

Preliminary & Final Drainage Report

Sanctuary of Peace Residential Community

PUD Development, Preliminary Plan and Final Plat

Project Number 61087

PCD Proj # PUDSP-019-002

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Preliminary & Final Drainage Report

for

Sanctuary of Peace Residential Community PUD Development, Preliminary Plan and Final Plat

Project No. 61087

April 28, 2020

prepared for

Benet Hill Monastery of Colorado Springs, Inc. 3190 Benet Lane Colorado Springs, CO 80921 719.355.1639

prepared by

MVE, Inc. 1903 Lelaray Street, Suite 200 Colorado Springs, CO 80909 719.635.5736

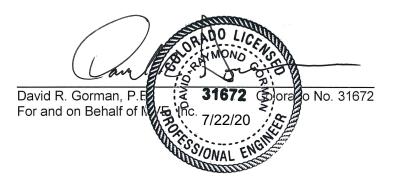
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Statements and Acknowledgments

Engineer's Statement

This attached Drainage plan and report were prepared by under my direct supervision and are correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with 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.



7/22/20 Date

Developer's Statement

Benet Hill Monastery of Colorado Springs, Inc., the owner/developer have read and will comply with all the requirements specified in this drainage report and plan.

Vincent Crowder Benet Hill Monastery of Colorado Springs, Inc. 3190 Benet Lane Colorado Springs, CO 80921

7.2 z . 20 Date

El Paso County

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

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

Date

Final Drainage Report

Sanctuary of Peace Filing No. 1

Project No. 61087

PURPOSE

This is the Final Drainage Report is for the Sanctuary of Peace Residential Community PUD Development and Preliminary Plan, and the Final Plat of Sanctuary of Peace Filing No. 1. The purpose of this Final Drainage Report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site and to safely route developed storm water to adequate outfalls.

SUMMARY OF DATA

- Black Squirrel Creek Drainage Basin Planning Study URS Consultants January, 1989
- Smith Creek Drainage Basin Planning Study JR Engineering August, 2002
- Drainage Letter for Benet Hill Monastery/Ministry Center Bradley B. Bean, PE August 17, 2007
- City of Colorado Springs "Drainage Criteria Manual, Volume 1", May, 2014.
- City of Colorado Springs and El Paso County "Drainage Criteria Manual, Volume 2" May, 2014.
- Soil Survey for El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service.
- "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), December 7, 2018.

Except for the previously mentioned drainage reports, no other drainage reports were reviewed during the course of preparing this drainage report.

GENERAL LOCATION & DESCRIPTION

The Sanctuary of Peace Residential Community contains 49.58+/- acres of land. Said Community is situate in South Half of Section 27, Township 11 South, Range 66 West of the 6th Principal Meridian within the County of El Paso, and the State of Colorado. The El Paso County Assessor Schedule Number is 7103001034 for the parcel of land and the address is 15760 State Highway 83.

The Sanctuary of Peace Residential Community is bounded on the east by State Highway 83, on the north by Benet Lane, on the west by Black Forest Park subdivision, and on the south by 10 & 20+/- acres parcels of un-platted land.

The Sanctuary of Peace Residential Community is located in two Major Drainage Basins and they are Black Squirrel Creek and Smith Creek of which are both Fee Basins.

FLOODPLAIN STATMENT

The Sanctuary of Peace Residential Community is not located in a designated floodplain as denoted on the Flood Insurance Rate Map (FIRM), map number 08041C0295G, effective date December 7, 2018. The FIRM is included in the **Appendix** for readers reference.

SOILS

The SCS Soils Map describes the soils as consisting of Kettle gravelly loamy sand (map unit 41), which is Hydrologic group "B". A soils Map and soils information is included for readers reference.

PROPOSED DEVELOPMENT

The proposed PUD Development Plan Preliminary Plan is composed of 27 Lots and 6 Tracts with drives, parking, landscaping, and three (3) Water Quality Sand Filter Basins. The proposed development is composed of 27 lots, clustered on 2.93 acres with 0.77 acres of paved roads, totaling 3.70 acres which is to be developed out of the parcel's total acreage of 49.58 acres. This Final Drainage report assumes a developed state for the entire development.

DRAINAGE CRITERIA

This Final Drainage Report for the Sanctuary of Peace Residential Community has been prepared according to the report guidelines presented in the *El Paso County Drainage Criteria Manual* (DCM). The County has also adopted portions of the City of Colorado Springs Drainage Criteria Volumes 1 and 2, especially concerning the calculation rainfall runoff rates. The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey, topographic mapping and property boundary information provided by Polaris Land Surveying, Inc. and proposed plan layout, grading, and drainage system layout developed by M.V.E., Inc. All proposed drainage facilities are approximate in size and may vary with actual layout and design.

For this final drainage report the Rational Method as described in the *City of Colorado Springs Drainage Criteria Manual* has been used for all Storm Runoff calculations, as the development and all sub-basins are less than 130 acres in area. "Colorado Springs Rainfall Intensity Duration Frequency" curves, Figure 6-5 in the DCM, was used to obtain the design rainfall values; a copy is included in the **Appendix**. The "Overland (Initial) Flow Equation" (Eq. 6-8) in the DCM, and Manning's equation with estimated depths were used in time of concentration calculations. "Runoff Coefficients for Rational Method", Table 6-6 in the

DCM, was utilized as a guide in estimating runoff coefficient and Percent Impervious values; a copy is included in the **Appendix**. Peak runoff discharges were calculated for each drainage sub-basin for both the 5-year storm event and the 100-year storm event with the Rational Method formula, (Eq. 6-5) in the DCM.

DRAINAGE CHARACTERISTICS AND EXISTING DRAINAGE FACILITIES

The Development Plan for this site is proposing a clustered residential community, with drives, parking, landscaping, and three (3) Water Quality Sand Filter Basins. The site site of 49.58 acres, will have 27 Lots clustered on 3.90 acres with drives, parking, and existing trees & vegetation. The remainder of lands will be undisturbed except for placement of the Onsite Wastewater Treatment Systems (OWTS) and the placement of the three (3) Water Quality Basins.

The following descriptions describe how the existing and developed storm water flows are and will be handled. This Final Drainage Report for the PUD Development, Preliminary Plan and Final Plat submittal is hereby provided for the proposed Development. The existing and proposed Drainage Maps have been included in this report showing the improvements on the Sanctuary of Peace Residential Community for the readers reference.

Hydraulic Grade Line calculations are required, but will be provided with the construction drawings.

EXISTING DRAINAGE BASIN DESCRIPTIONS

An Existing Drainage Map is included for readers reference and an analysis has been included in the report. The site is within two Major Drainage Basins split by a ridge traversing the site from north to south near the middle of the site. The Black Squirrel Major Basin composes the eastern portion of the site and contains 19.73 acres. The Smith Creek Basin composes the western portion of the site and contains 29.85 acres.

The off-site drainage Basins OS A, OS B, and OS C storm water flows are calculated as existing flows and will remain as existing as there is no proposed development in these off-site Basins proposed by this plan.

Refer to he included Existing Drainage Map for direction and quantity of these existing storm water flows.

DEVELOPED DRAINAGE BASIN DESCRIPTIONS

A Proposed Drainage Map is included for readers reference and an analysis has been included in the report. The 49.58 acre site has been split into nine (9) on-site Drainage Basins with 7 of these Drainage Basins being located in the Black Squirrel Major Basin and 2 of these Drainage Basins being located in the Smith Creek Major Basin. The off-site Drainage Basins number three (3) with one (1) of these Drainage Basins being located in the Black Squirrel Major Basin and two (2) of these Drainage Basins being located in the Smith Creek Major Basins being located in the Black Squirrel Major Basin and two (2) of these Drainage Basins being located in the Smith Creek Major Basin.

The clustered residential community portion to be developed of 3.90 acres is a very small portion of the total site and includes five (5) on site drainage basins.

The off-site drainage Basins OS A, OS B, and OS C storm water flows are not changed from their existing characteristics and do not affect our site as delineated in the above Existing Drainage Basin Descriptions.

Design Point P1 has existing storm water flows from drainage Basins OS A, OSB, & A2 and will flow overland & under Benet Lane continuing overland and exiting the Subdivision at the west side close to the southwest corner at a rate of Q5 = 34.8 cfs and Q100 = 230.2 cfs as it has historically done.

Design Point PP2 has proposed storm water flows from Drainage Basin A1 and will flow overland across the private drive and overland through 8 lots to the proposed Full Spectrum Sand Filter Basin (FSSFB) - A1 at DP2. Storm Drainage flows will be treated and released at a rate of Q5 = 0.1 cfs and Q100 = 3.1 cfs from the FSSFB - A1. The capacity of said FSSFB - A1 will be not less than 5,991+/- cubic feet (CF) to accept the required Water Quality Capture Volume for the developed Drainage Basin A1. Excess flows above the Water Quality Capture Volume requirement will over flow to a proposed 22' wide emergency spillway from the pond. These flows will pass through a 20' wide & 1' deep concrete weir onto a rip rap emergency spillway. These flows combine on site with Drainage Basin OS A, OS B, & A2 as shown on the included Proposed Drainage Map (Detail) for readers reference. The combined rate of flow is Q5 = 34.8 cfs and Q100 = 229.9 cfs and exit the site at Design Point DP1.

Design Point DP3 has proposed storm water flows from Drainage Basin C2 and will flow overland across the private driveway and overland through 3 lots to the proposed Full Spectrum Sand Filter Basin (FSSFB) - C2 at DP3. Storm Drainage flows will be treated and released at a rate of Q5 = 0.0 cfs and Q100 = 1.1 cfs from the FSSFB - C2. The capacity of said FSSFB - C2 will be not less than 1,783+/- cubic feet (CF) to accept the required Water Quality Capture Volume for the developed Drainage Basin C2. Excess flows above the Water Quality Capture Volume requirement will over flow to a proposed 12' wide emergency spillway from the pond. These flows will pass through a 10' wide & 1' deep concrete weir onto a rip rap emergency spillway. These flows combine on site with Drainage Basin C3 as shown on the included Proposed Drainage Map (Detail) for readers reference. The combined rate of flow is Q5 = 0.4 cfs and Q100 = 4.2 cfs and exit the site at Design Point DP4.

Design Point DP5 has proposed storm water flows from Drainage Basin C4 and will flow overland exiting the subdivision along the southern boundary line at a rate of Q5 = 0.2 cfs and Q100 = 1.6 cfs. This area remains in its existing state of forested land.

Design Point DP6 has proposed storm water flows from Drainage Basin C1 and will flow overland & through 8 lots, under the private drive via an 18" RC Pipe ccombining with the overland flow through 5 lots to the proposed Full Spectrum Sand Filter Basin (FSSFB) - C1 at PP6. Storm Drainage flows will be treated and released at a rate of Q5 = 0.1 cfs and Q100 = 6.1 cfs from the FSSFB - C1. The capacity of said FSSFB - C1 will be not less than 10,563+/- cubic feet (CF) to accept the required Water Quality Capture Volume for the developed Drainage Basin C1. Excess flows above the Water Quality Capture Volume requirement will over flow to a proposed 26' wide emergency spillway from the pond. These flows will pass through a 24' wide & 1' deep concrete weir onto a rip rap emergency

spillway. These flows combine on site with Drainage Basin C5 as shown on the included Proposed Drainage Map (Detail) for readers reference. The combined rate of flow is Q5 = 0.6 cfs and Q100 = 10.0 cfs and will exit the site at Design Point DP7.

Design Point DP8 has proposed storm water flows from Drainage Basin B1 and will flow overland to Benet Lane (private drive)and cross under said drive via an 18" RC Pipe into Basin B2. This area remains in its existing state of forested land. The rate of flow is Q5 = 0.6 cfs and Q100 = 10.0 cfs and exits at Design Point PP8.

Design Point PP9 has proposed storm water flows from Drainage Basin OS C and will flow overland to Benet Lane (private drive) and under Benet Lane via existing culverts. These storm water flows will combine with DP8 and overland flows from Basin B2. This area remains in its existing state of forested land. The rate of flow is Q5 = 24.9 cfs and Q100 = 137.2 cfs and exits the site along its southerly boundary designated as Point of Interest DP9.

WATER QUALITY

The Urban Drainage and Flood Control District provides criteria for design of a water quality pond as part of the Sand Filter design guidelines. This criteria specifies that this type of water quality pond shall be drained over a 12-hour period. The relief (grade change) of the natural gullies will allow the Water Quality Sand Filter Basin treated storm waters and storm waters to discharge at same grade.

The Full Spectrum Sand Filter Basins (are to be located on the southern and western side of the clustered housing will be constructed to collect the runoff from the developed portion of the site and treat & reduce the discharges from the site to existing levels. The Full Spectrum Sand Filter Basins will be constructed in accordance with El Paso County drainage criteria as supplemented by the accepted Urban Drainage Criteria, procedures, and methods. They will be owned and maintained by the Sanctuary of Peace Home Owners Association. These Full Spectrum Sand Filter Basins will be sited and located in the field by the Project Engineer to allow the designs to blend with the environment and limit unnecessary disturbance of land, trees, and vegetation. Once the Full Spectrum Sand Filter Basins are constructed, As- Built surveys will be conducted and a Substantial Compliance letter for the construction of them will be prepared by the Project Engineer.

EROSION CONTROL

During future construction, best management practices (BMP's) for erosion control will be employed based on the previously referenced El Paso County Drainage Criteria Manual Volume 1 & 2 and the approved Erosion Control Plan to minimize erosion from the site. The BMP's will remain in place until the site is stabilized with the new hard surfacing or landscape seeding, planting and cover materials. Also, BMP's will be utilized as deemed necessary by the contractor, engineer, owner, or County inspector and are not limited to the measures described on the Erosion Control Plan.

WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

This development will utilize the three (3) Full Spectrum Sand Filter Basins to be constructed. The Basins have been adequately sized for this purpose. Other drainage facilities in this project consist of two (2) - 18 " RC Pipes at proposed locations under the new private drive. These facilities will be private and will be maintained by the development's homeowners association. A Grading and Erosion Control Plan for the construction of the site has been prepared in accordance with the provisions of the County's Engineering Criteria Manual in conjunction with the private drive plan & profile design drawings. Placement of construction storm water BMP's will as required by the plan will limit soil erosion and deposition by storm water flowing over the site.

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) requires the consideration of a "Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage-ways, and implementing long term source controls". The Four Step Process is incorporated in this project and the elements are discussed below.

- 1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible. A significant portion of the site, 45.88 acres, which is 92% will remain as pervious well treed open space.
- 2) There are no drainage paths on the site that are required to be stabilized as the they are well vegetated with no visual erosion. The Water Quality Detention Water Quality Basins will intercept flows from developed areas. Additionally, all inflow points will be stabilized by re-vegetation as incoming flows are not erosive.
- 3) The project contains no potentially hazardous uses. All developed areas drain into a proposed a Water Quality Capture Volume (WQCV) BMP.
- 4) The site is residential in nature and contains no storage of potentially harmful substances or use of potentially harmful substances. No Site Specific or Other Source Control BMP's are required.

The following cost opinion is for the construction of the required private storm water appurtenances. There are no public storm water facilities required.

DRAINAGE FACILITIES CONSTRUCTION COST ESTIMATE

Opinion of Costs – Private Storm Water Facilities

•	73 Lf	18" RC Pipe	@ \$ 65 per Lf	= \$ 4,745
•	4 Ea	18" RC Flared End	@ \$ 390 per Ea	= 1,560
•	4 Tn	Type VL Rip-Rap	@ \$ 80 per Tn	= 320
•	1187 Cy	Sand Filter Basin Constr.	@ \$ 20 per Cy	= 23,740
•	3 Ea	Sand Filter Basin Spillway	@ \$2003 per Ea	= 6,009
•	3 Ea	Sand Filter Basin Outlet Str.	@ \$1480 per Ea	<u>= 4,440</u>
			Grand Total	= \$40,814

DRAINAGE, BRIDGE, AND SURCHARGE FEES

The Sanctuary of Peace Residential Community contains 49.58 acres of land. The Board of County Commissioners, County of El Paso, State of Colorado Resolution No. 99-383 allows the drainage basin fee to be based on impervious acreage. Black Squirrel Creek Basin contains 1.55 acres and Smith Creek Basin contains 0.67 acres of developed impervious acreage.

The resolution also allows a fee reduction of 25% for those portions of the development that consist entirely of 2.5 acre and larger lots. The Sanctuary of Peace Residential Community has clustered lots of below the 2.5 acre limit and therefore does not qualify.

FEE CALCULATION (2020 Fees)

Black Squirrel Drainage Basin

Drainage Fee \$8,664 / Impervious Acre @ 1.55 Acres	=	\$ 13	3,429.20
Bridge Fee \$545 / Impervious Acre @ 1.55 Acres	=	\$	844.75

Smith Creek Drainage Basin

Drainage Fee	\$7,780 / Impervious Acre @ 0.67 Acres	= \$ 5,212.60
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Bridge Fee	\$1,044 / Impervious Acre @ 0.67 Acres	= <u>\$ 699.</u> 4	<u> 18</u>
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Grand Total Fees = \$ 20,186.03

CONCLUSION

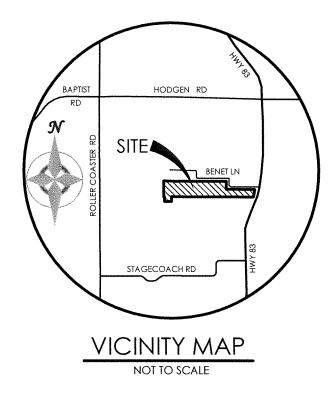
The proposed site improvements will direct, control, and treat storm drainage runoff. The downstream drainage facilities will accept the proposed flows as described in this report. The proposed development of said Sanctuary of Peace Residential Community will not negatively impact the adjacent properties and down stream drainage facilities.

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Appendices

1 General Maps and Supporting Data

Vicinity Map Portion of Flood Insurance Rate Map Soil Type map and Tables Official Soil Series Descriptions Hydrologic Soil Group Map and Tables



National Flood Hazard Layer FIRMette



Legend

LEGUERICU SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT	Without Base Flood Elevation (BFE) ZONEA JU ARG SPECIAL FLOOD With BFE or Depth Zone AF, NO, AF, WE, AF, HAZARD AREAS Regulatory Floodway	O.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X Future Conditions 1% Annual Chance Flood Hazard Zone X Area with Reduced Flood Risk due to Levee. See Notes, Zone X FLOOD HAZARD	No screen Area of Minimal Flood Hazard Zone X Effective LOMRs Effective LOMRs OTHER AREAS	GENERAL Channel, Culvert, or Storm Sewer STRUCTURES IIIIIII Levee, Dike, or Floodwall	Image: Sections with 1% Annual Chance Image: Sectio	Digital Data Available N MAP PANELS Unmapped	The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.	This map complies with FEMA's standards for the use of digital flood maps if it is not vold as described below. The basemap shown complies with FEMA's basemap accuracy standards		This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for revelopment on unmoses
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MAP INFORMATION	The soil surveys that comprise your AOI were mapped at 1:24,000.	Warning: Soil Map may not be valid at this scale.	Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil	line placement. The maps do not show the small areas of		Please rely on the bar scale on each map sheet for map	measurements.	Source of Map: Natural Resources Conservation Service	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		Soil map units are labeled (as space allows) for map scales	1:50,000 or larger.	Date(s) aerial images were photographed: Jul 4, 2010—Oct 16, 2017	The orthophoto or other base map on which the soil lines were	compiled and digitized probably differs from the background	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.		
EGEND	Spoil Area	🖄 Very Stony Spot	🕐 Wet Spot	△ Other	Special Line Features	Water Features Streams and Canals	Transportation	+++ Rails	Interstate Highways	US Routes	Major Roads	Local Roads	Background	Aerial Photography										
MAP LE	Area of Interest (AOI) Area of Interest (AOI)		soil Map Unit Polygons Soil Map Unit Lines	Soil Map Unit Points	Special Point Features	Blowout	Borrow Pit	Clay Spot	Closed Depression	Gravel Pit	Gravelly Spot	Landfill	Lava Flow	Marsh or swamp	Mine or Quarry	Miscellaneous Water	Perennial Water	Rock Outcrop	Saline Spot	Sandy Spot	Severely Eroded Spot	Sinkhole	Slide or Slip	Sodic Spot
	Area of In	Soils			Special	ව		×	\$	×	-1	0	X	and a second	ą,	0	0	>	+		Ú.	0	.Q.	Ø

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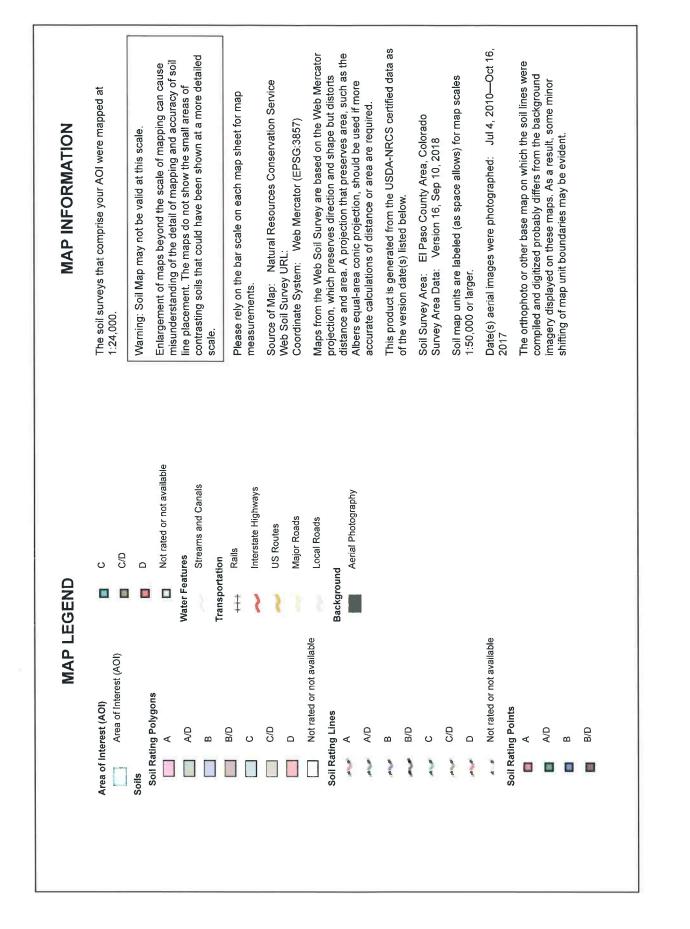


Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	47.2	100.0%
Totals for Area of Interest		47.2	100.0%



Hydrologic Soil Group-El Paso County Area, Colorado



Conservation Service

Natural Resources

NOSDA

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	В	47.2	100.0%
Totals for Area of Inter	est		47.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified Tie-break Rule: Higher Table 6-6. Runoff Coefficients for Rational Method (SC

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Characteristics	Impervious	2-Y	2-year	5-7	5-year	10-y	10-year	25-year	lear	50-year	ear	100	100-year
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSGC&D	HSG A&B	HSGC&D	HSG A&R	HCGC&D	HCC ARB	UCC CB.D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	8	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	6	0.71	0.73	`0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	2	0.05	60.0	0.12	0.19	0.20	0.29	0:30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis Greenbelts, Agriculture	7	0.03	0.05	60.0	0.16	0.17 0.17	0.26	0.26	0.38	0 31	0.45	950	55
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	051	0 20
													200
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	8	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	•	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

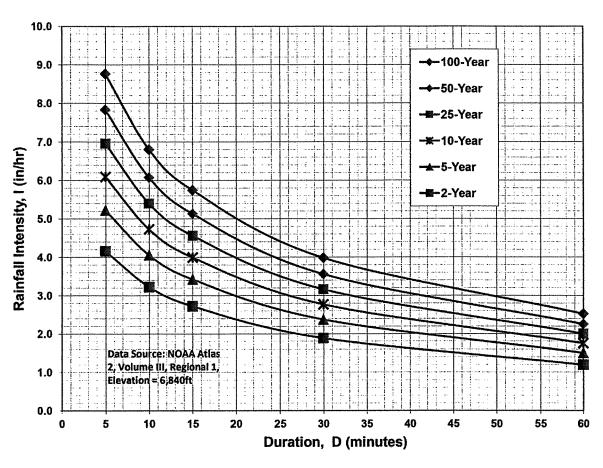


Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency

IDF Equations
$I_{100} = -2.52 \ln(D) + 12.735$
$I_{50} = -2.25 \ln(D) + 11.375$
I ₂₅ = -2.00 ln(D) + 10.111
$I_{10} = -1.75 \ln(D) + 8.847$
$I_5 = -1.50 \ln(D) + 7.583$
$I_2 = -1.19 \ln(D) + 6.035$
Note: Values calculated by equations may not precisely duplicate values read from figure.

Job No.: Project:

61087 Sanctuary of Peace

ASM

Time of Concentration (Modified from Standard Form SF-1)

		Sub-Basin Data	n Data			Overland				hannel			Channelized	lized		t, Check	eck	Γ
Sub-	Area			%		Ŝ	Ţ		Sot	V _{0sc}		L ₀	S _{0c}	V _{0c}	يه	, <u> </u>	t. alt	÷,
Basin	(Acres)	C5	C100/CN	Imp.	(ft)	(%)	(min)	(ft)	(ft/ft)	(ft/s)	(min)	(#)	(ft/ft)	(ft/s)	(min)	(min)	(min)	(min)
EX-A1	30.11		0.35	%0	100	%6	8.9	1483	0.072	1.9	13.1	117	0.043	1.6	1.2	1700	N/A	23.3
EX-B1	2.06		0.35	%0	100	8%	9.3	383	0.044	1.5	4.3	84	0.060	1.9	0.8	567	N/A	14.4
EX-B2	8.75		0.35	%0	100	%2	9.7	211	0.047	1.5	2.3	0	0.000	0.0	0.0	311	N/A	12.0
EX-CI	5.68		0.35	%0	100	11%	8.3	622	0.040	1.4	7.4	0	0.000	0.0	0.0	722	N/A	15.7
EX-C2	2.03	0.08	0.35	%0	100	8%	9.3	200	0.085	2.0	1.6	0	0.000	0.0	0.0	300	N/A	10.9
EX-C3	0.66		0.35	%0	100	10%	8.6	117	0.060	1.7	<u>-</u>	0	0.000	0.0	0.0	217	N/A	9.8
OS A	69.40		0.35	%0	100	3%	12.8	1030	0.063	1.8	9.8	1887	0.041	1.6	19.4	3017	N/A	41.9
OS B	83.92		0.37	3%	100	3%	12.5	1030	0.063	1.8	9.8	1887	0.041	1.6	19.4	3017	N/A	41.7
osc	49.12		0.38	5%	100	5%	10.4	995	0.070	1.9	8.9	597	0.090	2.2	4.6	1692	N/A	23.9
AI	1.85	0.36	0.55	36%	100	11%	6.1	217	0.055	1.2	3.1	0	0.000	0.0	0.0	317	N/A	9.1
A2	28.30	0.08	0.35	%0	100	%6	8.9	1483	0.072	1.3	18.4	117	0.043	5.7	0.3	1700	N/A	27.7
81	2.36	0.08	0.35	%0	100	8%	9.3	383	0.044	1.5	4.3	84	0.060	1.9	0.8	567	N/A	14.4
82	9.23	0.10	0.36	2%	100	%2	9.5	211	0.047	1.5	2.3	0	0.000	0.0	0.0	311	N/A	11.8
CI	4.07	0.27	0.49	25%	100	16%	6.0	457	0.046	1.1	7.1	0	0.000	0.0	0.0	557	N/A	13.1
3	0.66	0.28	0.49	27%	89	%2	7.5	100	0.060	1.2	4.	0	0.000	0.0	0.0	189	N/A	8.8
 S	1.36	0.08	0.35	%0	100	7%	9.7	173	0.075	1.4	2.1	0	0.000	0.0	0.0	273	N/A	11.8
C4	0.64	0.08	0.35	%0	81	14%	7.0	140	0.071	1.3	1.7	0	0.000	0.0	0.0	221	N/A	8.8
C5	1.61	0.08	0.35	%0	100	10%	8.6	123	0.065	1.3	1.6	0	0.000	0.0	0.0	223	N/A	10.2
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Event E				000			0												 	[
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EXC1 5.88 0.08 15.7 0.45 3.45 1.6 EXC2 0.08 10.9 0.16 4.00 0.7 1.98 1.14 EXC2 0.08 0.06 4.19 5.77 1.98 1.14 0.2 055 49.12 0.10 4.17 0.22 1.99 1.14 0.2 17 1.85 0.36 9.1 0.66 4.26 2.8 1.14 182 0.33 0.31 1.31 1.33 1.39 1.14 0.2 17 2.85 0.06 1.44 0.19 3.87 3.45 1.6 182 2.35 0.03 1.44 0.19 3.87 3.4 0.16 161 0.03 1.11 1.33 0.36 2.8 0.7 4.19 4.17 152 134 0.18 3.37 3.4 0.19 3.4 0.7 5.5 5.5 5.5 5.5 5.5 5.5		EX-82	8.75	0.08	12.0	0.70	3.86	2.7														
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EX-Cat 0.06 0.08 0.06 0.06 0.06 0.05 4.17 0.22 0S C 48.12 0.12 233 5.87 1.98 11.4 0S C 48.12 0.12 233 5.87 1.98 11.4 0S C 48.12 0.12 233 5.87 2.82 16.6 A1 1.85 0.36 9.1 0.66 4.26 2.8 17.4 B2 22.30 0.00 27.7 2.26 2.60 5.9 3.7 4.1 C1 4.07 0.27 2.35 0.01 11.8 0.89 3.7 4.1 C2 0.06 0.08 1.8 0.11 3.72 4.1 3.7 4.1 3.7 4.1 3.7 4.1 3.7 4.1 3.7 4.1 3.7 4.1 3.7 4.1 3.7 4.1 5.5 5.6 5.6 5.6 5.6 5.6 5.6 5.6 5.6		EX-C2	2.03	0.08	10.9	0.16	4.00	0.7	•••••													
ODS Method 69:40 0.06 41.3 b 5.77 1.98 1.14 1.98 1.14 A1 1.85 0.36 9.1 0.06 4.13 5.77 2.82 1.66 4.14 0.19 2.33 1.98 1.14 B1 2.336 0.008 27.7 2.26 2.66 5.9 5.87 2.82 1.66 4.13 5.77 1.14 B2 2.336 0.008 27.7 2.26 2.60 5.9 3.87 2.43 2.4 1.9 1.14 3.72 4.1 1.11 C2 1.96 0.028 8.8 0.11 1.11 3.72 4.1 1.11 1.11 3.72 4.1 1.11 1.11 1.11 1.11 1.11 1.11 1.11	leertan	EX-C3	0.66	0.08	9.6	0.05	4.17	0.2														
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568 0.35 15.7 1.99 5.79 59.93 0.37 23.9 2.79 5.79 59.93 0.37 23.9 2.73 4.73 183.47 0.36 0.49 9.1 65.80 3.50 1.85 0.55 0.49 9.1 65.80 3.50 1.85 0.55 0.49 9.1 1.02 7.16 0.64 0.35 0.49 1.1.8 0.48 6.22 1.36 0.35 1.1.8 0.49 6.22 7.16 2.36 0.35 0.49 1.1.8 0.48 6.22 1.61 0.35 0.35 11.8 0.48 6.25 1.61 0.35 0.35 11.4 0.83 6.02 1.60 1.61 0.35 1.27 1.44 22.78 6.02 DOM: 1=C1*In (tc) + C2 0.38 6.02 1.44 22.78 6.02 C1: 1.252 1.12 1.32 1.44 22.78 6.02 C1: 1.252 1.44 22.78 6.02 C1: 1.252 1.44 22.78 6.02	EX5		0.66	0.35					9.8	0.23	7.00	1.6										
3333 0.37 183.47 0.36 183.47 0.36 183.47 0.36 185 0.55 185 0.55 136 0.35 136 0.35 136 0.35 136 0.35 136 0.35 140 0.35 151 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 161 0.35 162 14.4 0.38 6.02 161 10.2 162 14.4 173 14.4 173 14.4 174 22.78 174 22.78 172 14.4 173 14.4 174 22.78 174 22.78 174 22.78 174 22.78 174 22.78 174 22.78 174	EX7	50.000	5.68	0.35					15.7	1.99	5.79	11.5										
183.47 0.36 9.1 65.80 3.50 183.47 0.36 9.1 65.80 3.50 1.85 0.55 9.1 65.80 3.50 0.66 0.49 8.8 0.33 7.25 1.36 0.35 8.8 0.33 7.25 0.64 0.35 8.8 0.33 7.25 1.61 0.35 8.8 0.33 7.27 1.61 0.35 8.8 0.23 7.27 1.61 0.35 9.1 1.02 0.56 6.88 1.61 0.35 0.35 14.4 22.78 6.02 0.01 1 = C1*in (tc) + C2 0.38 6.02 14.4 22.78 6.02 0.01 1 = C1*in (tc) + C2 0.38 6.02 6.02 6.02	EXa		C	1.5.0					2.02	PC-37	2 7	2.00										
183.47 0.36 9.1 65.80 3.50 1.85 0.55 0.49 9.1 1.02 7.16 0.66 0.49 0.35 0.64 0.33 7.25 1.36 0.35 0.49 11.8 0.48 6.52 1.61 0.35 11.8 0.48 6.52 2.36 0.35 11.8 0.48 6.52 2.36 0.35 11.1 1.99 6.25 1.61 0.35 0.35 11.4 0.83 6.02 0.00M: 1= C1* In (tc) + C2 0.38 6.02 6.02 0.01 12 C1* 10 (tc) + C2 0.38 6.02 6.02																						
185 0.55 9.1 1.02 7.16 0.66 0.49 1.35 0.35 7.25 1.36 0.35 0.49 1.18 0.38 0.33 1.407 0.49 1.18 0.48 0.33 7.25 1.61 0.35 1.18 0.49 1.18 0.23 7.27 2.36 0.35 1.49 0.35 1.12 7.27 2.36 0.35 1.44 0.83 6.02 1.61 0.35 1.02 1.44 0.83 6.02 0.011 1= C1* In (tc) + C2 0.38 6.02 6.02 0.11 1 2.278 6.02 0.11 1 2.278 6.02 0.11 1 2.25 1.14 2.2778 6.02 0.11 1 2.25 1.33 6.02 0.11 1 2.25 1.44 2.2778 6.02	DP1		183.47	0.36					9.1	65.80	3.50	230.2										
0.66 0.49 8.8 0.33 7.25 1.36 0.35 0.35 1.36 0.33 7.25 0.64 0.35 0.49 11.8 0.48 6.22 1.61 0.35 1.61 0.35 7.27 2.36 0.35 14.4 0.83 6.02 0.01 1= C1* In (tc) + C2 0.38 6.02 0.01 1= C1* In (tc) + C2 0.38 6.02 0.01 12 0.35 6.02	DP2		1.85	0.55					9.1	1.02	7.16	7.3										
1.36 0.35 0.35 0.48 0.32 0.64 0.35 0.49 1.18 0.23 7.27 1.61 0.35 1.61 0.35 6.02 7.27 2.36 0.35 1.44 0.33 6.02 2.36 0.35 14.4 0.83 6.02 0.0M: 1= C1* In (tc) + C2 0.38 6.02 0.11 12.52 0.33 6.02	DP3		0.66	0.49					8.8	0.33	7.25	2.4				********						
0.07 0.03 0.03 0.03 0.05 0.06 0.05 1.61 0.35 0.35 14.4 0.83 6.02 0.081 60.72 0.38 14.4 22.78 6.02 0.011 1= C1* In (tc) + C2 0.38 6.02 0.011 1 = C1* In (tc) + C2 0.33 6.02 0.011 1 = C1* In (tc) + C2 0.33 6.02	004		1.36	0.35 0.35				******	0.11 8.8	0.23	70.0	4 -										
161 0.35 10.2 0.56 6.88 2.36 0.35 14.4 0.83 6.02 60.72 0.38 14.4 22.78 6.02 DCM: I=C1*in (tc) + C2 C1: 2.52 6.02 C1: 1.2.52 C1: 2.52	DP6		4.07	0.49					13.1	1.99	6.25	12.5										
2.36 0.35 14.4 0.83 6.02 60.72 0.38 14.4 22.78 6.02 DCM: 1 = C1* In (tc) + C2 C1: 2.52 C1: 2.52 C1: 2.52	DP7		1.61	0.35					10.2	0.56	6.88	10.0										
60.72 0.38 14.4 22.78 6.02 DCM: I = C1 * In (tc) + C2 C1: 2.2.2 C1: 2.2.2	DP8		2.36	0.35					14.4	0.83	6.02	5.0										
	6d0		60.72	0.38					14.4	22.78	6.02	137.2										
															i denta i							
													-									
÷		DCM		tc) + C2																		
		3 5	÷																			

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Sub-Basin Ex-A1 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Typ	e	В
Runoff Coefficient	Surface Type	Urbaniza	ation	Non-Urban

Basin Land Use Characteristics

	Area			Runc	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	1,311,446 -	30.11 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	1,311,446	30.11	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	4000		*****						

Basin Travel Time

Shallo	w Channel Grou	nd Cover §	Short Pastu	ire/Lawns		
	L _{max,Overland}	100 f	t		Cv	7
·~ •	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	1,700	121	-	-	-	•
Initial Time	100	9	0.090	-	8.9	N/A DCM Eq. 6-8
Shallow Channel	1,483	107	0.072	1.9	13.1	- DCM Eq. 6-9
Channelized	117	5	0.043	1.6	1.2	- V-Ditch
				t _c	23.3	min.



Rainfall Intensity & Runoff

I	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.29	2.86	3.34	3.82	4.30	4.81
Runoff (cfs)	1.4	6.9	15.1	28.7	38.8	50.6
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.4	6.9	15.1	28.7	38.8	50.6
DCM: I	= C1 * in (to	t) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6 035	7.583	8.847	10.111	11.375	12.735

Sub-Basin Ex-B1 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:	· · · · · · · ·	
Jurisdiction	DCM	Soil Ty	/pe	В
Runoff Coefficient	Surface Type	Urbani	zation	Non-Urban

Basin Land Use Characteristics

	Area			Runo	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	89,528	2.06 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	89,528	2.06	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	4000								

Basin Travel Time

Shallo	w Channel Grou	nd Cover \$	Short Pastu	ire/Lawns		
	L _{max,Overland}	100 f	t		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Ait} (min)
Total	567	30	-	-	-	-
Initial Time	100	8	0.080	-	9.3	N/A DCM Eq. 6-8
Shallow Channel	383	17	0.044	1.5	4.3	- DCM Eq. 6-9
Channelized	84	5	0.060	1.9	0.8	- V-Ditch
				tc	14.4 n	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.86	3.59	4.18	4.78	5.38	6.02
Runoff (cfs)	0.1	0.6	1.3	2.5	3.3	4.3
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	0.6	1.3	2.5	3.3	4.3
DCM: I	= C1 * in (to	s) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
G2	6.035	7.583	8.847	10.111	11.375	12.735

Sub-Basin Ex-B2 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Typ	e	В
Runoff Coefficient	Surface Type	Urbaniza	ation	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	381,146	8.75 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	381,146	8.75	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	4000								

Basin Travel Time

Shallo	w Channel Grou	nd Cover S	Short Pastu	ire/Lawns		
	Lmax,Overland	100 f	t		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	311	17	-	-	-	-
Initial Time	100	7	0.070		9.7	N/A DCM Eq. 6-8
Shallow Channel	211	10	0.047	1.5	2.3	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				t _c	12.0 n	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.08	3.86	4.50	5.14	5.78	6.47
Runoff (cfs)	0.5	2.7	5.9	11.2	15.2	19.8
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	2.7	5.9	11.2	15.2	19.8
DCM:	l = C1 * In (te					
C1	1.19	1.5	1.75	2	2.25	2.52
02	6.035	7.583	8.847	10 111	11.375	12.735

Sub-Basin Ex-C1 Runoff Calculations

Job No.:	61087	Date:	9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by: A	SM
		Checked by:	
Jurisdiction	DCM	Soil Type	В
Runoff Coefficient	Surface Type	Urbanization	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	247,407 -	5.68 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	247,407	5.68	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	4000								

Basin Travel Time

Shallo	w Channel Grou	nd Cover \$	Short Pastu	ire/Lawns		
		100 f	ť		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	722	36	-	-	-	-
Initial Time	100	11	0.110	-	8.3	N/A DCM Eq. 6-8
Shallow Channel	622	25	0.040	1.4	7.4	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				tc	15.7 (min.



Rainfall Intensity & Runoff

I	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.76	3.45	4.02	4.60	5.17	5.79
Runoff (cfs)	0.3	1.6	3.4	6.5	8.8	11.5
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.3	1.6	3.4	6.5	8.8	11.5
DCM: 1	= C1 * In (to	$\Rightarrow + C2$				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Sub-Basin Ex-C2 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
	••••••••••••••••••••••••••••••••••••••	Checked by:		
Jurisdiction	DCM	Soil Typ	e	В
Runoff Coefficient	Surface Type	Urbaniz	ation	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%	
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.	
Forest	88,571	2.03 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%	
Combined	88,571	2.03	0.02	0.08	0.15	0.25	0.30	0.35	0.0%	
	88571									

Basin Travel Time

Shallo	w Channel Grou	nd Cover §	Short Pastu	ire/Lawns		
	Lmax,Overland	100 f	ť		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	300	25	-	•	-	-
Initial Time	100	8	0.080	-	9.3	N/A DCM Eq. 6-8
Shallow Channel	200	17	0.085	2.0	1.6	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				tc	10.9 (min.





Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.19	4.00	4.67	5.33	6.00	6.71
Runoff (cfs)	0.1	0.7	1.4	2.7	3.7	4.8
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	0.7	1.4	2.7	3.7	4.8
DCM:	l = C1 * In (to	c) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Sub-Basin Ex-C3 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type	; 	В
Runoff Coefficient	Surface Type	Urbaniza	tion	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%	
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.	
Forest	28,874	0.66 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%	
Combined	28,874	0.66	0.02	0.08	0.15	0.25	0.30	0.35	0.0%	

Basin Travel Time

Shallo	w Channel Grou	nd Cover S	Short Pastu	ire/Lawns		
	L _{max,Overland}	100 f	t		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	217	17	-	-	-	-
Initial Time	100	10	0.100	-	8.6	N/A DCM Eq. 6-8
Shallow Channel	117	7	0.060	1.7	1.1	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				tc	9.8	min.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.32	4.17	4.86	5.56	6.25	7.00
Runoff (cfs)	0.0	0.2	0.5	0.9	1.2	1.6
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.0	0.2	0.5	0.9	1.2	1.6
DCM: 1	= C1 * In (to	$\rangle + C2$				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Sub-Basin OS A Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type	•	В
Runoff Coefficient	Surface Type	Urbaniza	tion	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	3,004,559	68.98	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	18,357	0.42	0.57	0.59	0.63	0.66	0.68	0.7	80%
	Sector Constant - Sec	0.00							
		0.00							
Combined	3,022,916	69.40	0.02	0.08	0.15	0.25	0.30	0.35	0.5%
	4000	<u>U</u> .							

Basin Travel Time

Shallo	w Channel Grou	nd Cover	Short Pasti	ire/Lawns		
	L _{max,Overland}	100 f	ť		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	3,017	146	-	-	-	-
Initial Time	100	3	0.030	-	12.8	N/A DCM Eq. 6-8
Shallow Channel	1,030	65	0.063	1.8	9.8	- DCM Eq. 6-9
Channelized	1,887	78	0.041	1.6	19.4	- V-Ditch
				t _c	41.9 (min.





Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	1.59	1.98	2.31	2.64	2.97	3.32
Runoff (cfs)		11.4	24.5	46.2	62.3	81.1
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)		11.4	24.5	46.2	62.3	81.1
DCM:	I = C1 * In (to) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Sub-Basin OS B Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
	•	Checked by:		······································
Jurisdiction	DCM	Soil Ty	/pe	В
Runoff Coefficient	Surface Type	Urban	ization	Non-Urban

Basin Land Use Characteristics

	Area		Runoff Coefficient					%	
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	3,507,946	80.53	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	16,239	0.37	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	77,470	1.78	0.57	0.59	0.63	0.66	0.68	0.7	80%
Roofs	53,907	1.24	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	3,655,562	83.92	0.05	0.10	0.17	0.27	0.32	0.37	3.5%
	4000	B.							

Basin Travel Time

Shallo	w Channel Grou	nd Cover S	Short Pastu	ire/Lawns		
	L _{max,Overland}	100 f	t		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	3,017	146	-	-	-	-
Initial Time	100	3	0.030	-	12.5	N/A DCM Eq. 6-8
Shallow Channel	1,030	65	0.063	1.8	9.8	- DCM Eq. 6-9
Channelized	1,887	78	0.041	1.6	19.4	- V-Ditch
				tc	41.7	min.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr			
Intensity (in/hr)	1.60	1.99	2.32	2.65	2.98	3.34			
Runoff (cfs)	6.1	17.4	33.6	60.0	79.7	102.7			
Release Rates (cfs/ac)		-	-	-	-	-			
Allowed Release (cfs)	6.1	17.4	33.6	60.0	79.7	102.7			
DCM:	DCM: I = C1 * In (tc) + C2								
01	1.19	1.5	1.75	2	2.25	2.52			
G2	6 035	7.583	8.847	10.111	11.375	12.735			

Sub-Basin OS C Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Ty	/pe	В
Runoff Coefficient	Surface Type	Urban	ization	Non-Urban

Basin Land Use Characteristics

	Area		Runoff Coefficient					%	
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	2,023,425	46.45	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	76,619	1.76	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	29,852	0.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Roofs	9,943	0.23	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	2,139,839	49.12	0.06	0.12	0.19	0.28	0.33	0.38	5.1%
	4000								

Basin Travel Time

Shallo	w Channel Grou	nd Cover	Short Pastu	ire/Lawns		
	L _{max,Overland}	100 f	t		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	1,692	129	-	-	-	~
Initial Time	100	5	0.050	-	10.4	N/A DCM Eq. 6-8
Shallow Channel	995	70	0.070	1.9	8.9	- DCM Eq. 6-9
Channelized	597	54	0.090	2.2	4.6	- V-Ditch
				tc	23.9 ו	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.26	2.82	3.29	3.76	4.23	4.73
Runoff (cfs)	6.9	16.6	30.2	52.3	68.8	88.1
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	6.9	16.6	30.2	52.3	68.8	88.1
DCM: I	= C1 * In (to	s) + C2				
Q1	1.19	1.5	1.75	2	2.25	2.52
G2	6.035	7.583	8.847	10.111	11.375	12 735

Sub-Basin A1 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38	
Project:	Sanctuary of Peace	Calcs by:	ASM		
		Checked by:			
Jurisdiction	DCM	Soil Type		В	
Runoff Coefficient	Surface Type	Urbanizat	ion	Non-Urban	

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	50,438	1.16	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	16,558	0.38	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	13,532	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	80,528	1.85	0.31	0.36	0.41	0.48	0.52	0.55	35.7%
	80528								

Basin Travel Time

Shallo	w Channel Grou	nd Cover I	Forest			
	L _{max,Overland}	100 f	t		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Ait} (min)
Total	317	23	-	-	-	-
Initial Time	100	11	0.110	-	6.1	N/A DCM Eq. 6-8
Shallow Channel	217	12	0.055	1.2	3.1	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				t _c	9.1 ı	nin.



Rainfall Intensity & Runoff

1	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.40	4.26	4.97	5.68	6.39	7.16
Runoff (cfs)	2.0	2.8	3.8	5.1	6.1	7.3
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.0	2.8	3.8	5.1	6.1	7.3
DOM: L	= C1 * in (to	s) + C2				
01	1.19	1.5	1.75	2	2.25	2.52
C2	6 035	7.583	8.847	10.111	11.375	12.735

Sub-Basin A2 Runoff Calculations

Job No.: 61087		Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Typ	e	В
Runoff Coefficient	Surface Type	Urbaniz	ation	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	1,232,700	28.30	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	1,232,700	28.30	0.02	0.08	0.15	0.25	0.30	0.35	0.0%

Basin Travel Time

Shallo	w Channel Grou	Ind Cover F	Forest			
	L _{max,Overland}	100 f	ť		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	1,700	121	-	-	-	-
Initial Time	100	9	0.090	-	8.9	N/A DCM Eq. 6-8
Shallow Channel	1,483	107	0.072	1.3	18.4	- DCM Eq. 6-9
Channelized	117	5	0.043	5.7	0.3	- V-Ditch
				t _c	27.7	min.



Rainfall Intensity & Runoff

I	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.08	2.60	3.04	3.47	3.90	4.37
Runoff (cfs)	1.2	5.9	12.9	24.6	33.1	43.3
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.2	5.9	12.9	24.6	33.1	43.3
DCM: 1	= C1 * In (to	o) + C2				
C1	1.19	1.5	175	2	2.25	2.52
C2	6.035	7.583	8 847	10 111	11.375	12.735

Sub-Basin B1 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Typ	e	В
Runoff Coefficient	Surface Type	Urbaniz	ation	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	102,701	2.36 0.00	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	102,701	2.36	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	4000								

Basin Travel Time

Shallow Channel Ground Cover Short Pasture/Lawns

	L _{max,Overland}				Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	567	30	-	-	-	-
Initial Time	100	8	0.080	-	9.3	N/A DCM Eq. 6-8
Shallow Channel	383	17	0.044	1.5	4.3	- DCM Eq. 6-9
Channelized	84	5	0.060	1.9	0.8	- V-Ditch
				t _c	14.4 n	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.86	3.59	4.18	4.78	5.38	6.02
Runoff (cfs)	0.1	0.7	1.5	2.8	3.8	5.0
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	0.7	1.5	2.8	3.8	5.0
DCM: 1	= C1 * In (to	c) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6 035	7 583	8.847	10.111	11.375	12.735

Sub-Basin B2 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Typ	е	В
Runoff Coefficient	Surface Type	Urbaniza	ation	Non-Urban

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	394,481	9.06	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	7,783	0.18	0.89	0.9	0.92	0.94	0.95	0.96	100%
				0.10	0.16	0.26	0.31	0.36	1.9%

Basin Travel Time

Shallo	w Channel Grou	nd Cover S	Short Pastu	ire/Lawns		
	L _{max,Overland}	100 f	ť		Cv	7
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	311	17	-	-	-	-
Initial Time	100	7	0.070	-	9.5	N/A DCM Eq. 6-8
Shallow Channel	211	10	0.047	1.5	2.3	- DCM Eg. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				tc	11.8 r	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.09	3.87	4.52	5.17	5.81	6.51
Runoff (cfs)	1.1	3.4	6.9	12.6	16.8	21.7
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)		3.4	6.9	12.6	16.8	21.7
DCM: I	≈ C1 * In (to	:) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6 035	7.583	8 847	10 111	11.375	12 735

Sub-Basin C1 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type		В
Runoff Coefficient	Surface Type	Urbanizat	ion	Non-Urban

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	130,377	2.99	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	20,192	0.46	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	26,845	0.62	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	177,414	4.07	0.22	0.27	0.33	0.41	0.45	0.49	25.0%
	177414								

Basin Travel Time

Shallo	w Channel Grou	nd Cover I	Forest			
	L _{max,Overland}	100 f	t		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	557	37	-	-	-	-
Initial Time	100	16	0.160	-	6.0	N/A DCM Eq. 6-8
Shallow Channel	457	21	0.046	1.1	7.1	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				tc	13.1 ו	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.72	4.35	4.97	5.59	6.25
Runoff (cfs)	2.7	4.1	5.8	8.3	10.2	12.5
Release Rates (cfs/ac)	-	-	-	_	-	-
Allowed Release (cfs)	2.7	4.1	5.8	8.3	10.2	12.5
DCM: I	= C1 * In (to	:) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8 847	10.111	11.375	12.735

Sub-Basin C2 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Ty	be	В
Runoff Coefficient	Surface Type	Urbaniz	ation	Non-Urban

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	20,454	0.47	0.02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	1,280	0.03	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	7,150	0.16	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	28,884	0.66	0.23	0.28	0.33	0.41	0.45	0.49	26.7%
	28884								

Basin Travel Time

Shallo	w Channel Grou	nd Cover I	Forest			
	L _{max,Overland}	100 1	ft		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	189	12	-	-	-	-
Initial Time	89	6	0.067	-	7.5	N/A DCM Eq. 6-8
Shallow Channel	100	6	0.060	1.2	1.4	- DCM Eq. 6-9
Channelized			0.000	0,0	0.0	- V-Ditch
				tc	8.8	min.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.44	4.32	5.04	5.76	6.48	7.25
Runoff (cfs)	0.5	0.8	1.1	1.6	1.9	2.4
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.5	0.8	1.1	1.6	1.9	2.4
DCM: I	= C1 * In (to	:) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8 847	10.111	11.375	12 735

Sub-Basin C3 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type		В
Runoff Coefficient	Surface Type	Urbanizati	on	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv
Forest	59,267	1.36	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	59,267	1.36	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	59267								

Basin Travel Time

Shallo	w Channel Grou	Ind Cover	Forest			
	L _{max,Overland}	100 f	ť		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	273	20	-	-	-	-
Initial Time	100	7	0.070	-	9.7	N/A DCM Eq. 6-8
Shallow Channel	173	13	0.075	1.4	2.1	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				t _c	11.8 (nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.10	3.88	4.53	5.18	5.82	6.52
Runoff (cfs)	0.1	0.4	0.9	1.8	2.4	3.1
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)		0.4	0.9	1.8	2.4	3.1
DCM:	= C1 * In (to	s) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	8.035	7.583	8.847	10.111	11 375	12.735

Sub-Basin C4 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type		В
Runoff Coefficient	Surface Type	Urbanizat	tion	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	28,016	0.64	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	28,016	0.64	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	28016							N	

Basin Travel Time

Shallo	w Channel Grou	nd Cover I	Forest			
	L _{max,Overland}	100 f	t		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	221	21	-	-	-	-
Initial Time	81	11	0.136	-	7.0	N/A DCM Eq. 6-8
Shallow Channel	140	10	0.071	1.3	1.7	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				t _c	8.8	min.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.45	4.33	5.05	5.77	6.49	7.27
Runoff (cfs)	0.0	0.2	0.5	0.9	1.3	1.6
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.0	0.2	0.5	0.9	1.3	1.6
DCM: 1=	- C1 * In (to	:) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	8 035	7.583	8.847	10.111	11.375	12.735

Sub-Basin C5 Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
-		Checked by:	<u> </u>	
Jurisdiction	DCM	Soil Type	e	В
Runoff Coefficient	Surface Type	Urbaniza	ation	Non-Urban

Basin Land Use Characteristics

	Area	Area		Runoff Coefficient					
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	70,265	1.61	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	70,265	1.61	0.02	0.08	0.15	0.25	0.30	0.35	0.0%
	70265								

Basin Travel Time

Shallo	w Channel Grou	nd Cover I	Forest			
	L _{max,Overland}	100 f	ť		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	223	18	-	-	-	-
Initial Time	100	10	0.100	-	8.6	N/A DCM Eq. 6-8
Shallow Channel	123	8	0.065	1.3	1.6	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				t _c	10.2 r	nin.



Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.27	4.10	4.78	5.46	6.14	6.88
Runoff (cfs)	0.1	0.5	1.2	2.2	3.0	3.9
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	0.5	1.2	2.2	3.0	3.9
DOM: 1=	= C1 * In (to	;) + C2				
C1	1.19	1.5	175	2	2 25	2.52
02	6.035	7.583	8.847	10.111	11.375	12 735

M.V.E., Inc. 1903 Lelaray Street., Suite 200 Colorado Springs, CO 80909 (719) 635-5736

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DATE 9-16-19

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DATE _____

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Combined Sub-Basin EX4 Runoff Calculations

Includes Basins EX-C2

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type	Э	В
Runoff Coefficient	Surface Type	Urbaniza	ition	Non-Urban

Basin Land Use Characteristics

	Area	Area			Runoff Coefficient					
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.	
Forest	88,571	2.03	0.02	0.08	0.15	0.25	0.3	0.35	0%	
Combined	88,571	2.03	0.02	0.08	0.15	0.25	0.30	0.35	0.0%	

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach Channelized-1 Channelized-2 Channelized-3	EX-C2	-	300	25	-			-	10.9
Total			300	25				tc	10.9

(min) 10.9

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.19	4.00	4.67	5.33	6.00	6.71
Site Runoff (cfs)	0.13	0.65	1.42	2.71	3.66	4.78
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac) Allowed Release (cfs)	-	- 0.7	-	-	-	- 4.8
······	= C1 * In (to			I		
Cí	1.19	1.5	1.75	2	2 25	2.52
C2	6.035	7.583	8.847	10 111	11.375	12.735

Notes

Combined Sub-Basin EX5 Runoff Calculations

Includes Basins EX-C3

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:	NAME AND ADDRESS OF TAXABLE	
Jurisdiction	DCM	Soil Ty	ype	B
Runoff Coefficient	Surface Type	Urban	ization	Non-Urban

Basin Land Use Characteristics

	Area	Area			Runoff Coefficient					
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.	
Forest	28,874	0.66	0.02	0.08	0.15	0.25	0.3	0.35	0%	
Combined	28,874	0.66	0.02	0.08	0.15	0.25	0.30	0.35	0.0%	

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach Channelized-1 Channelized-2 Channelized-3	EX-C3	-	217	17	-		-	-	9.8
Total			217	17				tc	0.8

• 9.8 (min)

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.32	4.17	4.86	5.56	6.25	7.00
Site Runoff (cfs)	0.04	0.22	0.48	0.92	1.24	1.62
OffSite Runoff (cfs)		0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	
Allowed Release (cfs)	-	0.2	-	-	-	1.6
DCM: I	= C1 * In (to) + C2				
01	1.19	1.5	1.75	2	2.25	2.52
C2	6.036	7.583	8.847	10.111	11.375	12.735

Notes

Combined Sub-Basin EX7 Runoff Calculations

Includes Basins EX-C1

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Ty	pe	в
Runoff Coefficient	Surface Type	Urbani	zation	Non-Urban

Basin Land Use Characteristics

	Area	1		Runc	off Coeffici	ent		1	%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	247,407	5.68	0.02	0.08	0.15	0.25	0.3	0.35	0%
Combined	247,407	5.68	0.02	0.08	0.15	0.25	0.30	0.35	0.0%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	EX-C1	-	722	36	-	-	-	-	15.7
Channelized-1									
Channelized-2									
Channelized-3									
Total			722	36					
								t _c	15.7

(min) ² 15.7

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

I.	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.76	3.45	4.02	4.60	5.17	5.79
Site Runoff (cfs)	0.31	1.57	3.43	6.53	8.82	11.51
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	1.6	-	-	-	11.5
DOM: 1	= C1 * in (to	;) + C2				
C1	1.19	1.5	175	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11 375	12.735

Notes

Combined Sub-Basin EX8 Runoff Calculations

Includes Basins EX-B1

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil T	уре	В
Runoff Coefficient	Surface Type	Urbar	nization	Non-Urban

Basin Land Use Characteristics

	Area	Area			Runoff Coefficient					
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.	
Forest	89,528	2.06	0.02	0.08	0.15	0.25	0.3	0.35	0%	
Combined	89,528	2.06	0.02	0.08	0.15	0.25	0.30	0.35	0.0%	

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z ₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach Channelized-1 Channelized-2 Channelized-3	EX-A1	-	1,700	121	-			-	23.3
Total			1,700	121				t,	

(min) 23.3

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.29	2.86	3.34	3.82	4.30	4.81
Site Runoff (cfs)	0.09	0.47	1.03	1.96	2.65	3.46
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	+	~
Allowed Release (cfs)	-	0.5	-	-	-	3.5
DCM: I	≈ C1 * In (Ic	;) + C2				
C1	1.19	1.5	1 75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12 735

Notes

Combined Sub-Basin EX9 Runoff Calculations

Includes Basins OS C EX-B1 EX-B2

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Ty	/pe	В
Runoff Coefficient	Surface Type	Urbani	zation	Non-Urban

Basin Land Use Characteristics

	Area			Runc	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	2,494,099	57.26	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	29,852	0.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	76,619	1.76	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	9,943	0.23	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	2,610,513	59.93	0.05	0.11	0.18	0.28	0.33	0.37	4.2%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS C	-	1,692	129	-	-	-	-	23.9
Channelized-1			0	0					
Channelized-2									
Channelized-3									
Total			1,692	129					
								tc	<u></u>

(min) ^{Cc} 23.9

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.26	2.82	3.29	3.76	4.23	4.73
Site Runoff (cfs)	7.37	19.00	35.58	62.44	82.51	106.03
OffSite Runoff (cfs)	-	0.00	_	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	
Allowed Release (cfs)	-	19.0	-	-	-	106.0
DCM I	≂ Ć1 * In (tr	s) + C2				
C1	1 19	1.5	175	2	2 25	2.62
02	8 035	7.583	8 847	10.111	11 375	12.735

Notes

M.V.E., Inc. 1903 Lelaray Street., Suite 200 Colorado Springs, CO 80909 (719) 635-5736

JOB 61087 - SANCTUARY OF PEACE SHEET NO. ______ OF _____ CALCULATED BY 16-19

CHECKED BY_____

____ DATE _____

SCALE _ 0 and some has Besch 42. DPZ 1 058 0\$A ġ. 0,2 Q 10.4 0 PZ-but d. 1 c.A <u>475</u> 5.9 43.3 42 056 11. 4 81.1 OS R 17 4 102.7 34.804 Q_ = 230.2 A $\overline{\mathbb{Q}}_{\mathbb{Z}}$ 600

Combined Sub-Basin DP2 Runoff Calculations

Includes Basins A1

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:	-	
Jurisdiction	DCM	Soil T	уре	В
Runoff Coefficient	Surface Type	Urbar	nization	Non-Urban

Basin Land Use Characteristics

	Area	l		Runc	off Coeffici	ent	·····		%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	50,438	1.16	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	16,558	0.38	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	13,532	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	80,528	1.85	0.31	0.36	0.41	0.48	0.52	0.55	35.7%

Basin Travel Time

	Sub-basin or	Material		Elev.		Base or	Sides		
	Channel Type	Туре	L (ft)	ΔZ_0 (ft)	Q _i (cfs)	Dia (ft)	z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	A1	-	317	23	-	-	-	-	9.1
Channelized-1		2	0	0					
Channelized-2									
Channelized-3									
Total			317	23					
	2	2 = Natural, Wi	nding, minima	l vegetation/s	hallow grass			tc	0.4
								(min)	9.1

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.40	4.26	4.97	5.68	6.39	7.16
Site Runoff (cfs)	1.98	2.82	3.76	5.05	6.12	7.31
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	- 20	-	-	-	- 7 2
Allowed Release (cfs)	= C1 * In (to	2.8	-	_	-	7.
	1.19		1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10 111	11 375	12.735

Notes

Combined Sub-Basin DP3 Runoff Calculations

Includes Basins C2

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:	-	
Jurisdiction	DCM	Soil Ty	pe	в
Runoff Coefficient	Surface Type	Urbaniz	zation	Non-Urban

Basin Land Use Characteristics

	Area			Runc	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	20,454	0.47	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	1,280	0.03	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	7,150	0.16	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	28,884	0.66	0.23	0.28	0.33	0.41	0.45	0.49	26.7%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach Channelized-1 Channelized-2 Channelized-3	C2	- 2	189 0	12 0	-	-			8.8
Total	2	2 = Natural, Wi	189 nding, minima	12 I vegetation/s	hallow grass			t _c (min)	8.8

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

l l	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.44	4.32	5.04	5.76	6.48	7.25
Site Runoff (cfs)	0.52	0.79	1.11	1.57	1.94	2.36
OffSite Runoff (cfs)		0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	0.8	-	-	-	2.4
DCM: I	= C1 * In (to	c) + C2				
C1	1.19	1.5	1.75	2	2 25	2.52
C2	6.035	7.583	8 847	10.111	11.375	12.735

Notes

Combined Sub-Basin DP4 Runoff Calculations

Includes Basins C3

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Ty	pe	B
Runoff Coefficient	Surface Type	Urbaniz	zation	Non-Urban

Basin Land Use Characteristics

:	Area			Rund	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	59,267	1.36	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	59,267	1.36	0.02	0.08	0.15	0.25	0.30	0.35	0.0%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	C3	-	273	20	-	-	-	-	11.8
Channelized-1				0					
Channelized-2									
Channelized-3									
Total			273	20					
								t,	

(min) ¹

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

	Contributing	Basins/Areas	DP3 / Pond (C2 Outflow	
--	--------------	---------------------	--------------	------------	--

Q _{Minor}	0 (cfs) - 5-year Storm
Q _{Major}	1.1 (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.10	3.88	4.53	5.18	5.82	6.52
Site Runoff (cfs)	0.08	0.42	0.92	1.76	2.38	3.10
OffSite Runoff (cfs)	-	0.00	-	-	-	1.10
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	0.4	-	-	-	4.2
DOM: 1	= C1 * In (łd	:) + 02				
C1	1.19	1.5	1.75	2	2.25	2 52
C2	6.035	7.583	8 847	10 111	11 375	12 735

Notes

Combined Sub-Basin DP5 Runoff Calculations

Includes Basins C4

Job No.:	61087	Date:	9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM
		Checked by:	
Jurisdiction	DCM	Soil Type	B
Runoff Coefficient	Surface Type	Urbanizatio	on Non-Urban

Basin Land Use Characteristics

	Area			Runo	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	28,016	0.64	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	28,016	0.64	0.02	0.08	0.15	0.25	0.30	0.35	0.0%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	C4	-	221	21	-	-	-	-	8.8
Channelized-1		2	0	0					
Channelized-2				0					
Channelized-3									
Total			221	21					
	2	2 = Natural, Wi	nding, minima	l vegetation/s	hallow grass			t _c (min)	8.8

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.45	4.33	5.05	5.77	6.49	7.27
Site Runoff (cfs)	0.04	0.22	0.49	0.93	1.25	1.64
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	0.2	-	-	-	1.6
DCM: 1	= C1 * In (tc	:) + C2				
C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11 375	12.735

Notes

Combined Sub-Basin DP6 Runoff Calculations

Includes Basins C1

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil T	уре	В
Runoff Coefficient	Surface Type	Urban	ization	Non-Urban

Basin Land Use Characteristics

	Area			Runc	off Coeffici	ent		1	%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	130,377	2.99	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	20,192	0.46	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	26,845	0.62	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	177,414	4.07	0.22	0.27	0.33	0.41	0.45	0.49	25.0%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z _o (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach Channelized-1 Channelized-2 Channelized-3	C1	- 2	557 0	37 0	-	-	-		13.1
Total	2	! = Natural, Win	557 nding, minima	37 I vegetation/sl	hallow grass			t _c (min)	13.1

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.97	3.72	4.35	4.97	5.59	6.25
Site Runoff (cfs)	2.71	4.12	5.81	8.27	10.23	12.45
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	4.1	-	-	-	12.5
DCM- I	= C1 * in (to	s) + C2				
C 1	1.19	15	1.75	2	2.25	2.52
C2	6.035	7 583	8 847	10,111	11 375	12 735

Notes

Combined Sub-Basin DP7 Runoff Calculations

Includes Basins C5

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:	<u></u>	******
Jurisdiction	DCM	Soil Type	· · · · · · · · · · · · · · · · · · ·	В
Runoff Coefficient	Surface Type	Urbaniza	tion	Non-Urban

Basin Land Use Characteristics

	Area	1		Runc	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	70,265	1.61	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	70,265	1.61	0.02	0.08	0.15	0.25	0.30	0.35	0.0%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z _o (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	C5	-	223	18	-	-	-	-	10.2
Channelized-1		2	0	0					
Channelized-2									
Channelized-3									
Total			223	18					
	2	2 = Natural, Wi	nding, minima	l vegetation/s	hallow grass			t,	40.0
								(min)	10.2

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas	DP6 / Pond C1 Outflow
0	A 1 (ofc) 5 year Starm

	U. I		
Q _{Major}	6.1	(cfs)	- 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.27	4.10	4.78	5.46	6.14	6.88
Site Runoff (cfs)	0.11	0.53	1.16	2.20	2.97	3.88
OffSite Runoff (cfs)	~	0.10	-	-	-	6.10
Release Rates (cfs/ac)	-	-	-	-		-
Allowed Release (cfs)	-	0.6	-	-	-	10.0
DCM: I	= C1 * In (to	:) + C2				
C1	1.19	1.5	1 75	2	2 25	2.52
C2	6.035	7.583	8 847	10.111	11 375	12.735

Notes

Combined Sub-Basin DP8 Runoff Calculations

Includes Basins B1

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
	•	Checked by:		
Jurisdiction	DCM	Soil Ty	ype	B
Runoff Coefficient	Surface Type	Urban	ization	Non-Urban

Basin Land Use Characteristics

	Area			Runc	off Coeffici	ent			%
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	102,701	2.36	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	-	0.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	-	0.00	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	-	0.00	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	102,701	2.36	0.02	0.08	0.15	0.25	0.30	0.35	0.0%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	B1	-	567	30	-	-	-	-	14.4
Channelized-1				0					
Channelized-2									
Channelized-3									
Total			567	30					
								t.	

(min) ^{Lc} 14.4

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.86	3.59	4.18	4.78	5.38	6.02
Site Runoff (cfs)	0.14	0.68	1.48	2.82	3.81	4.97
OffSite Runoff (cfs)	-	0.00	-		-	0.00
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	0.7	-	-	-	5.0
DCM: I	= C1 * In (Ic	s) + C2				
C1	1,19	1.5	1.75	2	2.25	2 52
C2	6.035	7.583	8.847	10.111	11 375	12.735

Notes

Combined Sub-Basin DP9 Runoff Calculations

Includes Basins B1 B2 OS C

Job No.:	61087	Date:	9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by: A	SM
		Checked by:	
Jurisdiction	DCM	Soil Type	в
Runoff Coefficient	Surface Type	Urbanization	Non-Urban

Basin Land Use Characteristics

	Area	Runoff Coefficient						%	
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	2,520,607	57.87	0.02	0.08	0.15	0.25	0.3	0.35	0%
Gravel	29,852	0.69	0.57	0.59	0.63	0.66	0.68	0.7	80%
Driveways & Walks	84,402	1.94	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	9,943	0.23	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	2,644,804	60.72	0.06	0.11	0.18	0.28	0.33	0.38	4.4%

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ∆Z₀ (ft)	Q _i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	B1	-	567	30	-	-	-	-	14.4
Channelized-1			Ö	0					
Channelized-2									
Channelized-3									
Total			567	30					
								t.	

(min)

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} Q_{Major} (cfs) - 5-year Storm (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	2.86	3.59	4.18	4.78	5.38	6.02
Site Runoff (cfs)	9.84	24.91	46.31	80.92	106.80	137.16
OffSite Runoff (cfs)	-	0.00	-	-	-	0.00
Release Rates (cfs/ac) Allowed Release (cfs)	-	24.9	-	-	-	- 137.2
DCM: I	= C1 * In (k	c) + C2				
C1	1.19	1.5	175	2	2.25	2.52
C2	6 035	7.583	8.847	10.111	11 375	12.735

Notes

3 Hydraulic Calculations

IRF Worksheet FS EDB design calculations (UD-BMP) FS EDB design calculations (UD-Detention) Spillway Detail Culvert Calculations

	Design Procedure Fo	
	UD-BMP (Version 3	.07, March 2018) Sheet 1 of
Designer:	D. Gorman	
Company:	M.V.E., Inc.	
Date:	September 13, 2019	
Project:	Sanctuary of Peace	
Location:	Sub-basin A1 - Sand Filter	
1. Basin Sto	orage Volume	
	ive Imperviousness of Tributary Area, I _a 6 if all paved and roofed areas upstream of sand filter)	I _a = <u>35.7</u> %
B) Tribut	tary Area's Imperviousness Ratio (i = I _a /100)	i =
	r Quality Capture Volume (WQCV) Based on 12-hour Drain Time CV= 0.8 * (0.91* i ³ - 1.19 * i ² + 0.78 * i)	WQCV = 0.13 watershed inches
D) Contr	ibuting Watershed Area (including sand filter area)	Area = 80,528 sq ft
	r Quality Capture Volume (WQCV) Design Volume _{cv} = WQCV / 12 * Area	V _{wocv} =cu ft
	Vatersheds Outside of the Denver Region, Depth of age Runoff Producing Storm	d ₆ = 0.42 in
	Vatersheds Outside of the Denver Region, er Quality Capture Volume (WQCV) Design Volume	V _{WQCV OTHER} = 882 cu ft
	Input of Water Quality Capture Volume (WQCV) Design Volume if a different WQCV Design Volume is desired)	V _{Wacv USER} =cu ft
2. Basin Ge	sometry	
A) WQC	V Depth	D _{wocv} =ft
	Filter Side Slopes (Horizontal distance per unit vertical, flatter preferred). Use "0" if sand filter has vertical walls,	Z = 3.00 ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
C) Minim	um Filter Area (Flat Surface Area)	A _{Min} = 359 sq ft
D) Actua	I Filter Area	A _{Actual} = 1200 sq ft
E) Volum	ne Provided	V _T = 5990 cu ft
3. Filter Ma	terial	Choose One 18" CDOT Class B or C Filter Material Other (Explain):
4. Underdra	ain System	Choose One
	nderdrains provided?	● YES ○ NO
B) Under	rdrain system orifice diameter for 12 hour drain time	l.
	i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 20 ft
	ii) Volume to Drain in 12 Hours	Vol ₁₂ = 882 cu ft
	iii) Orifice Diameter, 3/8" Minimum	$D_{o} = 11/16$ in

	Design Procedure	Form: Sand Filter (SF)	
			Sheet 2 of
Designer:	D. Gorman		
Company:	M.V.E., Inc.		
Date:	September 13, 2019		
Project:	Sanctuary of Peace		
Location:	Sub-basin A1 - Sand Filter		
A) Is an i	able Geomembrane Liner and Geotextile Separator Fabric impermeable liner provided due to proximity uctures or groundwater contamination?	Choose One	
	tlet Works ribe the type of energy dissipation at inlet points and means of eying flows in excess of the WQCV through the outlet	emergency spillway with rip-rap protection rip-rap at inflow points	
Notes:			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

0.25

Stage

(ft)

0.00

0.25

0.50

0.66

0.75

1.00

1.25

1.50

1.75

1.81

2.00

2.25

2.50

Override

tage (ff

Length

(ft)

49.4

50.9

52.4

53.4

53.9

55.4

56.9

58.4

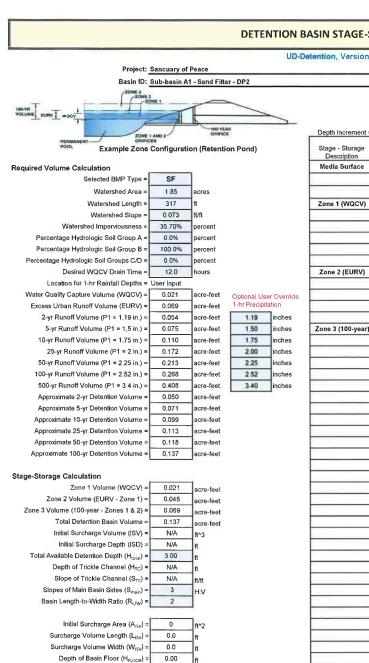
59.9

60.3

61,4

62.9

64.4



-	2.50	64.4	39.7	2,559		0.059	4,632	0,106
	2,75	65.9	41.2	2,717		0.062	5,292	0.121
Zone 3 (100-year)	3.00	67.4	42.7	2,880		0.066	5,991	0.138
	3.25	68.9	44.2	3,048		0.070	6,732	0.155
	3.50	70.4	45.7	3,220		0.074	7,516	0.173
	3.75	71.9	47.2	3,396		0.078	8,342	0.192
	4.00	73,4	48.7	3,577		0.082	9,214	0.212
	4.25	74.9	50.2	3,763	1	0.086	10,131	0.233
	4.50	76.4	51.7	3,953	1	0.091	11,096	0.255
	4.75	77.9	53.2	4,147		0.095	12,108	0.278
	5,00	79.4	54.7	4,346		0.100	13,170	0.302
	5.25	80.9	56.2	4,550		0.104	14,282	0.328
	5.50	82.4	57.7	4,758	1	0.109	15,445	0.355
	5.75	83.9	59.2	4,970		0.114	16,661	0.382
	6.00	85.4	60.7	5,187		0.119	17,930	0.412
	6.25	86.9	62.2	5,409		0.124	19,255	0,442
	6.50	88.4	63.7	5,634		0,129	20,635	0.474
	6.75	89,9	65.2	5,865		0.135	22,072	0.507
	7.00	91.4	66.7	6,100		0.140	23,568	0.541
	7.25	92.9	68.2	6,339		0.146	25,123	0.577
	7.50	94,4	69.7	6,583		0.151	26,738	0.614
	7.75	95.9	71.2	6,832		0.157	28,415	0.652
	8.00	97.4	72.7	7,085		0.163	30,154	0.692
	8.25	98.9	74.2	7,342		0.169	31,958	0.734
	8.50	100.4	75.7	7,604		0.175	33,826	0.777
	8.75	101.9	77.2	7,871		0.181	35,760	0.821
	9.00	103.4	78.7	8,142		0.187	37,761	0.867
	9.25	104.9	80.2	8,417	i i	0,193	39,831	0.914
	9.50	106.4	81.7	8,697		0.200	41,970	0.964
	9,75	107.9	83.2	8,982		0.206	44,180	1.014
	10.00	109.4	84.7	9,271		0.213	46,462	1.067
	10.25	110.9	86.2	9,564		0.220	48,816	1.121
	10.50	112.4	87.7	9,862		0.226	51,244	1.176
	10.75	113.9	89.2	10,164		0.233	53,747	1.234
	11,00	115.4	90.7	10,471		0.240	56,327	1.293
	11.25	116.9	92.2	10,783		0.248	58,983	1.354
	11.50	118.4	93.7	11,099		0.255	61,719	1.417
	11.75	119.9	95.2	11,419		0.262	64,533	1.481
	12.00	121.4	96.7	11,744		0.270	67,429	1.548
	12.25	122.9	98.2	12,074		0.277	70,406	1.616
	12.50	124.4	99,7	12,408		0.285	73,466	1.687
	12.75	125.9	101.2	12,746		0.293	76.610	1.759

Width

(ft)

24.7

26.2

27.7

28.7

29.2

30.7

32.2

33.7

35.2

35.6

36.7

38.2

39.7

Area

(ft^2)

1.222

1,331

1,448

1.531

1.571

1,697

1,829

1,965

2,105

2,145

2,250

2,405

2.559

Override

ea (ft^

Area

(acre

0.028

0.031

0.033

0.035

0.036

0.039

0.042

0.045

0.048

0.049

0,052

0.055

0.059

Volume

(ft^3)

306

653

907

1.031

1,439

1,880

2,354

2,863

3,011

3,407

4,012

4.632

Length of Basin Floor (L_{FLOOR})

Width of Basin Floor (W_{FLOOR})

Volume of Basin Floor (V_{FLOOR})

Area of Basin Floor (AFLOOR) =

Depth of Main Basin (H_{MAIN}) =

Length of Main Basin (L_{MAIN})

Width of Main Basin (WMAIN) =

Area of Main Basin (AMAIN)

Volume of Main Basin (V_{MAIN})

Calculated Total Basin Volume (Vtotal) =

49.4 ft

24.7

1,222

0

3.00

67.4

42.7

2.880

5.978

0.137

ft^2

ft^3

ft^2

ft^3

acre-feet

Volume

(ac-ft)

0.007

0.015

0.021

0.024

0.033

0.043

0.054

0.066

0.069

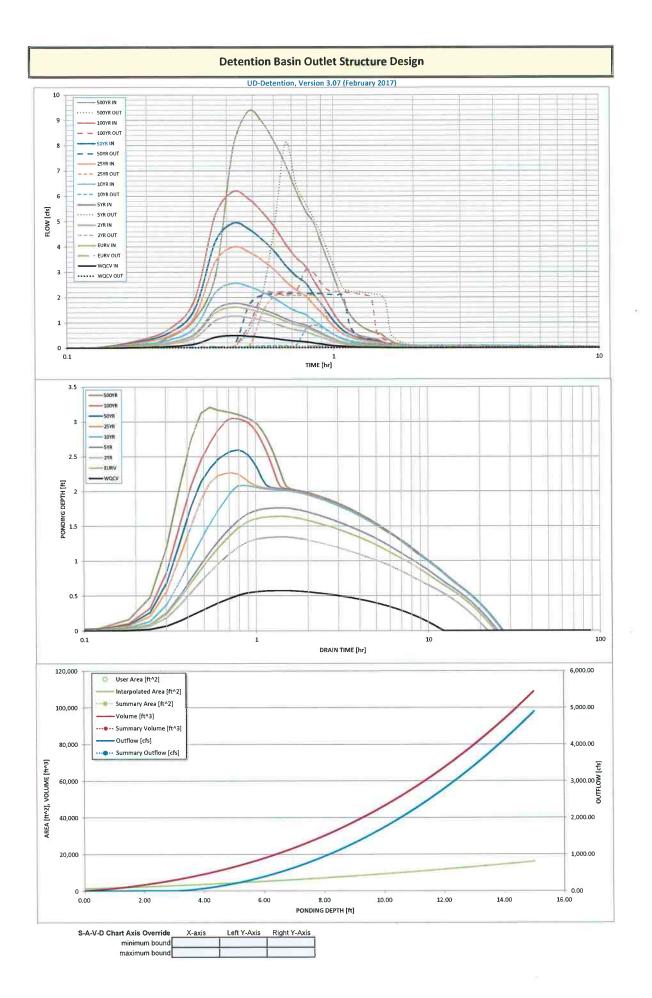
0,078

0.092

0.106

Detention Basin Outlet Structure Design

			11D-Detention Ver	rsion 3.07 (Februar	v 2017)				
Project.	0		ob betention, ver		y 2027 /				
·	Sanctuary of Peace Sub-basin A1 - Sanc								
JEONE 3	Sub-basin A1 - Sand	a Finter DP2							
ZONE 2	\sim								
100-YB				Stage (ft)	Zone Volume (ac-ft)	Outlet Type			
VOLUME EURV WOOV			Zone 1 (WQCV)	0.66	0,021	Filtration Media			
	-100-YEAR		Zone 2 (EURV)	1.81	0.048	Orifice Plate			
PERMANENT ONFICES	Ofurice		:one 3 (100-year)	3.00	0.069	Weir&Pipe (Restrict)			
P.C. Manufacture .	Configuration (Ret	ention Pond)	.one 5 (100-year)	5.00					
					0.137	Total			
User Input: Orifice at Underdrain Outlet (typically us							d Parameters for Un		
Underdrain Orifice Invert Depth =	2.00	ft (distance below th	e filtration media sur	face)	Unde	rdrain Orifice Area =	0.0	ft ²	
Underdrain Orifice Diameter =	0.72	inches			Underdra	in Orifice Centroid =	0.03	feet	
X									
User Input: Orifice Plate with one or more orifices of	or Elliptical Slot Weir	(typically used to dr	ain WQCV and/or EU	IRV in a sedimentati	on BMP)	Calcu	lated Parameters for	Plate	
Invert of Lowest Orifice =	0.66	ft (relative to basin b	ottom at Stage = 0 ft)	WQ OI	ifice Area per Row =	N/A	ft²	
Depth at top of Zone using Orifice Plate =	1.86	ft (relative to basin b	ottom at Stage = 0 ft)	E	liptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	N/A	inches			ENir	tical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	N/A	inches				Elliptical Slot Area =	N/A	ft²	
							,		
User Input: Stage and Total Area of Each Orifice F				David for the t	Davis E. C. C. F.	David (set)	Daw 7 (+)	Day 9 (and and	
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.66	1.06	1 46						
Orifice Area (sq. inches)	0.76	0 76	0.76						
									7
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	
Stage of Orifice Centroid (ft)									1
Orifice Area (sq. inches)									t i
(h)									
User Input: Vertical Orifice (Circo	ular or Rectangular)					Calculated	Parameters for Vert	tical Orifice	2.
	Not Selected	Not Selected					Not Selected	Not Selected	1
Invert of Vertical Orifice =	N/A		ft (relative to basin b	ottom at Stage = 0 f	t) V	ertical Orifice Area =	N/A	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	N/A		ft (relative to basin b	-		al Orifice Centroid =	N/A	N/A	feet
Debtil at tob of tone gaing vertical office -				occom ac scage = 01	cj veren				1.000
Vertical Orifica Diameter -	AI/A								
Vertical Orifice Diameter =	N/A	N/A	inches						
Vertical Orifice Diameter =	N/A	N/A	inches						
,		N/A	inches			6.1.1.1.1	10	B	
Vertical Orifice Diameter =	rate (Flat or Sloped)		Inches			Calculated	Parameters for Ove		
User Input: Overflow Weir (Dropbox) and Gi	rate (Flat or Sloped) Zone 3 Weir	Not Selected	inches				Zone 3 Weir	Not Selected]
,	rate (Flat or Sloped)	Not Selected	inches ft (relative to basin bo	ttom at Stage = 0 ft)	Height of Gr	Calculated ate Upper Ecige, H _t =	Zone 3 Weir 2.00	Not Selected N/A	feet
User Input: Overflow Weir (Dropbox) and Gi	rate (Flat or Sloped) Zone 3 Weir	Not Selected		ttom at Stage = 0 π̂}			Zone 3 Weir	Not Selected	feet feet
User Input: Overflow Weir (Dropbox) and Gi Overflow Weir Front Edge Height, Ho =	rate (Flat or Sloped) Zone 3 Weir 2.00	Not Selected N/A N/A	ft (relative to basin bo		Over Flow	ate Upper Edge, H _t =	Zone 3 Weir 2.00	Not Selected N/A	feet should be ≥ 4
User Input: Overflow Weir (Dropbox) and Gi Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92	Not Selected N/A N/A	ft (relative to basin bo feet		Over Flow	ate Upper Ecige, H _t = Weir Slope Length = 100-yr Orifice Area =	Zone 3 Weir 2.00 2.92	Not Selected N/A N/A	feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00	Not Selected N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl	at grate)	Over Flow Grate Open Area / Overflow Grate Op	ate Upper Ecige, H _t = Weir Slope Length = 100-yr Orifice Area =	Zone 3 Weir 2.00 2.92 32.34	Not Selected N/A N/A N/A	feet should be ≥ 4
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92	Not Selected N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet	at grate)	Over Flow Grate Open Area / Overflow Grate Op	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris =	Zone 3 Weir 2.00 2.92 32.34 6.91	Not Selected N/A N/A N/A N/A	feet should be <u>></u> 4 ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92 81%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet	at grate)	Over Flow Grate Open Area / Overflow Grate Op	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris =	Zone 3 Weir 2.00 2.92 32.34 6.91	Not Selected N/A N/A N/A N/A	feet should be <u>></u> 4 ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sldes = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92 81% 50%	Not Selected N/A N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t %	at grate)	Over Flow Grate Open Area / Overflow Grate Op Overflow Grate O	ate Upper Ecige, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris =	Zone 3 Weir 2.00 2.92 32.34 6.91 3.45	Not Selected N/A N/A N/A N/A N/A	feet should be ≥ 4 ft ² ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92 81% 50% Sicular Orifice, Restri	Not Selected N/A N/A N/A N/A N/A N/A ictor Plate, or Rectai	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t %	at grate)	Over Flow Grate Open Area / Overflow Grate Op Overflow Grate O	ate Upper Ecige, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris =	Zone 3 Weir 2.00 2.92 32.34 6.91 3.45	Not Selected N/A N/A N/A N/A N/A Flow Restriction Pla	feet should be ≥ 4 ft ² ft ²
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User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slotes = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Retum Period = OPTIONAL Override Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Peak Untflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hores) =	rate (Flat or Sloped) Zone 3 Weir 2 00 2 92 0 00 2 92 81% 50% Circular Orifice, Restri Zone 3 Restrictor 2 00 12 00 3 .80 200 2 00 1 00 2 00 2 00 1 00 2 00 2 00 1 00 2 00 0 00 2 00 0 .00 0 .02 0 .00 0 .00 0 .02 0 .00 0	Not Selected N/A	ft (relative to basin bo feet Hi-V (enter zero for ff feet %, grate open area/t % agular Orifice) ft (distance below bas inches inches bottom at Stage = 0 ff <u>2 Year</u> 1.19 0.054 <u>0.053</u> 0.02 0.0 1.3 0.1 N/A Plate N/A N/A 21	at grate) total area in bottom at Stage = 0 Half- t) 5 Year 1.50 0.075 0.03 0.1 1.8 0.1 1.7 Plate N/A N/A 24	Over Flow Grate Open Area / Overflow Grate Op Overflow Grate O Overflow Grate O Overflow Grate O Overflow Grate O Overflow Grate 1 0.109 0.29 0.5 2.6 0.9 1.7 Overflow Grate 1 0.1 N/A 25	ate Upper Edge, H ₁ = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/o Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 0.172 0.90 1.7 4.0 0.30 2.1 1.3 Outlet Plate 1 0.3 N/A 24	Zone 3 Weir 2.00 2.92 32.34 6.91 3.45 3.45 rs for Outlet Pipe w// Zone 3 Restrictor 0.21 0.19 1.20 ated Parameters for S 0.21 4.21 0.09 0.21 4.21 0.09 0.21 4.21 0.09 50 Year 2.25 0.213 1.24 2.3 4.9 2.2 0.9 Outlet Plate 1 0.3 N/A 23	Not Selected N/A N/A N/A N/A N/A N/A N/A N/A Spillway feet acres 0.267 1.64 3.0 6.2 3.1 1.0 Spillway 0.3 N/A	feet should be ≥ 4 ft ² ft ² ft ² feet radians 0.407 0.408 0.407
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slobe = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage= Spillway End Slopes = Freeboard above Max Water Surface = Spillway End Slopes = Freeboard above Max Water Surface = One-Hour Rainfall Depth (m) = Calculated Runoff Volume (acre-ft) = OPTIONAL Override Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Unflow Q (cfs) = Peak Unflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 2 ((ps) =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92 81% 50% Circular Orifice, Restri Zone 3 Restrictor 2.00 12.00 3.80 20.00 2.00 2.00 1.00 2.00 0.021 0.020 0.02 0.00 0.02 0	Not Selected N/A ft (relative to basin feet H:V feet 0.069 0.068 0.00 0.068 0.00 N/A Plate N/A Plate N/A 23 24	ft (relative to basin bo feet Hi-V (enter zero for ff feet %, grate open area/t % ngular Orifice) ft (distance below bas inches inches inches bottom at Stage = 0 ff 0.054 0.054 0.054 0.053 0.02 0.0 1.3 0.1 N/A Plate N/A N/A 21 22	at grate) total area in bottom at Stage = 0 Half- t) 5 Year 1.50 0.075 0.03 0.1 1.8 0.1 1.8 0.1 1.7 Plate N/A N/A 24 25	Over Flow Grate Open Area / Overflow Grate Op Overflow Grate O (ft) Out Central Angle of Rest Spillway Stage a Basin Area a Basin Area a 0.10 0.29 0.29 0.5 2.6 0.9 1.7 Overflow Grate 1 0.1 N/A 25 26	ate Upper Edge, H ₁ = Weir Slope Length = 100-yr Orifice Area = en Area w/ Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 0.172 0.172 0.90 1.7 4.0 2.1 1.3 Outlet Plate 1 0.3 N/A 24 26	Zone 3 Weir 2.00 2.92 32.34 6.91 3.45 20ne 3 Restrictor 0.21 0.19 1.20 ated Parameters for 3 0.21 4.21 0.09 2.25 0.213 1.24 2.3 4.9 2.2 0.9 Outlet Plate 1 0.3 N/A 2.3 26	Not Selected N/A Spillway feet feet acres 0.267 1.64 3.0 6.2 3.1 1.0 Spillway 0.3 N/A 22 25	feet should be ≥ 4 ft ² ft ² feet radians
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slobe = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Restrictor Plate Height Above Pipe Invert = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = OPTIONAL Override Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (ofs/acre) = Predevelopment Peak Q (cfs) = Peak Anflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Maximum Ponding Depth (ft) =	rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 81% 50% Solution 2.92 81% Cone 3 Restrictor 2.00 1.00 3.00 2.00 1.00 1.00 2.00 1.00 1.00 2.00 1.00 1.00 2.5 0.00 1.00 1.00 2.5 0.00 1.12 1.2 0.58 1.2 1.2 0.58 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2	Event EURV 1.6 0.068 0.006 0.068 0.006 0.068 0.006 0.068 0.006 0.068 0.006 0.068 0.00 1.6 0.1 N/A Plate N/A 1.6 0.1 N/A 23 24 1.64	ft (relative to basin bo feet H:V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below bas inches inches bottom at Stage = 0 ff 2 Year 1.19 0.054 0.053 0.02 0.0 1.3 0.1 N/A Plate N/A N/A 21 22 1.35	at grate) total area in bottom at Stage = 0 Half- t) 5 Year 1.50 0.075 0.03 0.1 1.8 0.1 1.8 0.1 1.8 0.1 1.7 Plate N/A N/A 24 25 1.77	Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate O Overflow Grate O Overflow Grate O Overflow Grate O Spillway Stage a Basin Area a Overflow Grate O Overflow Grate 1 Overflow Grate	ate Upper Edge, H ₁ = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/o Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 2.00 0.172 0.172 0.172 0.172 0.90 1.7 4.0 2.1 1.3 Outlet Plate 1 0.3 N/A 24 26 2.27	Zone 3 Weir 2.00 2.92 32.34 6.91 3.45 20re 3 Restrictor 0.21 0.19 1.20 ated Parameters for 5 0.21 4.21 0.09 2.25 0.213 1.24 2.3 4.9 2.2 0.9 Outlet Plate 1 0.3 N/A 23 26 2.60	Not Selected N/A Spillway 6.2 3.1 1.0 Spillway 0.3 N/A 22 25 3.06	feet should be ≥ 4 ft ² ft ² ftet feet radians
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sloes = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway Emergency Spillway (Rectang Spillway Invert Stage= Spillway Crest Length = Spillway Emergency Spillway (Rectang Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Reuted Hydrograph Results Design Storm Retum Period = OPTIONAL Override Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Qets (Cfs) = Peak Inflow Qets) = Peak Nufflow Qets) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) =	rate (Flat or Sloped) Zone 3 Weir 2 00 2 92 0.00 2.92 81% 50% Sircular Orifice, Restri Zone 3 Restrictor 2.00 12 00 3.80 200 2.00 1.2 00 3.80 200 2.00 1.00 2.5 0.00 1.00 2.5 0.00 2.5 0.00 5.5 0.03 5.5 0.03 5.	Not Selected N/A ft (relative to basin feet H:V feet 0.069 0.068 0.00 0.068 0.00 N/A Plate N/A Plate N/A 23 24	ft (relative to basin bo feet Hi-V (enter zero for ff feet %, grate open area/t % ngular Orifice) ft (distance below bas inches inches inches bottom at Stage = 0 ff 0.054 0.054 0.054 0.053 0.02 0.0 1.3 0.1 N/A Plate N/A N/A 21 22	at grate) total area in bottom at Stage = 0 Half- t) 5 Year 1.50 0.075 0.03 0.1 1.8 0.1 1.8 0.1 1.7 Plate N/A N/A 24 25	Over Flow Grate Open Area / Overflow Grate Op Overflow Grate O (ft) Out Central Angle of Rest Spillway Stage a Basin Area a Basin Area a 0.10 0.29 0.29 0.5 2.6 0.9 1.7 Overflow Grate 1 0.1 N/A 25 26	ate Upper Edge, H ₁ = Weir Slope Length = 100-yr Orifice Area = en Area w/ Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 0.172 0.172 0.90 1.7 4.0 2.1 1.3 Outlet Plate 1 0.3 N/A 24 26	Zone 3 Weir 2.00 2.92 32.34 6.91 3.45 20ne 3 Restrictor 0.21 0.19 1.20 ated Parameters for 3 0.21 4.21 0.09 2.25 0.213 1.24 2.3 4.9 2.2 0.9 Outlet Plate 1 0.3 N/A 2.3 26	Not Selected N/A Spillway feet feet acres 0.267 1.64 3.0 6.2 3.1 1.0 Spillway 0.3 N/A 22 25	feet should be ≥ 4 ft ² ft ² feet radians



	Design Procedure Form	n: Sand Filter (SF)
	UD-BMP (Version 3.07	, March 2018) Sheet 1 of 2
Designer:	D. Gorman	
Company:	M.V.E., Inc. September 13, 2019	<u> </u>
Date: Project:	Sanctuary of Peace	
Location:	Sub-basin C1 - Sand Filter	
1. Basin Sto	orage Volume	
	ive Imperviousness of Tributary Area, I _a 5 if all paved and roofed areas upstream of sand filter)	I _a =%
B) Tribut	ary Area's Imperviousness Ratio (i = I _a /100)	i = 0.250
	r Quality Capture Volume (WQCV) Based on 12-hour Drain Time CV= 0,8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)	WQCV = 0.11 watershed inches
D) Contr	ibuting Watershed Area (including sand filter area)	Area = 177,412 sq ft
	r Quality Capture Volume (WQCV) Design Volume _{CV} = WQCV / 12 * Area	V _{wacv} =cu ft
	/atersheds Outside of the Denver Region, Depth of age Runoff Producing Storm	d ₆ = 0.42 in
	Vatersheds Outside of the Denver Region, r Quality Capture Volume (WQCV) Design Volume	V _{WQCV OTHER} = 1,558 cu ft
	Input of Water Quality Capture Volume (WQCV) Design Volume if a different WQCV Design Volume is desired)	V _{WQCV USER} = cu ft
2. Basin Ge	ometry	
A) WQC	√ Depth	$D_{WQCV} = 0.8$ ft
	Filter Side Slopes (Horizontal distance per unit vertical, flatter preferred). Use "0" if sand filter has vertical walls,	Z = 3.00 ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
C) Minim	um Filter Area (Flat Surface Area)	A _{Min} = 554 sq ft
D) Actua	I Filter Area	A _{Actual} = 1843 sq ft
E) Volum	ne Provided	$V_{T} = 1601$ cu ft
3. Filter Ma	terial	Choose One 18" CDOT Class B or C Filter Material Other (Explain):
4. Underdra	ain System	Choose One
A) Are ur	nderdrains provided?	● YES ○ NO
B) Under	drain system orifice diameter for 12 hour drain time	
	i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 2.0 ft
	ii) Volume to Drain in 12 Hours	Vol ₁₂ =1,558 cu ft
	iii) Orifice Diameter, 3/8" Minimum	D _o = <u>15/16</u> in

	Design Procedure F	Form: Sand Filter (SF)	
Designer:	D. Gorman		Sheet 2 of
Company:	M.V.E., Inc.		
Date:	September 13, 2019		
Project:	Sanctuary of Peace		
ocation:	Sub-basin C1 - Sand Filter		
A) Is an i	able Geomembrane Liner and Geotextile Separator Fabric impermeable liner provided due to proximity uctures or groundwater contamination?	Choose One	
	ttlet Works ribe the type of energy dissipation at inlet points and means of eying flows in excess of the WQCV through the outlet	emergency spillway with rip-rap protection rip-rap at inflow points	
Notes:			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Depth Increment :

Stage - Storage

nches

nches

0.25

Stage

Optic

Override

Length

Width

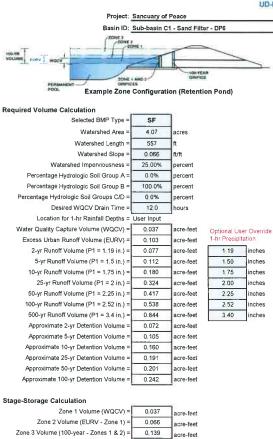
Area

Override

Агеа

Volume

Volume



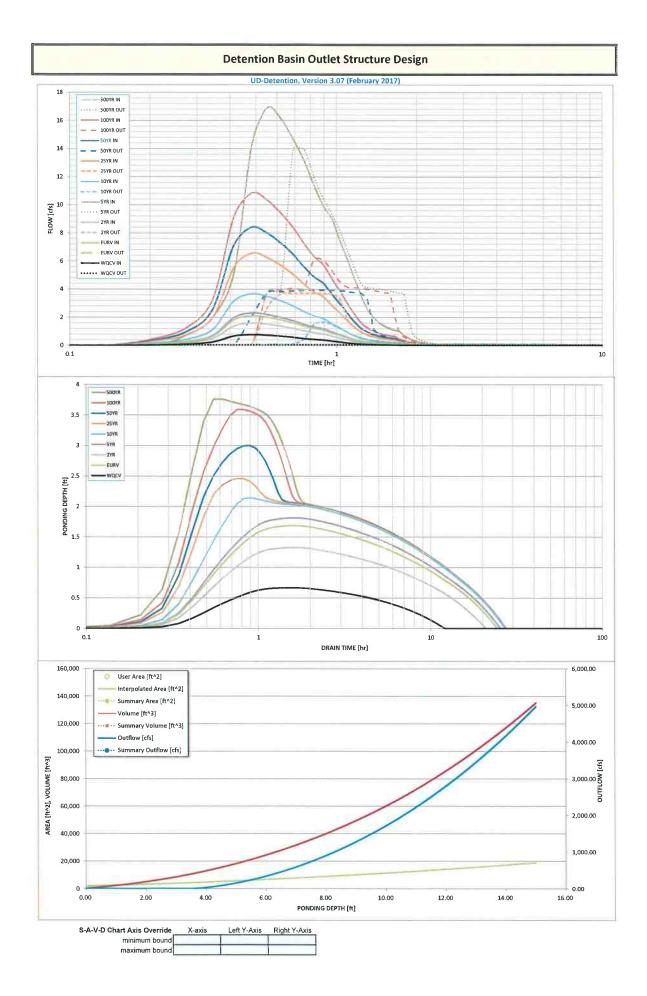
Stage - Storage	Stage	Override Store (#)	Length	Width	Area	Override Area (#42)	Area	Volume	Volun
Description Media Surface	(ft) 0.00	Stage (ft)	(ft) 74.3	(ft) 24.8	(ft^2) 1,843	Area (ft^2)	(acre) 0.042	(ft^3)	{ac-1
media oditace	0.25		75.8	26.2	1,987		0.046	460	0.01
		-							-
	0.50		77.3	27.7	2,143		0.049	976	0.02
-	0.75	_	78.8	29.2	2,302		0.053	1,531	0.03
Zone 1 (WQCV)	0.77		79.0 80.3	29.4 30.7	2,322		0.053	1,601	0.03
	1.00			30.7	2,467		0.061		0.04
	1.25		81.8 83.3	32.2	2,636 2,809		0.061	2,765	0.06
	1.75		84.8	35.2	2,987		0.069	4,170	0.07
Zone 2 (EURV)	1.85		85.4	35.9	3,066		0.070	4,170	0.09
Zone Z (Loitv)	2.00		86.3	36.7	3,169		0.073	4,939	0.11
	2.25	-	87.8	38.3	3,363		0.077	5,788	0.13
	2.50		89.3	39.8	3,555		0.082	6,653	0.15
	2.75		90.8	41.3	3,751		0.086	7,566	0.17
	3.00		92.3	42.8	3,951		0.091	8,528	0.19
	3.25		93.8	44.3	4,156		0.095	9,542	0.21
Zone 3 (100-year)	3.49		95.3	45.7	4,357		0,100	10,563	0.24
	3.50		95.3	45.8	4,365		0.100	10,607	0.24
	3.75		96.8	47.3	4,579		0.105	11,725	0.26
	4.00		98.3	48.8	4,798		0.110	12,897	0.29
	4.25		99.8	50.3	5,021		0.115	14,124	0 32
	4.50		101.3	51.8	5,248		0.120	15,408	0.35
	4.75		102.8	53.3	5,480		0.126	16,749	0.38
	5.00		104.3	54.8	5,717		0.131	18,148	0,41
	5.25		105.8	56.3	5,958		0.137	19,607	0.45
	5.50		107_3	57,8	6,203		0.142	21,127	0.48
	5.75		108.8	59.3	6,453		0.148	22,709	0.52
	6.00		110.3	60.8	6,707		0,154	24,354	0.55
	6.25		111_8	62.3	6,966		0.160	26,063	0.59
	6.50		113.3	63.8	7,230		0_166	27,838	0.63
	6.75		114.8	65.3	7,498		0,172	29,678	0.68
	7.00	-	116.3	66.8	7,770		0 178	31,587	0.72
	7.25		117.8	68.3	8,047		0,185	33,564	0.77
	7.50		119.3	69.8	8,329		0,191	35,611	0.81
	7 75		120.8	71.3	8,615		0,198	37,729	0.86
	8.00		122.3	72.8	8,905		0.204	39,918	0.91
	8.25		123.8	74.3	9,200	-	0.211	42,181	0.96
	8,50		125.3	75.8	9,499		0.218	44,519	1.02
	8 75		126.8	77.3	9,803	-	0.225	46,932	1.07
	9.00		128.3	78.8	10,112		0.232	49,421	1.13
	9.25		129.8 131.3	80.3 81.8	10,425	-	0.239	51,988 54,634	1.19
	9.50		131.3	81.8			0.247	54,634	1.25
	9.75		132.8	83.3	11,064 11,391	-	0.254	57,359 60,166	1.31
	10.00	-	134.3	84.8	11,391	-	0.261	63,055	1.38
	10.25		135.8	87.8	11,722		0.269	66,027	1.44
	10,50		137.3	89.3	12,057		0.277	69,027	1.51
	11.00		140.3	90.8	12,397	-	0.283	72,226	1.65
	11.00	-	140.3	92.3	13.090		0.301	75,455	1 73
	11.50		141.0	93.8	13,444		0.309	78,772	1.80
	11_75		143.3	95.3	13,444		0.303	82,177	1.88
	12.00		144.0	96.8	14,164	-	0.317	85,673	1.96
	12.00		140.5	98.3	14,531		0.334	89,260	2.04
	12.50	-	149.3	99.8	14,903	1	0.342	92,939	2.13

Zone 1 Volume (WQCV) =	0.037	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.066	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0,139	acre-feet
Total Detention Basin Volume =	0.242	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H _{total}) ≐	3 50	ft
Depth of Trickle Channel $(H_{TC}) =$	N/A	ft
Slope of Trickle Channel (S _{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (Smain) =	3	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	3	1

Initial Surcharge Area (Arsv) =	0	ft^2
Surcharge Volume Length (L _{ISV}) =	0.0	ft
Surcharge Volume Width (W _{ISV}) =	0,0	ft
Depth of Basin Floor (H _{FLOOR}) =	0.00	ft
Length of Basin Floor (L _{FLOOR}) =	74.3	ft
Width of Basin Floor (W _{FLOOR}) =	24.8	ft
Area of Basin Floor (A _{FLOOR}) =	1,843	ft^2
Volume of Basin Floor (V _{FLOOR}) =	0	ft^3
Depth of Main Basin (H _{MAIN}) =	3.50	ft
Length of Main Basin (L _{MAN}) =	95.3	ft
Width of Main Basin (W _{MAIN}) =	45.8	ft
Area of Main Basin (A _{MAIN}) =	4,365	ft^2
Volume of Main Basin (V _{MAIN}) =	10,552	ft^3
Calculated Total Basin Volume (V_{total}) =	0.242	acre-feet

Detention Basin Outlet Structure Design

		Dete							
Berlinte	· · · · · · · · · · · · · · · · · · ·		UD-Detention, Ver	rsion 3.07 (Februar	y 2017)				
	Sanctuary of Peace Sub-basin C1 - San								_
ZONE 3									
				Stage (ft)	Zone Volume (ac-ft)	Outlet Type			
OLUME AUNY WOOV			Zone 1 (WQCV)	0.77	0.037	Filtration Media			
	TOD YEAR		Zone 2 (EURV)	1.85	0.066	Orifice Plate			
PERMANENT OMIFICES	ONFICE		:one 3 (100-year)	3.49	0.139	Weir&Pipe (Restrict)			
Example Zone	Configuration (Re	tention Pond)			0.242	Total			
er Input: Orifice at Underdrain Outlet (typically us	sed to drain WQCV i	n a Filtration BMP)				Calculate	ed Parameters for Un	nderdrain	
Underdrain Orifice Invert Depth =	2.00	ft (distance below th	ne filtration media sur	face)	Unde	rdrain Orifice Area =	0.0	ft²	
Underdrain Orifice Diameter =	0.96	inches			Underdra	in Orifice Centroid =	0.04	feet	
ser Input: Orifice Plate with one or more orifices of	ar Elliptical Elat Main	(tunically used to de	rain WOCV and/or El	IDV in a codimentati	on RMD)	Calau	lated Parameters for	Plata	
Invert of Lowest Orifice =	0.77		pottom at Stage = 0 ft			ifice Area per Row =		ft ²	
Depth at top of Zone using Orifice Plate =	1.86		pottom at Stage = 0 ft			liptical Half-Width =		feet	
Orifice Plate: Orifice Vertical Spacing =	4.20	inches			Ellip	tical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.68	sq. inches (diameter	= 15/16 inch)			Elliptical Slot Area =	N/A	ft²	
ser Input: Stage and Total Area of Each Orifice I				Pour d (antianali	Bow 5 (cotional)	Bow & (antianal)	Row 7 (optional)	Row 8 (optional)	1
Stage of Orifice Centroid (ft)	Row 1 (required) 0.77	Row 2 (optional) 1.13	Row 3 (optional) 1.50	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	now / (optional)	now o (optional)	1
Orifice Area (sq. inches)	0.68	0.68	0.68						1
									2
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)]
Stage of Orifice Centroid (ft)									
Orifice Area (sq. inches)]
User Input: Vertical Orifice (Circ	ular or Rostonaula -					Calculat-d	Parameters for Vert	tical Orifica	
User Input: Vertical Orifice (Circ	Not Selected	Not Selected	1			Calculated	Not Selected	Not Selected	1
Invert of Vertical Orifice =	N/A		ft (relative to basin b	ottom at Stage = 0 f	t) V	ertical Orifice Area =	N/A	N/A	ft ²
i					,				1.
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin b	ottom at Stage = 0 f	t) Vertic	al Orifice Centroid =	N/A	N/A	feet
Depth at top of Zone using Vertical Orifice = Vertical Orifice Diameter =	N/A N/A		ft (relative to basin b inches	oottom at Stage = 0 f	t) Vertic	al Orifice Centroid =	N/A	N/A	feet
			•	oottom at Stage = 0 f	t) Vertic	al Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A		•	oottom at Stage = 0 f	t) Vertic	0			feet
	N/A rate (Flat or Sloped)	N/A	•	oottom at Stage = 0 f	t) Vertic	0	Parameters for Ove	rflow Weir	feet
Vertical Orifice Diameter =	N/A rate (Flat or Sloped) Zone 3 Weir	N/A Not Selected	linches			Calculated	Parameters for Ove Zone 3 Weir	rflow Weir Not Selected]
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and Gi Overflow Weir Front Edge Height, Ho =	N/A rate (Flat or Sloped) Zone 3 Weir 2.00	N/A Not Selected N/A	inches ft (relative to basin bo		Height of Gr	Calculatec ate Upper Edge, H _t =	Parameters for Ove Zone 3 Weir 2.00	rflow Weir Not Selected N/A	feet
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	N/A rate (Flat or Sloped) Zone 3 Weir 2.00 2.92	N/A Not Selected N/A N/A	inches ft (relative to basin bo feet	ttom at Stage = 0 ft)	Height of Gr Over Flow	Calculated ate Upper Edge, H _t = Weir Slope Length =	Parameters for Ove Zone 3 Weir 2.00 2.92	rflow Weir Not Selected N/A N/A	 feet feet
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and Gi Overflow Weir Front Edge Height, Ho =	N/A rate (Flat or Sloped) Zone 3 Weir 2.00	N/A Not Selected N/A	inches ft (relative to basin bo	ttom at Stage = 0 ft)	Height of Gr Over Flow	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area =	Parameters for Ove Zone 3 Weir 2.00	rflow Weir Not Selected N/A	feet
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope =	N/A rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00	N/A Not Selected N/A N/A N/A	inches ft (relative to basin bo feet H;V (enter zero for fl	ttom at Stage = 0 ft) at grate)	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area =	Parameters for Ove Zone 3 Weir 2.00 2.92 18.37	rflow Weir Not Selected N/A N/A N/A	feet feet should be ≥ 4
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides =	N/A rate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92	N/A Not Selected N/A N/A N/A	inches ft (relative to basin bo feet H:V (enter zero for fl feet	ttom at Stage = 0 ft) at grate)	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope	Calculated ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris =	Parameters for Ove Zone 3 Weir 2.00 2.92 18.37 6.91	rflow Weir Not Selected N/A N/A N/A N/A	feet feet should be ≥ 4 ft ²
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	N/A Zone 3 Weir 2.00 2.92 0.00 2.92 81% 50%	N/A Not Selected N/A N/A N/A N/A N/A	inches ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t %	ttom at Stage = 0 ft) at grate)	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Op	Calculated ate Upper Edge, H ₁ = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = een Area w/ Debris =	Parameters for Ove Zone 3 Weir 2.00 2.92 18.37 6.91 3.45	rflow Weir Not Selected N/A N/A N/A N/A N/A	$\int_{\frac{1}{2}}^{\frac{1}{2}} feet$ feet should be ≥ 4 ft ² ft ²
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	N/A Zone 3 Weir 2.06 2.92 0.00 2.92 81% 50% ircular Orifice, Restr	N/A Not Selected N/A N/A N/A N/A N/A N/A ictor Plate, or Rectar	inches ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t %	ttom at Stage = 0 ft) at grate)	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Op	Calculated ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = een Area w/ Debris =	Parameters for Ove Zone 3 Weir 2.00 2.92 18.37 6.91 3.45 rs for Outlet Pipe w/	rflow Weir Not Selected N/A N/A N/A N/A N/A Flow Restriction Pla	$\begin{bmatrix} feet \\ feet \\ should be \geq 4 \\ ft^2 \\ ft^2 \end{bmatrix}$
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Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = Debris Clogging % = Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage- Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Leak O(cfs) = Predevelopment Peak O(cfs) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flows Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 9% of Inflow Volume (hours) =	N/A zate (Flat or Sloped) Zone 3 Weir 2.00 2.92 0.00 2.92 8.1% 50% ircular Orifice, Restrictor 2.00 12.00 5.80 zular or Trapezoidal) 3.50 24.00 2.00 1.00 WQCV 0.53 0.037 0.036 0.00 0.7 0.7 12 12 12	N/A Not Selected N/A fet H:V feet URV 1.07 0.103 0.102 0.00 0.102 0.00 0.102 0.103 Plate N/A Plate N/A 23 24	inches inches it, (relative to basin bo feet H:V (enter zero for fi feet %, grate open area/t % ft (distance below bas inches inches bottom at Stage = 0 fi 2 Year 1.19 0.077 0.01 1.6 0.1 1.6 0.1 1.6 0.1 N/A Plate N/A N/A 20 21	ttom at Stage = 0 ft) at grate) cotal area in bottom at Stage = 0 Half-1 c) 5 Year 1.50 0.112 0.112 0.112 0.112 0.112 0.1 1.0 Plate N/A N/A N/A 24 25	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Ope Overflow Grate Ope C ft) Outl Central Angle of Rest Spillway Stage a Basin Area a D 0.179 0.25 1.0 3.7 1.7 0.25 1.0 3.7 1.7 0.25 1.0 3.7 1.7 0.25 1.0	Calculated ate Upper Edge, H ₁ = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = alculated Parameter Outlet Orifice Centroid = ictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 0.324 0.323 0.79 3.2 6.6 3.7 1.2 Outlet Plate 1 0.5 N/A 24 26	Parameters for Ove Zone 3 Weir 2.00 2.92 18.37 6.91 3.45 rs for Outlet Pipe w/ Zone 3 Restrictor 0.38 0.28 1.54 Sted Parameters for S 0.27 4.77 0.13 Sted Parameters for S 0.27 4.77 0.13 Sted Parameters for S 0.417 0.416 1.09 4.4 8.4 3.9 0.9 Outlet Plate 1 0.5 N/A 23 26	rflow Weir Not Selected N/A N/A N/A N/A N/A N/A N/A N/A	feet feet feet should be ≥ 4 ft^2 ft^2 feet faet radians 500 Year 3.40 0.844 0.843 2.32 9.5 16.9 1.5 \$pillway 0.6 N/A 19 25
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway Gorest Length = Spillway Gorest Length = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q (cfs) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) =	N/A Zone 3 Weir 2.06 2.92 0.00 2.92 81% 50% ircular Orifice, Restrictor 2.00 12.00 12.00 5.80 zular or Trapezoidal) 3.50 24.00 1.00 WQCV 0.53 0.037 0.036 0.00 N/A Filtration Media N/A 12	N/A Not Selected N/A N/A N/A N/A N/A N/A N/A N/A N/A ictor Plate, or Rectar Not Selected N/A N/A i ft (relative to basin feet H:V feet EURV 1.07 0.103 0.102 0.00 0.0 2.1 0.1 N/A Plate N/A N/A 23	inches inches ft (relative to basin bo feet H:V (enter zero for ff feet %, grate open area/t % ngular Orifice) ft (distance below bas inches inches bottom at Stage = 0 ff 2 Year 1.19 0.077 0.01 0.1 1.6 0.1 N/A Plate N/A N/A 20	ttom at Stage = 0 ft) at grate) total area in bottom at Stage = 0 Half-4 t) S Year 1.50 0.112 0.02 0.1 2.3 0.1 1.0 Plate N/A N/A 24	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Op Overflow Grate Op (C ft) Outi Central Angle of Restr Spillway Stage a Basin Area a Basin Area a 0.179 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 1.7 0.25 1.0 3.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = in Area w/o Debris = ben Area w/o Debris = alculated Parameter Outlet Orifice Area = et Orifice Centroid = ictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 0.324 0.79 3.2 6.6 3.7 1.2 Outlet Plate 1 0.5 N/A 24	Parameters for Ove Zone 3 Weir 2.00 2.92 18.37 6.91 3.45 rs for Outlet Pipe w/ Zone 3 Restrictor 0.38 0.28 1.54 a.0.28 1.54 a.0.27 4.77 0.13 a.0.13 a.0.27 4.77 0.13 a.0.13 a.0.25 0.417 a.0.416 1.09 4.4 8.4 3.9 0.9 0.9 Outlet Plate 1 0.5 N/A 23 a.0.23 a.0.23 a.0.23 a.0.23 a.0.23 a.0.24 a.0.25	rflow Weir Not Selected N/A N/A N/A N/A N/A Flow Restriction Pla Not Selected N/A N/A N/A N/A Spillway feet feet feet acres 100 Year 2.52 0.538 0.537 1.46 5.9 10.8 6.1 1.0 Spillway 0.6 N/A 22	feet feet should be ≥ 4 ft ² ft ² ft ² feet radians 7adians 500 Year 7adians 7adians 0.843 2.32 9.5 16.9 13.9 1.5 Spillway 0.6 N/A 19



	Design Procedure Forr	n: Sand Filter (SF)
	UD-BMP (Version 3.07	, March 2018) Sheet 1 of 2
Designer:	D. Gorman M.V.E., Inc.	i
Company: Date:	September 13, 2019	
Project:	Sanctuary of Peace	
Location:	Sub-basin C2 - Sand Filter	
1. Basin Sto	rage Volume	
	ve Imperviousness of Tributary Area, I _a ; if all paved and roofed areas upstream of sand filter)	l _a = <u>26.7</u> %
B) Tribut	ary Area's Imperviousness Ratio (i = I _e /100)	i = 0.267
	r Quality Capture Volume (WQCV) Based on 12-hour Drain Time CV= 0.8 * (0.91* i^3- 1.19 * i^2 + 0.78 * i)	WQCV = 0.11 watershed inches
D) Contr	ibuting Watershed Area (including sand filter area)	Area =
	r Quality Capture Volume (WQCV) Design Volume _{2V} = WQCV / 12 * Area	V _{wacv} =cu ft
	/atersheds Outside of the Denver Region, Depth of age Runoff Producing Storm	d ₆ = 0.42 in
	Vatersheds Outside of the Denver Region, r Quality Capture Volume (WQCV) Design Volume	V _{WQCV OTHER} = 265 cu ft
	Input of Water Quality Capture Volume (WQCV) Design Volume if a different WQCV Design Volume is desired)	V _{WQCVUSER} =cu ft
2. Basin Ge	ometry	
A) WQC	✓ Depth	D _{WQCV} = 0.9 ft
	Filter Side Slopes (Horizontal distance per unit vertical, flatter preferred). Use "0" if sand filter has vertical walls.	Z = 3.00 ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
C) Minim	um Filter Area (Flat Surface Area)	A _{Min} =96]sq ft
D) Actual	Filter Area	A _{Actual} = 546 sq ft
E) Volum	e Provided	V _T = 270 cu ft
3. Filter Mat	terial	Choose One 18" CDOT Class B or C Filter Material Other (Explain):
4. Underdra	ain System	Choose One
A) Are ur	nderdrains provided?	YES NO
B) Under	drain system orifice diameter for 12 hour drain time	1
	 Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice 	y= 20 ft
	ii) Volume to Drain in 12 Hours	Vol ₁₂ = <u>265</u> cu ft
	iii) Orifice Diameter, 3/8" Minimum	D _o = in

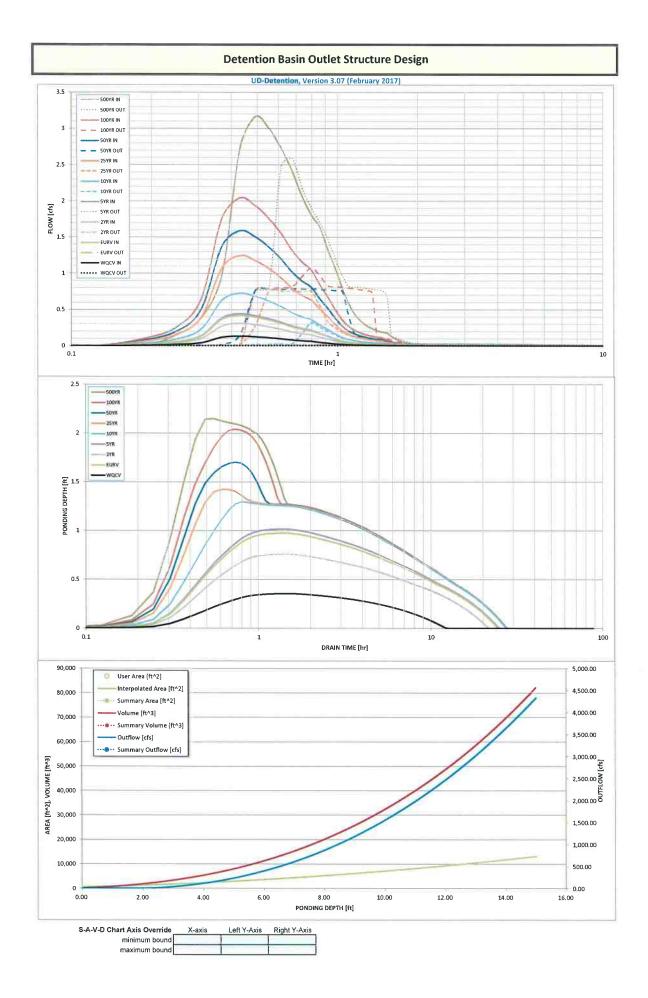
	Design Procedure Form: Sand Filter (SF)							
Designer:	D. Gorman		Sheet 2 of 2					
Company:	M.V.E., Inc.							
Date:	September 13, 2019							
Project:	Sanctuary of Peace							
Location:	Sub-basin C2 - Sand Filter							
A) is an	able Geomembrane Liner and Geotextile Separator Fabric impermeable liner provided due to proximity uctures or groundwater contamination?	Choose One						
6. Inlet / Outlet WorksA) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet		emergency spillway with rip-rap protection rip-rap at inflow points	74					
Notes:								

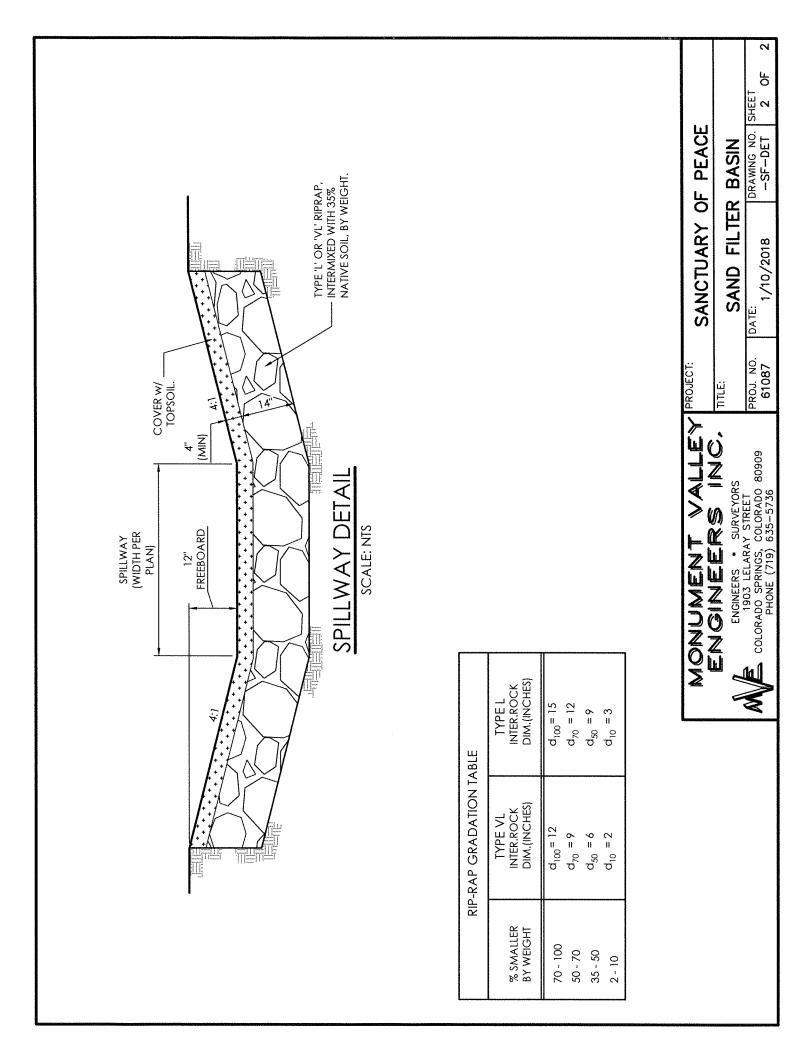
		_		UD-D	etention, Version 3	.07 (Febru	iary 2017)							
	Sancuary of Sub-basin Ca		er - DP3											
ZDANE 3	Sub-basin 62	2 • Sand Fild	er - DF3					_						
	INNE I	1	-											
VOLUME ELINY WOOD	-1			1										
ZONE	AND 2	100-YEA	A.M		Depth Increment =	0.25	ft							
POR Example Zone	65	on (Petenti	on Rond)		Stage - Storage	Stage	Optional Override	Length	Width	Area	Optional Override	Area	Volume	Volume
Example 2016	oonngarari	on filetenti	on rona,		Description	(ft)	Stage (ft)	(ft)	(ft)	(ft^2)	Area (ft^2)	(acre)	(ft^3)	(ac-ft)
Required Volume Calculation					Media Surface	0.00		33.0	16.5	546		0.013		_
Selected BMP Type =	SF	-				0.25		34.5	18.0	619		0.014	140	0.003
Watershed Area =	0.66	acres			Zone 1 (WQCV)	0.44		35.7	19.2	684		0.016	270	0.006
Watershed Length = Watershed Slope =	189	ft ft/ft				0.50	-	36.0 37.5	19.5 21.0	700 786		0.016	305 490	0.007
Watershed Slope - Watershed Imperviousness =	26 70%	percent				1.00		37.5	21.0	876		0.018	698	0.011
Percentage Hydrologic Soil Group A =	0.0%	percent			Zone 2 (EURV)	1.09		39.6	23.1	913		0.021	787	0.018
Percentage Hydrologic Soil Group B =	100 0%	percent				1,25		40.5	24.0	970		0.022	929	0.021
Percentage Hydrologic Soil Groups C/D =	0.0%	percent				1,50		42.0	25 5	1,069		0.025	1,183	0.027
Desired WQCV Drain Time =	12.0	hours				1,75		43.5	27.0	1,173		0.027	1,464	0.034
Location for 1-hr Rainfall Depths =	· · ·	1				2.00		45.0	28.5	1,280		0.029	1,770	0.041
Water Quality Capture Volume (WQCV) =	0,006	acre-feet	Optional Use 1-hr Precipit		Zone 3 (100-year)	2.00	-	45.0	28.5	1.285	-	0.029	1,783	0.041
Excess Urban Runoff Volume (EURV) = 2-yr Runoff Volume (P1 = 1, 19 in.) =	0,018	acre-feet acre-feet	1.19	inches		2.25	-	46.5 48.0	30 0 31 5	1,397 1,515		0.032	2,118	0.049
5-yr Runoff Volume (P1 = 1.5 in.) =	0.020	acre-feet	1 50	inches		2.75		49.5	33.0	1,636		0.038	2,876	0.066
10-yr Runoff Volume (P1 = 1.75 in.) =	0.031	acre-feet	1 75	inches		3.00		51.0	34.5	1,762	-	0.040	3,300	0.076
25-yr Runoff Volume (P1 = 2 in.) =	0.054	acre-feet	2 00	inches		3.25		52.5	36.0	1,893		0.043	3,757	0.086
50-yr Runoff Volume (P1 = 2.25 in.) =	0.069	acre-feet	2 25	inches		3,50		54.0	37.5	2,028		0.047	4,247	0.098
100-yr Runoff Volume (P1 = 2.52 in.) =	0.089	acre-feet	2.52	inches		3.75	[]	55.5	39.0	2,168		0.050	4,772	0.110
500-yr Runoff Volume (P1 = 3.4 in.) =	D.138	acre-feet	3 40	inches		4.00		57,0	40.5	2,312		0,053	5,331	0.122
Approximate 2-yr Detention Volume =	0.013	acre-feet				4.25		58.5	42.0	2,460		0.056	5,928	0.136
Approximate 5-yr Detention Volume = Approximate 10-yr Detention Volume =	0.018	acre-feet acre-feet				4.50		60.0 61,5	43.5 45.0	2,613 2,771		0.060	6,562 7,235	0.151
Approximate 25-yr Detention Volume =	0.027	acre-feet				5.00		63.0	46.5	2,933	-	0.067	7,948	0.100
Approximate 50-yr Detention Volume =	0.034	acre-feet				5.25		64.5	48.0	3,100		0.071	8,702	0.200
Approximate 100-yr Detention Volume =	0.041	acre-feet				5.50	1	66.0	49.5	3,271		0.075	9,498	0.218
					A	5.75		67.5	51.0	3,446		0.079	10,338	0.237
Stage-Storage Calculation						6.00		69.0	52.5	3,627		0.083	11,222	0.258
Zone 1 Volume (WQCV) =	0.006	acre-feet				6.25		70.5	54.0	3,811	1	0.087	12,151	0.279
Zone 2 Volume (EURV - Zone 1) =	0.012	acre-feet				6.50		72.0	55.5	4,000	_	0.092	13,128	0.301
Zone 3 Volume (100-year - Zones 1 & 2) =	0.023	acre-feet				6.75	-	73.5	57.0	4,194		0.096	14,152	0.325
Total Detention Basin Volume = Initial Surcharge Volume (ISV) =	0.041 N/A	acre-feet				7.00		75.0 76.5	58.5 60.0	4,392 4,595		0.101	15,225	0.350
Initial Surcharge Depth (ISD) =	N/A	ft^3				7.50		78.0	61.5	4,802	-	0.100	17,523	0.402
Total Available Detention Depth (H _{totai}) =	2.00	ff.				7.75		79.5	63.0	5,013		0.115	18,749	0.430
Depth of Trickle Channel (H _{TC}) =	N/A	ft				8.00		81.0	64.5	5,229		0.120	20,030	0.460
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft				8.25		82.5	66.0	5,450		0.125	21,364	0.490
Slopes of Main Basin Sides $(S_{main}) =$	3	H:V				8,50		84.0	67.5	5,675		0.130	22,755	0.522
Basin Length-to-Width Ratio $(R_{L/W})$ =	2					8.75		85.5	69.0	5,905		0.136	24,202	0.556
	-	1				9,00		87.0	70.5	6,139		0.141	25,708	0.590
Initiat Surcharge Area (A _{tsv}) = Surcharge Volume Length (L _{tsv}) =	0	ft^2				9.25 9.50		88.5 90.0	72.0	6,377 6,620	-	0.146	27,272 28,897	0.626
Surcharge Volume Length (L _{ISV}) =	0.0	- n				9.75		91.5	75.0	6,868	-	0.152	30,583	0.702
Depth of Basin Floor (H _{FLOOR}) =	0.00	n ft				10,00		93.0	76.5	7,120		0,163	32,331	0.742
Length of Basin Floor (L _{FLOOR}) =	33.0	ft				10,25		94.5	78.0	7,377		0,169	34,143	0.784
Width of Basin Floor (W _{FLOOR}) =	16.5	ft				10.50		96.0	79.5	7,638		0,175	36,020	0.827
Area of Basin Floor (A _{FLOOR}) =	546	ft^2				10.75		97,5	81.0	7,904		0,181	37,962	0.871
Volume of Basin Floor (V _{FLOOR}) =	0	ft^3			2	11.00		99.0	82.5	8,174		0.188	39,972	0 918
Depth of Main Basin (H _{MAIN}) =	2.00	ft				11.25		100.5	84.0	8,448		0,194	42,050	0.965
Length of Main Basin (L _{MAIN}) =	45.0	ft.				11.50		102.0	85.5	8,727	-	0.200	44,197	1.015
Width of Main Basin (W _{MAIN}) =	28.5	ft				11.75		103.5	87.0	9,011 9,299	-	0.207	46,414	1.066
Area of Main Basin (A _{MAIN}) = Volume of Main Basin (V _{MAIN}) =	1,285	ft^2				12.00		105.0 106.5	88.5 90.0	9,299	-	0.213	48,702 51,064	1.178
Calculated Total Basin Volume (V _{total}) =	0.041	ft^3 acre-feet				12.25		108.0	90.0	9,392	-	0.220	53,499	1.172

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Detention Basin Outlet Structure Design

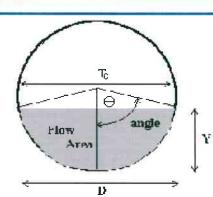
Project	Construct of Bonco		UD-Detention, Ver	sion 3.07 (Februar	y 2017)				
	Sanctuary of Peace Sub-basin C2 - San								
ZONE A	Sup-pasin C2 - San	a Filter DP3							
ZONE 2 (ZONE 2 -ZONE 1									
00-YR	-			Stage (ft)	Zone Volume (ac-ft)	Outlet Type			
OLUME EURY WOOV			Zone 1 (WQCV)	0.44	0.006	Filtration Media			
	100-TEAH		Zone 2 (EURV)	1.09	0.012	Orifice Plate			
ZONE 1 AND 2	ORIFICE								
PERMANENT OMFICES	Configuration (De)	antion Dand)	:one 3 (100-year)	2.00	0.023	Weir&Pipe (Restrict)			
Example 20ne	Configuration (Re	tention Pond)			0.041	Total			
er Input: Orifice at Underdrain Outlet (typically us	ed to drain WQCV in	a Filtration BMP)				Calculate	d Parameters for Un	derdrain	
Underdrain Orifice Invert Depth =	2.00	ft (distance below th	e filtration media sur	face)	Under	drain Orifice Area =	0.0	ft ²	
Underdrain Orifice Diameter =		inches			Underdrai	n Orifice Centroid =	0.02	feet	
er Input: Orifice Plate with one or more orifices of	- Elliptical Flat Main	(tomically used to de	nin WOCV and for El	IDV in a codimentati	on RMD)	Coloui	ated Parameters for	Plata	_
Invert of Lowest Orifice =			oottom at Stage = 0 ft			fice Area per Row =		ft ²	
Depth at top of Zone using Orifice Plate =		- 20	pottom at Stage = 0 ft)		iptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	4.20	inches			Ellip	tical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.28	sq. inches (diameter	= 9/16 inch)			Elliptical Slot Area =	N/A	ft ²	
ser Input: Stage and Total Area of Each Orifice I				B 44 5 B	D C C C D		D T (15 - 15	Di Olivitino D	F
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.44	0.66	0.87			_		N	ļ
Orifice Area (sq. inches)	0.28	0.28	0.28						1
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	
Stage of Orifice Centroid (ft)									1
Orifice Area (sq. inches)									1
Office Area (sq. friches)									4)
Hoos Innerty Mantal Add - Inter-	ulas as Bactanand - 1					Calculated	Parameters for Vert	ical Orifico	-
User Input: Vertical Orifice (Circ	-		12			Calculated			1
	Not Selected	Not Selected					Not Selected	Not Selected	1
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin b	ottom at Stage = 0 f	t) Ve	ertical Orifice Area =	N/A	N/A	ft ²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin b	ottom at Stage = 0 f	t) Vertic	al Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches						
Vertical Orifice Diameter = User Input: Overflow Weir (Dropbox) and G	rate (Flat or Sloped)		linches			Calculated	Parameters for Ove		1
User Input: Overflow Weir (Dropbox) and G	rate (Flat or Sloped) Zone 3 Weir	Not Selected]	ttom at Stage = 0 ft)	Height of Gr.	0	Parameters for Ove Zone 3 Weir 1.25	Not Selected] feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho =	rate (Flat or Sloped) Zone 3 Weir 1.25	Not Selected N/A] ft (relative to basin bo	ttom at Stage = 0 ft)		ate Upper Edge, H _t =	Zone 3 Weir 1.25	Not Selected N/A	feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92	Not Selected N/A N/A	ft (relative to basin bo		Over Flow	ate Upper Edge, H _t = Weir Slope Length =	Zone 3 Weir 1.25 2.92	Not Selected N/A N/A	feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00	Not Selected N/A N/A N/A	ft (relative to basin bo feet H;V (enter zero for f		Over Flow Grate Open Area / :	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area =	Zone 3 Weir 1.25 2.92 80.27	Not Selected N/A N/A N/A	feet should be≥4
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92	Not Selected N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for f feet	at grate)	Over Flow Grate Open Area / 3 Overflow Grate Ope	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = n Area w/o Debris =	Zone 3 Weir 1.25 2.92 80.27 6.91	Not Selected N/A N/A N/A N/A	feet should be <u>></u> 4 ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo feet H;V (enter zero for f	at grate)	Over Flow Grate Open Area / 3 Overflow Grate Ope	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area =	Zone 3 Weir 1.25 2.92 80.27	Not Selected N/A N/A N/A	feet should be≥4
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92	Not Selected N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for f feet	at grate)	Over Flow Grate Open Area / 3 Overflow Grate Ope	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = n Area w/o Debris =	Zone 3 Weir 1.25 2.92 80.27 6.91	Not Selected N/A N/A N/A N/A	feet should be ≥ 4 ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for f feet	at grate)	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op	ate Upper Edge, H _e = Weir Slope Length = 100-yr Orifice Area = In Area w/o Debris = Iven Area w/ Debris =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45	Not Selected N/A N/A N/A N/A N/A	feet should be ≥ 4 ft ² ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50%	Not Selected N/A N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/i %	at grate)	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op	ate Upper Edge, H _e = Weir Slope Length = 100-yr Orifice Area = In Area w/o Debris = Iven Area w/ Debris =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45	Not Selected N/A N/A N/A N/A	feet should be≥4 ft ² ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50%	Not Selected N/A N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/i %	at grate)	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op	ate Upper Edge, H _e = Weir Slope Length = 100-yr Orifice Area = In Area w/o Debris = Iven Area w/ Debris =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45	Not Selected N/A N/A N/A N/A N/A	feet should be ≥ 4 ft ² ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = Ser Input: Outlet Pipe w/ Flow Restriction Plate (C	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50% ircular Orifice, Restr Zone 3 Restrictor	Not Selected N/A N/A N/A N/A N/A N/A ictor Plate, or Rectar Not Selected	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/t % ngular Orifice)	at grate) sotal area	Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Op	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = n Area w/o Debris = wen Area w/ Debris = alculated Parameter	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45	Not Selected N/A N/A N/A N/A N/A Flow Restriction Pla Not Selected	feet should be ≥ 4 ft ² ft ²
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = ser Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50% ircular Orifice, Restr Zone 3 Restrictor 2.00	Not Selected N/A N/A N/A N/A N/A ictor Plate, or Rectar Not Selected N/A	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/ % ngular Orifice) ft (distance below bas	at grate) sotal area	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op C ft)	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = In Area w/o Debris = Ien Area w/ Debris = alculated Parameter Dutlet Orifice Area =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45	Not Selected N/A N/A N/A N/A N/A Flow Restriction Pla Not Selected N/A	feet should be ≥ 4 $\frac{1}{R^2}$ $\frac{1}{R^2}$ te $\frac{1}{R^2}$
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = ser Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50% ircular Orifice, Restr Zone 3 Restrictor 2.00 12.00	Not Selected N/A N/A N/A N/A N/A N/A ictor Plate, or Rectar Not Selected	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/ % gular Orifice) ft (distance below bas inches	at grate) :otal area in bottom at Stage = 0	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op C ft)	ate Upper Edge, H _t = Weir Slope Length = 1.00-yr Orifice Area = in Area w/o Debris = alculated Parameter Dutlet Orifice Area = et Orifice Centroid =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45 s for Outlet Pipe w/ Zone 3 Restrictor 0.09 0.10	Not Selected N/A N/A N/A N/A N/A N/A N/A Flow Restriction Pla Not Selected N/A N/A	feet should be ≥ 4 ft ² ft ² ft ² fteet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = ser Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50% ircular Orifice, Restr Zone 3 Restrictor 2.00	Not Selected N/A N/A N/A N/A N/A ictor Plate, or Rectar Not Selected N/A	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/ % ngular Orifice) ft (distance below bas	at grate) :otal area in bottom at Stage = 0	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op C ft)	ate Upper Edge, H _t = Weir Slope Length = 1.00-yr Orifice Area = in Area w/o Debris = alculated Parameter Dutlet Orifice Area = et Orifice Centroid =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45	Not Selected N/A N/A N/A N/A N/A Flow Restriction Pla Not Selected N/A	feet should be ≥ 4 $\frac{1}{R^2}$ $\frac{1}{R^2}$ te $\frac{1}{R^2}$
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slides = Overflow Grate Open Area % = Debris Clogging % = ser Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50% 50% ircular Orifice, Restr Zone 3 Restrictor 2.00 12.00 2.00	Not Selected N/A N/A N/A N/A N/A ictor Plate, or Rectar Not Selected N/A	ft (relative to basin bo feet H:V (enter zero for f feet %, grate open area/ % gular Orifice) ft (distance below bas inches	at grate) :otal area in bottom at Stage = 0	Over Flow Grate Open Area / : Overflow Grate Ope Overflow Grate Op C ft)	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = in Area w/o Debris = een Area w/ Debris = alculated Parameter Dutlet Orifice Area = et Orifice Centroid = ictor Plate on Pipe =	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45 s for Outlet Pipe w/ Zone 3 Restrictor 0.09 0.10 0.84	Not Selected N/A N/A N/A N/A N/A N/A N/A Flow Restriction Pla Not Selected N/A N/A N/A N/A	feet should be ≥ 4 ft ² ft ² ft ² fteet
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User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sldes = Overflow Grate Open Area % = Debris Clogging % = ser Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectang Spillway Invert Stage= Spillway Invert Stage= Spillway Crest Length = Spillway Crest Length = Spillway Gases = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Que 2 (fs) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) =	rate (Flat or Sloped) Zone 3 Weir 1.25 2.92 0.00 2.92 81% 50% ircular Orifice, Restr Zone 3 Restrictor 2.00 12.00 2.00 12.00 2.00 10.00 2.00 10.00 2.00 10.00 2.00 10.00 0.53 0.006 0.006 0.006 0.00	Not Selected N/A Ictor Plate, or Rectar Not Selected N/A ft (relative to basin lifeet H:V feet B.0.018 0.018 0.018 0.00 0.0 N/A Plate N/A N/A 23	ft (relative to basin bo feet H: V (enter zero for f feet %, grate open area/i % ft (distance below basin bo inches inches bottom at Stage = 0 f 2 Year 1.19 0.014 0.013 0.02 0.0 0.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	at grate) total area in bottom at Stage = 0 Half-1 t) 5 Year 1.50 0.020 0.019 0.03 0.0 0.03 0.0 0.0 1.2 Plate N/A N/A 24	Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Ope Overflow Grate Op C ft) Central Angle of Restr Spillway Stage a Basin Area a 0.031 0.29 0.2 0.7 0.3 1.7 Overflow Grate 1 0.0 N/A 25	ate Upper Edge, H _t = Weir Slope Length = 100-yr Orifice Area = in Area w/o Debris = een Area w/o Debris = alculated Parameter Dutiet Orifice Area = et Orifice Centroid = ictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = Cop of Freeboard = 25 Year 2.00 0.054 0.053 0.90 0.66 1.2 0.8 1.3 Outlet Plate 1 0.1 N/A 24	Zone 3 Weir 1.25 2.92 80.27 6.91 3.45 s for Outlet Pipe w// Zone 3 Restrictor 0.09 0.10 0.84 ted Parameters for S 0.16 3.16 0.04 50 Year 2.25 0.069 0.068 1.24 0.8 1.6 0.8 1.24 0.8 1.6 0.8 1.24 0.8 1.6 0.8 1.24 0.8 1.24 0.8 1.0 Outlet Plate 1 0.1 N/A 23	Not Selected N/A N/A N/A N/A N/A N/A N/A N/A NA NA NA NA Spilway feet feet acres 0.088 1.64 1.1 2.0 Spillway 0.1 N/A	feet should be ≥ 4 ft ² ft ² ft ² feet radians 0.137 2.62 1.7 3.2 2.6 1.5 Spillwar 0.1 N/A 19 25



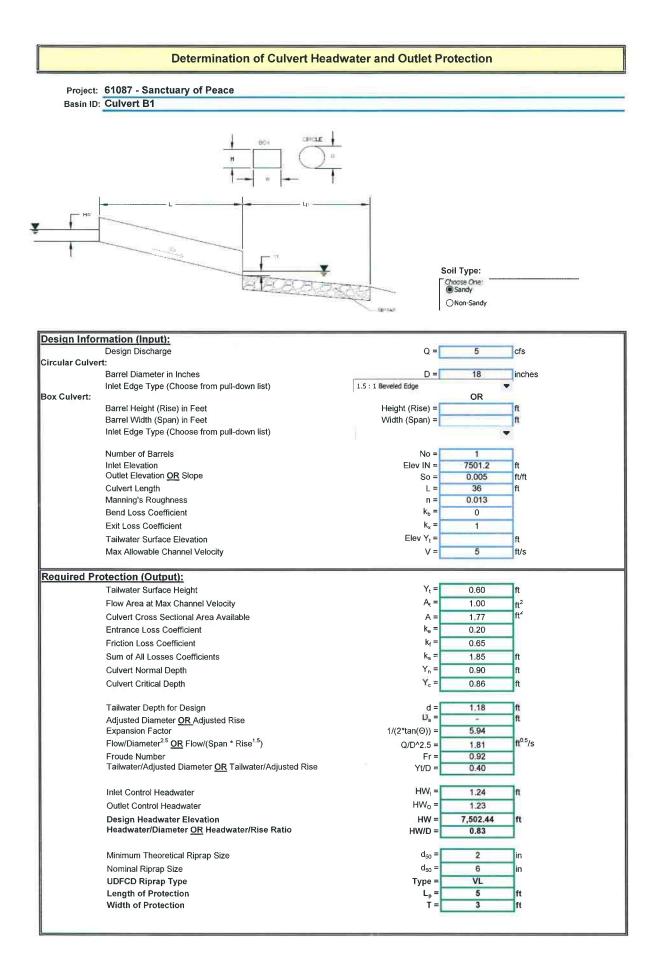


CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project:	61087 -	Sanctuary	of Peace
Pipe ID:	Culvert	B1	



Design Information (Input) Pipe Invert Slope	So =	0.0050	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	5.00	cfs
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	7.45	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0 <theta<3.14)< td=""><td>Theta =</td><td>1.77</td><td>radians</td></theta<3.14)<>	Theta =	1.77	radians
Flow area	An =	1.11	sq ft
Top width	Tn =	1.47	ft
Wetted perimeter	Pn =	2.66	ft
Flow depth	Yn =	0.90	ft
Flow velocity	Vn =	4.52	fps
Discharge	Qn =	5.00	cfs
Percent Full Flow	Flow =	67.1%	of full flow
Normal Depth Froude Number	Fr _n =	0.92	subcritical
Calculation of Critical Flow Condition			
Half Central Angle (0 <theta-c<3.14)< td=""><td>Theta-c =</td><td>1.72</td><td>radians</td></theta-c<3.14)<>	Theta-c =	1.72	radians
Critical flow area	Ac =	1.05	sq ft
Critical top width	Tc =	1.48	ft
Critical flow depth	Yc =	0.86	ft
Critical flow velocity	Vc =	4.77	fps
Critical Depth Froude Number	Fr _c =	1.00	



Sub-Basin C1 (Culvert) Runoff Calculations

Job No.:	61087	Date:		9/16/2019 10:38
Project:	Sanctuary of Peace	Calcs by:	ASM	
		Checked by:		
Jurisdiction	DCM	Soil Type	8	В
Runoff Coefficient	Surface Type	Urbaniza	ation	Non-Urban

Basin Land Use Characteristics

	Area	Runoff Coefficient						%	
Surface	(SF)	(Acres)	C2	C5	C10	C25	C50	C100	Imperv.
Forest	74,698	1.71	0:02	0.08	0.15	0.25	0.3	0.35	0%
Driveways & Walks	5,171	0.12	0.89	0.9	0.92	0.94	0.95	0.96	100%
Roofs	15,854	0.36	0.71	0.73	0.75	0.78	0.8	0.81	90%
-									
Combined	95,723	2.20	0.18	0.23	0.29	0.38	0.42	0.46	20.3%
	95723		-						

Basin Travel Time

Shallo	w Channel Grou	nd Cover I	Forest			
	L _{max,Overland}	100 f	ť		Cv	5
	L (ft)	ΔZ_0 (ft)	S ₀ (ft/ft)	v (ft/s)	t (min)	t _{Alt} (min)
Total	367	25	-	-	-	-
Initial Time	100	16	0.160	-	6.3	N/A DCM Eq. 6-8
Shallow Channel	267	9	0.034	0.9	4.8	- DCM Eq. 6-9
Channelized			0.000	0.0	0.0	- V-Ditch
				tc	11.1	min.



Rainfall Intensity & Runoff

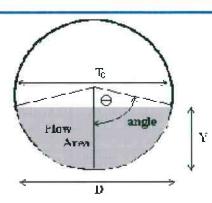
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.17	3.97	4.63	5.29	5.95	6.66
Runoff (cfs)	1.3	2.0	3.0	4.4	5.5	6.7
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	1.3	2.0	3.0	4.4	5.5	6.7
DCM: I	= C1 * in (to	c) + C2				
Ç1	1.19	1.5	1.75	2	2.25	2.52
G2	6.035	7.583	8 847	10 111	11.375	12.735

Notes

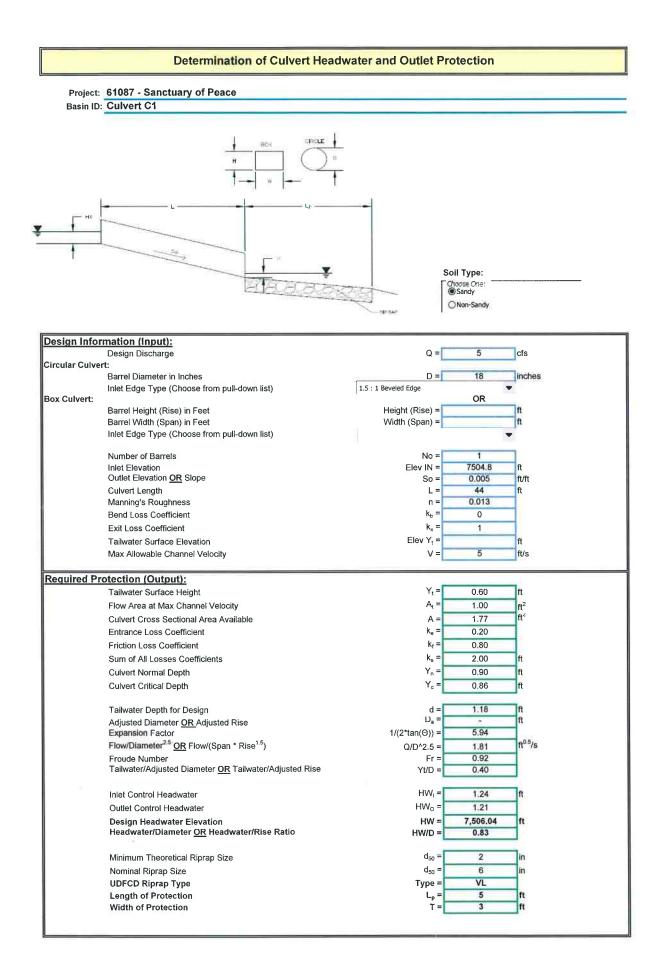
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project:	61087	-	Sanctuary of Peace	
				-

Pipe ID: Culvert C1



Design Information (Input)			
Pipe Invert Slope	So =	0.0050	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	6.70	cfs
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	7.45	cfs
Calculation of Normal Flow Condition			-
Half Central Angle (0 <theta<3.14)< td=""><td>Theta =</td><td>2.07</td><td>radians</td></theta<3.14)<>	Theta =	2.07	radians
Flow area	An =	1.40	sq ft
Top width	Tn =	1.31	ft
Wetted perimeter	Pn =	3.11	ft
Flow depth	Yn =	1.11	ft
Flow velocity	Vn =	4.77	fps
Discharge	Qn =	6.70	cfs
Percent Full Flow	Flow =	89.9%	of full flow
Normal Depth Froude Number	Fr _n =	0.81	subcritical
Calculation of Critical Flow Condition	-		-
Half Central Angle (0 <theta-c<3.14)< td=""><td>Theta-c =</td><td>1.91</td><td>radians</td></theta-c<3.14)<>	Theta-c =	1.91	radians
Critical flow area	Ac =	1.25	sq ft
Critical top width	Tc =	1.41	ft
Critical flow depth	Yc =	1.00	ft
Critical flow velocity	Vc =	5.34	f <mark>ps</mark>
Critical Depth Froude Number	Fr _c =	1.00	



4 Drainage Maps

Existing Conditions Drainage Map Proposed Conditions Drainage Map (Map Pocket) (Map Pocket)

EXISTING DRAINAGE SUMMARY TABLE								
DESIGN POINT	BASIN	AREA (AC)	Tc (MIN.)	RUN Q5 (CFS)	OFF Q100 (CFS)			
	OS A	69.40	41.9	11.4	81.1			
	OS B	83.92	41.7	17.4	102.7			
	EX-A1	30.11	23.3	6.9	50.6			
EX1	OS A, OS B, EX-A1	153.32	41.9	35.7	234.4			
	EX-C1	5.68	15.7	1.6	11.5			
EX7	EX-C1	5.68	15.7	1.6	11.5			
	EX-C2	2.03	10.9	0.7	4.8			
EX4	EX-C2	2.03	10.9	0.7	4.8			
	EX-C3	0.66	9.8	0.2	1.6			
EX5	EX-C3	0.66	9.8	0.2	1.6			
	EX-B1	2.06	14.4	0.6	4.3			
EX8	EX-B1	2.06	14.4	0.6	4.3			
	EX-B2	8.75	12.0	2.7	19.8			
	OS C	49.12	23.9	16.6	88.1			
EX9	EX-B1, EX-B2, OS C	59.93	23.9	19.0	106.0			

LEGEND

PROPERTY LINE ----- EASEMENT LINE LOT LINE

EXISTING

PROPOSED

Q = 19.0 cfs $Q_{100} = 60.0$ cfs

1.5%

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5985 INDEX CONTOUR - INTERMEDIATE CONTOUR BASIN BOUNDARY

GENERAL FLOW/DIRECTION SLOPE DIRECTION AND GRADE

BASIN LABEL AREA IN ACRES PERCENT IMPERVIOUS POINT OF INTEREST

FLOODPLAIN STATEMENT:

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBER 08041C0295 G, EFFECTIVE DECEMBER 7, 2018.

MIDDLE ROAD (30' R.O., W. PUBLIC)

g

LOT 26 GOLD .q.w. PUBLU

_LQT 21 LOT 20 lot 19 ⁴25

LOT 18 BLACK FOREST LOT 17 PARK 7LQT 16 _____

> LOT 15 LOT 14

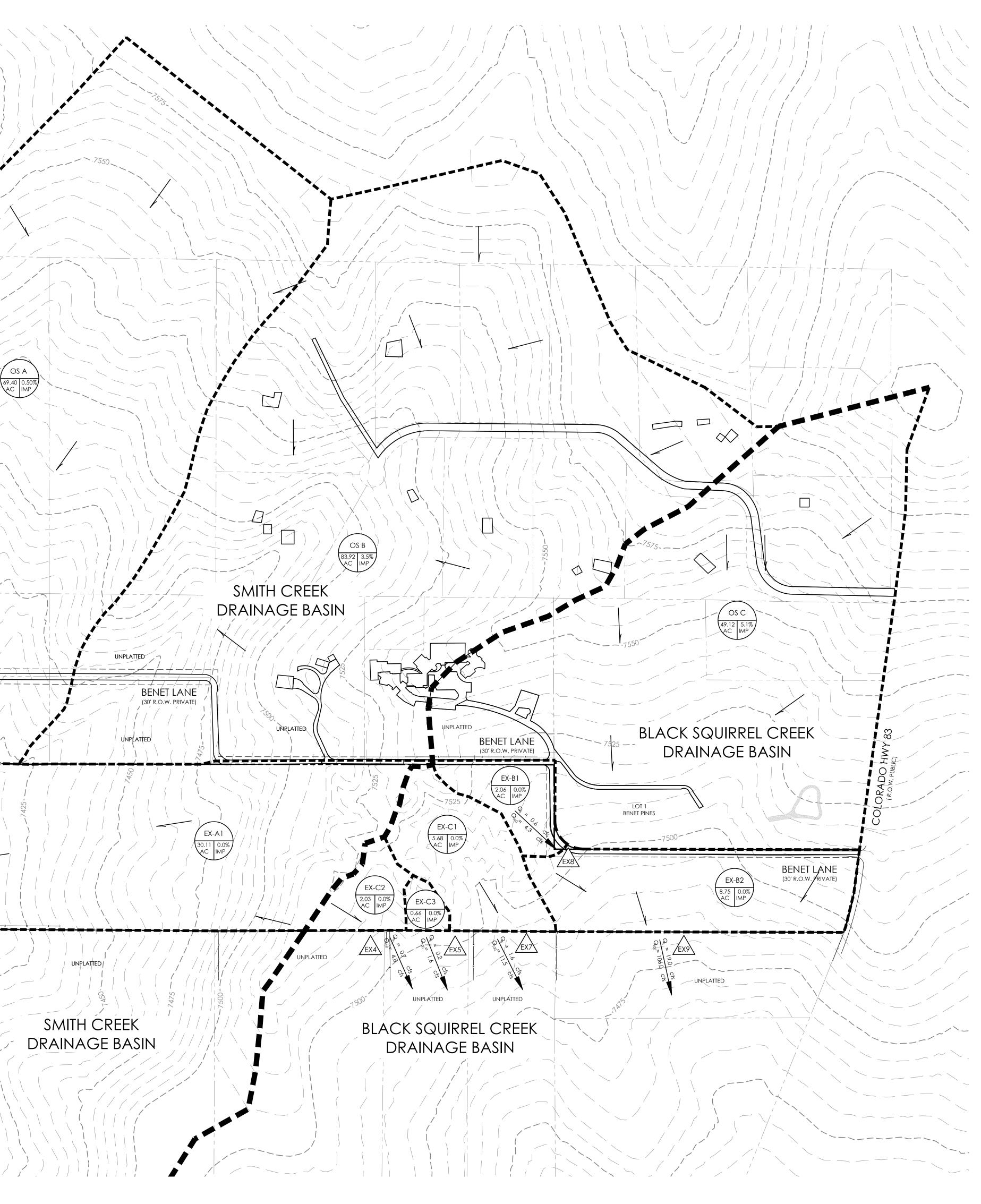
> > LOT 12

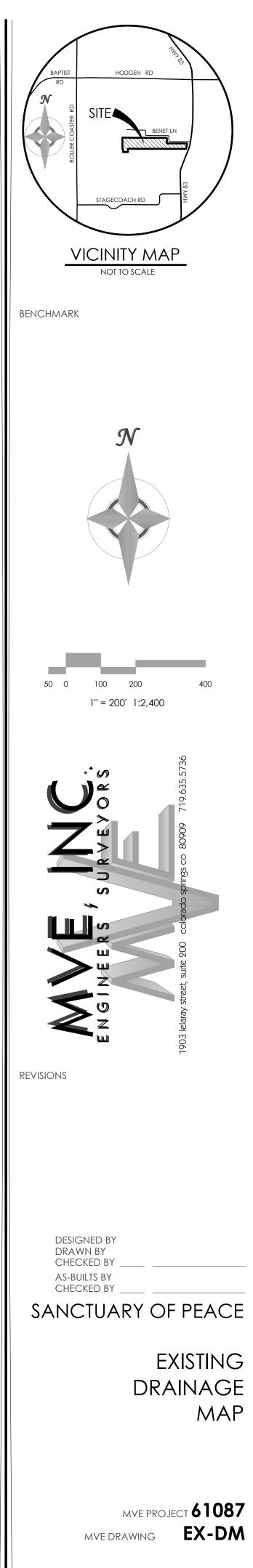
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April 28, 2020 SHEET 1 OF 1



DEVELOPED DRAINAGE SUMMARY TABLE									
DESIGN AREA TC RUNOFF									
POINT	BASIN	(AC)	(MIN)	Q5 (CFS)	Q100 (CFS)				
	OS A	69.40	41.9	11.4	81.1				
	OS B	83.92	41.7	17.4	102.7				
	A1	1.85	9.1	2.8	7.3				
	A2	28.30	27.7	5.9	43.3				
DP1	OS A, OS B, DP2, A2	183.47	41.9	34.8	230.2				
DP2 In	Al	1.85	9.1	2.8	7.3				
DP2 Out	Al	1.85	9.1	0.1	3.1				
	C2	0.66	8.8	0.8	2.4				
DP3 In	C2	0.66	8.8	0.8	2.4				
DP3 Out	C2	0.66	8.8	0.0	1.1				
	C3	1.36	11.8	0.4	3.1				
DP4	C2, C3	2.02	11.8	0.4	4.2				
	C4	0.64	8.8	0.2	1.6				
DP5	C4	0.64	8.8	0.2	1.6				
	C1	4.07	13.1	4.1	12.5				
DP6 In	C1	4.07	13.1	4.1	12.5				
DP6 Out	C1	4.07	13.1	0.1	6.1				
	C5	1.61	10.2	0.5	3.9				
DP7	C1, C5	5.69	13.1	0.6	10.0				
	B1	2.36	14.4	0.7	5.0				
DP8	B1	2.36	14.4	0.7	5.0				
	B2	9.23	11.8	3.4	21.7				
	OS C	49.12	23.9	16.6	88.1				
DP9	B1, B2, OS C	60.72	14.4	24.9	137.2				

legend

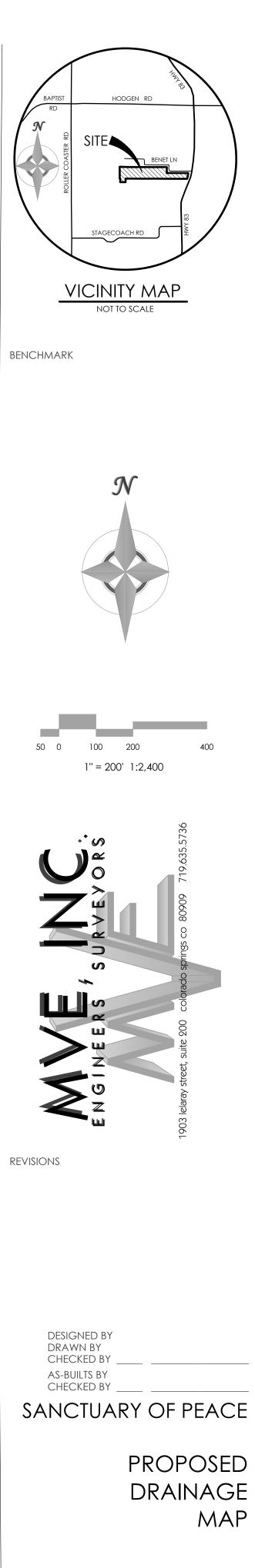
----- EASEMENT LINE LOT LINE PROPOSED 5985 INDEX CONTOUR ______84_____ INTERMEDIATE CONTOUR BASIN BOUNDARY Q = 19.0 cfs $Q_{100} = 60.0$ cfs GENERAL FLOW/DIRECTION 1.5% SLOPE DIRECTION AND GRADE A1 BASIN LABEL AREA IN ACRES PERCENT IMPERVIOUS POINT OF INTEREST $\overline{1}$ (\mathbb{A}) full spectrum sand filter basin (fssfb)

FLOODPLAIN STATEMENT:

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS -MAP NUMBER 08041C0295 G, EFFECTIVE DECEMBER 7, 2018.

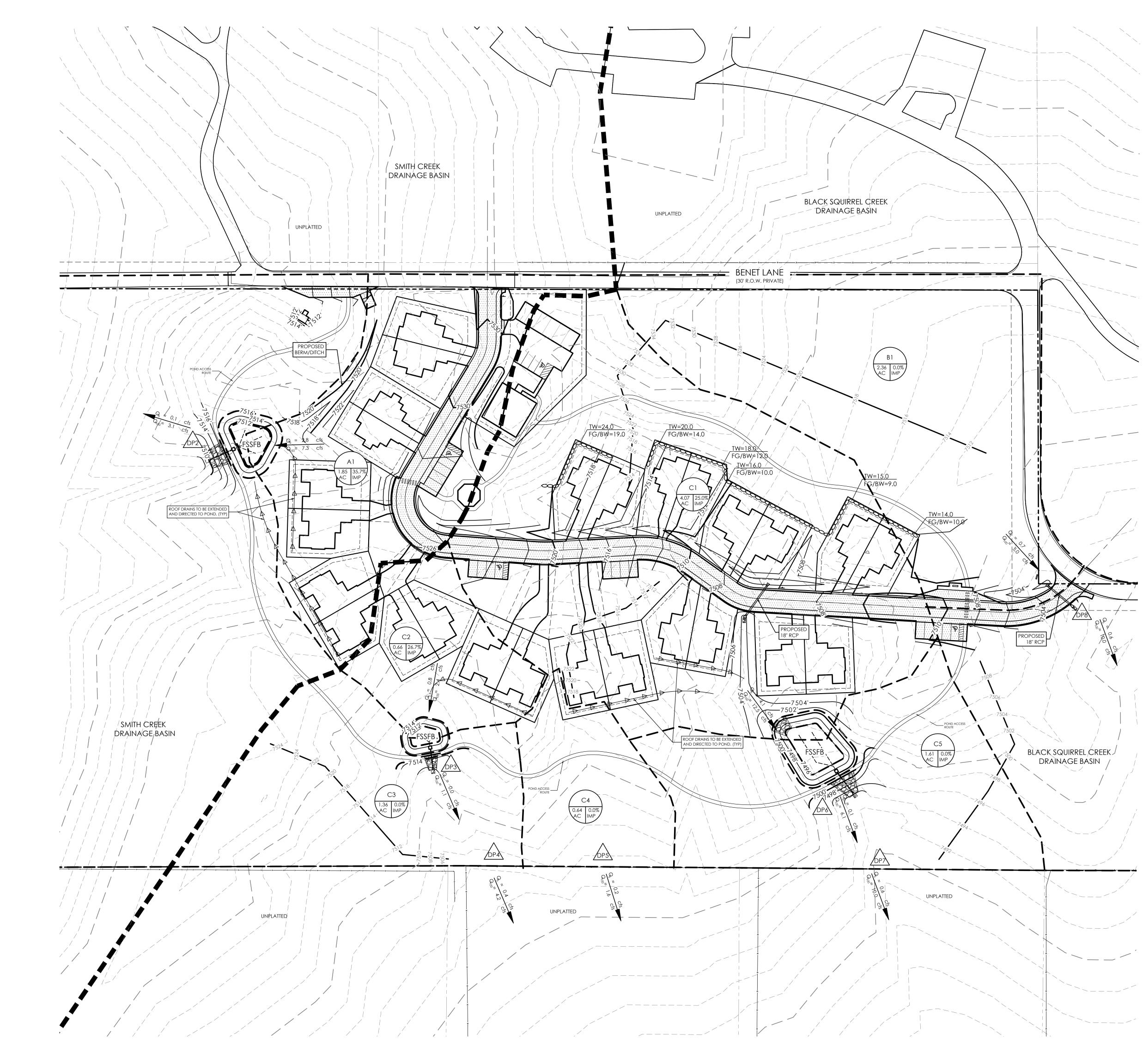
WATER QUALITY BASIN NOTES

THE FULL SPECTRUM SAND FILTER BASINS A1, B1, AND C1 SHALL BE ESTABLISHED IN THE FIELD BY THE PROJECT ENGINEER AT OR ABOVE THE CALCULATED REQUIRED VOLUME. THE FULL SPECTRUM SAND FILTER BASINS SHALL BE FIELD SURVEYED FOR AS-BUILT CONDITIONS AND APPROVED BY THE PROJECT ENGINEER AS BEING CONSTRUCTED IN SUBSTANTIAL COMPLIANCE WITH APPROVED DETAILS FOR CONSTRUCTION.



MVE PROJECT 61087 MVE DRAWING **PP-DM**

> April 28, 2020 SHEET 1 OF 1



LEGEND

----- EASEMENT LINE LOT LINE EXISTING PROPOSED Q = 19.0 cfs $Q_{100} = 60.0$ cfs 1.5% A1 1.0 50% AC IMP

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A

5985 INDEX CONTOUR ______84_____ INTERMEDIATE CONTOUR BASIN BOUNDARY GENERAL FLOW/DIRECTION SLOPE DIRECTION AND GRADE

PROPERTY LINE

BASIN LABEL AREA IN ACRES PERCENT IMPERVIOUS POINT OF INTEREST

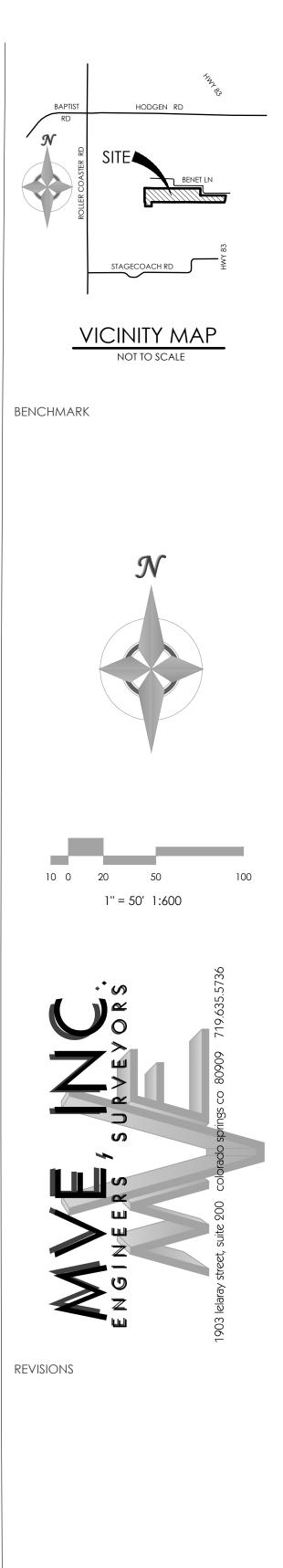
full spectrum sand filter basin (fssfb)

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DESIGNED BY DRAWN BY CHECKED BY AS-BUILTS BY CHECKED BY SANCTUARY OF PEACE

> PROPOSED DRAINAGE MAP (DETAIL)

MVE PROJECT 61087 MVE DRAWING **PP-DM2**

April 28, 2020 SHEET 1 OF 1