	41		0.001	24	0.001
	0.90		18.6	12.4	230		0.005	41	0.001
	1.20		79.8	42.4	3,382		0.078	491	0.011
<b>Floor</b>	1.27		96.1	50.4	4,843		0.111	818	0.019
	1.50		98.5	52.4	5,161		0.118	1,925	0.044
	1.80		100.9	54.8	5,529		0.127	3,528	0.081
<b>Zone 1 (WQCV)</b>	1.96		102.2	56.2	5,743		0.132	4,486	0.103
	2.10		103.4	57.3	5,922		0.136	5,303	0.122
<b>Zone 2 (EURV)</b>	2.20		104.2	58.1	6,051		0.139	5,901	0.135
	2.40		105.8	59.7	6,313		0.145	7,138	0.164
	2.70		108.2	62.1	6,716		0.154	9,092	0.209
	3.00		110.6	64.5	7,130		0.164	11,168	0.256
	3.30		113.0	66.9	7,556		0.173	13,371	0.307
	3.60		115.4	69.3	7,993		0.184	15,703	0.360
	3.90		117.8	71.7	8,442		0.194	18,168	0.417
	4.20		120.2	74.1	8,903		0.204	20,770	0.477
	4.50		122.6	76.5	9,375		0.215	23,511	0.540
	4.80		125.0	78.9	9,858		0.226	26,396	0.606
	5.10		127.4	81.3	10,353		0.238	29,427	0.676
	5.40		129.8	83.7	10,860		0.249	32,609	0.749
	5.70		132.2	86.1	11,378		0.261	35,944	0.825
<b>Zone 3 (100-year)</b>	6.00		134.6	88.5	11,907		0.273	39,437	0.905
	6.30		137.0	90.9	12,449		0.286	43,090	0.989
	6.60		139.4	93.3	13,001		0.298	46,907	1.077
	6.90		141.8	95.7	13,565		0.311	50,892	1.168
	7.20		144.2	98.1	14,141		0.325	55,047	1.264
	7.50		146.6	100.5	14,728		0.338	59,377	1.363
	7.80		149.0	102.9	15,327		0.352	63,885	1.467
	8.10		151.4	105.3	15,937		0.366	68,575	1.574
	8.40		153.8	107.7	16,559		0.380	73,449	1.686
	8.70		156.2	110.1	17,192		0.395	78,511	1.802
	9.00		158.6	112.5	17,837		0.409	83,765	1.923
	9.30		161.0	114.9	18,493		0.425	89,214	2.048
	9.60		163.4	117.3	19,161		0.440	94,862	2.178
	9.90		165.8	119.7	19,840		0.455	100,712	2.312
	10.20		168.2	122.1	20,531		0.471	106,767	2.451
	10.50		170.6	124.5	21,233		0.487	113,032	2.595
	10.80		173.0	126.9	21,947		0.504	119,508	2.744
	11.10		175.4	129.3	22,673		0.520	126,201	2.897
	11.40		177.8	131.7	23,410		0.537	133,113	3.056
	11.70		180.2	134.1	24,158		0.555	140,248	3.220
	12.00		182.6	136.5	24,918		0.572	147,609	3.389
	12.30		185.0	138.9	25,689		0.590	155,200	3.563
	12.60		187.4	141.3	26,472		0.608	163,024	3.743
	12.90		189.8	143.7	27,267		0.626	171,085	3.928
	13.20		192.2	146.1	28,073		0.644	179,385	4.118
	13.50		194.6	148.5	28,891		0.663	187,929	4.314
	13.80		197.0	150.9	29,720		0.682	196,721	4.516
	14.10		199.4	153.3	30,560		0.702	205,762	4.724
	14.40		201.8	155.7	31,412		0.721	215,058	4.937
	14.70		204.2	158.1	32,276		0.741	224,611	5.156



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

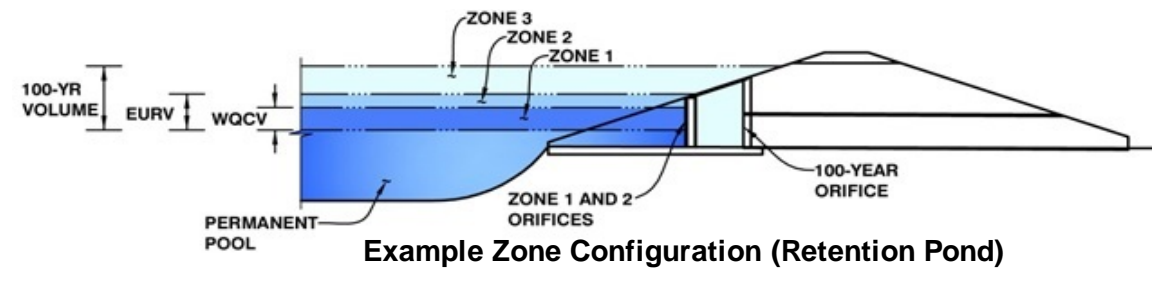
UD-Detention, Version 3.07 (February 2017)



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**  
Basin ID: **A10**



Example Zone Configuration (Retention Pond)

### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	263.34	acres
Watershed Length =	7.992	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	3.50%	percent
Percentage Hydrologic Soil Group A =	5.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	95.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.568	acre-feet
Excess Urban Runoff Volume (EURV) =	0.695	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.565	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.225	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	30.934	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.526	acre-feet
Approximate 5-yr Detention Volume =	2.150	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.991	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

### Stage-Storage Calculation

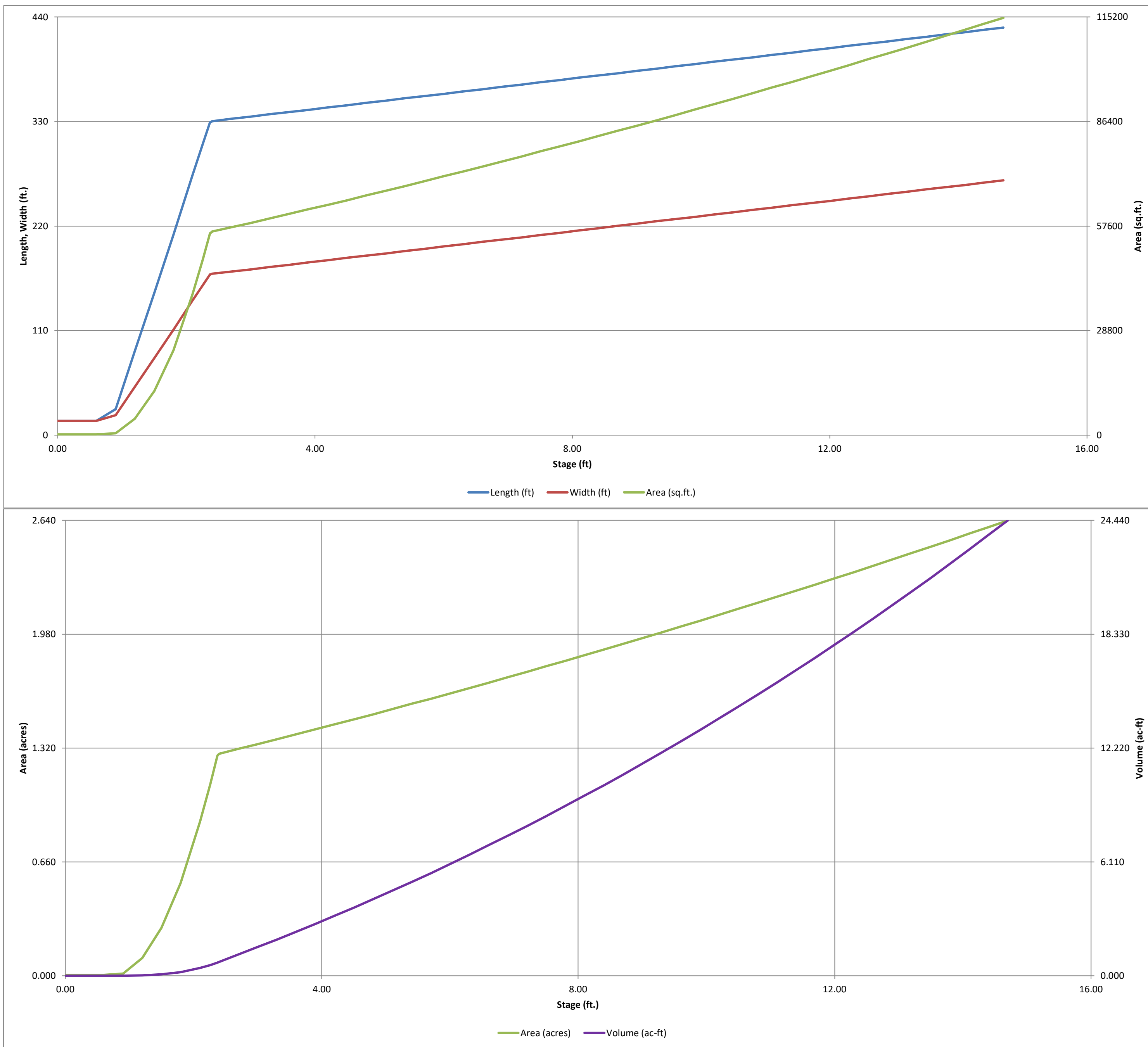
Zone 1 Volume (WQCV) =	0.568	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.297	acre-feet
Total Detention Basin Volume =	5.991	acre-feet
Initial Surcharge Volume (ISV) =	74	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	225	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	15.0	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	15.0	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	1.54	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	330.1	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	169.5	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	55,951	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	30,753	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	3.63	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	359.1	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	198.5	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	71,281	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	230,060	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	5,992	acre-feet

Depth Increment = 0.3 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		15.0	15.0	225		0.005		
<b>ISV</b>	0.33		15.0	15.0	225		0.005	72	0.002
	0.60		15.0	15.0	225		0.005	133	0.003
	0.90		27.2	21.0	572		0.013	210	0.005
	1.20		88.4	51.0	4,510		0.104	880	0.020
	1.50		149.6	81.0	12,120		0.278	3,283	0.075
	1.80		210.8	111.0	23,402		0.537	8,520	0.196
	2.10		274.1	142.0	38,918		0.893	18,078	0.415
<b>Zone 1 (WQCV)</b>	2.26		306.7	158.0	48,460		1.112	25,054	0.575
<b>Zone 2 (EURV)</b>	2.37		329.2	169.0	55,627		1.277	30,775	0.706
<b>Floor</b>	2.37		329.2	169.0	55,627		1.277	30,775	0.706
	2.40		330.3	169.7	56,051		1.287	32,453	0.745
	2.70		332.7	172.1	57,257		1.314	49,449	1.135
	3.00		335.1	174.5	58,474		1.342	66,808	1.534
	3.30		337.5	176.9	59,703		1.371	84,535	1.941
	3.60		339.9	179.3	60,944		1.399	102,631	2.356
	3.90		342.3	181.7	62,196		1.428	121,102	2.780
	4.20		344.7	184.1	63,459		1.457	139,950	3.213
	4.50		347.1	186.5	64,734		1.486	159,178	3.654
	4.80		349.5	188.9	66,020		1.516	178,791	4.104
	5.10		351.9	191.3	67,318		1.545	198,792	4.564
	5.40		354.3	193.7	68,628		1.575	219,183	5.032
	5.70		356.7	196.1	69,949		1.606	239,970	5.509
<b>Zone 3 (100-year)</b>	6.00		359.1	198.5	71,281		1.636	261,154	5.995
	6.30		361.5	200.9	72,625		1.667	282,739	6.491
	6.60		363.9	203.3	73,981		1.698	304,730	6.996
	6.90		366.3	205.7	75,348		1.730	327,129	7.510
	7.20		368.7	208.1	76,727		1.761	349,940	8.034
	7.50		371.1	210.5	78,117		1.793	373,166	8.567
	7.80		373.5	212.9	79,518		1.825	396,811	9.110
	8.10		375.9	215.3	80,931		1.858	420,878	9.662
	8.40		378.3	217.7	82,356		1.891	445,371	10.224
	8.70		380.7	220.1	83,792		1.924	470,293	10.796
	9.00		383.1	222.5	85,240		1.957	495,648	11.379
	9.30		385.5	224.9	86,699		1.990	521,438	11.971
	9.60		387.9	227.3	88,170		2.024	547,668	12.573
	9.90		390.3	229.7	89,652		2.058	574,342	13.185
	10.20		392.7	232.1	91,146		2.092	601,461	13.808
	10.50		395.1	234.5	92,651		2.127	629,030	14.441
	10.80		397.5	236.9	94,168		2.162	657,053	15.084
	11.10		399.9	239.3	95,697		2.197	685,532	15.738
	11.40		402.3	241.7	97,237		2.232	714,472	16.402
	11.70		404.7	244.1	98,788		2.268	743,876	17.077
	12.00		407.1	246.5	100,351		2.304	773,746	17.763
	12.30		409.5	248.9	101,925		2.340	804,087	18.459
	12.60		411.9	251.3	103,511		2.376	834,902	19.167
	12.90		414.3	253.7	105,109		2.413	866,195	19.885
	13.20		416.7	256.1	106,718		2.450	897,969	20.615
	13.50		419.1	258.5	108,338		2.487	930,227	21.355
	13.80		421.5	260.9	109,970		2.525	962,973	22.107
	14.10		423.9	263.3	111,614		2.562	996,210	22.870
	14.40		426.3	265.7	113,269		2.600	1,029,942	23.644
	14.70		428.7	268.1	114,936		2.639	1,064,173	24.430

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



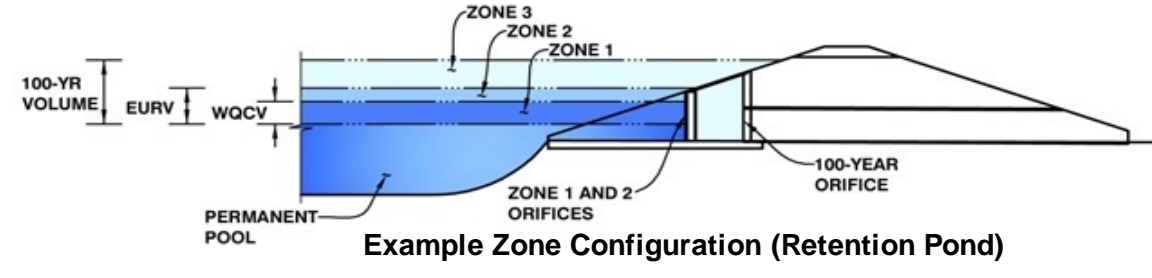


## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A11**



Example Zone Configuration (Retention Pond)

### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	224.01	acres
Watershed Length =	8,048	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	3.70%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.509	acre-feet
Excess Urban Runoff Volume (EURV) =	0.637	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.523	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.028	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	27.367	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.488	acre-feet
Approximate 5-yr Detention Volume =	1.959	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.329	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

### Stage-Storage Calculation

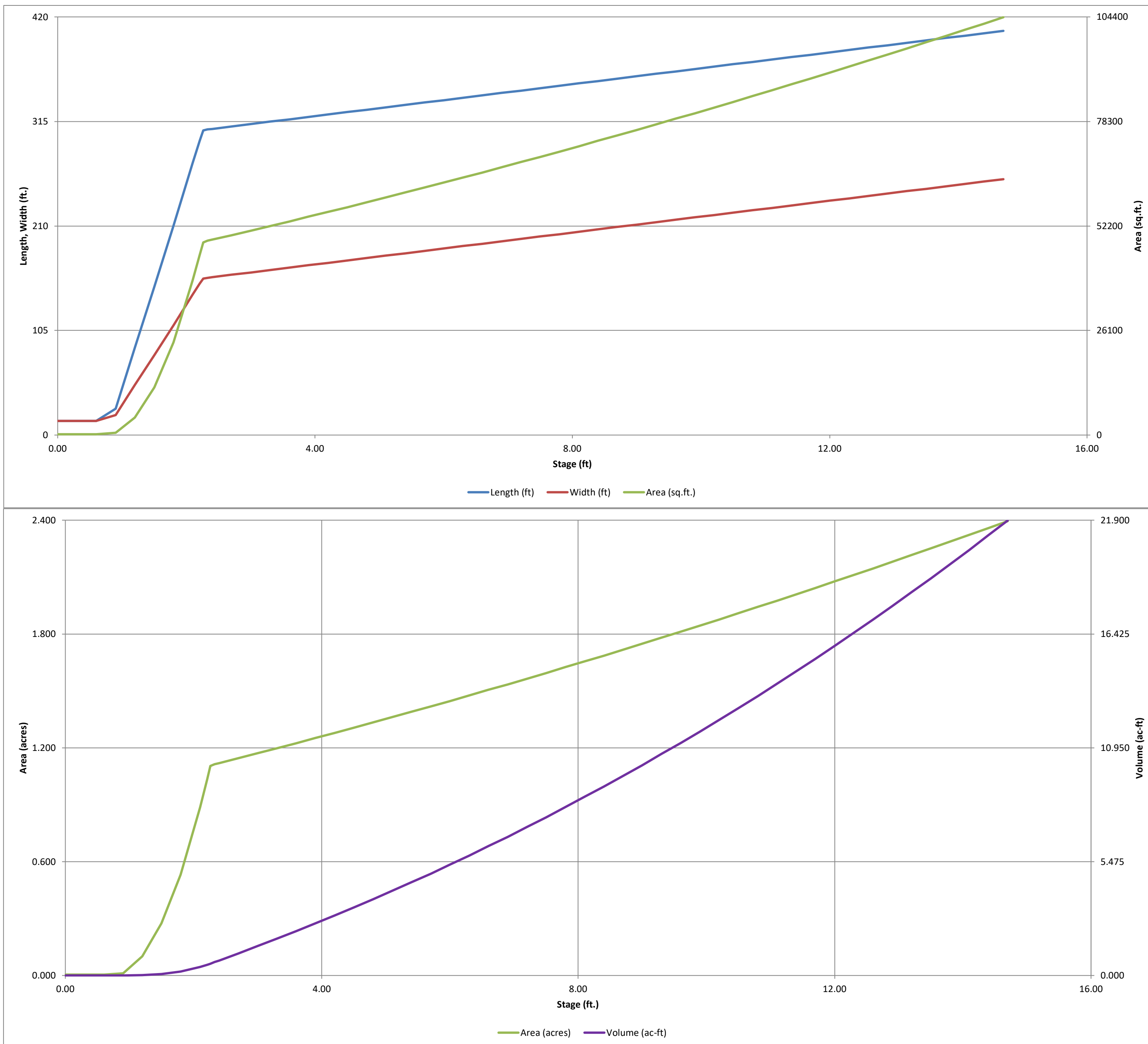
Zone 1 Volume (WQCV) =	0.509	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.692	acre-feet
Total Detention Basin Volume =	5.329	acre-feet
Initial Surcharge Volume (ISV) =	67	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	202	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	14.2	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	14.2	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	1.43	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	306.5	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	157.5	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	48,260	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	24,633	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	3.74	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	336.4	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	187.4	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	63,025	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	207,340	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	5.329	acre-feet

Depth Increment = 0.3 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		14.2	14.2	202		0.005		
<b>ISV</b>	0.33		14.2	14.2	202		0.005	65	0.001
	0.60		14.2	14.2	202		0.005	119	0.003
	0.90		26.4	20.2	534		0.012	189	0.004
	1.20		87.6	50.2	4,400		0.101	837	0.019
	1.50		148.8	80.2	11,937		0.274	3,196	0.073
	1.80		210.0	110.2	23,146		0.531	8,366	0.192
	2.10		273.3	141.2	38,587		0.886	17,834	0.409
<b>Zone 1 (WQCV)</b>	2.21		295.7	152.2	45,009		1.033	22,427	0.515
<b>Floor</b>	2.26		305.9	157.2	48,091		1.104	24,754	0.568
<b>Zone 2 (EURV)</b>	2.33		307.0	158.0	48,510		1.114	28,140	0.646
	2.40		307.6	158.6	48,771		1.120	31,545	0.724
	2.70		310.0	161.0	49,895		1.145	46,344	1.064
	3.00		312.4	163.4	51,031		1.172	61,483	1.411
	3.30		314.8	165.8	52,179		1.198	76,964	1.767
	3.60		317.2	168.2	53,338		1.224	92,791	2.130
	3.90		319.6	170.6	54,508		1.251	108,968	2.502
	4.20		322.0	173.0	55,691		1.278	125,498	2.881
	4.50		324.4	175.4	56,884		1.306	142,383	3.269
	4.80		326.8	177.8	58,089		1.334	159,629	3.665
	5.10		329.2	180.2	59,306		1.361	177,238	4.069
	5.40		331.6	182.6	60,534		1.390	195,214	4.481
	5.70		334.0	185.0	61,774		1.418	213,560	4.903
<b>Zone 3 (100-year)</b>	6.00		336.4	187.4	63,025		1.447	232,279	5.332
	6.30		338.8	189.8	64,288		1.476	251,376	5.771
	6.60		341.2	192.2	65,562		1.505	270,853	6.218
	6.90		343.6	194.6	66,848		1.535	290,714	6.674
	7.20		346.0	197.0	68,145		1.564	310,963	7.139
	7.50		348.4	199.4	69,454		1.594	331,602	7.613
	7.80		350.8	201.8	70,774		1.625	352,636	8.095
	8.10		353.2	204.2	72,106		1.655	374,068	8.587
	8.40		355.6	206.6	73,449		1.686	395,901	9.089
	8.70		358.0	209.0	74,804		1.717	418,139	9.599
	9.00		360.4	211.4	76,171		1.749	440,785	10.119
	9.30		362.8	213.8	77,549		1.780	463,842	10.648
	9.60		365.2	216.2	78,938		1.812	487,315	11.187
	9.90		367.6	218.6	80,339		1.844	511,206	11.736
	10.20		370.0	221.0	81,752		1.877	535,520	12.294
	10.50		372.4	223.4	83,176		1.909	560,258	12.862
	10.80		374.8	225.8	84,611		1.942	585,426	13.440
	11.10		377.2	228.2	86,058		1.976	611,026	14.027
	11.40		379.6	230.6	87,517		2.009	637,062	14.625
	11.70		382.0	233.0	88,987		2.043	663,537	15.233
	12.00		384.4	235.4	90,468		2.077	690,455	15.851
	12.30		386.8	237.8	91,962		2.111	717,820	16.479
	12.60		389.2	240.2	93,466		2.146	745,633	17.117
	12.90		391.6	242.6	94,982		2.180	773,900	17.766
	13.20		394.0	245.0	96,510		2.216	802,624	18.426
	13.50		396.4	247.4	98,049		2.251	831,808	19.096
	13.80		398.8	249.8	99,600		2.287	861,455	19.776
	14.10		401.2	252.2	101,162		2.322	891,569	20.468
	14.40		403.6	254.6	102,736		2.358	922,153	21.170
	14.70		406.0	257.0	104,321		2.395	953,211	21.883

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

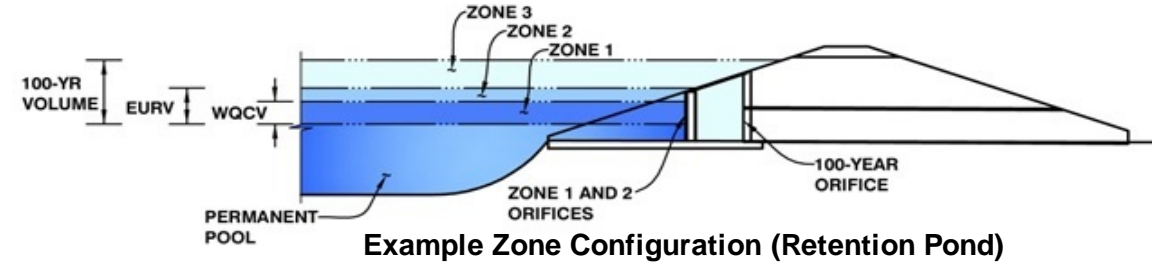


## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A12**



### Required Volume Calculation

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	10.97	acres
Watershed Length =	444	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	6.70%	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 =	User Input	
Water Quality Capture Volume (WQCV) =	0.043	acre-feet
Excess Urban Runoff Volume (EURV) =	0.059	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.050	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.140	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.373	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.047	acre-feet
Approximate 5-yr Detention Volume =	0.134	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.337	acre-feet

Note: L / W Ratio < 1  
L / W Ratio = 0.4

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

### Stage-Storage Calculation

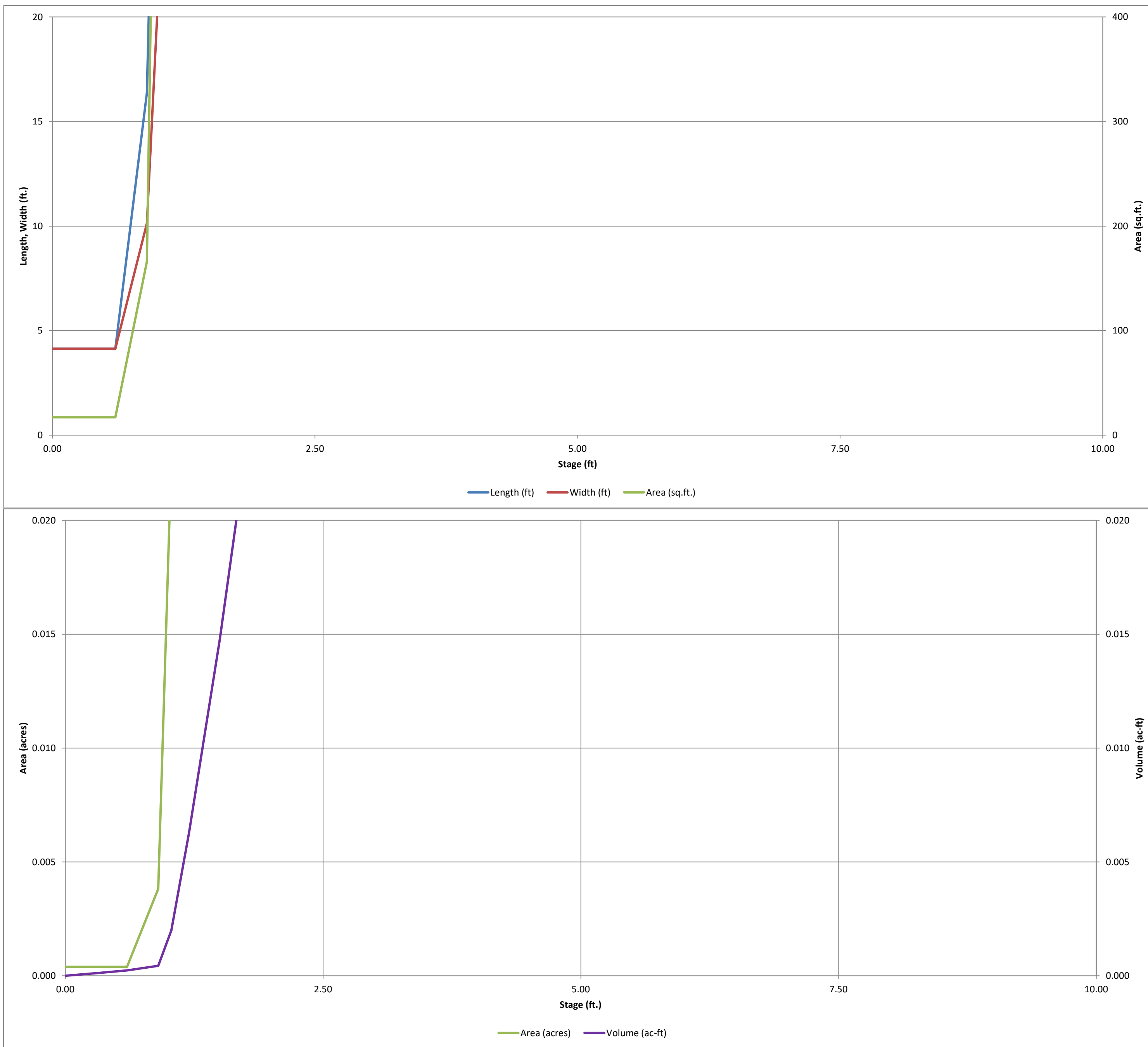
Zone 1 Volume (WQCV) =	0.043	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.016	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.278	acre-feet
Total Detention Basin Volume =	0.337	acre-feet
Initial Surcharge Volume (ISV) =	6	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.005	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	2	
Initial Surcharge Area (A <sub>ISV</sub> ) =	17	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	4.1	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	4.1	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.20	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	44.4	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	23.9	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	1,059	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	80	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.97	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	84.2	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	63.6	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	5,357	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	14,583	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	0.337	acre-feet

Depth Increment = 0.3 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		4.1	4.1	17		0.000		
<b>ISV</b>	0.33		4.1	4.1	17		0.000	5	0.000
	0.60		4.1	4.1	17		0.000	10	0.000
	0.90		16.4	10.1	166		0.004	19	0.000
<b>Floor</b>	1.03		42.9	23.1	992		0.023	87	0.002
	1.20		45.7	25.2	1,150		0.026	274	0.006
	1.50		48.1	27.6	1,325		0.030	645	0.015
	1.80		50.5	30.0	1,513		0.035	1,070	0.025
	2.10		53.0	32.4	1,718		0.039	1,571	0.036
<b>Zone 1 (WQCV)</b>	2.28		54.4	33.9	1,843		0.042	1,891	0.043
	2.40	User Input	55.4	34.8	1,929		0.044	2,118	0.049
<b>Zone 2 (EURV)</b>	2.63		57.2	36.7	2,099		0.048	2,581	0.059
	2.70		57.8	37.2	2,151		0.049	2,729	0.063
	3.00		60.2	39.6	2,385		0.055	3,410	0.078
	3.30		62.6	42.0	2,630		0.060	4,162	0.096
	3.60		65.0	44.4	2,887		0.066	4,989	0.115
	3.90		67.4	46.8	3,156		0.072	5,895	0.135
	4.20		69.8	49.2	3,436		0.079	6,884	0.158
	4.50		72.2	51.6	3,727		0.086	7,958	0.183
	4.80		74.6	54.0	4,030		0.093	9,121	0.209
	5.10		77.0	56.4	4,344		0.100	10,377	0.238
	5.40		79.4	58.8	4,670		0.107	11,729	0.269
	5.70		81.8	61.2	5,008		0.115	13,180	0.303
<b>Zone 3 (100-year)</b>	5.99		84.1	63.6	5,345		0.123	14,681	0.337
	6.00		84.2	63.6	5,357		0.123	14,734	0.338
	6.30		86.6	66.0	5,717		0.131	16,395	0.376
	6.60		89.0	68.4	6,089		0.140	18,166	0.417
	6.90		91.4	70.8	6,473		0.149	20,050	0.460
	7.20		93.8	73.2	6,868		0.158	22,050	0.506
	7.50		96.2	75.6	7,274		0.167	24,171	0.555
	7.80		98.6	78.0	7,692		0.177	26,416	0.606
	8.10		101.0	80.4	8,122		0.186	28,788	0.661
	8.40		103.4	82.8	8,563		0.197	31,291	0.718
	8.70		105.8	85.2	9,016		0.207	33,927	0.779
	9.00		108.2	87.6	9,480		0.218	36,701	0.843
	9.30		110.6	90.0	9,956		0.229	39,616	0.909
	9.60		113.0	92.4	10,443		0.240	42,676	0.980
	9.90		115.4	94.8	10,942		0.251	45,883	1.053
	10.20		117.8	97.2	11,452		0.263	49,242	1.130
	10.50		120.2	99.6	11,974		0.275	52,756	1.211
	10.80		122.6	102.0	12,507		0.287	56,427	1.295
	11.10		125.0	104.4	13,052		0.300	60,261	1.383
	11.40		127.4	106.8	13,608		0.312	64,260	1.475
	11.70		129.8	109.2	14,176		0.325	68,427	1.571
	12.00		132.2	111.6	14,755		0.339	72,766	1.670
	12.30		134.6	114.0	15,346		0.352	77,281	1.774
	12.60		137.0	116.4	15,949		0.366	81,975	1.882
	12.90		139.4	118.8	16,563		0.380	86,852	1.994
	13.20		141.8	121.2	17,188		0.395	91,914	2.110
	13.50		144.2	123.6	17,825		0.409	97,166	2.231
	13.80		146.6	126.0	18,474		0.424	102,610	2.356
	14.10		149.0	128.4	19,134		0.439	108,251	2.485
	14.40		151.4	130.8	19,805		0.455	114,092	2.619
	14.70		153.8	133.2	20,488		0.470	120,135	2.758

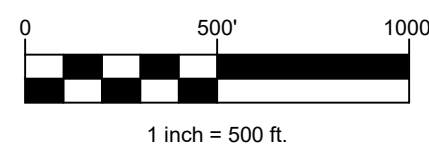
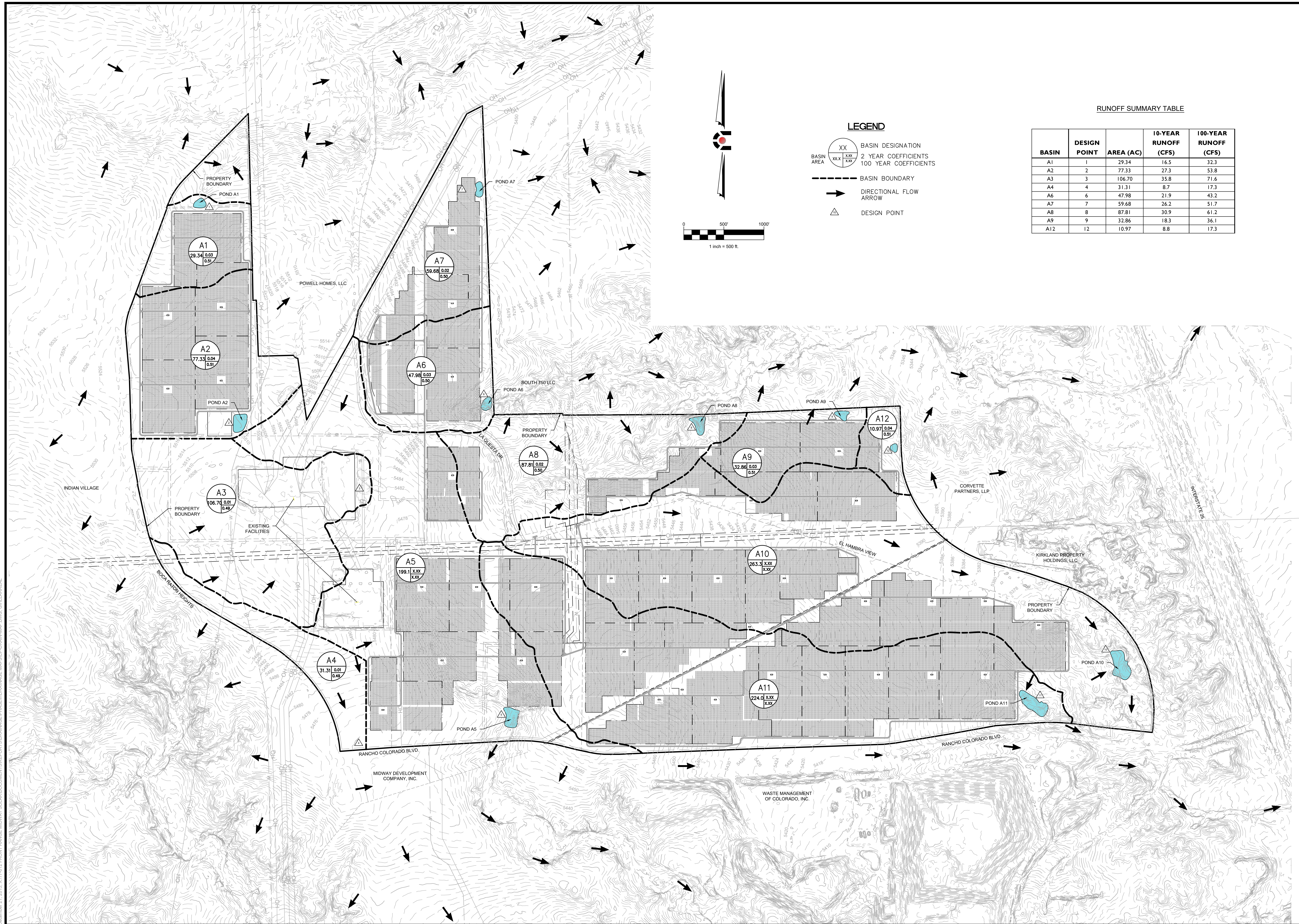
# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)





December 21, 2015 X:\174202 FRONT RANGE MIDWAY SOLAR DEVELOPMENT REPORT\DRAWINGS\DRAINAGE\MAPS\CD-DRAIN\MAP.DWG: C:\LAPR\B



**LEGEND**

- XX  
XXX  
XXX BASIN DESIGNATION
- XX  
XXX  
XXX 2 YEAR COEFFICIENTS
- XX  
XXX  
XXX 100 YEAR COEFFICIENTS
- BASIN BOUNDARY
- ➔ DIRECTIONAL FLOW ARROW
- △ DESIGN POINT

**RUNOFF SUMMARY TABLE**

BASIN	DESIGN POINT	AREA (AC)	10-YEAR RUNOFF (CFS)	100-YEAR RUNOFF (CFS)
A1	1	29.34	16.5	32.3
A2	2	77.33	27.3	53.8
A3	3	106.70	35.8	71.6
A4	4	31.31	8.7	17.3
A6	6	47.98	21.9	43.2
A7	7	59.68	26.2	51.7
A8	8	87.81	30.9	61.2
A9	9	32.86	18.3	36.1
A12	12	10.97	8.8	17.3

CALL 24 HOURS BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND UTILITIES. CORE ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS, HORIZONTAL AND VERTICAL ALIGNMENT, DEPTH, OR THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE USER'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL UTILITIES FROM THE COMPETENCY OF ANY CONSTRUCTION ACTIVITIES.



REVISIONS	DATE	BY
#	DESCRIPTION	

**FRONT RANGE MIDWAY SOLAR**  
**OVERALL DRAINAGE MAP**  
**FOUNTAIN, CO**

INITIAL PLAN  
 RELEASE: 12/12/2017  
 DESIGNED BY: GMV  
 DRAWN BY: GMV  
 CHECKED BY: DB

JOB NO.  
 17-012  
 SHEET  
 1 OF 1

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