PRELIMINARY
DRAINAGE ANALYSIS and
STORM WATER COMPLIANCE REPORT

Garden Street Hotel
101 Garden Street
Santa Barbara, CA
93101

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Revised May 2022
Revised August 2022

PREPARED FOR:

City of Santa Barbara
Public Works Department/Engineering
630 Garden Street
Santa Barbara. CA 93101

PREPARED BY:

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PURPOSE

The purpose of this report is to analyze existing and proposed drainage characteristics of the project site, evaluate impacts, if any, to existing downstream properties and demonstrate compliance with City of Santa Barbara's NPDES Phase II General Permit for storm water discharges, which are defined in the City's Municipal Code (Chapter 22.87) and the City's Storm Water BMP Guidance Manual (July 2013).

PROJECT DESCRIPTION

The proposed project is located at 101 Garden Street in Santa Barbara, CA (APNs 017-630-008, -009, -018, -021, -024, & -027). The existing 4.53-acre site is bounded by Yanonali Street on the north, Santa Barbara Street on the west, Garden Street on the east and the Union Pacific Railroad on the south. See Figure 1 for the project vicinity map.

Figure 1. Vicinity Map

The project proposes to merge the existing six lots and develop the site into a new hotel. The existing lots are currently occupied by a variety of commercial and industrial uses, primarily related to open storage, fabrication, contractor yards, and automobile repair. The existing site will be demolished to construct a new ±152,000 SF hotel with 250 rooms, a ±85,000 SF subterranean parking garage, at-grade parking, and various guest amenities including, but not limited to, a pool, children's play area, and outdoor lounge areas. Various offsite improvements are proposed within the public right-of-way including relocation of the existing sidewalk along Yanonali Street, reconfiguration of the frontage along Santa Barbara Street, and ADA improvements at the southwest corner of the Garden and Yanonali Street intersections.

SITE CONDITIONS

EXISTING SITE CONDITION AND DRAINAGE PATTERNS

The attached Existing Conditions Plan (Attachment 1) shows the existing parcels, the adjacent right-of-way, topography, surfacing, and drainage patterns. The existing parcels are flat and have an average slope of less than 0.5%. The northern portion of the existing project site sheet flows in the easterly direction, to an existing wetland located parallel to Garden Street. The southern portion of the site sheet flows to the adjacent frontages along Santa Barbara Street, the Union Pacific Railroad, and Garden Street. Due to existing site topography, the existing parcels do not receive offsite drainage.

Drainage within Santa Barbara Street drains in the southerly direction, to an existing sidewalk underdrain. Runoff from the underdrain is routed to an existing storm drain located on the Union Pacific Railroad property to the south. Drainage in Yanonali Street along the existing project site frontage drains to two existing curb opening catch basins (in sump condition). Drainage on Garden Street flows in the southerly direction and is conveyed to existing curb opening catch basins in Garden Street. Ultimately, all runoff from the project parcel and adjacent right-of-way is conveyed to the City's storm drain system and discharges to the Pacific Ocean.

The site soils are classified as "Aquents, fill areas" and is not associated with a specific Hydrologic Soil Group. (Appendix C) For purposes of this study, we have assumed site soils are consistent with Hydrologic Soil Group D. Historically, the site was home to a lumbar yard. A majority of the site is covered with asphalt or concrete (confirmed with further research and discussions with the property owner), although over the years gravel has been placed on top of existing deteriorating asphalt/concrete. For calculation purposes, visible asphalt, concrete, and buildings have been designated as impervious areas. Although Appendix A of the City's 2013 Storm Water BMP Guidance Manual also defines gravel roads as impervious area, gravel roadways have been designated as permeable for the purposes of this report per the City's request. Calculations are conservative; the photos included in Attachment 1 indicate that concrete/asphalt is visible in many locations that have been counted as existing pervious area.

POST-DEVELOPMENT SITE CONDITION AND DRAINAGE PATTERNS

The attached Preliminary Onsite and Offsite Stormwater Control Plans (Attachment 2 and Attachment 3) depicts site drainage management areas and proposed stormwater management improvements for the project parcel and adjacent right-of-way.

The proposed project site will be approximately 66.6% impervious. Green roofs will be constructed over a portion of the parking garage to increase pervious areas onsite. Roof drainage will be conveyed to various post-construction stormwater BMPs for stormwater treatment and retention including planter boxes, bioretention areas, and permeable paving. At-grade parking and surface improvements will be routed to bioretention areas or permeable paving for stormwater treatment and retention before discharging offsite to the adjacent street or City storm drain system. Runoff from driveways to the underground parking garage, the entrance motor court, and the interior courtyard/pool area will drain to a sump pump; the sump pumps will pump runoff to bioretention areas for stormwater treatment/retention as shown in Attachment 2. Runoff from the redeveloped project site will ultimately be conveyed to the proposed onsite (private) storm drain system. The proposed storm drain will connect to the existing curb opening catch basins in Yanonoli and Garden Streets. The existing wetland will remain and be protected in place. Santa Barbara Street frontage improvements will continue to drain in the southerly direction, towards the Union Pacific Railroad property.

FEMA flood insurance rate maps for the area show the project parcel located in Special Flood Hazard Area (SFHA) Zone AH. The corresponding Base Flood Elevation (BFE) for the project site is 12.0'. (Appendix F) The lowest habitable floor of the proposed building is required to be elevated at or above the Design Flood Elevation (DFE), which is equal to 13.0' (1 foot above the BFE). The lowest habitable floor has been elevated to 13.5'; 0.5' higher than the corresponding DFE.

Runoff in the right-of-way along the project frontage along Garden, Yanonali, and Santa Barbara Streets will be captured through various curb cuts and conveyed to bioretention areas constructed in the adjacent parkways prior to being routed to the City storm drain system.

Site statistics from the project parcel and public right-of-way are summarized below:

Project Parcel (APNs 017-630-008, -009, -018, -021, -024, & -027)

- Proposed New Impervious Area = 66,314 sf
- Proposed Replaced Impervious Area = 64,906 sf
- Proposed Removed Impervious Area = 15,053 sf

Public Right-of-Way

- Proposed New Impervious Area = 1,790 sf
- Proposed Replaced Impervious Area = 6,400 sf
- Proposed Removed Impervious Area = 796 sf

DESIGN METHODOLOGY

EXISTING RUNOFF

Pre-project hydrologic peak flows for the existing project parcel and public right-of-way were analyzed using HydroCAD Stormwater Modeling System software. The existing runoff analysis is based on topography provided by Gilmour Land Surveying. Runoff calculations were prepared using the Santa Barbara County Urban Hydrograph (SBUH) Method. When considering gravel roadways as pervious area, the existing project parcel is approximately 41.4% impervious; the existing public right-of-way is approximately 82.1% impervious. Results for the existing peak flows for the project parcel and public right-of-way are summarized in Table 1; existing stormwater runoff volumes are summarized in Table 2.

Table 1. Pre-Project Peak Flows

Drainage Area	*Area (Ac)*	*1", 24-hour (cfs)*	*Q2 (cfs)*	*Q5 (cfs)*	*Q10 (cfs)*	*Q25 (cfs)*	*Q50 (cfs)*	*Q100 (cfs)*
Project Parcel	4.53	1.30	6.21	9.41	11.54	14.15	16.06	17.89
Public Right-of-Way	1.70	0.60	2.38	3.55	4.34	5.30	6.01	6.70

Table 2. Pre-Project Runoff Volumes

Drainage Area	*Area (Ac)*	*1", 24-hour (ac-ft)*	*Q2 (ac-ft)*	*Q5 (ac-ft)*	*Q10 (ac-ft)*	*Q25 (ac-ft)*	*Q50 (ac-ft)*	*Q100 (ac-ft)*
Project Parcel	4.53	0.189	0.874	1.329	1.632	2.006	2.280	2.543
Public Right-of-Way	1.70	0.085	0.339	0.507	0.619	0.757	0.858	0.956

Supporting calculations for pre-project runoff can be found in Appendix A, Pre-Project Hydrology Calculations.

POST-DEVELOPMENT RUNOFF

Post-development hydrologic peak flows for the project parcel and public right-of-way were analyzed using HydroCAD Stormwater Modeling System software. The runoff analysis is based on the Preliminary Grading & Drainage Plans for the site, dated 8/4/22, prepared by Flowers & Associates. Runoff calculations were prepared using the Santa Barbara County Urban Hydrograph (SBUH) Method. The proposed project parcel is approximately 66.6% impervious; the proposed public right-of-way is approximately 81.1% impervious. Results for the post-development peak flows for the project parcel and public right-of-way are summarized in Table 3; post-development stormwater runoff volumes are summarized in Table 4.

Table 3. Post-Development Peak Flows

Drainage Area	*Area (Ac)*	*1", 24-hour (cfs)*	*Q2 (cfs)*	*Q5 (cfs)*	*Q10 (cfs)*	*Q25 (cfs)*	*Q50 (cfs)*	*Q100 (cfs)*
Project Parcel	4.53	1.28	5.68	8.76	10.84	13.43	15.33	17.17
Public Right-of-Way	1.70	0.58	2.31	3.47	4.25	5.21	5.92	6.6

Table 4. Post-Development Runoff Volumes

Drainage Area	Area (Ac)	1", 24-hour (ac-ft)	Q2 (ac-ft)	Q5 (ac-ft)	Q10 (ac-ft)	Q25 (ac-ft)	Q50 (ac-ft)	Q100 (ac-ft)
Project Parcel	4.53	0.188	0.815	1.25	1.545	1.912	2.182	2.443
Public Right-of-Way	1.70	0.083	0.331	0.496	0.607	0.744	0.845	0.943

Supporting calculations for pre-project runoff can be found in Appendix B, Post-Development Hydrology Calculations.

CITY OF SANTA BARBARA STORM WATER COMPLIANCE

Because more than 4,000 sf of new/replaced impervious area is proposed on the project parcel and more than 500 sf of new/replaced impervious area is proposed within the public right-of-way, both onsite and offsite development triggers City of Santa Barbara "Tier 3" stormwater compliance. Tier 3 projects are required to comply with the following:

1. Storm Discharge Rate Control: Provide storm water detention as required to keep peak storm flow below the existing site flows, up to the 25-yr Storm.
2. Storm Water Volume Reduction: Retain the larger of: a) the volume difference between existing and proposed conditions for the 25-yr, 24-hr storm or b) the proposed 1-inch, 24-hr storm.
3. Water Quality Treatment: Treat the runoff from the 1-inch 24-hr storm or ¼-inch per hour for 4 hours, via flow-through treatment.

Compliance with the above requirements for the project parcel and public right-of-way are further described below.

Storm Water Discharge Rate Control Requirements

Project Parcel (APNs 017-630-008, -009, -018, -021, -024, & -027)

Comparison of the existing peak flows in Table 1 to proposed peak flows in Table 3, show that the post-development condition for the project parcel results in decreased peak flows from the existing condition, thereby satisfying the Tier 3 storm water discharge rate control

requirement. No additional stormwater detention is proposed on the project parcel. See Table 5 for comparison of peak flows for the site, up to the 25-year storm event.

Table 5. Pre-Project vs. Post-Project Flow Comparison for the Project Parcel

	Q 1", 24-hour (cfs)	*Q2 (cfs)*	*Q5 (cfs)*	*Q10 (cfs)*	*Q25 (cfs)*
Pre-Project	1.30	6.21	9.41	11.54	14.15
Post-Project	1.28	5.68	8.76	10.84	13.43
Change	-0.02	-0.53	-0.65	-0.70	-0.72

Public Right-of-Way

When comparing the existing and proposed site development associated with the public right-of-way, the total landscape/pervious area in the existing condition is approximately 0.30 acres, or approximately 17.9% of the total project area, while the total landscaping/pervious areas is approximately 0.32 acres in the proposed condition, which is approximately 18.9% of the total project area. The increase of pervious surfaces in the post-development condition results in decreased peak flows from the existing condition, thereby satisfying the Tier 3 storm water discharge rate control requirement. No additional stormwater detention is proposed in the public right-of-way.

Volume Reduction Requirements and Storm Water Quality Treatment Requirements

Project Parcel (APNs 017-630-008, -009, -018, -021, -024, & -027)

Since the project parcel proposes an increase to site impervious areas in the proposed condition, volume reduction requirements are applicable for project parcel. The existing 25-year, 24-hour pre-project runoff volume is 2.006 ac-ft (Table 2); the proposed 25-year, 24-hour post-development runoff volume is 1.912 ac-ft (Table 4). Since the runoff volume for the proposed, post-development 25-year, 24-hour storm is reduced from the existing, pre-development 25-year, 24-hour storm, the project is required to retain the proposed 1-inch, 24-hour storm onsite.

The proposed project is also required to treat storm water runoff from the 1", 24-hr storm for trash, nutrients, bacteria, sediment, pesticides and herbicides, hydrocarbons and metals (defined as "pollutants of concern" in the City's Storm Water BMP Guidance Manual). The City's Storm Water BMP Guidance Manual (July 2013) advises projects to achieve storm water treatment through "natural" filtration and infiltration designs.

The following stormwater treatment BMPs are proposed on the project parcel to satisfy volume reduction and storm water quality treatment requirements:

"Bio-Filtration" Planter Boxes: Six planter boxes are proposed on the project site and are identified in Attachment 2. The planter boxes are located aboveground, adjacent to the proposed building and are designed specifically to capture and treat roof runoff before

runoff is routed to adjacent permeable paving for stormwater retention. Planter box treatment is achieved through soil filtration as well as biological plant uptake. The project's planter box filtration design and specific soil media (24" min. depth) is specified on the project plans (60-70% sand, 15-25% compost, and 10-20% clean topsoil; organic content 8-12% and pH 5.5 to 7.5.) and meets the City's Design Criteria for treatment.

Bioretention Areas: Ten bioretention areas are proposed on the project parcel and are identified in Attachment 2. These areas are self-contained within landscaping areas and are designed to treat and retain roof runoff from the building as well as hardscape proposed throughout the project site. These areas treat storm water through soil filtration, (a minimum of 24 inches in depth), as well as biological plant uptake before infiltrating into the ground below. The special soil mix (60-70% sand, 15-25% compost, and 10-20% clean topsoil; organic content 8-12% and pH 5.5 to 7.5).

Permeable Pavement: Proposed permeable paving is identified in Attachment 2. Permeable paving is proposed throughout the project site to reduce site impervious area and treat and retain runoff from the at-grade parking areas, hardscape, and a portion of the roof runoff.

As shown in Table 2 the runoff volume created by the post-development 1-inch, 24-hour storm is 0.188 acre-feet (or approximately **8,189 cubic feet**). Post-construction BMPs are designed for the overall volume produced from the 1-inch, 24-hour storm.

Individual treatment BMPs were sized by prorating the volume produced from the 1-inch, 24-hour storm based on the percentage of area tributary to each treatment BMP. Sizing calculations for the planter boxes, bioretention areas and permeable pavement are attached for reference (Appendix D). Sizing of all treatment BMPs associated with the project parcel are summarized in Table 6. The following items should be noted regarding design of BMPs for the subject project site:

- DMAs "1", "3", and "5" drain to the right-of-way. Offsite stormwater BMPs within offsite DMAs "2", "4", and "6" have been sized to accommodate the design volume of the DMAs "1", "3", and "5", respectively.
- The existing wetland and existing vegetated tributary area, DMA "DA", is self-treating; no post-construction BMPs are proposed for DMA "DA".
- The existing public sidewalk in DMA "A" drains to the existing UPRR property and cannot be feasibly routed to a treatment BMP. The bioretention area in DMA "A" has been oversized to allow for additional treatment of onsite runoff to compensate for runoff that cannot be feasibly captured/treated in the existing City easement.
- DMAs "I", "J", "H", "Q" and "U" drain to a sump pump; runoff will be routed internally within the building and pumped to the bioretention area in DMA "I" for stormwater treatment and retention.
- DMA "K" drains to a sump pump; runoff will be pumped to the bioretention area in areas in DMA "K" for stormwater treatment and retention.
- DMAs "W", "Z", "R", "EA", "T", "V", "S", "AA", and "Y" drain to a sump pump; runoff will be routed internally within the building and pumped to the bioretention area in DMA "CA" for stormwater treatment and retention.

See the Preliminary Onsite Stormwater Control Plan (Attachment 2) for post-construction BMP locations.

Table 6. Project Parcel Stormwater BMP Sizing Summary

Drainage Management Area (DMA)	Treatment Method (BMP)	Area (sf)	Percentage of Site Tributary to BMP (%)	Design Volume (CF)	Required BMP Surface Area (SF)	Provided BMP Surface Area (SF)
A	Bioretention	7,638	3.9%	317	101	120
B	Bioretention	10,955	5.5%	454	87	187
C	Bioretention	16,120	8.2%	669	127	564
D[3]	Pre-treatment Planter Box (runoff routed to DMA E for stormwater retention)	6,123	3.1%	254	51	58
E	Permeable Pavement	8,143	4.1%	=338+254 =592[3]	304	1,698
F	Bioretention	3,355	1.7%	139	27	94
G	Bioretention	350	0.2%	15	17	18
H	Routed to DMA "I"	6,620	3.4%	275	See DMA "I"	
I	Bioretention	20,248	10.3%	=840+275+254+83+182 =1,633[4]	311	338
J	Routed to DMA "I"	6,113	3.1%	254	See DMA "I"	
K	Bioretention	9,530	4.8%	395	75	97
L	Permeable Pavement	9,959	5.0%	=413+355+224 +97=1,089[5]	559	2,971
M	Permeable Pavement	1,428	0.7%	59	30	1,042
N	Pre-treatment Planter Box (runoff routed to DMA L for stormwater retention)	8,565	4.3%	355	71	90
O	Pre-treatment Planter Box (runoff routed to	5,397	2.7%	224	45	50

	DMA L for stormwater retention)					
P	Pre-treatment Planter Box (runoff routed to DMA L for stormwater retention)	2,329	1.2%	97	19	23
Q	Routed to DMA “I”	2,003	1.0%	83	See DMA “I”	
R	Routed to DMA “CA”	1,815	0.9%	75	See DMA “CA”	
S	Routed to DMA “CA”	5,088	2.6%	211	See DMA “CA”	
T	Routed to DMA “CA”	3,563	1.8%	148	See DMA “CA”	
U	Routed to DMA “I”	4,382	2.2%	182	See DMA “I”	
V	Routed to DMA “CA”	2,221	1.1%	92	See DMA “CA”	
W	Routed to DMA “CA”	4,708	2.4%	195	See DMA “CA”	
X	Bioretention	2,063	1.0%	86	37	44
Y	Routed to DMA “CA”	4,371	2.2%	181	See DMA “CA”	
Z	Routed to DMA “CA”	4,752	2.4%	197	See DMA “CA”	
AA	Routed to DMA “CA”	1,881	1.0%	78	See DMA “CA”	
BA	Bioretention	3,961	2.0%	164	52	103
CA[(1)]	Bioretention	7,908	4.0%	=328+75+211+92 +195+181+197+78 +27=1,385	440	443
DA	Existing Wetland	24,323	12.3%	1,006	Self-Treating	
EA	Routed to DMA “CA”	644	0.3%	27	See DMA “CA”	
1[(2)]	Drains to Offsite DMA “2”	349	0.2%	14	See Note 2, below	
3[(2)]	Drains to Offsite DMA “4”	100	0.1%	4	See Note 2, below	
5[(2)]	Drains to Offsite DMA “6”	547	0.3%	23	See Note 2, below	

Notes:

(1) The bioretention basin within DMA "CA" has been oversized to retain runoff from DMAs "CA", "W", "Z", "R", "EA", "T", "V", "S", "AA", and "Y".
(2) Sidewalks within DMAs "1", "3", and "5" drain to the right-of-way. Offsite stormwater BMPs within offsite DMAs "2", "4", and "6" have been sized to accommodate the design volume of the DMAs "1", "3", and "5", respectively. See Attachment 3 for DMA "1", "2", and "3" locations. See Table 7 for sizing of offsite BMPs.
(3) Runoff from DMA "D" will be routed to DMA "E" for stormwater retention. Permeable paving within DMA "E" has been sized to accommodate the combined design volume of DMA "D" and "E".
(4) Runoff from DMAs "H", "I", "J", "Q", and "U" will be routed to DMA "I" for stormwater retention. The bioretention area within DMA "I" has been sized to accommodate the combined design volume of DMAs "H", "I", "J", "Q", and "U".
(5) Permeable pavement within DMA "L" has been oversized to retain runoff from DMAs "L", "N", "O", and "P".

Public Right-of-Way

When comparing the existing and proposed site development associated with the public right-of-way, the total landscape/pervious area in the existing condition is approximately 0.30 acres, or approximately 17.9% of the total project area, while the total landscaping/pervious areas is approximately 0.32 acres in the proposed condition, which is approximately 18.9% of the total project area. The increase of pervious surfaces in the post-development condition results in decreased runoff volumes from the existing condition, thereby satisfying the Tier 3 volume reduction requirement. Stormwater retention for the purposes of storm water runoff volume reduction is not required/proposed in the public right-of-way.

The proposed project is required to treat storm water runoff from the 1", 24-hr storm for trash, nutrients, bacteria, sediment, pesticides and herbicides, hydrocarbons and metals (defined as "pollutants of concern" in the City's Storm Water BMP Guidance Manual). The City's Storm Water BMP Guidance Manual (July 2013) advises projects to achieve storm water treatment through "natural" filtration and infiltration designs.

As depicted in the Preliminary Offsite Stormwater Control Plan (Attachment 3), the treatment area in the public right-of-way is taken as the western half of Garden Street along the project frontage, the eastern half of Santa Barbara Street along the project frontage, and the southern half of Yanonali Street along the project frontage. The following stormwater treatment BMPs are proposed in the public right-of-way:

Bioretention Areas: Twenty-one bioretention areas are proposed along Garden Street, seven bioretention areas are proposed along Yanonali Street and one bioretention area is proposed at the southern end of Santa Barbara Street. Bioretention areas are identified in Attachment 3. Runoff will be routed to the proposed bioretention areas through curb cuts. Local depressions will be constructed at each curb cut to direct drainage to each bioretention area. These areas are self-contained within landscaping areas and are designed to treat runoff from the adjacent roadway and concrete sidewalks. Underdrains have been removed from all bioretention areas in the right-of-way at the City's request. These areas treat storm water through soil filtration through a special soil mix (a minimum of 24 inches in depth), as well as biological plant uptake. The special soil mix consists of 60-70% sand, 15-25% compost, and 10-20% clean topsoil. The organic content of the soil

mix is 8-12% and pH is 5.5 to 7.5. The bioretention areas along Garden Street have been oversized to provide additional stormwater treatment to offset the ±491 sf of proposed median improvements on the eastern side of Garden Street.

As shown in Table 4 the runoff volume created by the post-development 1-inch, 24-hour storm is 0.083 acre-feet (or approximately **3,615 cubic feet**). Post-construction BMPs are designed for the overall volume produced from the 1-inch, 24-hour storm.

Individual treatment BMPs were sizing by prorating the volume produced from the 1-inch, 24-hour storm based on the percentage of area tributary to each treatment BMP. Sizing calculations for the bioretention areas are attached for reference (Appendix E). Sizing of all treatment BMPs associated with the public right-of-way are summarized in Table 7. As noted in Table 7, BMPs within DMAs "2", "4", "6" and "8" have been sized to accommodate the design volume from project parcel DMAs "1", "3", "5", and "10", respectively. See the Preliminary Offsite Stormwater Control Plan (Attachment 3) for post-construction BMP locations.

Table 7. Public Right-of-Way Stormwater BMP Sizing Summary

Drainage Management Area (DMA)	Treatment Method (BMP)	Area (sf)	Percentage of Site Tributary to BMP (%)	Design Volume (CF)	Required BMP Surface Area (SF)	Provided BMP Surface Area (SF)
1(1)(2)	Routed to DMA "2"(2)			14(1)	See DMA "2"	
2	Bioretention w/ underdrains(2)	4,017	5.4%	=196+14 =210 (2)	42	56
3(1)(3)	Routed to DMA "4"(3)			4(1)	See DMA "4"	
4	Bioretention w/ underdrains(3)	1,188	1.6%	=58+4 =62 (3)	12	28
5(1)(4)	Routed to DMA "6"(4)			23(1)	See DMA "6"	
6	Bioretention w/ underdrains(4)	7,810	10.6%	=382+23 =405 (3)	81	112
7	Bioretention w/ underdrains	24,201	32.7%	1,190	236	240
8	Bioretention w/ underdrains	27,032	36.5%	=1,321+24 =1,345(5)	269	288
9	Bioretention w/ underdrains	9,171	12.4%	449	90	115
10(5)	Routed to DMA "8"	491	0.7%	24	See DMA "8"	

Notes:
(1) See Table 6 for design volume calculations for all onsite areas that drain to offsite BMPs
(2) Sidewalks within DMA "1" drains to DMA "2". The bioretention area within DMA "2" has been sized to treat 14 CF of runoff from DMA "1" and 196 CF of runoff from DMA "2".
(3) Sidewalks within DMA "3" drains to DMA "4". The bioretention area within DMA "4" has been sized to treat 4 CF of runoff from DMA "3" and 58 CF of runoff from DMA "4".

(4) Sidewalks within DMA “5” drains to DMA “6”. The bioretention area within DMA “6” has been sized to treat 23 CF of runoff from DMA “5” and 382 CF of runoff from DMA “6”.
(5) Median improvements within DMA “10” drain to DMA “8”. The bioretention area within DMA “8” has been sized to treat 1,321 CF of runoff from DMA “8” and 24 CF of runoff from DMA “10”.

CONCLUSION

The preceding analysis demonstrates that this project meets the City’s Tier 3 storm water requirements (treatment, volume, and rate requirements).

R/W, TYP.

SANTA BARBARA STREET (PUBLIC)

UPRR

APN 017-630-009

APN 017-630-021

APN 017-022-007
110 SANTA BARBARA ST.
(NOT A PART)

APN 017-022-004
116 SANTA BARBARA ST.
(NOT A PART)

APN 017-022-003
120 SANTA BARBARA ST.
(NOT A PART)

APN 017-022-002
122 SANTA BARBARA ST.
(NOT A PART)

APN 017-022-009
132 SANTA BARBARA ST.
(NOT A PART)

P/L, TYP.

P/L, TYP.

R/W, TYP.

APN 017-630-008

APN 017-630-024

APN 017-630-027

APN 017-630-018
102 SANTA BARBARA ST.

E. YANONALI STREET (PUBLIC)

R/W, TYP.

GARDEN STREET (PUBLIC)

LEGEND

- LANDSCAPING (ONSITE PERVIOUS AREA)
- ASPHALT/CONCRETE (ONSITE IMPERVIOUS AREA)
- COMPACTED GRAVEL/BASE/ROCK (ONSITE PERVIOUS AREA)
- LANDSCAPING (OFFSITE PERVIOUS AREA)
- ASPHALT/CONCRETE (OFFSITE IMPERVIOUS AREA)
- PHOTO TAG WITH CORRESPONDING DOCUMENTATION (SEE SHEETS NO 2-4 FOR PHOTOS)
- ONSITE/OFFSITE BOUNDARY LINE

EXISTING - SITE COVERAGE CALCS

EXISTING:

ONSITE (PROJECT PARCEL)	
- PERVIOUS AREA	136,546 SF
- IMPERVIOUS AREA	132,319 SF
TOTAL	197,447 SF
OFFSITE (RIGHT-OF-WAY)	
- PERVIOUS AREA	13,218 SF
- IMPERVIOUS AREA	60,287 SF
TOTAL	73,505 SF

IMPORTANT NOTICE

ALL UTILITY LOCATIONS ARE APPROXIMATE CONTRACTOR IS TO NOTIFY UNDERGROUND SERVICE ALERT TWO WORKING DAYS PRIOR TO STARTING ANY EXCAVATION OR RESURFACING.

CALL TOLL FREE 1-800-422-4133

N

SCALE: 1"=30'
GRAPHIC SCALE
0 30 60 90

ATTACHMENT 1

EXISTING IMPERVIOUS AREA EXHIBIT

GARDEN STREET HOTEL

101 GARDEN STREET, SANTA BARBARA

CITY OF SANTA BARBARA, CALIFORNIA

SHEET NO 1 OF 4

FLOWERS & ASSOCIATES, INC.
115 W. Canon Perdido Street
Santa Barbara, CA 93101
Telephone (805) 966-2224
CIVIL ENGINEERING • PLANNING
CONSTRUCTION ENGINEERING

PRELIMINARY
NOT FOR CONSTRUCTION
BY: _____ DATE: _____

REGISTERED PROFESSIONAL ENGINEER
ROBERT A. SCHULTZ
No. 71335
CIVIL
STATE OF CALIFORNIA


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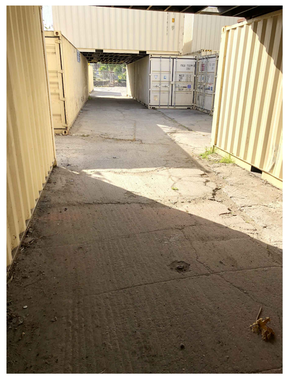
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ATTACHMENT 1

EXISTING IMPERVIOUS AREA EXHIBIT

GARDEN STREET HOTEL

101 GARDEN STREET, SANTA BARBARA

CITY OF SANTA BARBARA, CALIFORNIA

F&A CIVIL ENGINEERING • PLANNING CONSTRUCTION ENGINEERING

FLOWERS & ASSOCIATES, INC.

115 W. Canon Perdido Street

Santa Barbara, CA 93101

Telephone (805) 966-2224

PRELIMINARY

NOT FOR CONSTRUCTION

BY: _____ DATE: _____

REGISTERED PROFESSIONAL ENGINEER ROBERT A. SCHNITZER No. 71335 CIVIL STATE OF CALIFORNIA

PLOTTED: Thursday, May 19, 2022 4:50:30 PM

21093_EXISTING IMPERVIOUS AREA EXHIBIT.DWG

W.O. 21093


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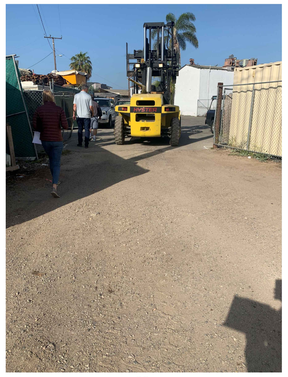
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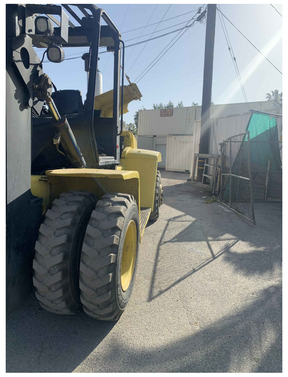
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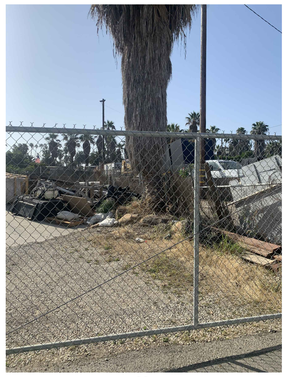
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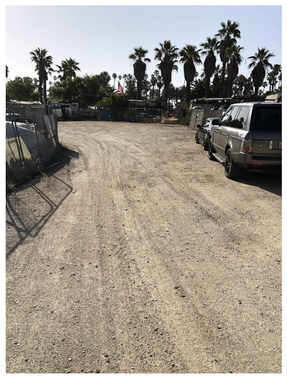
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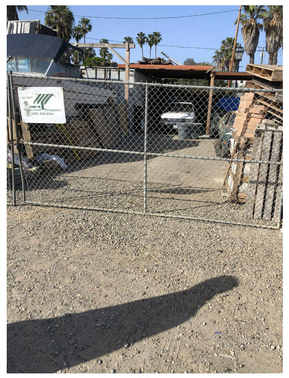
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ATTACHMENT 1

EXISTING IMPERVIOUS AREA EXHIBIT

GARDEN STREET HOTEL

101 GARDEN STREET, SANTA BARBARA

CITY OF SANTA BARBARA, CALIFORNIA

F&A
CIVIL ENGINEERING • PLANNING
CONSTRUCTION ENGINEERING

FLOWERS & ASSOCIATES, INC.
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PRELIMINARY
NOT FOR CONSTRUCTION
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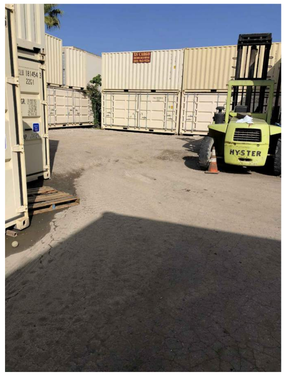
REGISTERED PROFESSIONAL ENGINEER
ROBERT A. SCHMIDT
No. 71335
CIVIL
STATE OF CALIFORNIA



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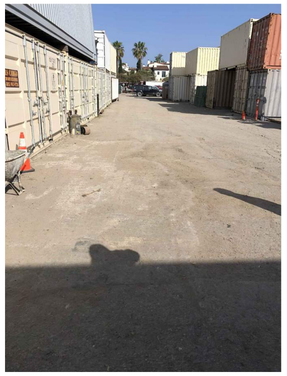
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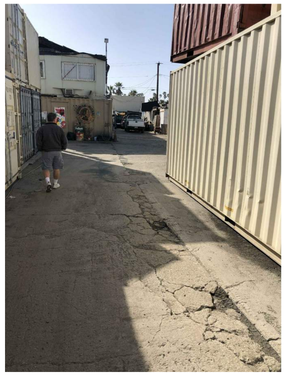
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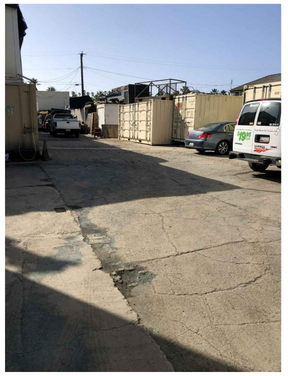
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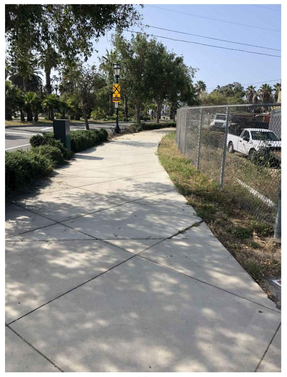
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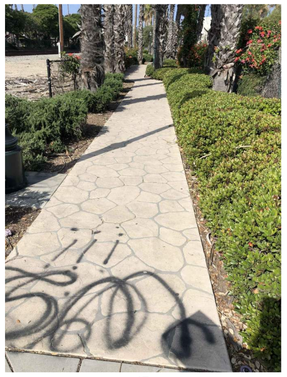
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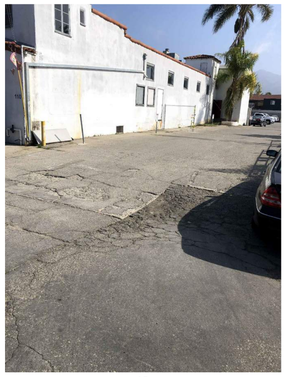
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ATTACHMENT 1

EXISTING IMPERVIOUS AREA EXHIBIT

GARDEN STREET HOTEL

101 GARDEN STREET, SANTA BARBARA

CITY OF SANTA BARBARA, CALIFORNIA

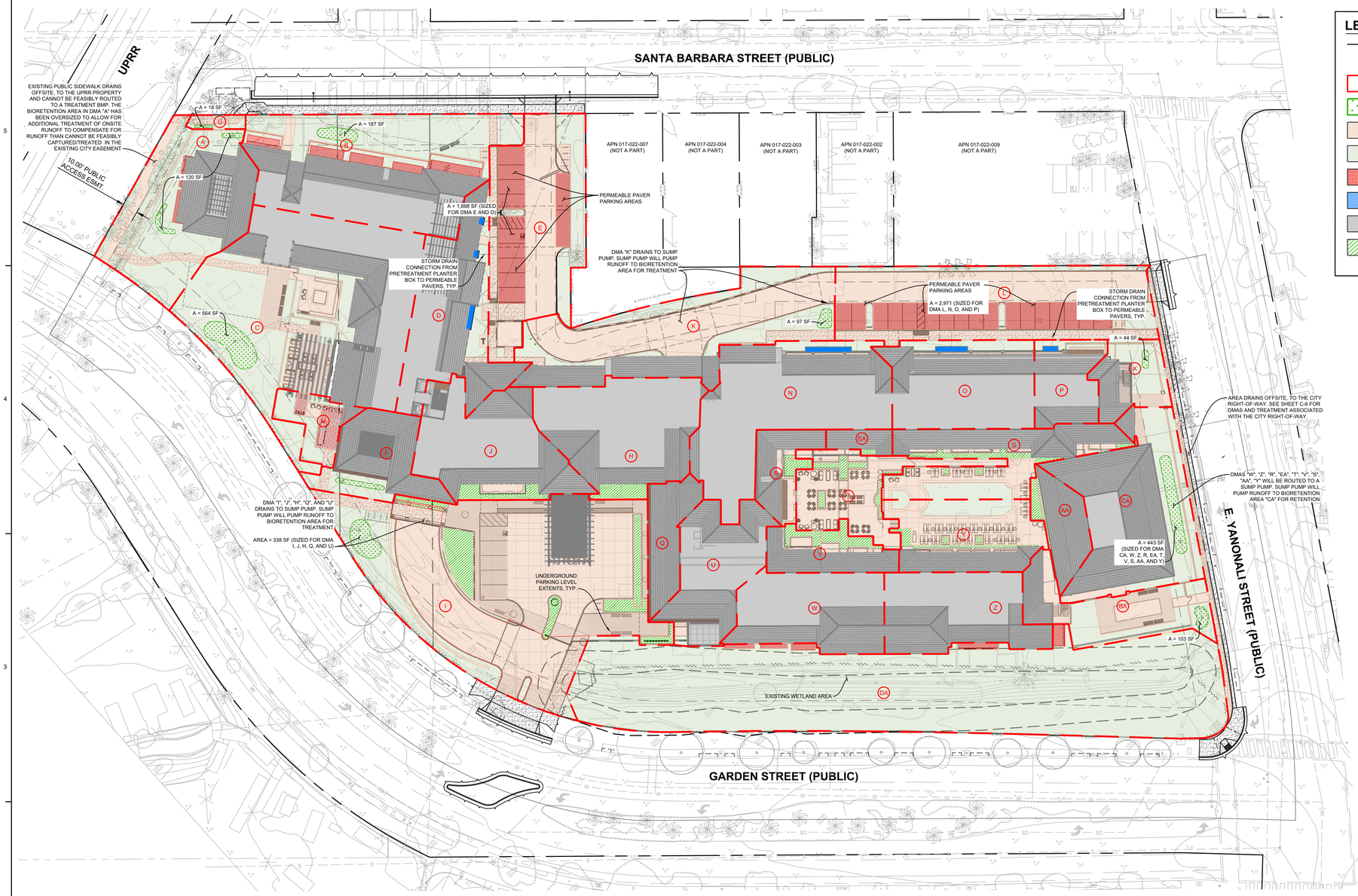
SHEET NO 4 OF 4

F&A CIVIL ENGINEERING • PLANNING CONSTRUCTION ENGINEERING

FLOWERS & ASSOCIATES, INC.
115 W. Canon Perdido Street
Santa Barbara, CA 93101
Telephone (805) 966-2224

PRELIMINARY
NOT FOR CONSTRUCTION BY: _____ DATE: _____

REGISTERED PROFESSIONAL ENGINEER ROBERT A. SCHMITZ No. 71335 CIVIL STATE OF CALIFORNIA



LEGEND

- PROPERTY LINE
- DIRECTION OF FLOW FOR SURFACE RUNOFF
- DRAINAGE MANAGEMENT AREA (DMA) BOUNDARY
- PROPOSED BIORETENTION BASIN AREA (SEE TYPICAL DETAIL 3, THIS SHEET)
- PROPOSED IMPERVIOUS AREA
- PROPOSED PERVIOUS AREA
- PROPOSED PERMEABLE PAVERS (SEE TYPICAL 2, THIS SHEET)
- PROPOSED PRETREATMENT BIOFILTRATION PLANTER BOX (SEE TYPICAL DETAIL 1, THIS SHEET)
- PROPOSED ROOF
- PROPOSED PERVIOUS GREEN ROOF AREA

PROJECT PARCEL - SITE COVERAGE CALCS

EXISTING:		
PERVIOUS AREA		115,715 SF
IMPERVIOUS AREA		81,732 SF
TOTAL SITE		197,447 SF
PROPOSED:		
PERVIOUS AREA		65,997 SF
-55,271 SF LANDSCAPE		
-3,924 SF GREEN ROOF		
-6,802 SF PERMEABLE PAVERS		
IMPERVIOUS AREA		131,450 SF
TOTAL SITE		197,447 SF
PROPOSED NEW IMPERVIOUS AREA	=	66,314 SF
PROPOSED REPLACED IMPERVIOUS AREA	=	64,906 SF
PROPOSED NEW PERVIOUS AREA	=	15,053 SF

I UNDERSTAND THIS PROJECT IS SUBJECT TO CITY OF SANTA BARBARA TIER 3 STORMWATER REQUIREMENTS AND AGREE TO CONTRACT WITH THE CIVIL ENGINEER SUCH THAT A STAMPED LETTER VERIFYING THAT ALL POST CONSTRUCTION BMP'S ARE INSTALLED AS DESIGNED AND APPROVED.

I ALSO AGREE TO MAINTAIN THE PROPOSED STORMWATER BMP'S INCLUDING BIORETENTION AREA, PERMEABLE PAVERS AND RAINWATER TANKS PER PURSUANT TO SBMC 22.87.050.

_____
PROPERTY OWNER

IMPORTANT NOTICE

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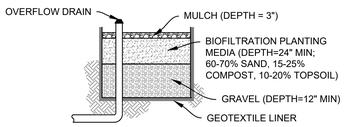
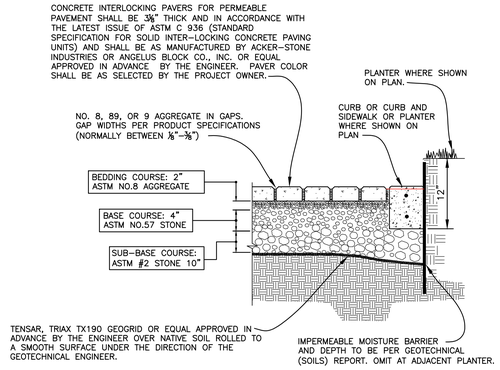
CALL TOLL FREE 1-800-422-4133



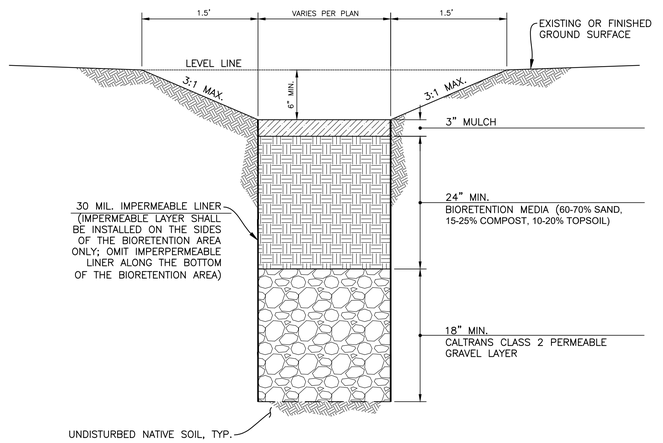
1 **TYPICAL PLANTER BOX DETAIL**
NOT TO SCALE



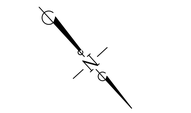
NOTES:

1. NO. 2 STONE MAY BE SUBSTITUTED WITH NO. 3 OR NO. 4 STONE.
2. STRUCTURAL SECTION IS AS PROVIDED BY THE GEOTECHNICAL ENGINEER.
3. FOR EDGING CURB CONSTRUCT WEAKENED PLANE CONTROL JOINTS @ 10' INTERVALS AND CONSTRUCT ½" RADIUS ON ALL EXPOSED CORNERS.
4. AGGREGATE SPECIFICATIONS ARE PER ASTM D448-12.

2 **TYPICAL PERMEABLE PAVEMENT DETAIL**
NOT TO SCALE



3 **TYPICAL BIORETENTION DETAIL**
NOT TO SCALE
NOT FOR CONSRUCTION



SCALE: 1"=30'
GRAPHIC SCALE
0 30 60 90

GARDEN STREET HOTEL

CLIENT / DEVELOPER:

DAUNTLESS DEVELOPMENT
101 GARDEN STREET
SANTA BARBARA, CA 93101

CLIENT: D5 PARTNERS LLC
DEVELOPER: DAUNTLESS DEVELOPMENT
4041 MACARTHUR BLVD
NEWPORT BEACH, CA 92660

DESIGN ARCHITECT:

CEARNAL COLLECTIVE
architecture - interior design
521 1/2 STATE STREET
SANTA BARBARA, CA 93101
(805) 963-8077

ARCHITECT OF RECORD:

delawie
Architecture • Experience • Integrity
1515 MORENA BLVD
SAN DIEGO, CA 92110
(619) 299-6690

LANDSCAPE ARCHITECT:

CJM::LA
1221 STATE STREET #206
SANTA BARBARA, CA 93101
(805) 698-2120

CIVIL ENGINEER:

F&A
FLOWERS & ASSOCIATES, INC.
201 N. CALLE CESAR CHAVEZ, SUITE 100
SANTA BARBARA, CA 93103
(805) 966-2224

ENVIROMENTAL PLANNER:

DUDEK
621 CHAPALA STREET
SANTA BARBARA, CA 93101
(805) 963-0651

JOB NUMBER: 21093

ISSUE DATE: ##########

REVISIONS

#	DATE	DESCRIPTION
1	11/19/2021	DART SUBMITTAL
2	02/25/2022	LDT SUBMITTAL
3	05/20/2022	LDT SUBMITTAL

ATTACHMENT 2

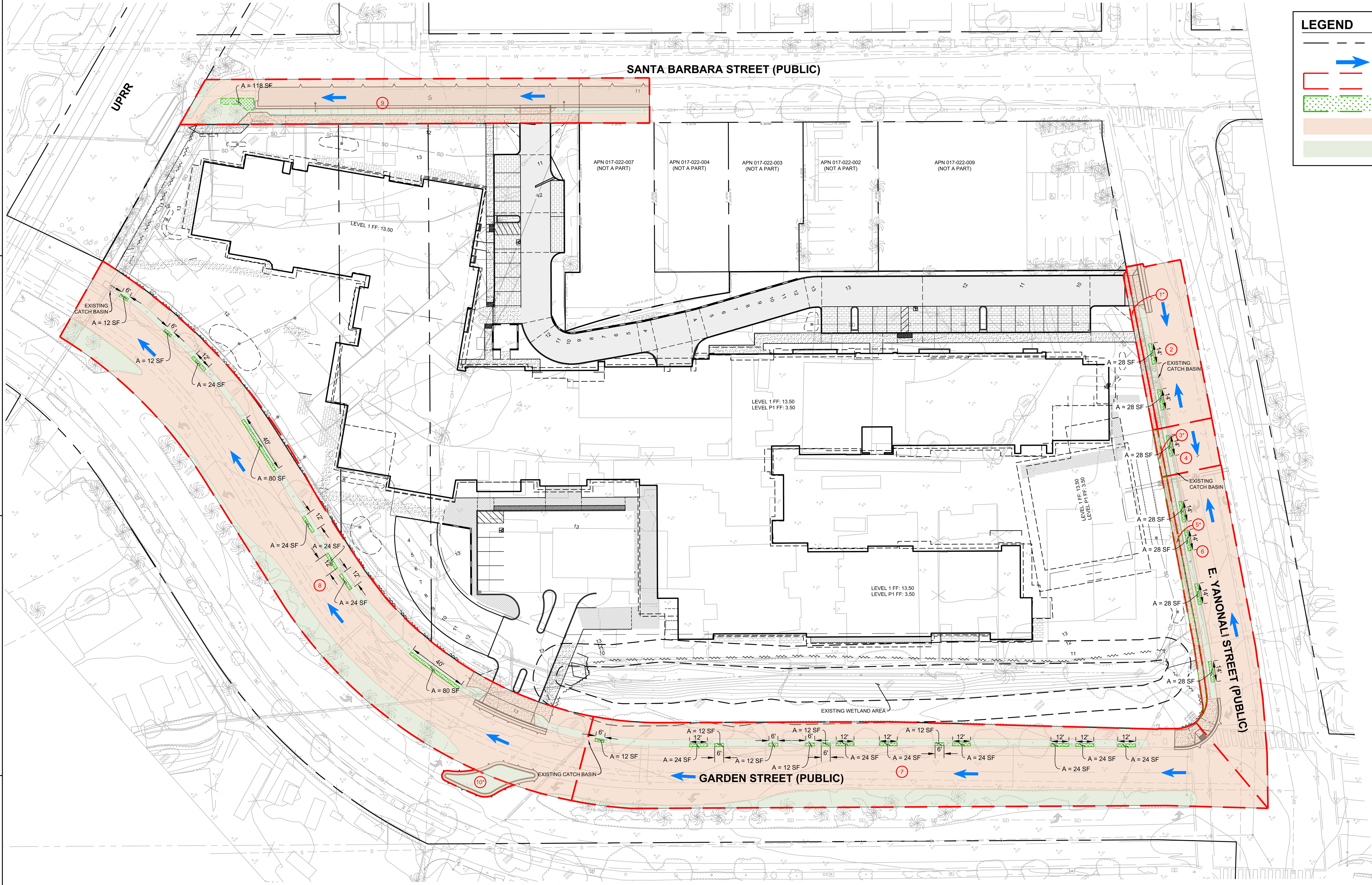
SHEET TITLE:

PRELIMINARY ONSITE STORMWATER CONTROL PLAN

SHEET NUMBER:

C-5

PLOTTED: Friday, August 5, 2022 2:43:22 PM
21093_ENTITLEMENT SET - ONSITE - PRELIM SCP.DWG



LEGEND

(line)	PROPERTY LINE
(arrow)	DIRECTION OF FLOW FOR SURFACE RUNOFF
(red dashed)	DRAINAGE MANAGEMENT AREA (DMA)
(green hatched)	PROPOSED BIOFILTRATION / BIORETENTION BASIN AREA (SEE TYPICAL DETAIL 1, THIS SHEET)
(tan)	PROPOSED IMPERVIOUS AREA
(light green)	PROPOSED PERVIOUS AREA

PROJECT PARCEL - SITE COVERAGE CALCS

EXISTING:	
PERVIOUS AREA	13,218 SF
IMPERVIOUS AREA	60,778 SF
TOTAL SITE	73,996 SF
PROPOSED:	
PERVIOUS AREA	14,014 SF
IMPERVIOUS AREA	59,982 SF
TOTAL SITE	73,996 SF

PROPOSED NEW IMPERVIOUS AREA	=	1,790 SF
PROPOSED REPLACED IMPERVIOUS AREA	=	6,400 SF
PROPOSED NEW PERVIOUS AREA	=	796 SF

I UNDERSTAND THIS PROJECT IS SUBJECT TO CITY OF SANTA BARBARA TIER 3 STORMWATER REQUIREMENTS AND AGREE TO CONTRACT WITH THE CIVIL ENGINEER SUCH THAT A STAMPED LETTER VERIFYING THAT ALL POST CONSTRUCTION BMP'S ARE INSTALLED AS DESIGNED AND APPROVED.

I ALSO AGREE TO MAINTAIN THE PROPOSED STORMWATER BMP'S INCLUDING BIORETENTION AREA, PERMEABLE PAVERS AND RAINWATER TANKS PER PURSUANT TO SBMC 22.87.050.

____
PROPERTY OWNER

*NOTES:
(1) BIORETENTION AREAS PROPOSED ALONG GARDEN STREET WITHIN DMA "8" HAVE BEEN OVERSIZED TO PROVIDE ADDITIONAL STORMWATER TREATMENT TO OFFSET THE +/- 192 SF OF PROPOSED MEDIAN IMRPOVEMENTS SHOWN ON THE SOUTHEAST SIDE OF GARDEN STREET
(2) SIDEWALKS WITHIN DMA "1" DRAIN TO DMA "2". THE BIORETENTION AREAS WITHIN DMA "2" HAVE BEEN SIZED TO ACCOMADATE THE DESIGN VOLUME OF DMAS "1" AND "2".
(3) SIDEWALKS WITHIN DMA "3" DRAIN TO DMA "4". THE BIORETENTION AREAS WITHIN DMA "4" HAVE BEEN SIZED TO ACCOMADATE THE DESIGN VOLUME OF DMAS "3" AND "4".
(4) SIDEWALKS WITHIN DMA "5" DRAIN TO DMA "6". THE BIORETENTION AREAS WITHIN DMA "6" HAVE BEEN SIZED TO ACCOMADATE THE DESIGN VOLUME OF DMAS "5" AND "6".

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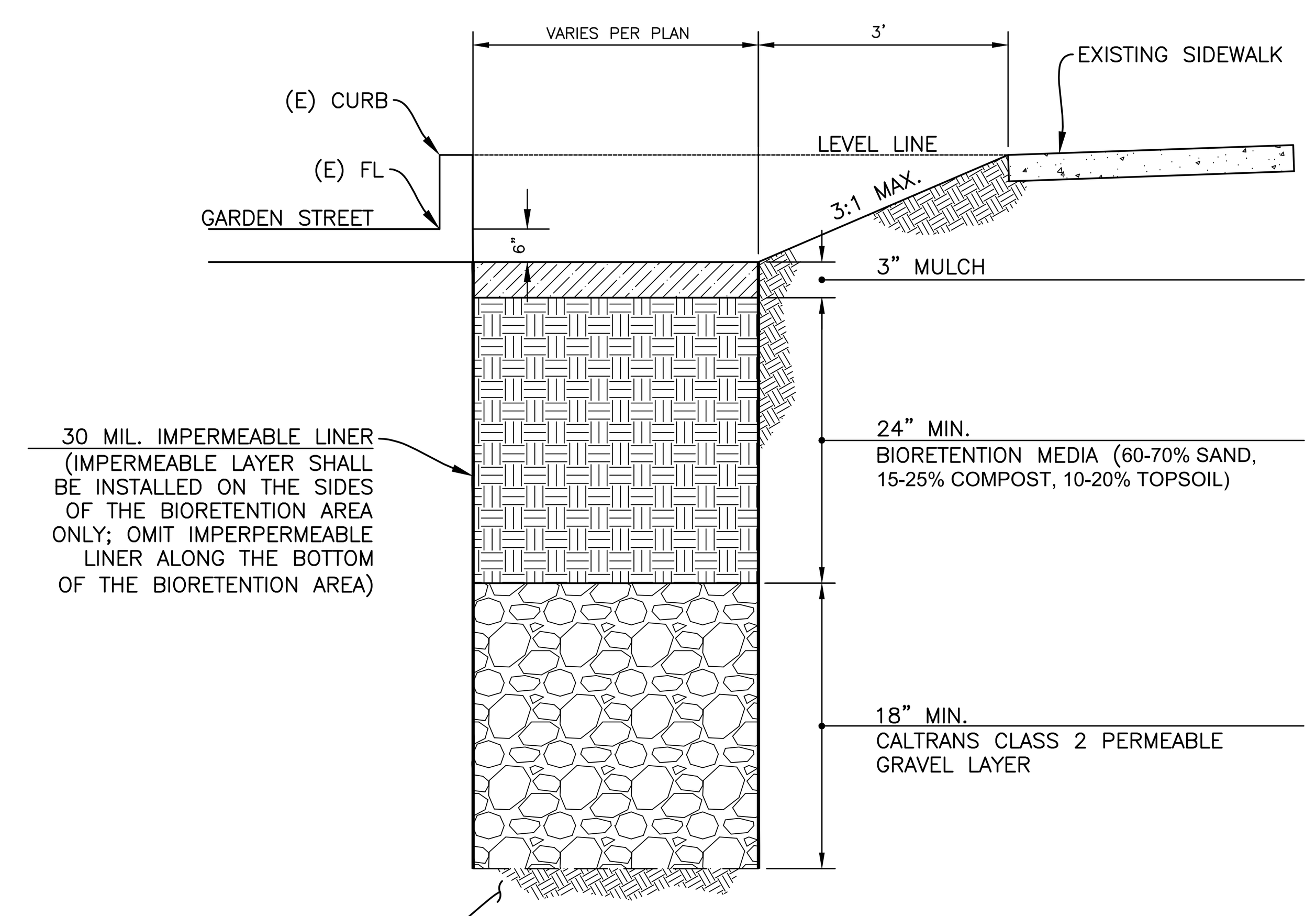
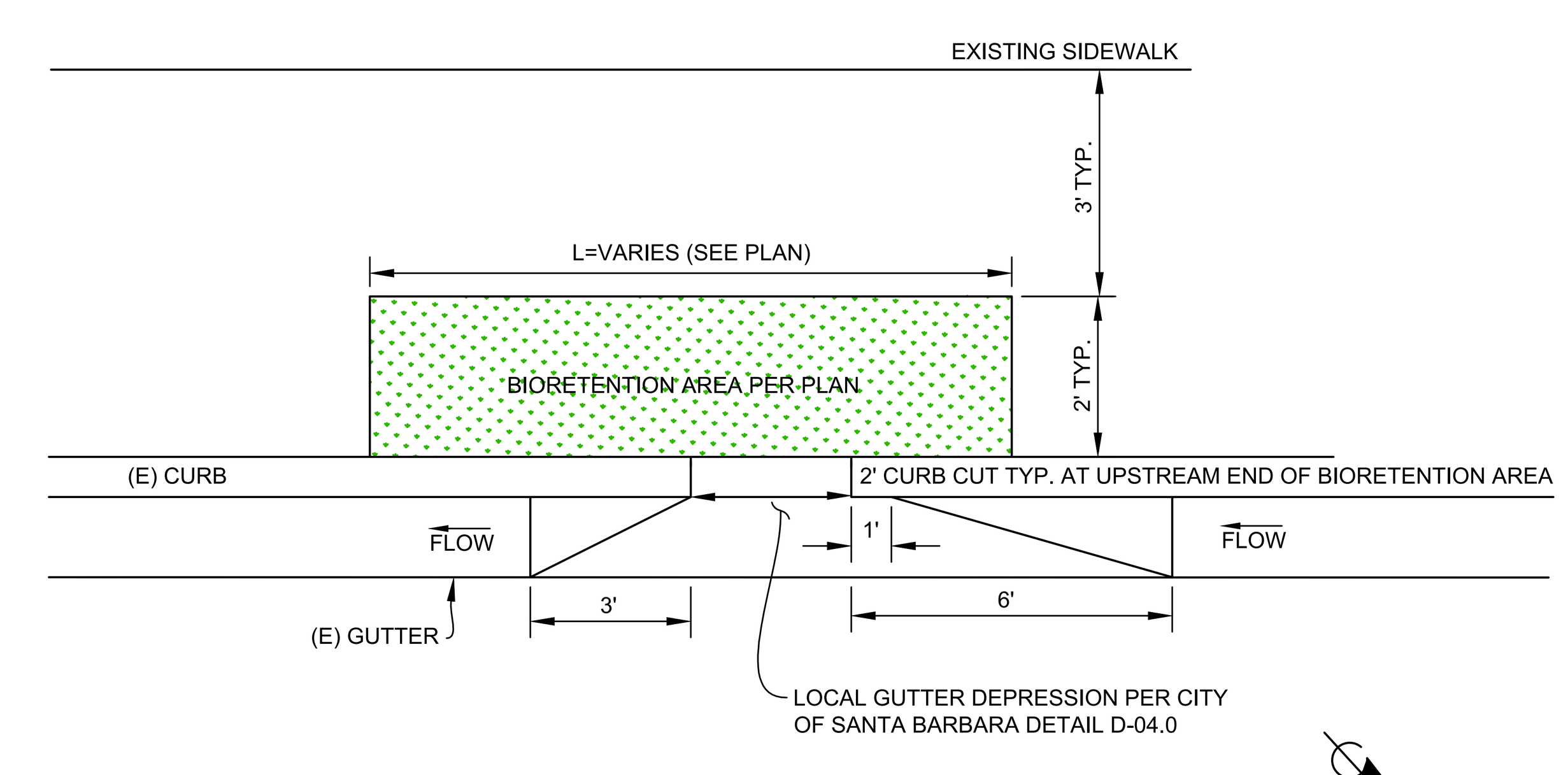


SECTION



PLAN VIEW

1 **TYPICAL BIORETENTION DETAIL**
NOT TO SCALE
NOT FOR CONSTRUCTION

SCALE: 1"=30'
GRAPHIC SCALE
0 30 60 90

GARDEN STREET HOTEL

CLIENT / DEVELOPER:

DAUNTLESS DEVELOPMENT
101 GARDEN STREET
SANTA BARBARA, CA 93101

CLIENT: D5 PARTNERS LLC
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DUDEK
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SANTA BARBARA, CA 93101
(805) 963-0651

JOB NUMBER: 21093

ISSUE DATE: ###########

REVISIONS

#	DATE	DESCRIPTION
1	11/19/2021	DART SUBMITTAL
2	02/25/2022	LDT SUBMITTAL
3	05/20/2022	LDT SUBMITTAL

ATTACHMENT 3

SHEET TITLE:

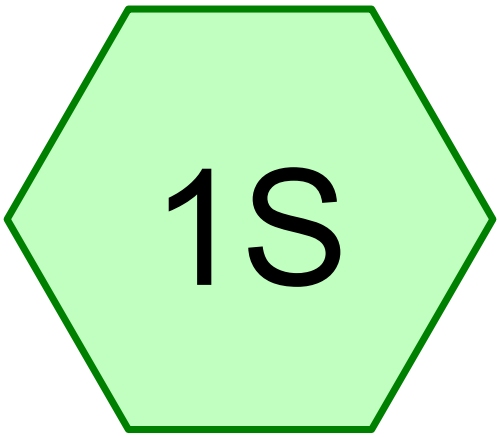
PRELIMINARY OFFSITE STORMWATER CONTROL PLAN

SHEET NUMBER:

C-6

APPENDIX A

HYDROCAD OUTPUT – PRE-PROJECT PROJCT PARCEL AND PUBLIC RIGHT-OF-WAY HYDROLOGY CALCULATIONS



Existing onsite

Subcat Reach Pond Link

Routing Diagram for 21093_Hydro Calcs
Prepared by {enter your company name here}, Printed 2/25/2022

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 inch WQ	Type I 24-hr		Default	24.00	1	1.00	2
2	2 YR	Type I 24-hr		Default	24.00	1	3.20	2
3	5 YR	Type I 24-hr		Default	24.00	1	4.61	2
4	10 YR	Type I 24-hr		Default	24.00	1	5.55	2
5	25 YR	Type I 24-hr		Default	24.00	1	6.71	2
6	50 YR	Type I 24-hr		Default	24.00	1	7.56	2
7	100 YR	Type I 24-hr		Default	24.00	1	8.38	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.633	80	>75% Grass cover, Good, HSG D (1S)
2.024	96	Gravel surface, HSG D (1S)
1.876	98	Unconnected pavement, HSG D (1S)
4.533	**95**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
4.533	HSG D	1S
0.000	Other	
4.533		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.633	0.000	0.633	>75% Grass cover, Good	1S
0.000	0.000	0.000	2.024	0.000	2.024	Gravel surface	1S
0.000	0.000	0.000	1.876	0.000	1.876	Unconnected pavement	1S
0.000	**0.000**	**0.000**	**4.533**	**0.000**	**4.533**	**TOTAL AREA**	

Summary for Subcatchment 1S: Existing onsite

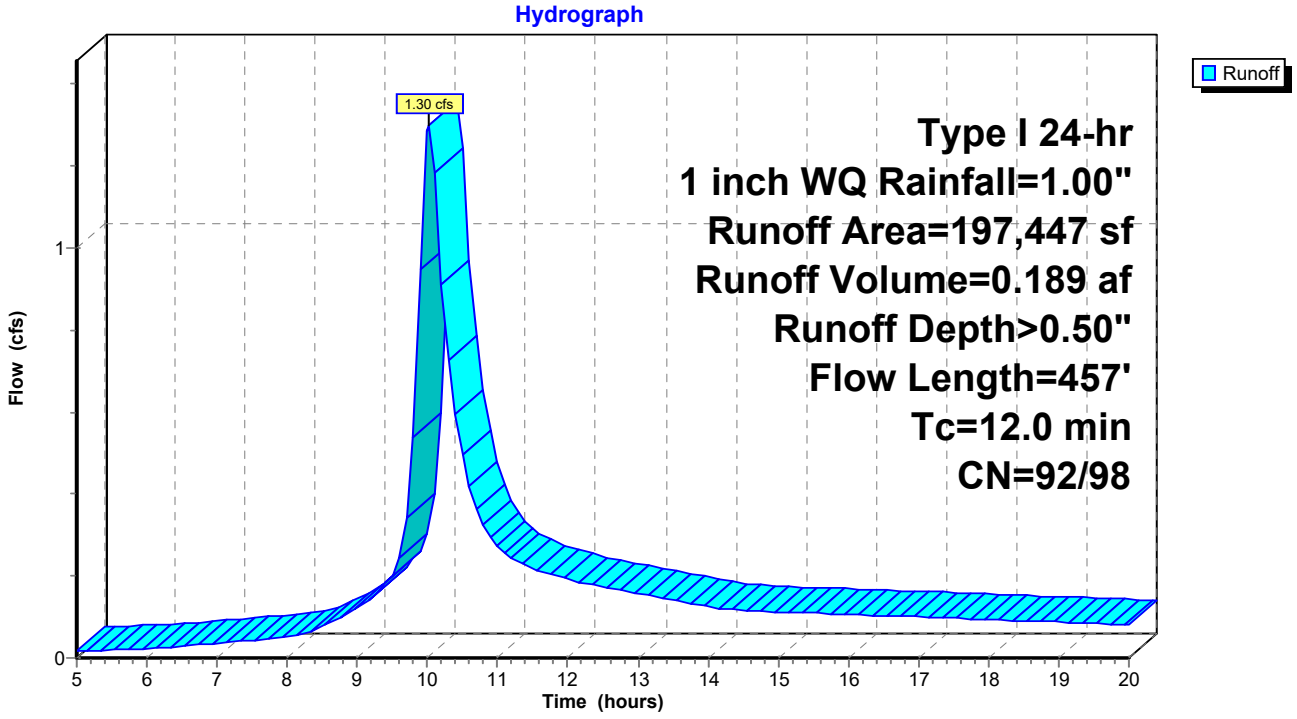
Runoff = 1.30 cfs @ 10.03 hrs, Volume= 0.189 af, Depth> 0.50"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 1 inch WQ Rainfall=1.00"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.10	0.00	0.01	0.02
5.50	0.11	0.00	0.02	0.02
6.00	0.12	0.00	0.02	0.02
6.50	0.14	0.00	0.03	0.03
7.00	0.16	0.00	0.04	0.04
7.50	0.17	0.00	0.05	0.04
8.00	0.19	0.00	0.07	0.05
8.50	0.22	0.00	0.08	0.08
9.00	0.25	0.01	0.11	0.12
9.50	0.30	0.02	0.15	0.20
10.00	0.52	0.10	0.33	**1.28**
10.50	0.58	0.13	0.39	0.49
11.00	0.62	0.15	0.43	0.27
11.50	0.66	0.17	0.46	0.22
12.00	0.68	0.19	0.49	0.19
12.50	0.71	0.20	0.51	0.17
13.00	0.73	0.22	0.53	0.16
13.50	0.75	0.23	0.55	0.14
14.00	0.77	0.24	0.57	0.13
14.50	0.79	0.25	0.59	0.12
15.00	0.80	0.26	0.60	0.11
15.50	0.82	0.27	0.61	0.11
16.00	0.83	0.28	0.63	0.11
16.50	0.85	0.29	0.64	0.10
17.00	0.86	0.30	0.66	0.10
17.50	0.87	0.31	0.67	0.10
18.00	0.89	0.32	0.68	0.09
18.50	0.90	0.33	0.69	0.09
19.00	0.91	0.34	0.70	0.09
19.50	0.92	0.35	0.71	0.08
20.00	**0.93**	**0.35**	**0.73**	0.08

Summary for Subcatchment 1S: Existing onsite

[47] Hint: Peak is 353% of capacity of segment #2

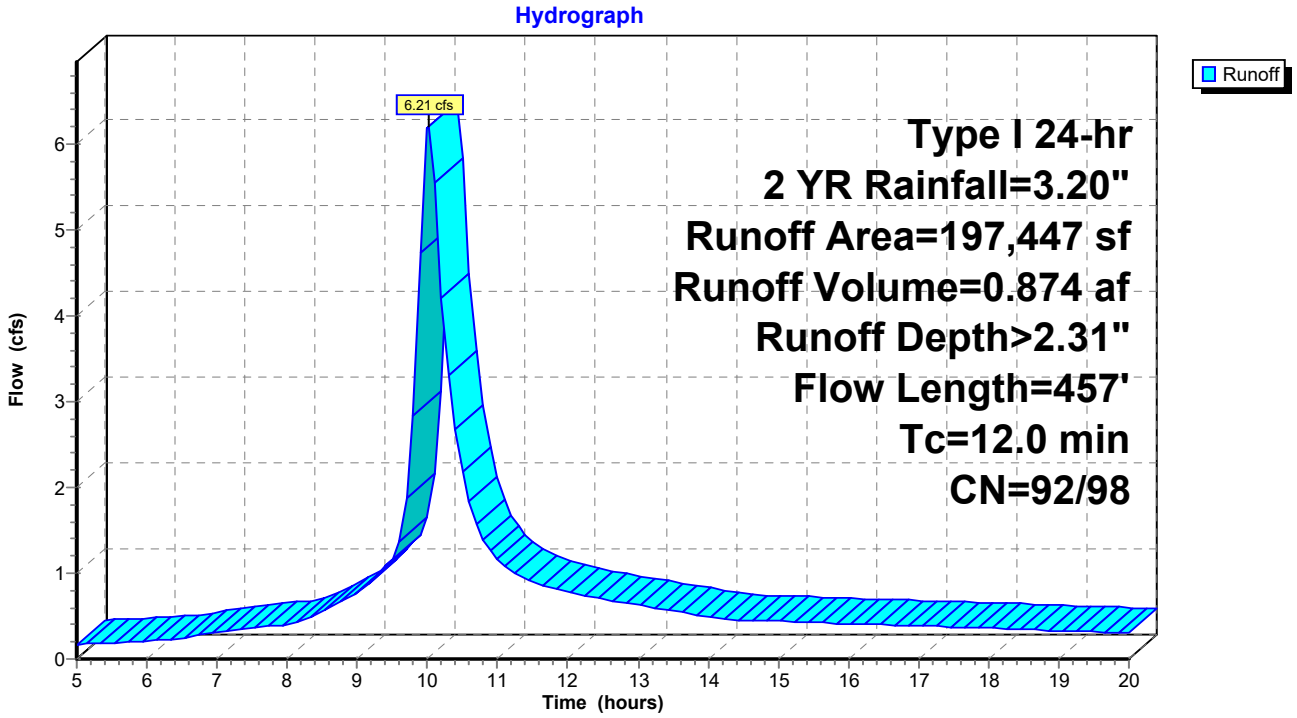
Runoff = 6.21 cfs @ 10.02 hrs, Volume= 0.874 af, Depth> 2.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.32	0.02	0.16	0.17
5.50	0.36	0.03	0.19	0.19
6.00	0.40	0.05	0.23	0.21
6.50	0.45	0.06	0.27	0.25
7.00	0.50	0.09	0.32	0.31
7.50	0.56	0.12	0.37	0.36
8.00	0.62	0.15	0.43	0.40
8.50	0.70	0.20	0.50	0.55
9.00	0.81	0.27	0.61	0.79
9.50	0.97	0.38	0.76	1.17
10.00	1.65	0.93	1.43	**6.17**
10.50	1.87	1.12	1.64	2.19
11.00	1.99	1.23	1.77	1.16
11.50	2.10	1.32	1.87	0.90
12.00	2.19	1.41	1.96	0.79
12.50	2.27	1.48	2.04	0.70
13.00	2.34	1.55	2.11	0.63
13.50	2.41	1.61	2.18	0.56
14.00	2.46	1.66	2.23	0.49
14.50	2.52	1.71	2.29	0.46
15.00	2.57	1.75	2.34	0.44
15.50	2.62	1.80	2.39	0.43
16.00	2.66	1.84	2.43	0.41
16.50	2.71	1.89	2.48	0.40
17.00	2.75	1.93	2.52	0.39
17.50	2.79	1.97	2.56	0.37
18.00	2.84	2.01	2.60	0.36
18.50	2.87	2.04	2.64	0.35
19.00	2.91	2.08	2.68	0.33
19.50	2.95	2.11	2.72	0.32
20.00	**2.98**	**2.14**	**2.75**	0.30

Summary for Subcatchment 1S: Existing onsite

[47] Hint: Peak is 536% of capacity of segment #2

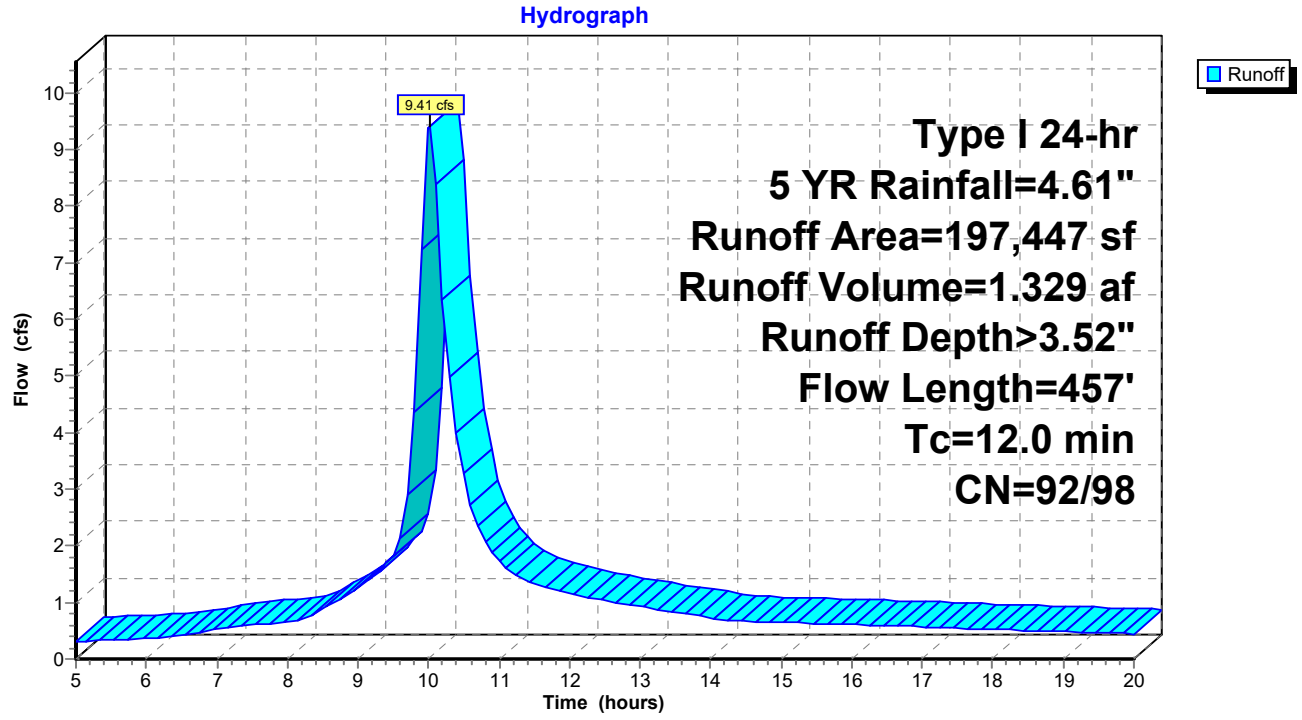
Runoff = 9.41 cfs @ 10.02 hrs, Volume= 1.329 af, Depth> 3.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 YR Rainfall=4.61"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.46	0.07	0.28	0.31
5.50	0.52	0.10	0.33	0.34
6.00	0.58	0.13	0.39	0.36
6.50	0.64	0.16	0.45	0.43
7.00	0.72	0.21	0.52	0.53
7.50	0.80	0.27	0.60	0.60
8.00	0.89	0.33	0.69	0.65
8.50	1.01	0.41	0.80	0.88
9.00	1.17	0.53	0.96	1.25
9.50	1.40	0.71	1.18	1.83
10.00	2.37	1.58	2.15	**9.36**
10.50	2.69	1.87	2.46	3.28
11.00	2.87	2.04	2.64	1.72
11.50	3.02	2.18	2.79	1.34
12.00	3.15	2.31	2.92	1.16
12.50	3.27	2.42	3.04	1.03
13.00	3.37	2.52	3.14	0.93
13.50	3.47	2.61	3.23	0.83
14.00	3.55	2.68	3.32	0.73
14.50	3.62	2.76	3.39	0.67
15.00	3.70	2.83	3.46	0.65
15.50	3.77	2.89	3.53	0.63
16.00	3.84	2.96	3.60	0.61
16.50	3.90	3.02	3.67	0.59
17.00	3.96	3.08	3.73	0.57
17.50	4.03	3.14	3.79	0.55
18.00	4.08	3.20	3.85	0.53
18.50	4.14	3.25	3.91	0.51
19.00	4.20	3.31	3.96	0.49
19.50	4.25	3.36	4.01	0.46
20.00	**4.30**	**3.40**	**4.06**	0.44

Summary for Subcatchment 1S: Existing onsite

[47] Hint: Peak is 657% of capacity of segment #2

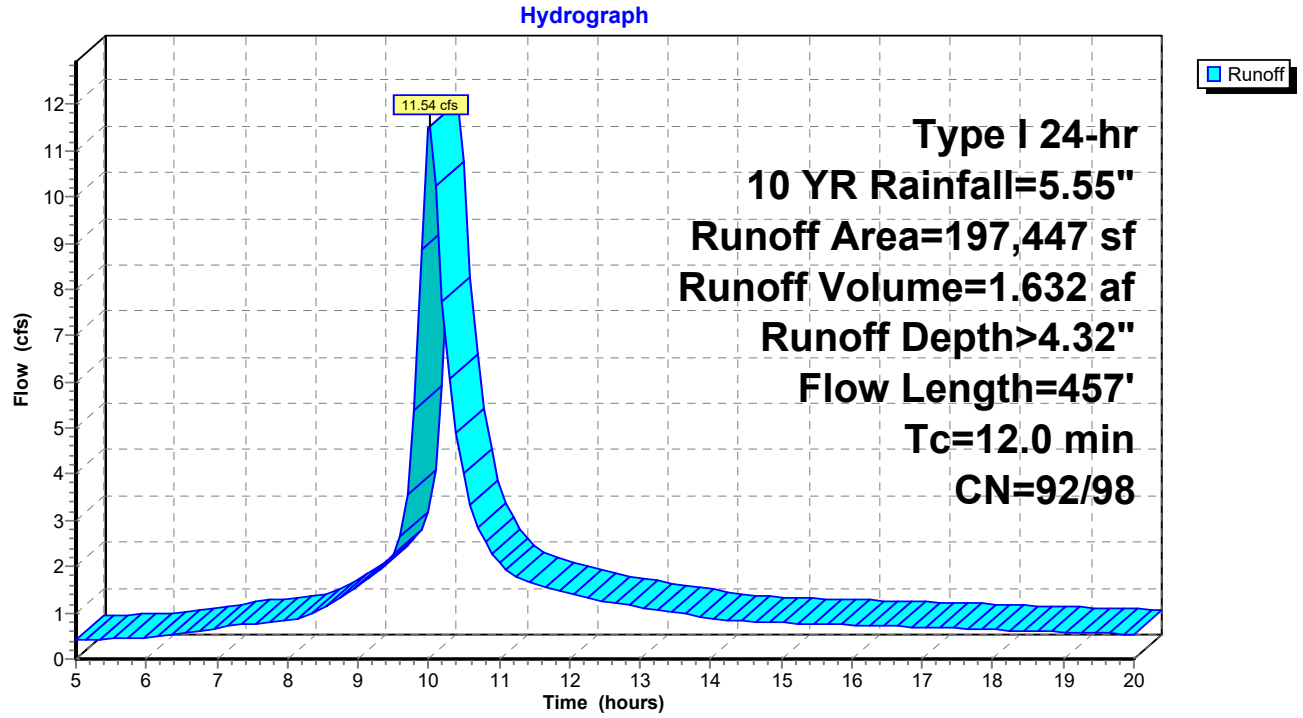
Runoff = 11.54 cfs @ 10.02 hrs, Volume= 1.632 af, Depth> 4.32"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 YR Rainfall=5.55"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.55	0.12	0.37	0.41
5.50	0.62	0.15	0.43	0.44
6.00	0.69	0.19	0.50	0.47
6.50	0.77	0.24	0.57	0.55
7.00	0.87	0.31	0.66	0.67
7.50	0.97	0.38	0.76	0.77
8.00	1.08	0.46	0.87	0.82
8.50	1.22	0.57	1.00	1.11
9.00	1.41	0.73	1.19	1.57
9.50	1.68	0.96	1.46	2.27
10.00	2.86	2.03	2.63	**11.48**
10.50	3.24	2.38	3.00	4.01
11.00	3.46	2.60	3.22	2.09
11.50	3.64	2.77	3.40	1.63
12.00	3.80	2.92	3.56	1.41
12.50	3.94	3.06	3.70	1.26
13.00	4.06	3.18	3.83	1.13
13.50	4.17	3.29	3.94	1.01
14.00	4.27	3.38	4.04	0.88
14.50	4.36	3.47	4.13	0.81
15.00	4.45	3.55	4.22	0.79
15.50	4.54	3.64	4.30	0.76
16.00	4.62	3.72	4.38	0.74
16.50	4.70	3.79	4.46	0.71
17.00	4.77	3.87	4.54	0.69
17.50	4.85	3.94	4.61	0.66
18.00	4.92	4.01	4.68	0.64
18.50	4.99	4.07	4.75	0.61
19.00	5.05	4.14	4.81	0.59
19.50	5.11	4.20	4.88	0.56
20.00	**5.17**	**4.26**	**4.94**	0.54

Summary for Subcatchment 1S: Existing onsite

[47] Hint: Peak is 806% of capacity of segment #2

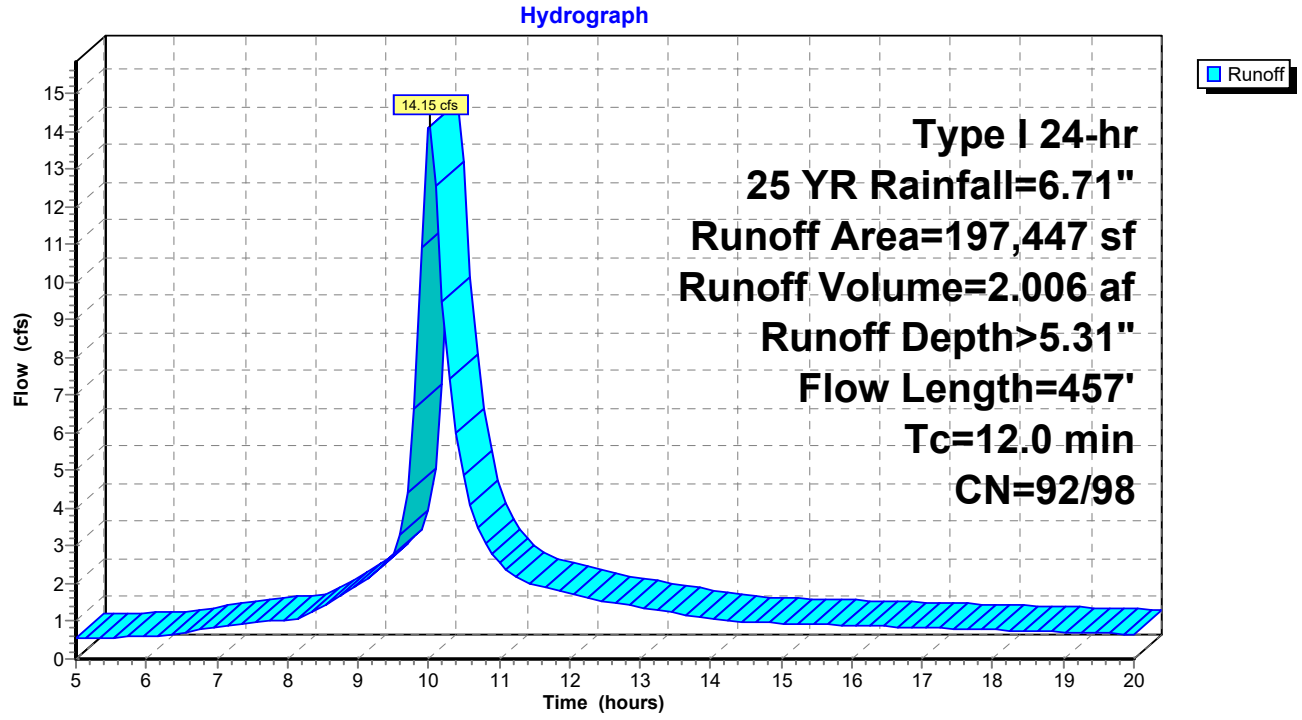
Runoff = 14.15 cfs @ 10.02 hrs, Volume= 2.006 af, Depth> 5.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 YR Rainfall=6.71"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.67	0.18	0.48	0.53
5.50	0.75	0.23	0.55	0.57
6.00	0.84	0.29	0.64	0.61
6.50	0.93	0.35	0.73	0.71
7.00	1.05	0.44	0.84	0.86
7.50	1.17	0.53	0.96	0.97
8.00	1.30	0.64	1.09	1.04
8.50	1.47	0.78	1.25	1.39
9.00	1.70	0.98	1.48	1.95
9.50	2.03	1.27	1.81	2.81
10.00	3.46	2.59	3.22	**14.08**
10.50	3.91	3.03	3.68	4.89
11.00	4.18	3.29	3.95	2.55
11.50	4.40	3.50	4.16	1.98
12.00	4.59	3.69	4.35	1.72
12.50	4.76	3.85	4.52	1.53
13.00	4.91	4.00	4.68	1.37
13.50	5.05	4.14	4.81	1.22
14.00	5.17	4.25	4.93	1.07
14.50	5.28	4.36	5.04	0.99
15.00	5.38	4.46	5.14	0.95
15.50	5.48	4.56	5.25	0.92
16.00	5.58	4.66	5.35	0.89
16.50	5.68	4.75	5.44	0.86
17.00	5.77	4.84	5.53	0.83
17.50	5.86	4.93	5.62	0.80
18.00	5.95	5.02	5.71	0.77
18.50	6.03	5.10	5.79	0.74
19.00	6.11	5.17	5.87	0.71
19.50	6.18	5.25	5.94	0.68
20.00	**6.25**	**5.32**	**6.02**	0.65

Summary for Subcatchment 1S: Existing onsite

[47] Hint: Peak is 914% of capacity of segment #2

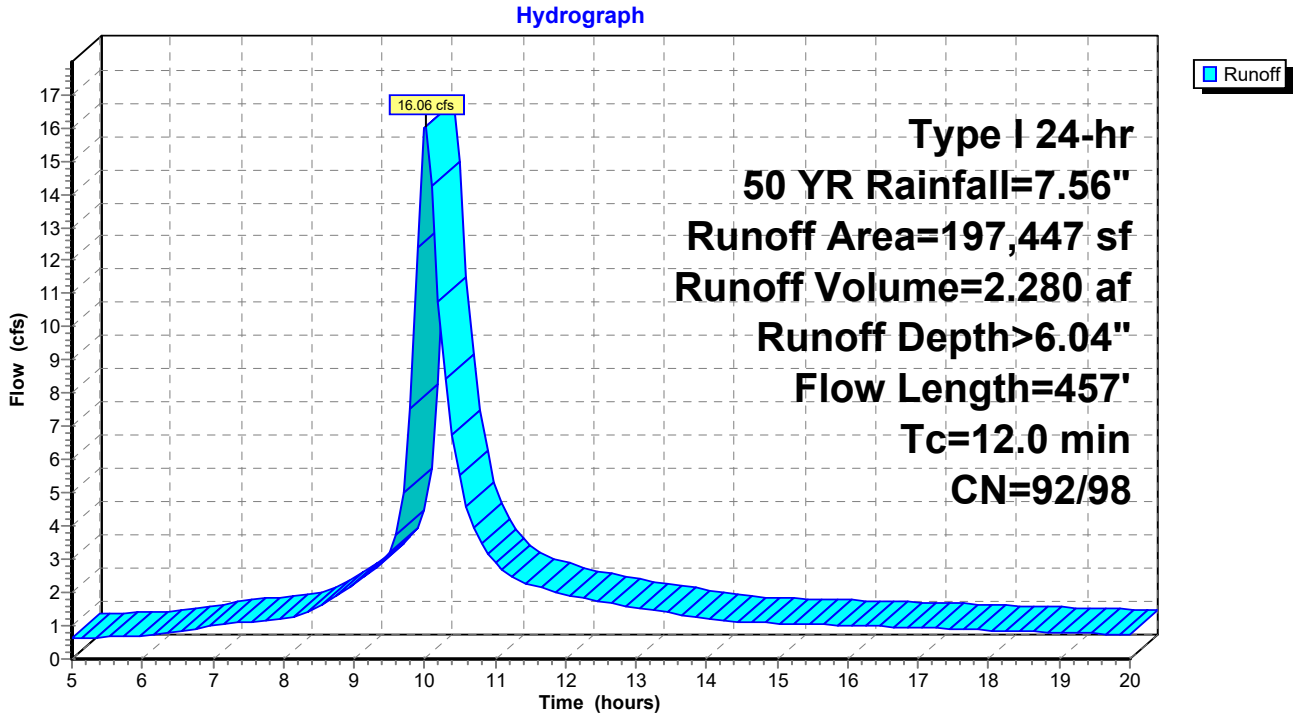
Runoff = 16.06 cfs @ 10.02 hrs, Volume= 2.280 af, Depth> 6.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 50 YR Rainfall=7.56"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.76	0.23	0.56	0.63
5.50	0.85	0.30	0.65	0.67
6.00	0.95	0.36	0.74	0.71
6.50	1.05	0.44	0.84	0.82
7.00	1.18	0.54	0.97	1.00
7.50	1.32	0.65	1.10	1.12
8.00	1.47	0.77	1.25	1.19
8.50	1.66	0.93	1.43	1.59
9.00	1.92	1.17	1.70	2.23
9.50	2.29	1.50	2.06	3.21
10.00	3.89	3.01	3.66	**15.98**
10.50	4.41	3.51	4.17	5.54
11.00	4.71	3.81	4.47	2.89
11.50	4.96	4.05	4.72	2.24
12.00	5.17	4.26	4.93	1.94
12.50	5.36	4.44	5.12	1.73
13.00	5.53	4.61	5.30	1.55
13.50	5.69	4.76	5.45	1.38
14.00	5.82	4.89	5.58	1.21
14.50	5.94	5.01	5.71	1.12
15.00	6.06	5.13	5.82	1.08
15.50	6.18	5.24	5.94	1.04
16.00	6.29	5.35	6.05	1.01
16.50	6.40	5.46	6.16	0.98
17.00	6.50	5.56	6.26	0.94
17.50	6.60	5.66	6.36	0.91
18.00	6.70	5.76	6.46	0.87
18.50	6.79	5.85	6.55	0.84
19.00	6.88	5.94	6.64	0.81
19.50	6.96	6.02	6.73	0.77
20.00	**7.05**	**6.10**	**6.81**	0.74

Summary for Subcatchment 1S: Existing onsite

[47] Hint: Peak is 1019% of capacity of segment #2

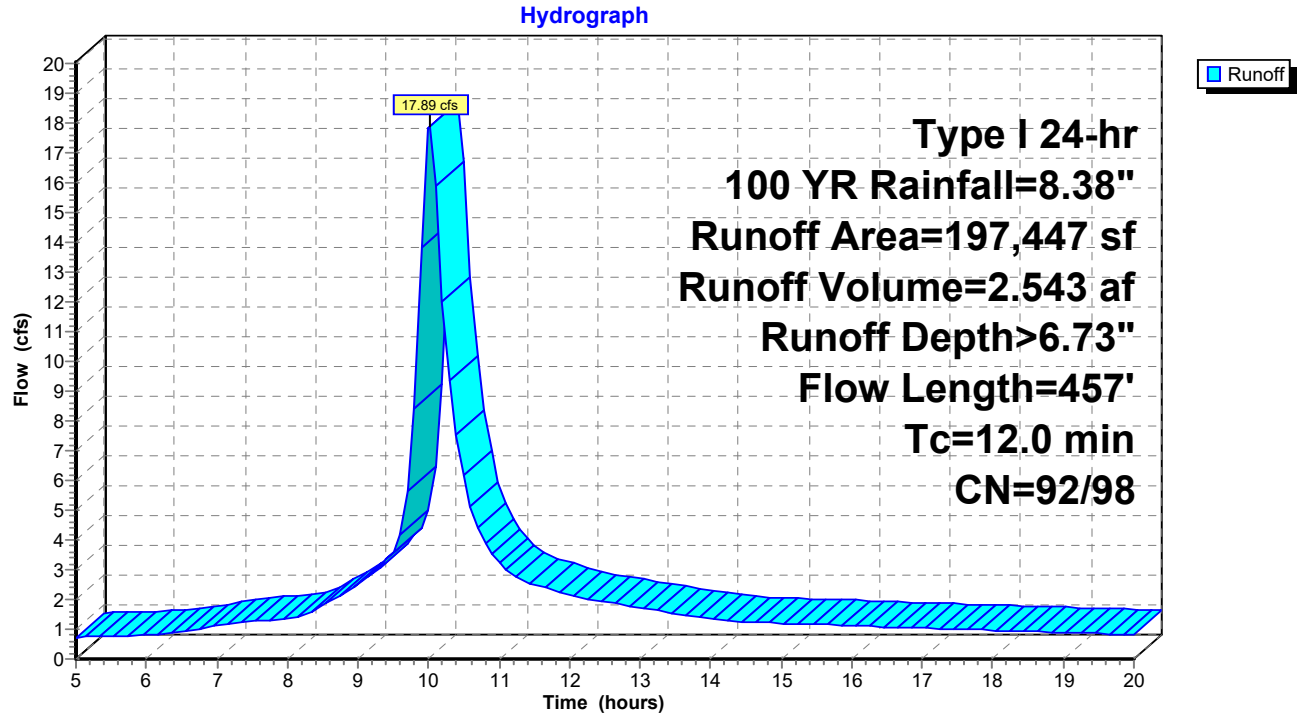
Runoff = 17.89 cfs @ 10.02 hrs, Volume= 2.543 af, Depth> 6.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 100 YR Rainfall=8.38"

Area (sf)	CN	Description
81,732	98	Unconnected pavement, HSG D
88,157	96	Gravel surface, HSG D
27,558	80	>75% Grass cover, Good, HSG D
197,447	95	Weighted Average
115,715	92	58.61% Pervious Area
81,732	98	41.39% Impervious Area

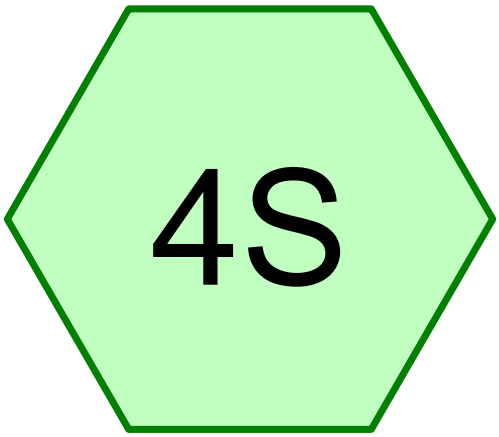
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	300	0.0030	0.59		**Sheet Flow, Sheet flow existing site** n= 0.016 P2= 3.20"
2.1	157	0.0200	1.25	1.76	**Trap/Vee/Rect Channel Flow, Wetland channel** Bot.W=0.00' D=2.00' Z= 0.4 & 0.3 '/' Top.W=1.40' n= 0.080 Earth, long dense weeds
1.5					**Direct Entry,**
12.0	457	Total			

Subcatchment 1S: Existing onsite



Hydrograph for Subcatchment 1S: Existing onsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.84	0.29	0.63	0.72
5.50	0.94	0.36	0.73	0.77
6.00	1.05	0.44	0.84	0.81
6.50	1.17	0.53	0.95	0.93
7.00	1.31	0.64	1.09	1.13
7.50	1.46	0.77	1.24	1.26
8.00	1.63	0.91	1.40	1.35
8.50	1.84	1.09	1.61	1.79
9.00	2.13	1.35	1.90	2.51
9.50	2.54	1.73	2.31	3.59
10.00	4.32	3.42	4.08	**17.81**
10.50	4.89	3.98	4.65	6.17
11.00	5.22	4.31	4.98	3.21
11.50	5.49	4.57	5.26	2.49
12.00	5.73	4.81	5.49	2.16
12.50	5.94	5.01	5.71	1.92
13.00	6.13	5.20	5.90	1.73
13.50	6.30	5.37	6.07	1.54
14.00	6.45	5.51	6.21	1.35
14.50	6.59	5.65	6.35	1.24
15.00	6.72	5.78	6.48	1.20
15.50	6.85	5.91	6.61	1.16
16.00	6.97	6.03	6.73	1.12
16.50	7.09	6.15	6.85	1.08
17.00	7.21	6.26	6.97	1.05
17.50	7.32	6.37	7.08	1.01
18.00	7.42	6.47	7.19	0.97
18.50	7.53	6.58	7.29	0.93
19.00	7.63	6.67	7.39	0.89
19.50	7.72	6.77	7.48	0.86
20.00	**7.81**	**6.86**	**7.57**	0.82



Existing offsite

Subcat Reach Pond Link

Routing Diagram for 21093_Hydro Calcs
Prepared by {enter your company name here}, Printed 5/20/2022

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 inch WQ	Type I 24-hr		Default	24.00	1	1.00	2
2	2 YR	Type I 24-hr		Default	24.00	1	3.20	2
3	5 YR	Type I 24-hr		Default	24.00	1	4.61	2
4	10 YR	Type I 24-hr		Default	24.00	1	5.55	2
5	25 YR	Type I 24-hr		Default	24.00	1	6.71	2
6	50 YR	Type I 24-hr		Default	24.00	1	7.56	2
7	100 YR	Type I 24-hr		Default	24.00	1	8.38	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.303	84	50-75% Grass cover, Fair, HSG D (4S)
1.395	98	Paved parking, HSG D (4S)
1.699	**95**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.699	HSG D	4S
0.000	Other	
1.699		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.303	0.000	0.303	50-75% Grass cover, Fair	4S
0.000	0.000	0.000	1.395	0.000	1.395	Paved parking	4S
0.000	**0.000**	**0.000**	**1.699**	**0.000**	**1.699**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>0.61"
Tc=12.0 min CN=84/98 Runoff=0.60 cfs 0.086 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.086 af Average Runoff Depth = 0.61"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

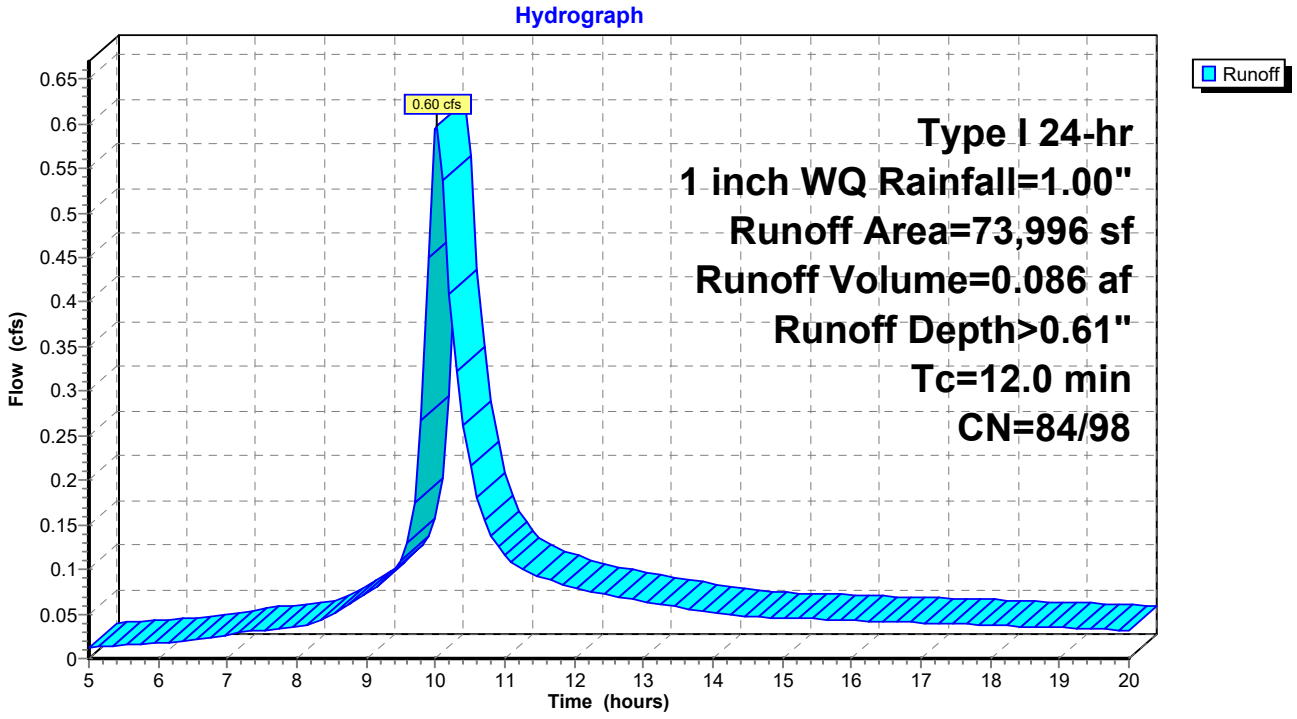
Runoff = 0.60 cfs @ 10.02 hrs, Volume= 0.086 af, Depth> 0.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 1 inch WQ Rainfall=1.00"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite



Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.10	0.00	0.01	0.01
5.50	0.11	0.00	0.02	0.01
6.00	0.12	0.00	0.02	0.02
6.50	0.14	0.00	0.03	0.02
7.00	0.16	0.00	0.04	0.03
7.50	0.17	0.00	0.05	0.03
8.00	0.19	0.00	0.07	0.04
8.50	0.22	0.00	0.08	0.05
9.00	0.25	0.00	0.11	0.07
9.50	0.30	0.00	0.15	0.11
10.00	0.52	0.01	0.33	**0.59**
10.50	0.58	0.02	0.39	0.22
11.00	0.62	0.03	0.43	0.12
11.50	0.66	0.03	0.46	0.09
12.00	0.68	0.04	0.49	0.08
12.50	0.71	0.05	0.51	0.07
13.00	0.73	0.05	0.53	0.06
13.50	0.75	0.06	0.55	0.06
14.00	0.77	0.07	0.57	0.05
14.50	0.79	0.07	0.59	0.05
15.00	0.80	0.08	0.60	0.05
15.50	0.82	0.08	0.61	0.04
16.00	0.83	0.09	0.63	0.04
16.50	0.85	0.09	0.64	0.04
17.00	0.86	0.10	0.66	0.04
17.50	0.87	0.10	0.67	0.04
18.00	0.89	0.11	0.68	0.04
18.50	0.90	0.11	0.69	0.04
19.00	0.91	0.12	0.70	0.03
19.50	0.92	0.12	0.71	0.03
20.00	**0.93**	**0.12**	**0.73**	0.03

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>2.40"
Tc=12.0 min CN=84/98 Runoff=2.38 cfs 0.339 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.339 af Average Runoff Depth = 2.40"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

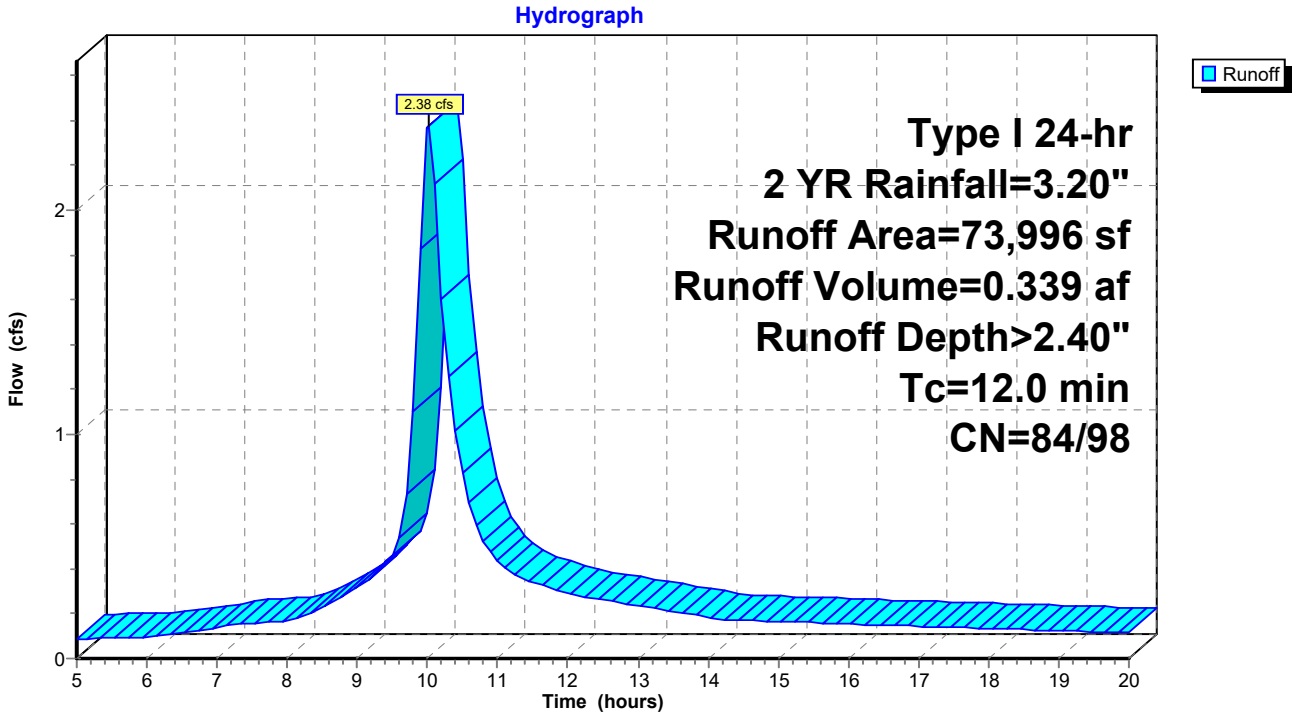
Runoff = 2.38 cfs @ 10.02 hrs, Volume= 0.339 af, Depth> 2.40"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite



Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.32	0.00	0.16	0.09
5.50	0.36	0.00	0.19	0.09
6.00	0.40	0.00	0.23	0.10
6.50	0.45	0.00	0.27	0.11
7.00	0.50	0.01	0.32	0.14
7.50	0.56	0.02	0.37	0.16
8.00	0.62	0.03	0.43	0.17
8.50	0.70	0.05	0.50	0.23
9.00	0.81	0.08	0.61	0.32
9.50	0.97	0.14	0.76	0.46
10.00	1.65	0.51	1.43	**2.37**
10.50	1.87	0.65	1.64	0.83
11.00	1.99	0.74	1.77	0.44
11.50	2.10	0.81	1.87	0.34
12.00	2.19	0.88	1.96	0.30
12.50	2.27	0.94	2.04	0.26
13.00	2.34	1.00	2.11	0.24
13.50	2.41	1.04	2.18	0.21
14.00	2.46	1.09	2.23	0.19
14.50	2.52	1.13	2.29	0.17
15.00	2.57	1.17	2.34	0.17
15.50	2.62	1.21	2.39	0.16
16.00	2.66	1.24	2.43	0.15
16.50	2.71	1.28	2.48	0.15
17.00	2.75	1.31	2.52	0.14
17.50	2.79	1.35	2.56	0.14
18.00	2.84	1.38	2.60	0.13
18.50	2.87	1.41	2.64	0.13
19.00	2.91	1.44	2.68	0.12
19.50	2.95	1.47	2.72	0.12
20.00	**2.98**	**1.50**	**2.75**	0.11

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>3.58"
Tc=12.0 min CN=84/98 Runoff=3.55 cfs 0.507 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.507 af Average Runoff Depth = 3.58"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

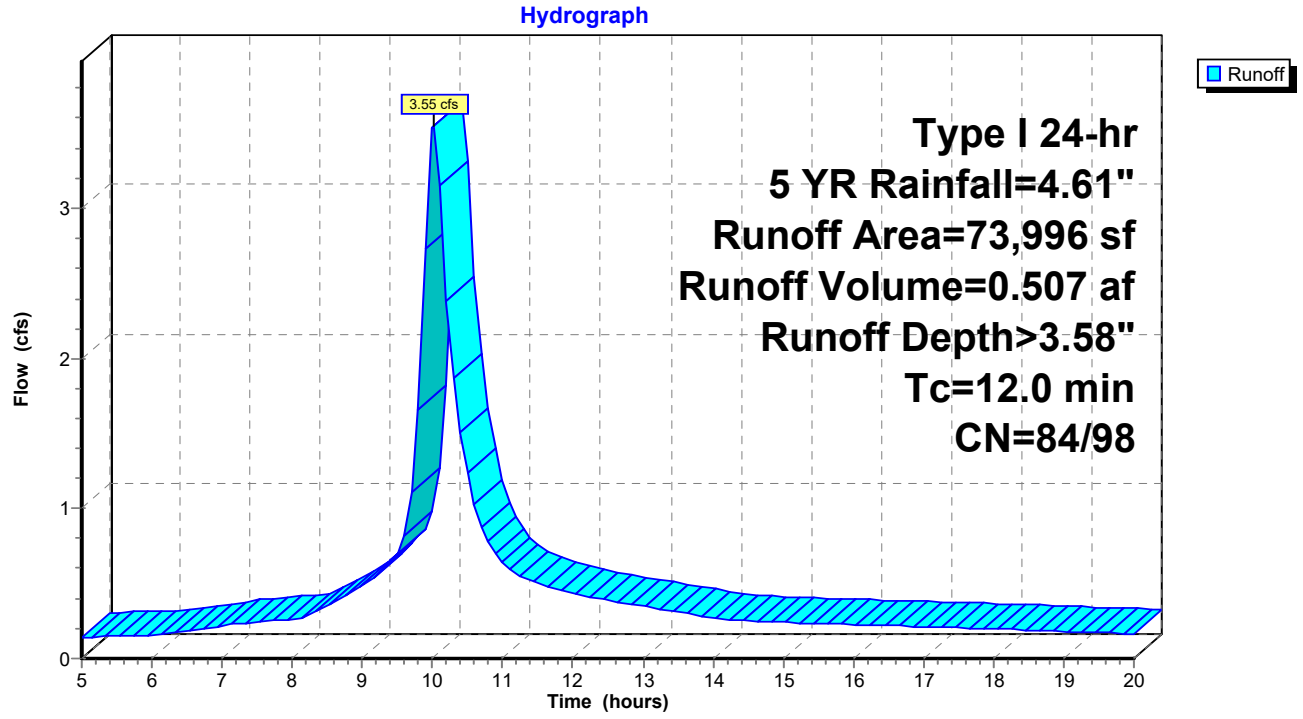
Runoff = 3.55 cfs @ 10.02 hrs, Volume= 0.507 af, Depth> 3.58"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 YR Rainfall=4.61"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite



Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.46	0.00	0.28	0.14
5.50	0.52	0.01	0.33	0.15
6.00	0.58	0.02	0.39	0.16
6.50	0.64	0.03	0.45	0.18
7.00	0.72	0.05	0.52	0.22
7.50	0.80	0.08	0.60	0.24
8.00	0.89	0.11	0.69	0.26
8.50	1.01	0.16	0.80	0.35
9.00	1.17	0.23	0.96	0.49
9.50	1.40	0.35	1.18	0.70
10.00	2.37	1.02	2.15	**3.53**
10.50	2.69	1.26	2.46	1.23
11.00	2.87	1.41	2.64	0.64
11.50	3.02	1.53	2.79	0.50
12.00	3.15	1.64	2.92	0.44
12.50	3.27	1.74	3.04	0.39
13.00	3.37	1.83	3.14	0.35
13.50	3.47	1.91	3.23	0.31
14.00	3.55	1.98	3.32	0.27
14.50	3.62	2.04	3.39	0.25
15.00	3.70	2.11	3.46	0.24
15.50	3.77	2.17	3.53	0.23
16.00	3.84	2.23	3.60	0.23
16.50	3.90	2.28	3.67	0.22
17.00	3.96	2.34	3.73	0.21
17.50	4.03	2.39	3.79	0.20
18.00	4.08	2.45	3.85	0.20
18.50	4.14	2.50	3.91	0.19
19.00	4.20	2.54	3.96	0.18
19.50	4.25	2.59	4.01	0.17
20.00	**4.30**	**2.63**	**4.06**	0.17

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>4.37"
Tc=12.0 min CN=84/98 Runoff=4.34 cfs 0.619 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.619 af Average Runoff Depth = 4.37"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

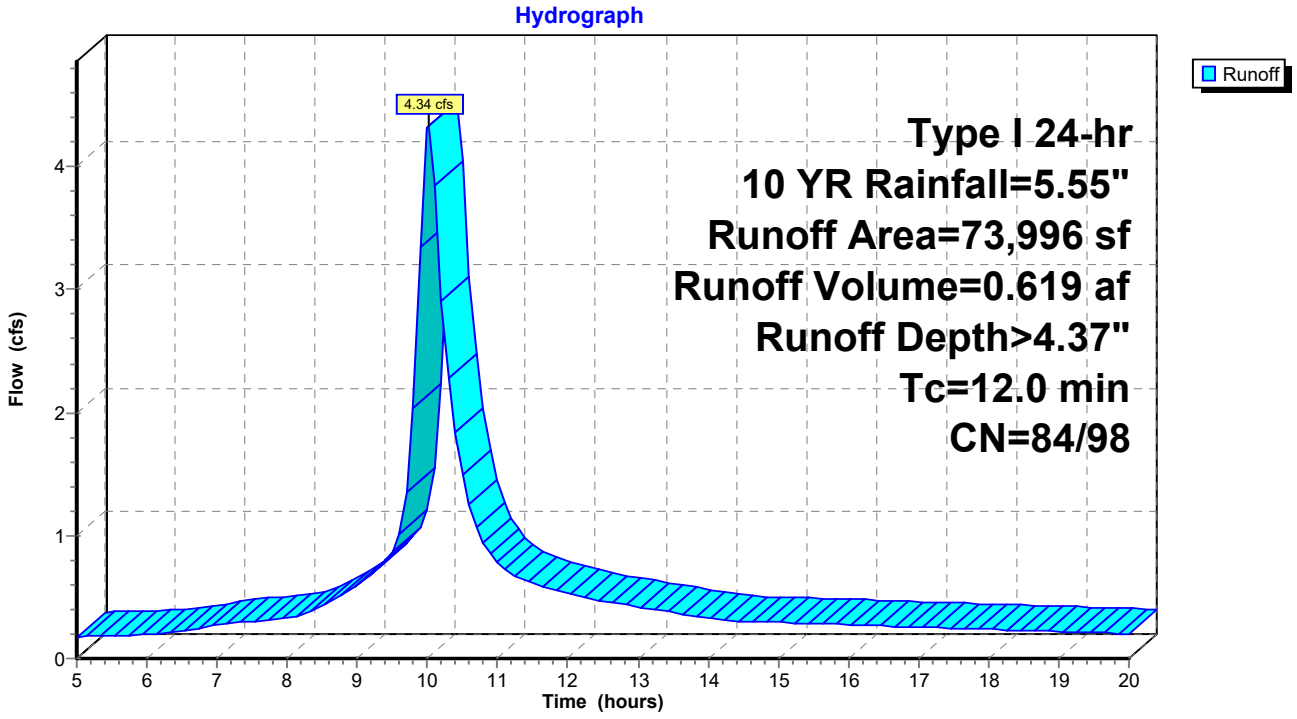
Runoff = 4.34 cfs @ 10.02 hrs, Volume= 0.619 af, Depth> 4.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 YR Rainfall=5.55"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite



Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.55	0.01	0.37	0.18
5.50	0.62	0.03	0.43	0.19
6.00	0.69	0.04	0.50	0.20
6.50	0.77	0.07	0.57	0.22
7.00	0.87	0.10	0.66	0.27
7.50	0.97	0.14	0.76	0.30
8.00	1.08	0.19	0.87	0.32
8.50	1.22	0.25	1.00	0.43
9.00	1.41	0.36	1.19	0.60
9.50	1.68	0.53	1.46	0.86
10.00	2.86	1.40	2.63	**4.31**
10.50	3.24	1.71	3.00	1.50
11.00	3.46	1.90	3.22	0.78
11.50	3.64	2.06	3.40	0.61
12.00	3.80	2.19	3.56	0.53
12.50	3.94	2.32	3.70	0.47
13.00	4.06	2.43	3.83	0.42
13.50	4.17	2.53	3.94	0.38
14.00	4.27	2.61	4.04	0.33
14.50	4.36	2.69	4.13	0.30
15.00	4.45	2.77	4.22	0.29
15.50	4.54	2.85	4.30	0.28
16.00	4.62	2.92	4.38	0.28
16.50	4.70	2.99	4.46	0.27
17.00	4.77	3.06	4.54	0.26
17.50	4.85	3.13	4.61	0.25
18.00	4.92	3.19	4.68	0.24
18.50	4.99	3.26	4.75	0.23
19.00	5.05	3.32	4.81	0.22
19.50	5.11	3.37	4.88	0.21
20.00	**5.17**	**3.43**	**4.94**	0.20

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>5.35"
Tc=12.0 min CN=84/98 Runoff=5.30 cfs 0.757 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.757 af Average Runoff Depth = 5.35"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

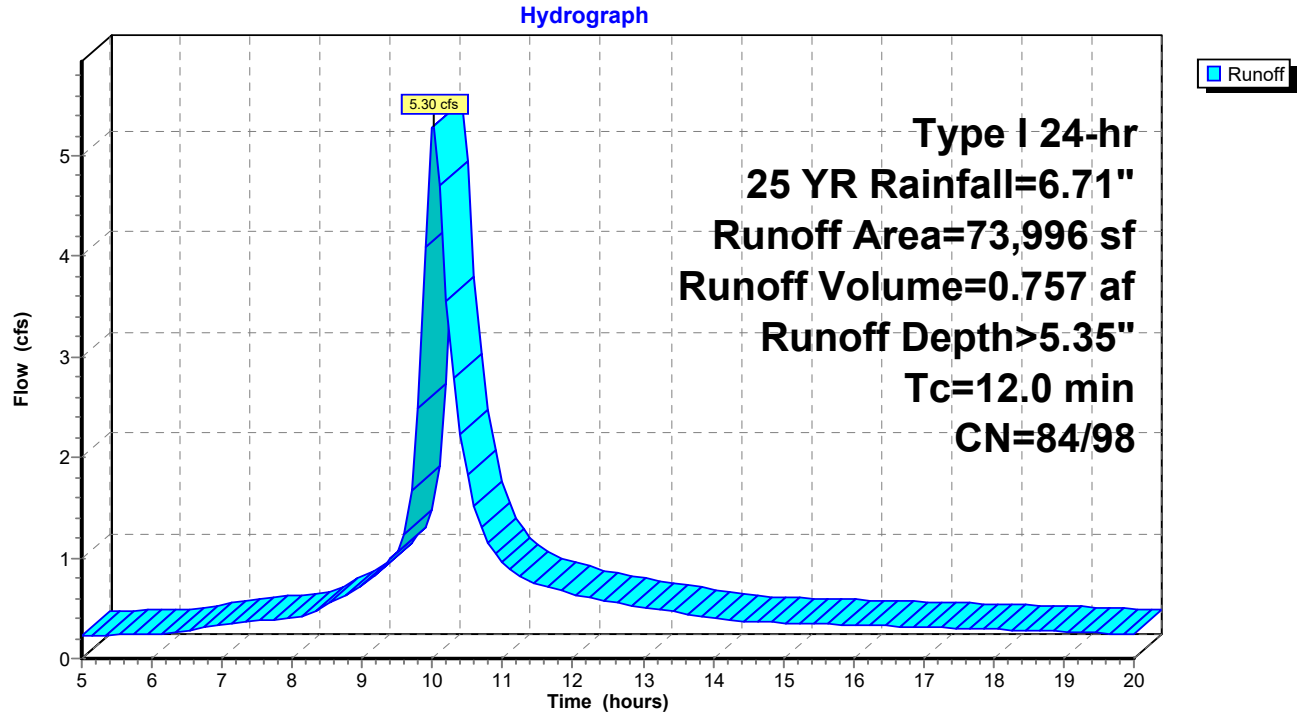
Runoff = 5.30 cfs @ 10.02 hrs, Volume= 0.757 af, Depth> 5.35"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 YR Rainfall=6.71"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite



Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.67	0.04	0.48	0.22
5.50	0.75	0.06	0.55	0.24
6.00	0.84	0.09	0.64	0.25
6.50	0.93	0.12	0.73	0.28
7.00	1.05	0.17	0.84	0.34
7.50	1.17	0.23	0.96	0.38
8.00	1.30	0.30	1.09	0.40
8.50	1.47	0.40	1.25	0.53
9.00	1.70	0.54	1.48	0.74
9.50	2.03	0.77	1.81	1.06
10.00	3.46	1.90	3.22	**5.28**
10.50	3.91	2.29	3.68	1.83
11.00	4.18	2.53	3.95	0.95
11.50	4.40	2.73	4.16	0.74
12.00	4.59	2.90	4.35	0.64
12.50	4.76	3.05	4.52	0.57
13.00	4.91	3.19	4.68	0.51
13.50	5.05	3.31	4.81	0.46
14.00	5.17	3.42	4.93	0.40
14.50	5.28	3.52	5.04	0.37
15.00	5.38	3.62	5.14	0.36
15.50	5.48	3.72	5.25	0.35
16.00	5.58	3.81	5.35	0.33
16.50	5.68	3.90	5.44	0.32
17.00	5.77	3.98	5.53	0.31
17.50	5.86	4.07	5.62	0.30
18.00	5.95	4.15	5.71	0.29
18.50	6.03	4.22	5.79	0.28
19.00	6.11	4.30	5.87	0.27
19.50	6.18	4.37	5.94	0.26
20.00	**6.25**	**4.43**	**6.02**	0.24

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>6.06"
Tc=12.0 min CN=84/98 Runoff=6.01 cfs 0.858 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.858 af Average Runoff Depth = 6.06"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

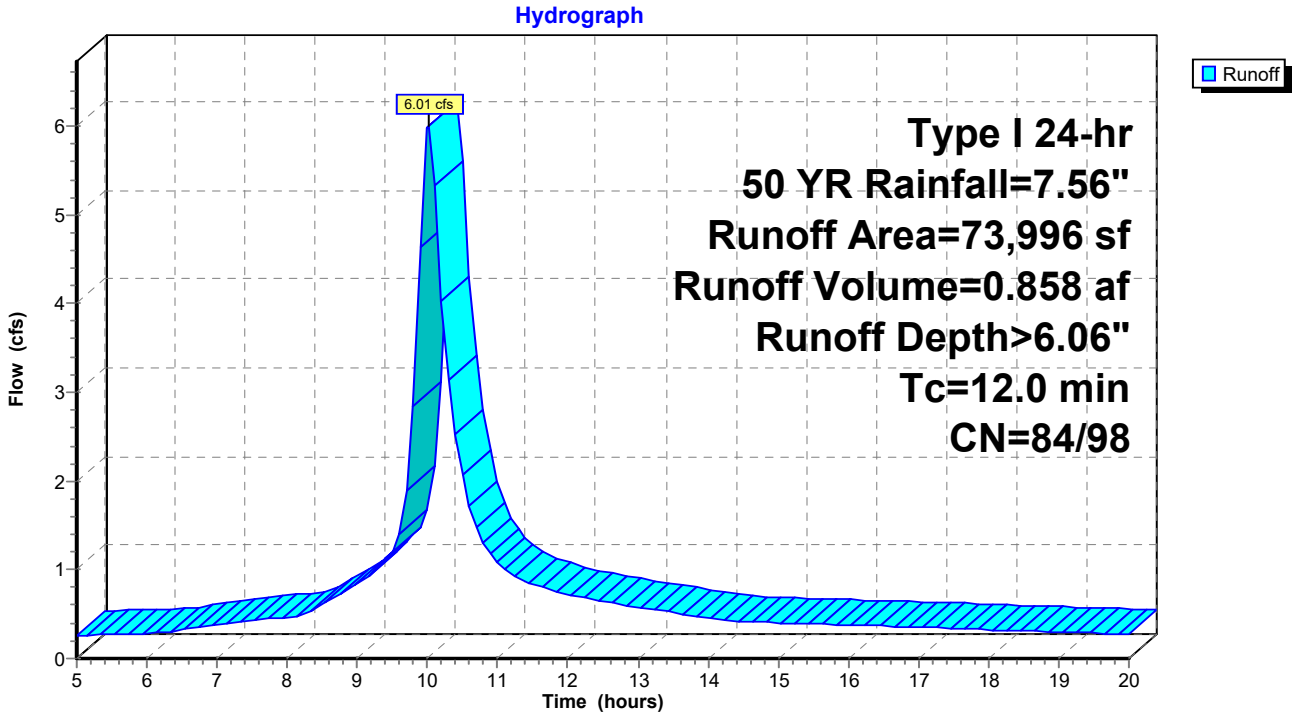
Runoff = 6.01 cfs @ 10.02 hrs, Volume= 0.858 af, Depth> 6.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 50 YR Rainfall=7.56"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite



Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.76	0.06	0.56	0.26
5.50	0.85	0.09	0.65	0.27
6.00	0.95	0.13	0.74	0.28
6.50	1.05	0.17	0.84	0.32
7.00	1.18	0.24	0.97	0.39
7.50	1.32	0.31	1.10	0.43
8.00	1.47	0.39	1.25	0.46
8.50	1.66	0.51	1.43	0.61
9.00	1.92	0.69	1.70	0.84
9.50	2.29	0.96	2.06	1.21
10.00	3.89	2.28	3.66	**5.98**
10.50	4.41	2.73	4.17	2.07
11.00	4.71	3.01	4.47	1.08
11.50	4.96	3.23	4.72	0.84
12.00	5.17	3.43	4.93	0.73
12.50	5.36	3.60	5.12	0.65
13.00	5.53	3.76	5.30	0.58
13.50	5.69	3.90	5.45	0.52
14.00	5.82	4.03	5.58	0.45
14.50	5.94	4.14	5.71	0.42
15.00	6.06	4.26	5.82	0.40
15.50	6.18	4.36	5.94	0.39
16.00	6.29	4.47	6.05	0.38
16.50	6.40	4.57	6.16	0.36
17.00	6.50	4.67	6.26	0.35
17.50	6.60	4.76	6.36	0.34
18.00	6.70	4.85	6.46	0.33
18.50	6.79	4.94	6.55	0.31
19.00	6.88	5.03	6.64	0.30
19.50	6.96	5.11	6.73	0.29
20.00	**7.05**	**5.18**	**6.81**	0.28

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment4S: Existing offsite Runoff Area=73,996 sf 82.14% Impervious Runoff Depth>6.75"
Tc=12.0 min CN=84/98 Runoff=6.70 cfs 0.956 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.956 af Average Runoff Depth = 6.75"
17.86% Pervious = 0.303 ac 82.14% Impervious = 1.395 ac

Summary for Subcatchment 4S: Existing offsite

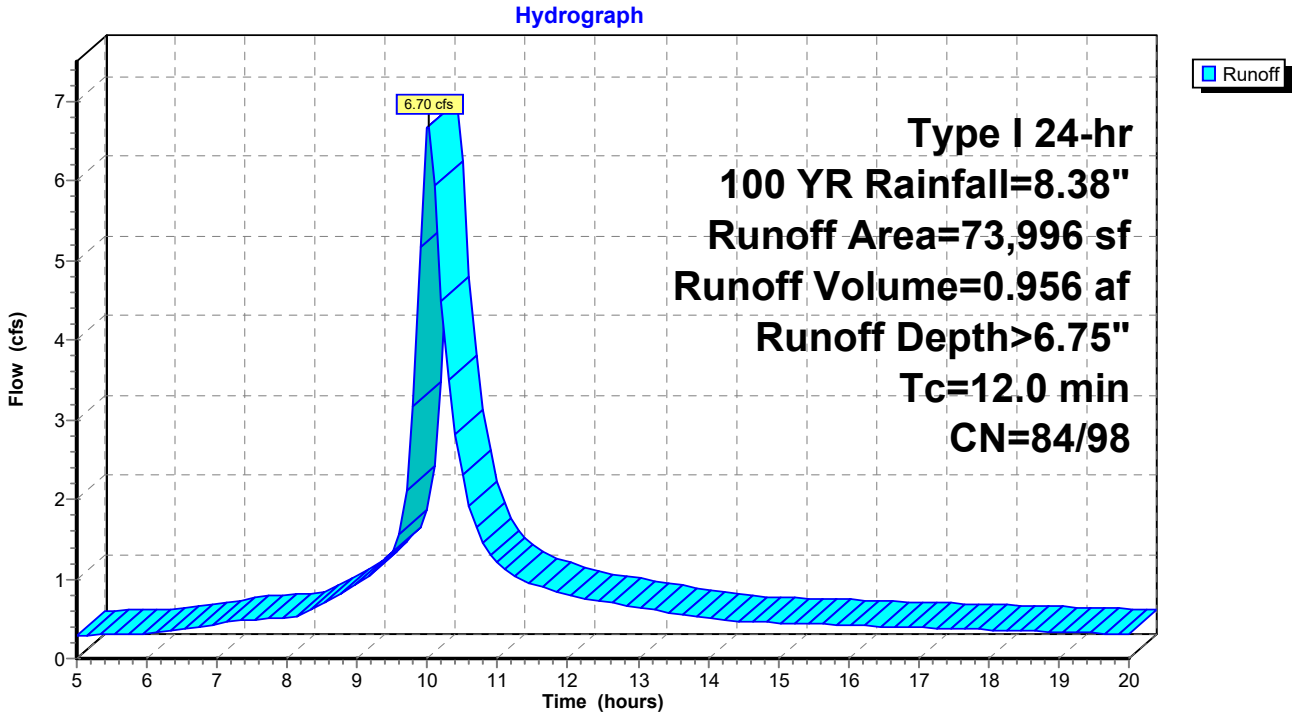
Runoff = 6.70 cfs @ 10.02 hrs, Volume= 0.956 af, Depth> 6.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 100 YR Rainfall=8.38"

Area (sf)	CN	Description
13,218	84	50-75% Grass cover, Fair, HSG D
60,778	98	Paved parking, HSG D
73,996	95	Weighted Average
13,218	84	17.86% Pervious Area
60,778	98	82.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 4S: Existing offsite

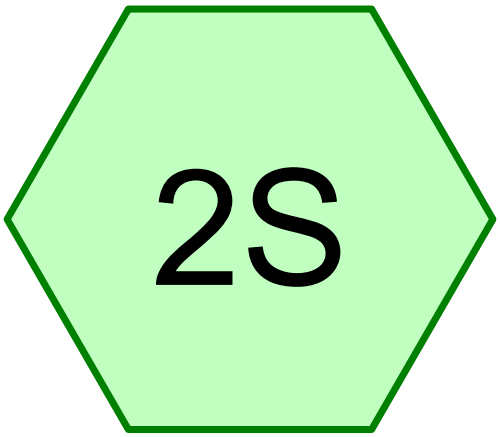


Hydrograph for Subcatchment 4S: Existing offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.84	0.09	0.63	0.29
5.50	0.94	0.13	0.73	0.30
6.00	1.05	0.17	0.84	0.32
6.50	1.17	0.23	0.95	0.36
7.00	1.31	0.30	1.09	0.43
7.50	1.46	0.39	1.24	0.48
8.00	1.63	0.49	1.40	0.51
8.50	1.84	0.63	1.61	0.68
9.00	2.13	0.84	1.90	0.94
9.50	2.54	1.15	2.31	1.35
10.00	4.32	2.65	4.08	**6.66**
10.50	4.89	3.17	4.65	2.31
11.00	5.22	3.47	4.98	1.20
11.50	5.49	3.72	5.26	0.93
12.00	5.73	3.95	5.49	0.81
12.50	5.94	4.14	5.71	0.72
13.00	6.13	4.32	5.90	0.65
13.50	6.30	4.48	6.07	0.57
14.00	6.45	4.62	6.21	0.50
14.50	6.59	4.75	6.35	0.46
15.00	6.72	4.88	6.48	0.45
15.50	6.85	5.00	6.61	0.43
16.00	6.97	5.11	6.73	0.42
16.50	7.09	5.23	6.85	0.41
17.00	7.21	5.34	6.97	0.39
17.50	7.32	5.44	7.08	0.38
18.00	7.42	5.54	7.19	0.36
18.50	7.53	5.64	7.29	0.35
19.00	7.63	5.74	7.39	0.33
19.50	7.72	5.83	7.48	0.32
20.00	**7.81**	**5.91**	**7.57**	0.31

APPENDIX B

HYDROCAD OUTPUT – POST-DEVELOPMENT PROJECT PARCEL AND PUBLIC RIGHT-OF-WAY HYDROLOGY CALCULATIONS



Proposed onsite

Subcat Reach Pond Link

Routing Diagram for 21093_Hydro Calcs
Prepared by {enter your company name here}, Printed 2/25/2022

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 inch WQ	Type I 24-hr		Default	24.00	1	1.00	2
2	2 YR	Type I 24-hr		Default	24.00	1	3.20	2
3	5 YR	Type I 24-hr		Default	24.00	1	4.61	2
4	10 YR	Type I 24-hr		Default	24.00	1	5.55	2
5	25 YR	Type I 24-hr		Default	24.00	1	6.71	2
6	50 YR	Type I 24-hr		Default	24.00	1	7.56	2
7	100 YR	Type I 24-hr		Default	24.00	1	8.38	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.156	89	<50% Grass cover, Poor, HSG D (2S)
1.359	80	>75% Grass cover, Good, HSG D (2S)
1.888	98	Roofs, HSG D (2S)
1.130	98	Unconnected pavement, HSG D (2S)
4.533	**92**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
4.533	HSG D	2S
0.000	Other	
4.533		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.156	0.000	0.156	<50% Grass cover, Poor	2S
0.000	0.000	0.000	1.359	0.000	1.359	>75% Grass cover, Good	2S
0.000	0.000	0.000	1.888	0.000	1.888	Roofs	2S
0.000	0.000	0.000	1.130	0.000	1.130	Unconnected pavement	2S
0.000	**0.000**	**0.000**	**4.533**	**0.000**	**4.533**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>0.50"
Tc=12.0 min CN=81/98 Runoff=1.28 cfs 0.188 af

Total Runoff Area = 4.533 ac Runoff Volume = 0.188 af Average Runoff Depth = 0.50"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

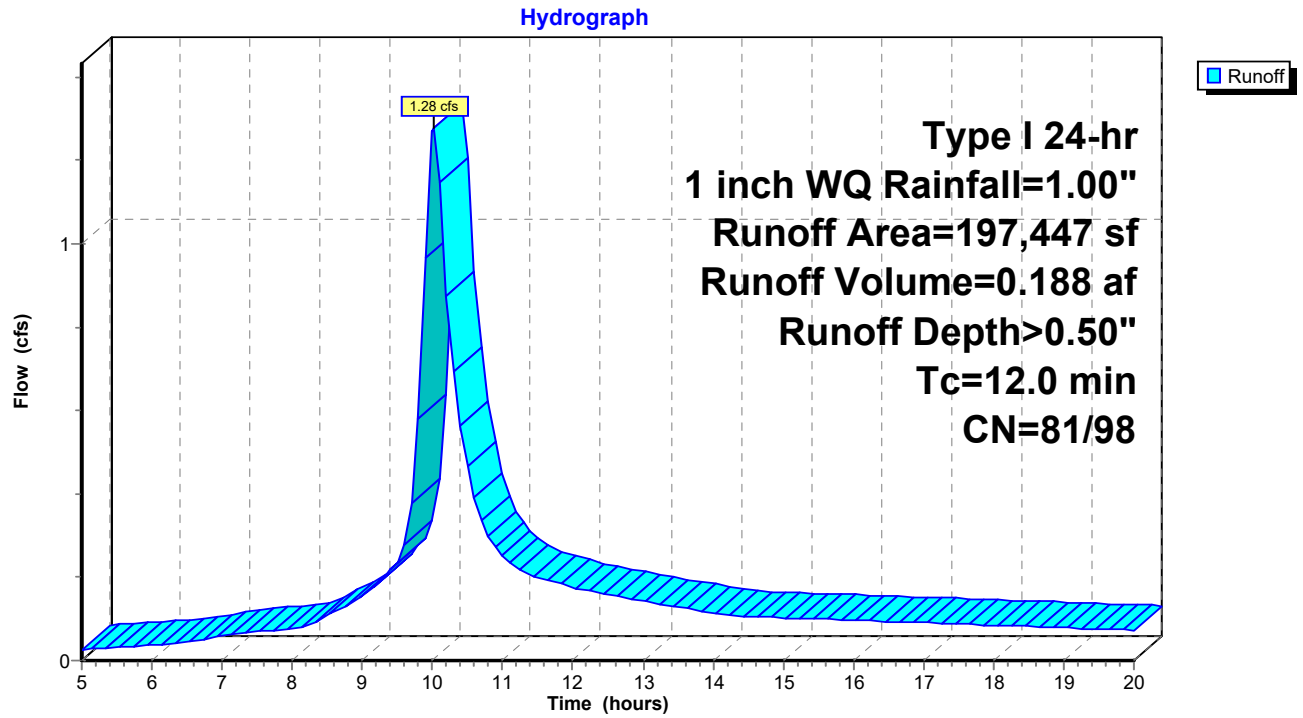
Runoff = 1.28 cfs @ 10.02 hrs, Volume= 0.188 af, Depth> 0.50"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 1 inch WQ Rainfall=1.00"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite



Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>2.16"
Tc=12.0 min CN=81/98 Runoff=5.68 cfs 0.815 af

Total Runoff Area = 4.533 ac Runoff Volume = 0.815 af Average Runoff Depth = 2.16"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

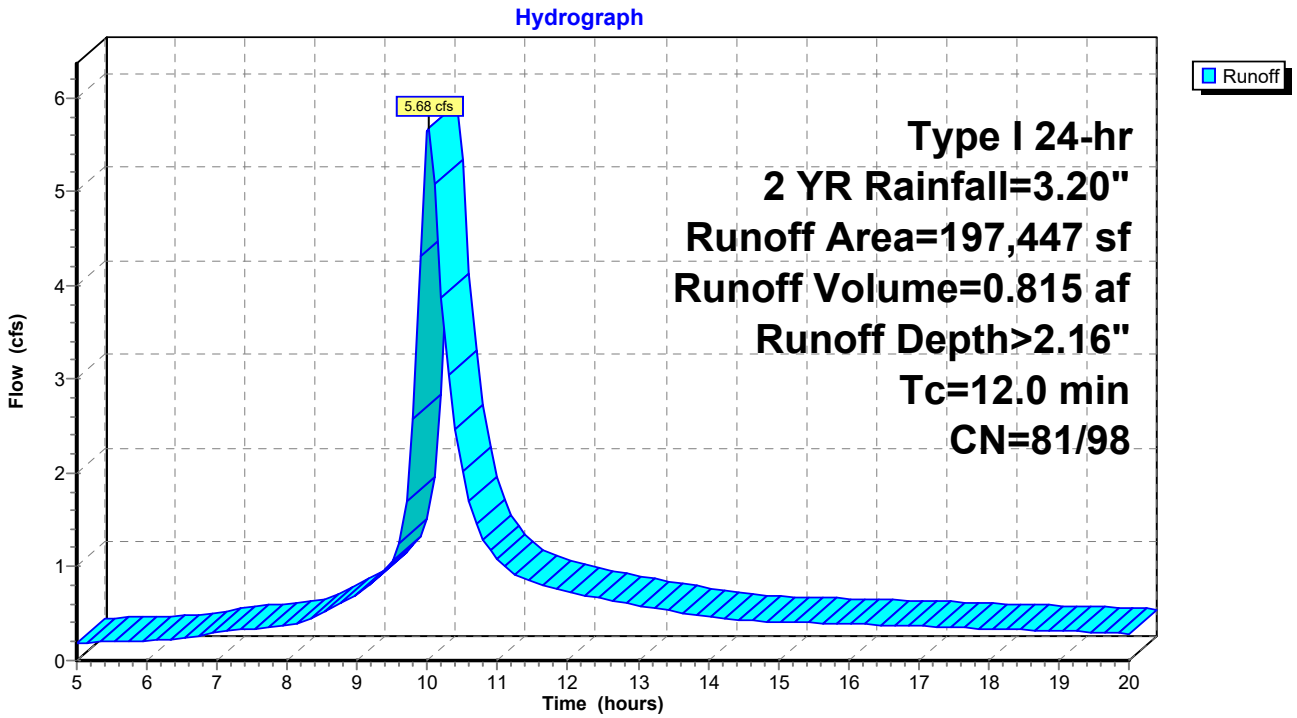
Runoff = 5.68 cfs @ 10.02 hrs, Volume= 0.815 af, Depth> 2.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite



Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>3.31"
Tc=12.0 min CN=81/98 Runoff=8.76 cfs 1.250 af

Total Runoff Area = 4.533 ac Runoff Volume = 1.250 af Average Runoff Depth = 3.31"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

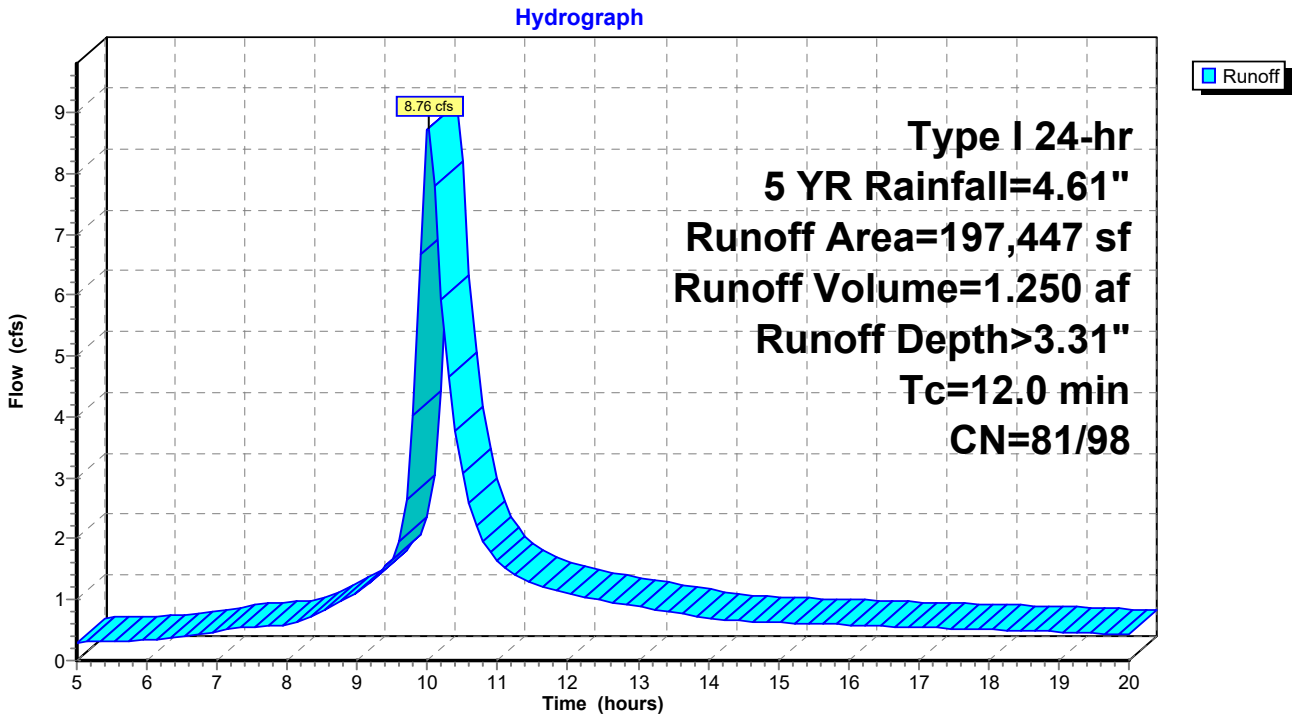
Runoff = 8.76 cfs @ 10.02 hrs, Volume= 1.250 af, Depth> 3.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 YR Rainfall=4.61"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite



Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>4.09"
Tc=12.0 min CN=81/98 Runoff=10.84 cfs 1.545 af

Total Runoff Area = 4.533 ac Runoff Volume = 1.545 af Average Runoff Depth = 4.09"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

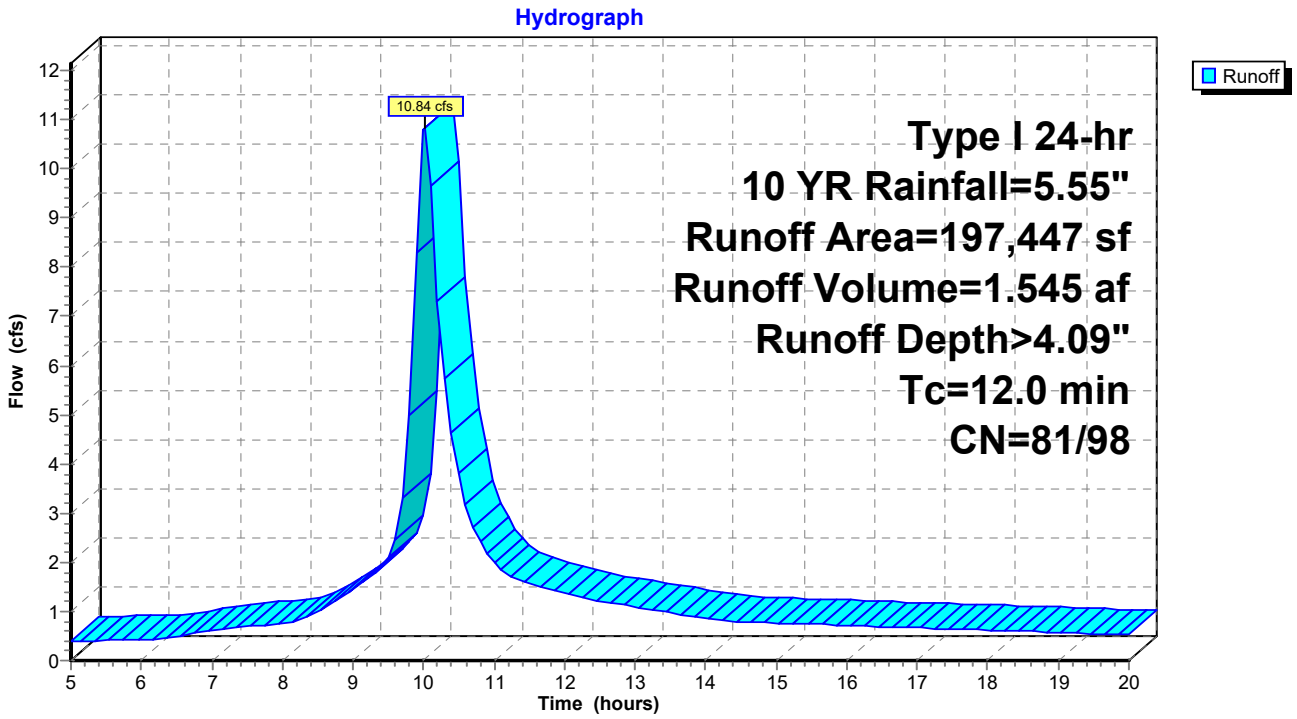
Runoff = 10.84 cfs @ 10.02 hrs, Volume= 1.545 af, Depth> 4.09"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 YR Rainfall=5.55"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite



Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>5.06"
Tc=12.0 min CN=81/98 Runoff=13.43 cfs 1.912 af

Total Runoff Area = 4.533 ac Runoff Volume = 1.912 af Average Runoff Depth = 5.06"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

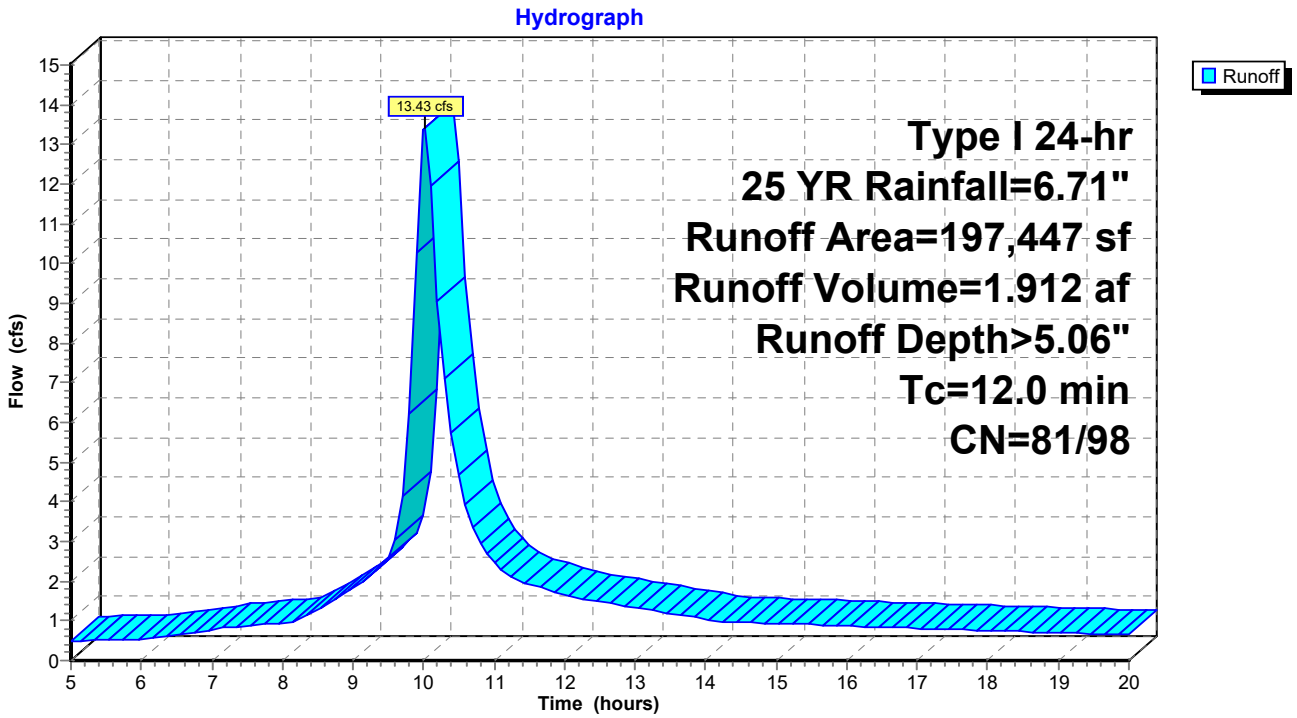
Runoff = 13.43 cfs @ 10.02 hrs, Volume= 1.912 af, Depth> 5.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 YR Rainfall=6.71"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite



Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>5.78"
Tc=12.0 min CN=81/98 Runoff=15.33 cfs 2.182 af

Total Runoff Area = 4.533 ac Runoff Volume = 2.182 af Average Runoff Depth = 5.78"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

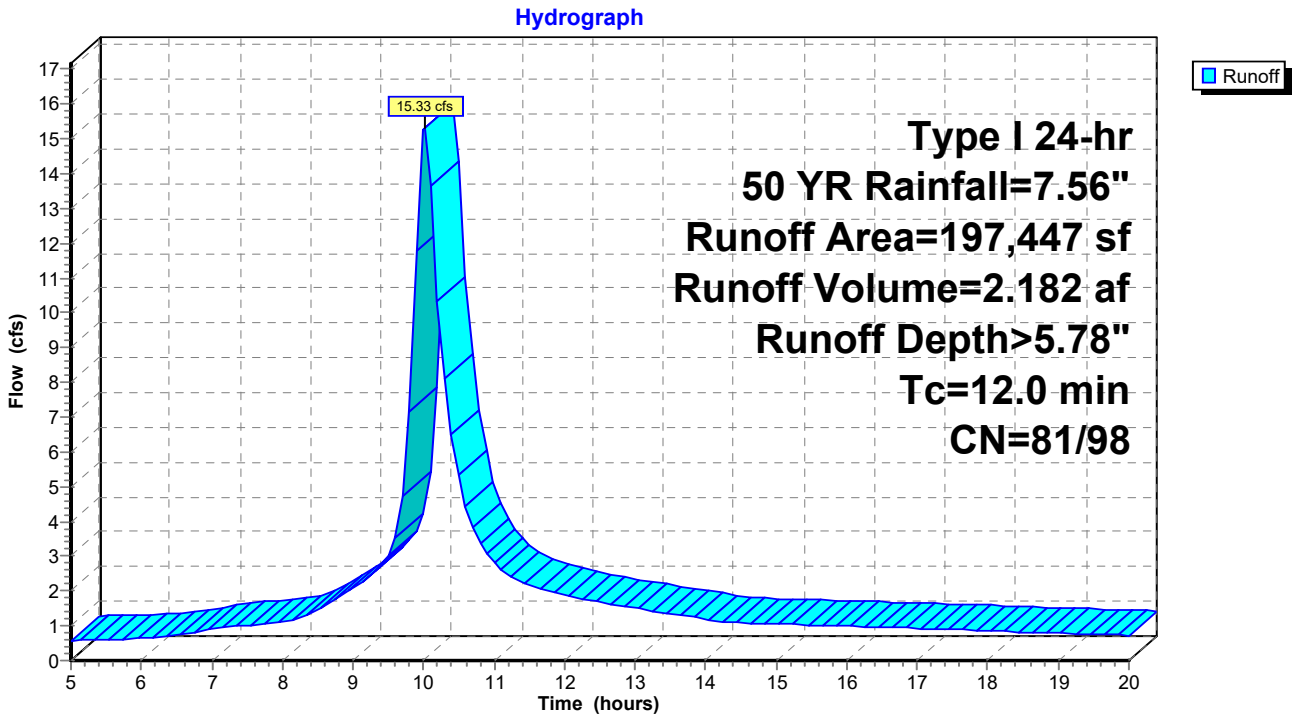
Runoff = 15.33 cfs @ 10.02 hrs, Volume= 2.182 af, Depth> 5.78"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 50 YR Rainfall=7.56"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite



Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: Proposed onsite Runoff Area=197,447 sf 66.57% Impervious Runoff Depth>6.47"
Tc=12.0 min CN=81/98 Runoff=17.17 cfs 2.443 af

Total Runoff Area = 4.533 ac Runoff Volume = 2.443 af Average Runoff Depth = 6.47"
33.43% Pervious = 1.515 ac 66.57% Impervious = 3.018 ac

Summary for Subcatchment 2S: Proposed onsite

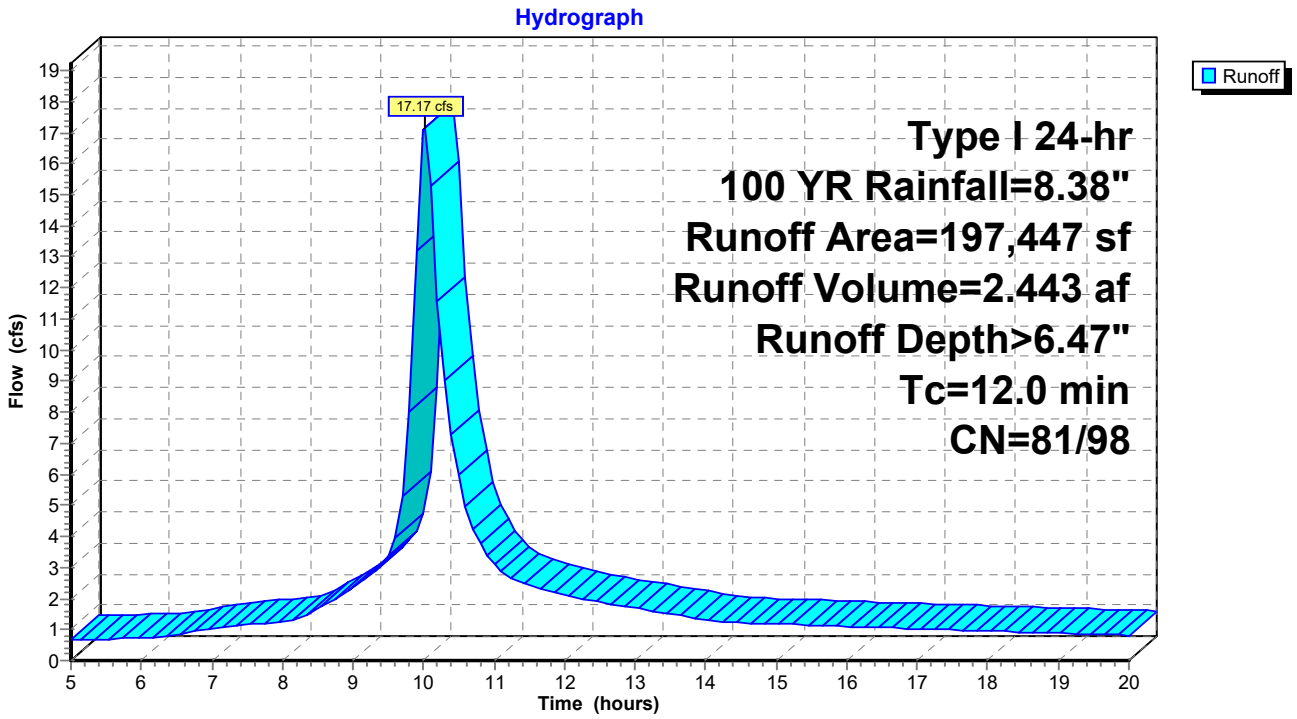
Runoff = 17.17 cfs @ 10.02 hrs, Volume= 2.443 af, Depth> 6.47"

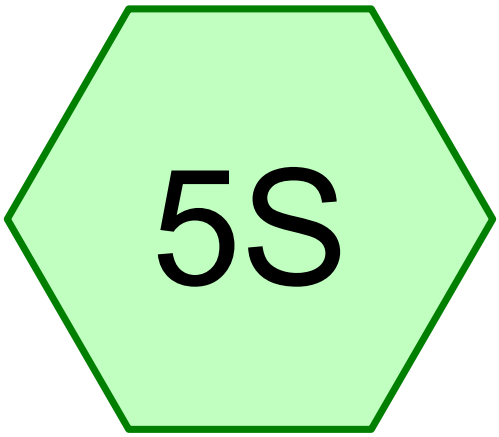
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 100 YR Rainfall=8.38"

Area (sf)	CN	Description
82,239	98	Roofs, HSG D
49,211	98	Unconnected pavement, HSG D
59,195	80	>75% Grass cover, Good, HSG D
6,802	89	<50% Grass cover, Poor, HSG D
197,447	92	Weighted Average
65,997	81	33.43% Pervious Area
131,450	98	66.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 2S: Proposed onsite





Proposed offsite

Subcat Reach Pond Link

Routing Diagram for 21093_Hydro Calcs
Prepared by {enter your company name here}, Printed 5/20/2022

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 inch WQ	Type I 24-hr		Default	24.00	1	1.00	2
2	2 YR	Type I 24-hr		Default	24.00	1	3.20	2
3	5 YR	Type I 24-hr		Default	24.00	1	4.61	2
4	10 YR	Type I 24-hr		Default	24.00	1	5.55	2
5	25 YR	Type I 24-hr		Default	24.00	1	6.71	2
6	50 YR	Type I 24-hr		Default	24.00	1	7.56	2
7	100 YR	Type I 24-hr		Default	24.00	1	8.38	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.322	80	>75% Grass cover, Good, HSG D (5S)
1.377	98	Paved parking, HSG D (5S)
1.699	**95**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.699	HSG D	5S
0.000	Other	
1.699		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.322	0.000	0.322	>75% Grass cover, Good	5S
0.000	0.000	0.000	1.377	0.000	1.377	Paved parking	5S
0.000	**0.000**	**0.000**	**1.699**	**0.000**	**1.699**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>0.59"
Tc=12.0 min CN=80/98 Runoff=0.58 cfs 0.083 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.083 af Average Runoff Depth = 0.59"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

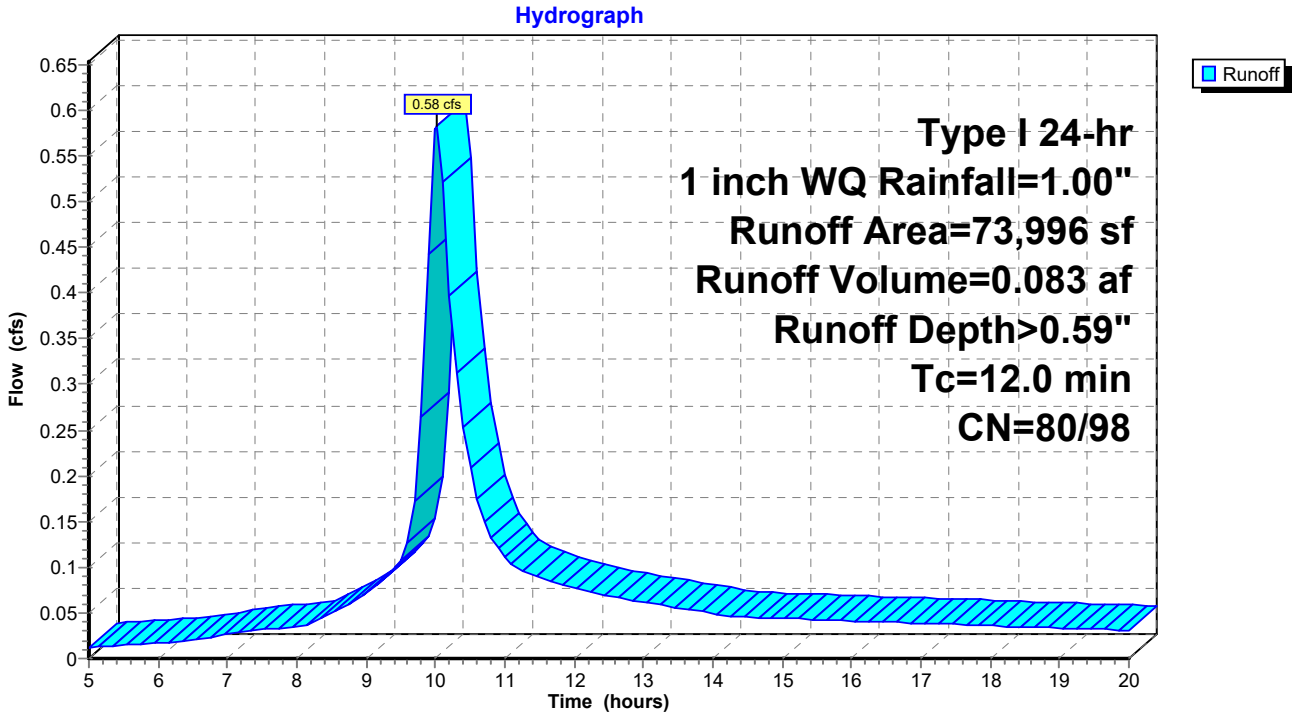
Runoff = 0.58 cfs @ 10.02 hrs, Volume= 0.083 af, Depth> 0.59"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 1 inch WQ Rainfall=1.00"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite



Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.10	0.00	0.01	0.01
5.50	0.11	0.00	0.02	0.01
6.00	0.12	0.00	0.02	0.02
6.50	0.14	0.00	0.03	0.02
7.00	0.16	0.00	0.04	0.03
7.50	0.17	0.00	0.05	0.03
8.00	0.19	0.00	0.07	0.04
8.50	0.22	0.00	0.08	0.05
9.00	0.25	0.00	0.11	0.07
9.50	0.30	0.00	0.15	0.11
10.00	0.52	0.00	0.33	**0.58**
10.50	0.58	0.00	0.39	0.21
11.00	0.62	0.01	0.43	0.11
11.50	0.66	0.01	0.46	0.09
12.00	0.68	0.01	0.49	0.08
12.50	0.71	0.02	0.51	0.07
13.00	0.73	0.02	0.53	0.06
13.50	0.75	0.02	0.55	0.06
14.00	0.77	0.03	0.57	0.05
14.50	0.79	0.03	0.59	0.05
15.00	0.80	0.03	0.60	0.04
15.50	0.82	0.04	0.61	0.04
16.00	0.83	0.04	0.63	0.04
16.50	0.85	0.04	0.64	0.04
17.00	0.86	0.05	0.66	0.04
17.50	0.87	0.05	0.67	0.04
18.00	0.89	0.05	0.68	0.04
18.50	0.90	0.05	0.69	0.03
19.00	0.91	0.06	0.70	0.03
19.50	0.92	0.06	0.71	0.03
20.00	**0.93**	**0.06**	**0.73**	0.03

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>2.34"
Tc=12.0 min CN=80/98 Runoff=2.31 cfs 0.331 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.331 af Average Runoff Depth = 2.34"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

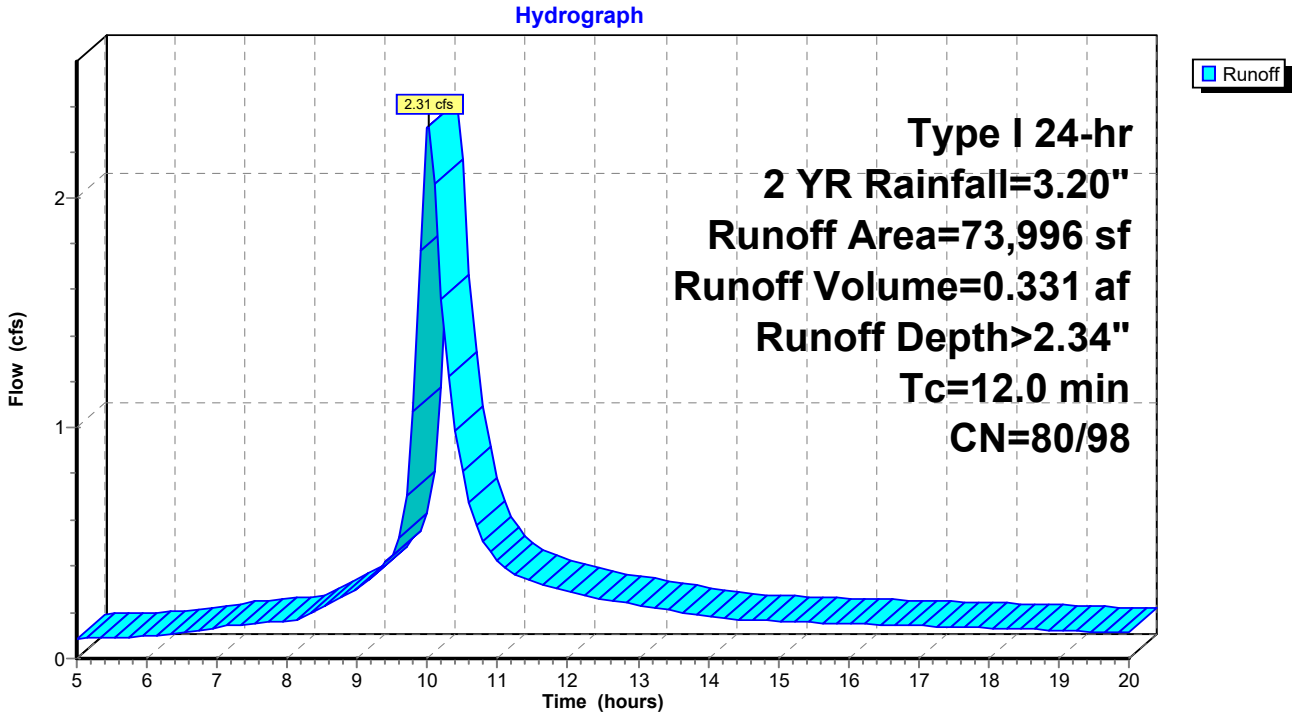
Runoff = 2.31 cfs @ 10.02 hrs, Volume= 0.331 af, Depth> 2.34"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite



Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.32	0.00	0.16	0.09
5.50	0.36	0.00	0.19	0.09
6.00	0.40	0.00	0.23	0.10
6.50	0.45	0.00	0.27	0.11
7.00	0.50	0.00	0.32	0.13
7.50	0.56	0.00	0.37	0.15
8.00	0.62	0.01	0.43	0.16
8.50	0.70	0.01	0.50	0.22
9.00	0.81	0.03	0.61	0.31
9.50	0.97	0.07	0.76	0.45
10.00	1.65	0.36	1.43	**2.30**
10.50	1.87	0.48	1.64	0.81
11.00	1.99	0.56	1.77	0.43
11.50	2.10	0.62	1.87	0.33
12.00	2.19	0.68	1.96	0.29
12.50	2.27	0.73	2.04	0.26
13.00	2.34	0.78	2.11	0.23
13.50	2.41	0.83	2.18	0.21
14.00	2.46	0.86	2.23	0.18
14.50	2.52	0.90	2.29	0.17
15.00	2.57	0.94	2.34	0.16
15.50	2.62	0.97	2.39	0.16
16.00	2.66	1.00	2.43	0.15
16.50	2.71	1.04	2.48	0.15
17.00	2.75	1.07	2.52	0.14
17.50	2.79	1.10	2.56	0.14
18.00	2.84	1.13	2.60	0.13
18.50	2.87	1.16	2.64	0.13
19.00	2.91	1.18	2.68	0.12
19.50	2.95	1.21	2.72	0.12
20.00	**2.98**	**1.24**	**2.75**	0.11

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>3.50"
Tc=12.0 min CN=80/98 Runoff=3.47 cfs 0.496 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.496 af Average Runoff Depth = 3.50"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

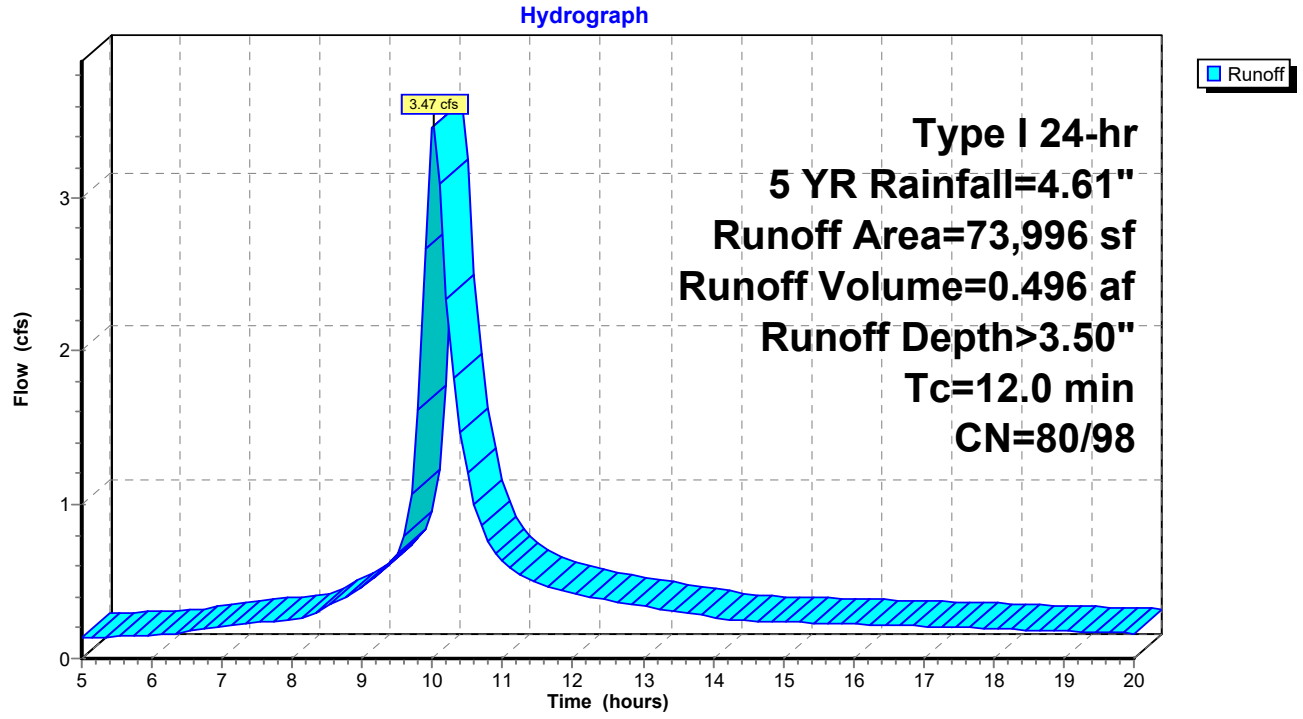
Runoff = 3.47 cfs @ 10.02 hrs, Volume= 0.496 af, Depth> 3.50"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 YR Rainfall=4.61"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite



Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.46	0.00	0.28	0.14
5.50	0.52	0.00	0.33	0.14
6.00	0.58	0.00	0.39	0.15
6.50	0.64	0.01	0.45	0.17
7.00	0.72	0.02	0.52	0.21
7.50	0.80	0.03	0.60	0.24
8.00	0.89	0.05	0.69	0.25
8.50	1.01	0.09	0.80	0.34
9.00	1.17	0.14	0.96	0.47
9.50	1.40	0.24	1.18	0.68
10.00	2.37	0.80	2.15	**3.45**
10.50	2.69	1.02	2.46	1.21
11.00	2.87	1.15	2.64	0.63
11.50	3.02	1.27	2.79	0.49
12.00	3.15	1.37	2.92	0.43
12.50	3.27	1.46	3.04	0.38
13.00	3.37	1.54	3.14	0.34
13.50	3.47	1.61	3.23	0.31
14.00	3.55	1.68	3.32	0.27
14.50	3.62	1.74	3.39	0.25
15.00	3.70	1.79	3.46	0.24
15.50	3.77	1.85	3.53	0.23
16.00	3.84	1.91	3.60	0.22
16.50	3.90	1.96	3.67	0.22
17.00	3.96	2.01	3.73	0.21
17.50	4.03	2.06	3.79	0.20
18.00	4.08	2.11	3.85	0.19
18.50	4.14	2.16	3.91	0.19
19.00	4.20	2.20	3.96	0.18
19.50	4.25	2.25	4.01	0.17
20.00	**4.30**	**2.29**	**4.06**	0.16

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>4.29"
Tc=12.0 min CN=80/98 Runoff=4.25 cfs 0.607 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.607 af Average Runoff Depth = 4.29"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

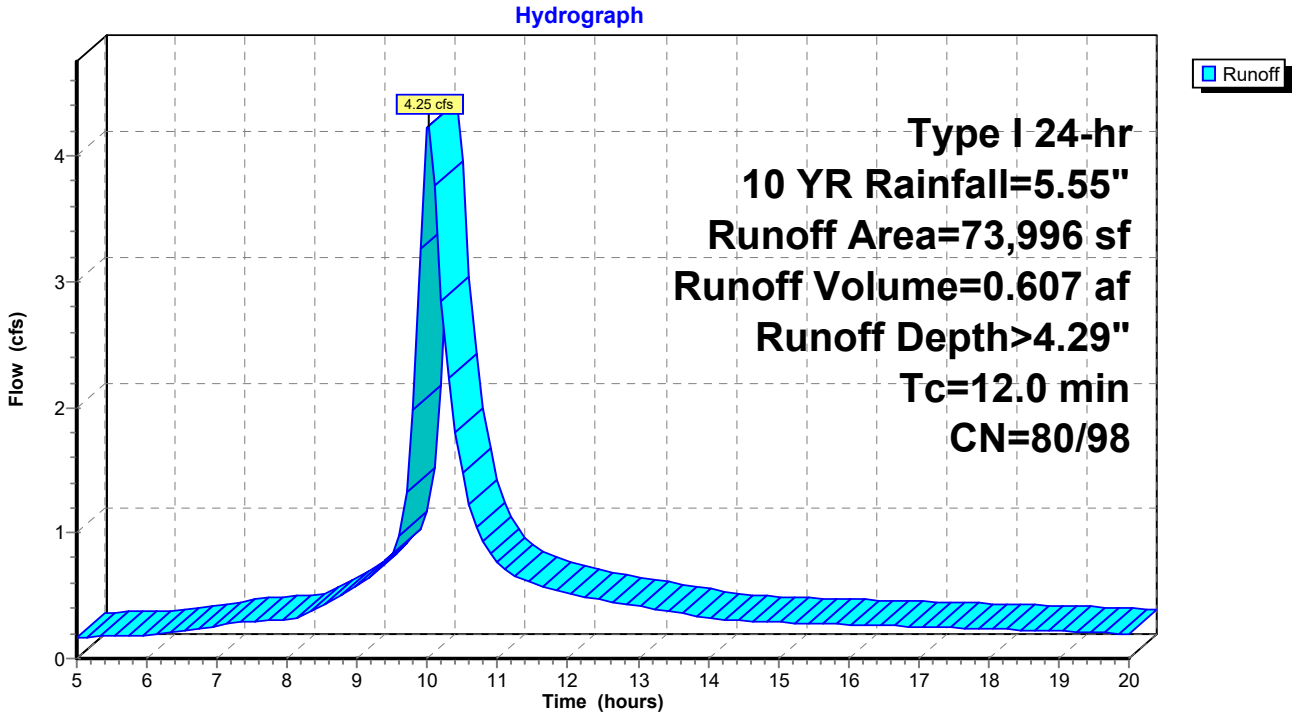
Runoff = 4.25 cfs @ 10.02 hrs, Volume= 0.607 af, Depth> 4.29"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 YR Rainfall=5.55"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite



Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.55	0.00	0.37	0.17
5.50	0.62	0.01	0.43	0.18
6.00	0.69	0.01	0.50	0.19
6.50	0.77	0.03	0.57	0.22
7.00	0.87	0.05	0.66	0.26
7.50	0.97	0.07	0.76	0.29
8.00	1.08	0.11	0.87	0.31
8.50	1.22	0.16	1.00	0.42
9.00	1.41	0.24	1.19	0.58
9.50	1.68	0.38	1.46	0.84
10.00	2.86	1.14	2.63	**4.23**
10.50	3.24	1.43	3.00	1.48
11.00	3.46	1.60	3.22	0.77
11.50	3.64	1.75	3.40	0.60
12.00	3.80	1.87	3.56	0.52
12.50	3.94	1.99	3.70	0.46
13.00	4.06	2.09	3.83	0.42
13.50	4.17	2.19	3.94	0.37
14.00	4.27	2.27	4.04	0.33
14.50	4.36	2.35	4.13	0.30
15.00	4.45	2.42	4.22	0.29
15.50	4.54	2.49	4.30	0.28
16.00	4.62	2.56	4.38	0.27
16.50	4.70	2.63	4.46	0.26
17.00	4.77	2.70	4.54	0.25
17.50	4.85	2.76	4.61	0.25
18.00	4.92	2.82	4.68	0.24
18.50	4.99	2.88	4.75	0.23
19.00	5.05	2.94	4.81	0.22
19.50	5.11	2.99	4.88	0.21
20.00	**5.17**	**3.04**	**4.94**	0.20

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>5.26"
Tc=12.0 min CN=80/98 Runoff=5.21 cfs 0.744 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.744 af Average Runoff Depth = 5.26"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

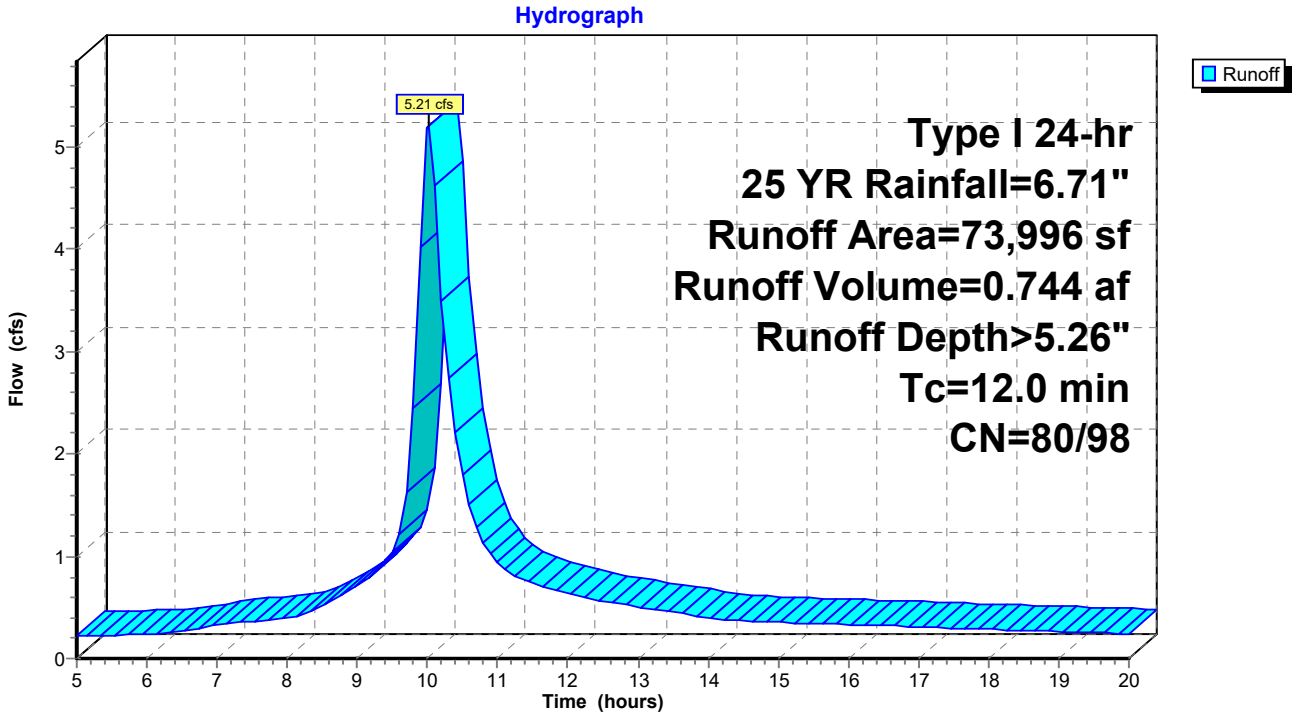
Runoff = 5.21 cfs @ 10.02 hrs, Volume= 0.744 af, Depth> 5.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 YR Rainfall=6.71"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite



Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.67	0.01	0.48	0.22
5.50	0.75	0.02	0.55	0.23
6.00	0.84	0.04	0.64	0.24
6.50	0.93	0.06	0.73	0.27
7.00	1.05	0.10	0.84	0.33
7.50	1.17	0.14	0.96	0.36
8.00	1.30	0.19	1.09	0.39
8.50	1.47	0.27	1.25	0.52
9.00	1.70	0.39	1.48	0.72
9.50	2.03	0.58	1.81	1.04
10.00	3.46	1.60	3.22	**5.18**
10.50	3.91	1.97	3.68	1.81
11.00	4.18	2.19	3.95	0.94
11.50	4.40	2.38	4.16	0.73
12.00	4.59	2.54	4.35	0.64
12.50	4.76	2.68	4.52	0.57
13.00	4.91	2.82	4.68	0.51
13.50	5.05	2.93	4.81	0.45
14.00	5.17	3.04	4.93	0.40
14.50	5.28	3.13	5.04	0.37
15.00	5.38	3.23	5.14	0.35
15.50	5.48	3.32	5.25	0.34
16.00	5.58	3.41	5.35	0.33
16.50	5.68	3.49	5.44	0.32
17.00	5.77	3.57	5.53	0.31
17.50	5.86	3.65	5.62	0.30
18.00	5.95	3.73	5.71	0.29
18.50	6.03	3.81	5.79	0.28
19.00	6.11	3.88	5.87	0.26
19.50	6.18	3.95	5.94	0.25
20.00	**6.25**	**4.01**	**6.02**	0.24

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>5.97"
Tc=12.0 min CN=80/98 Runoff=5.92 cfs 0.845 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.845 af Average Runoff Depth = 5.97"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

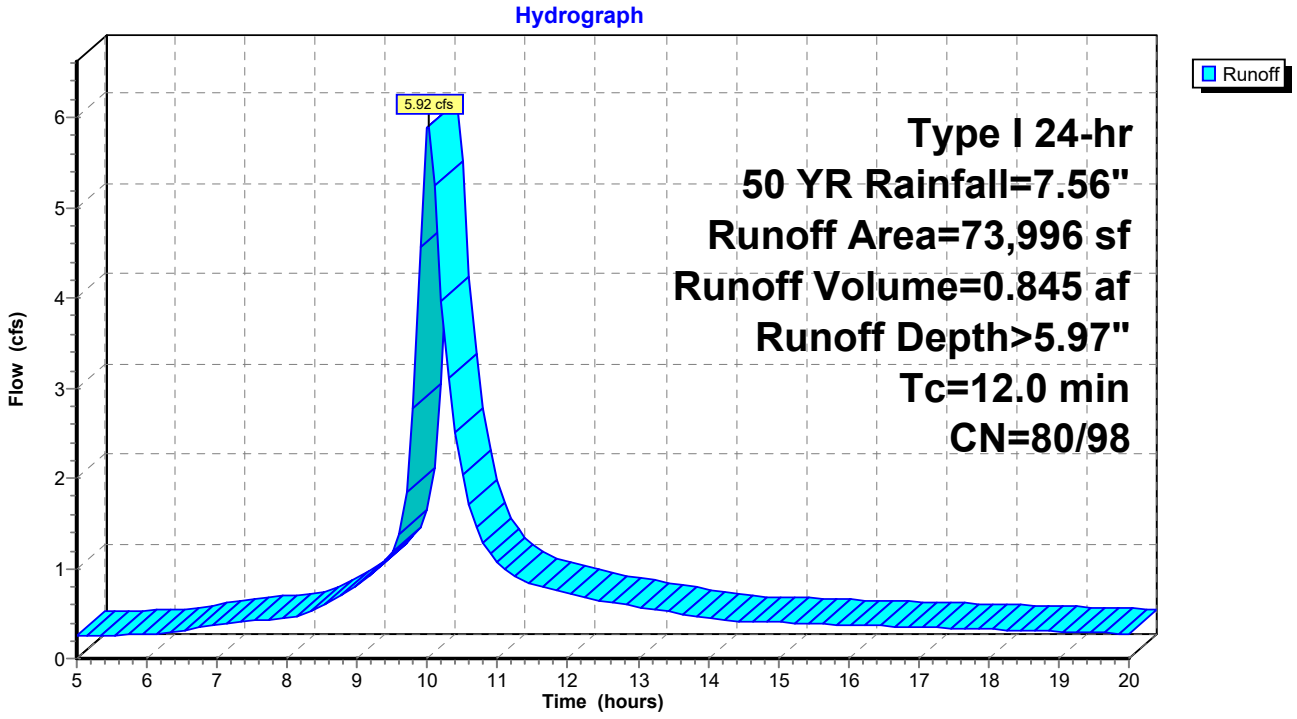
Runoff = 5.92 cfs @ 10.02 hrs, Volume= 0.845 af, Depth> 5.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 50 YR Rainfall=7.56"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite



Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.76	0.02	0.56	0.25
5.50	0.85	0.04	0.65	0.26
6.00	0.95	0.07	0.74	0.27
6.50	1.05	0.10	0.84	0.31
7.00	1.18	0.15	0.97	0.37
7.50	1.32	0.20	1.10	0.42
8.00	1.47	0.27	1.25	0.44
8.50	1.66	0.37	1.43	0.59
9.00	1.92	0.51	1.70	0.82
9.50	2.29	0.75	2.06	1.18
10.00	3.89	1.95	3.66	**5.89**
10.50	4.41	2.38	4.17	2.05
11.00	4.71	2.64	4.47	1.07
11.50	4.96	2.85	4.72	0.83
12.00	5.17	3.04	4.93	0.72
12.50	5.36	3.21	5.12	0.64
13.00	5.53	3.36	5.30	0.58
13.50	5.69	3.50	5.45	0.51
14.00	5.82	3.62	5.58	0.45
14.50	5.94	3.73	5.71	0.41
15.00	6.06	3.84	5.82	0.40
15.50	6.18	3.94	5.94	0.39
16.00	6.29	4.04	6.05	0.38
16.50	6.40	4.14	6.16	0.36
17.00	6.50	4.24	6.26	0.35
17.50	6.60	4.33	6.36	0.34
18.00	6.70	4.42	6.46	0.32
18.50	6.79	4.50	6.55	0.31
19.00	6.88	4.58	6.64	0.30
19.50	6.96	4.66	6.73	0.29
20.00	**7.05**	**4.74**	**6.81**	0.27

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment5S: Proposed offsite Runoff Area=73,996 sf 81.06% Impervious Runoff Depth>6.66"
Tc=12.0 min CN=80/98 Runoff=6.60 cfs 0.943 af

Total Runoff Area = 1.699 ac Runoff Volume = 0.943 af Average Runoff Depth = 6.66"
18.94% Pervious = 0.322 ac 81.06% Impervious = 1.377 ac

Summary for Subcatchment 5S: Proposed offsite

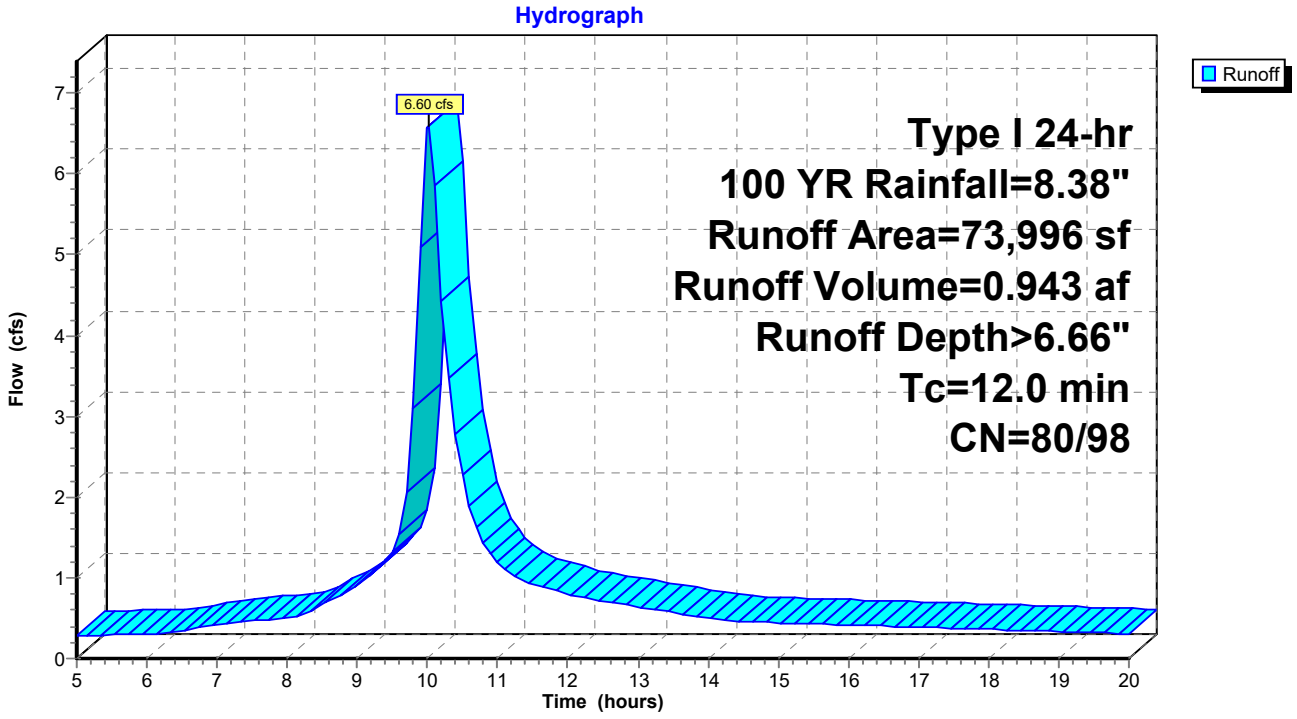
Runoff = 6.60 cfs @ 10.02 hrs, Volume= 0.943 af, Depth> 6.66"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type I 24-hr 100 YR Rainfall=8.38"

Area (sf)	CN	Description
14,014	80	>75% Grass cover, Good, HSG D
59,982	98	Paved parking, HSG D
73,996	95	Weighted Average
14,014	80	18.94% Pervious Area
59,982	98	81.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					**Direct Entry,**

Subcatchment 5S: Proposed offsite

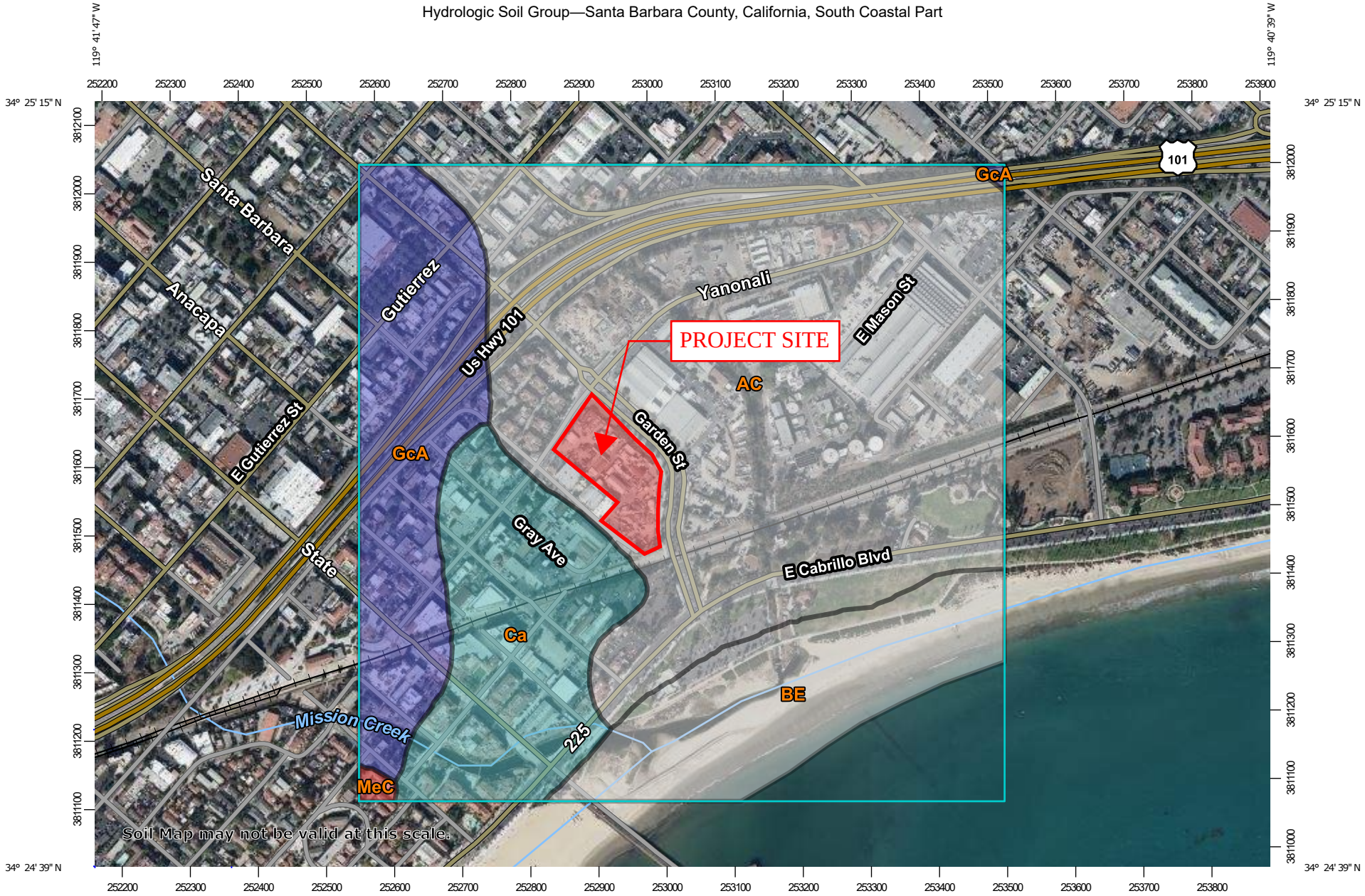


Hydrograph for Subcatchment 5S: Proposed offsite

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
5.00	0.84	0.04	0.63	0.28
5.50	0.94	0.07	0.73	0.29
6.00	1.05	0.10	0.84	0.31
6.50	1.17	0.14	0.95	0.35
7.00	1.31	0.20	1.09	0.42
7.50	1.46	0.27	1.24	0.47
8.00	1.63	0.35	1.40	0.50
8.50	1.84	0.46	1.61	0.66
9.00	2.13	0.64	1.90	0.92
9.50	2.54	0.92	2.31	1.32
10.00	4.32	2.31	4.08	**6.57**
10.50	4.89	2.79	4.65	2.28
11.00	5.22	3.09	4.98	1.19
11.50	5.49	3.33	5.26	0.93
12.00	5.73	3.54	5.49	0.80
12.50	5.94	3.73	5.71	0.71
13.00	6.13	3.90	5.90	0.64
13.50	6.30	4.06	6.07	0.57
14.00	6.45	4.19	6.21	0.50
14.50	6.59	4.32	6.35	0.46
15.00	6.72	4.44	6.48	0.44
15.50	6.85	4.55	6.61	0.43
16.00	6.97	4.67	6.73	0.42
16.50	7.09	4.78	6.85	0.40
17.00	7.21	4.89	6.97	0.39
17.50	7.32	4.99	7.08	0.37
18.00	7.42	5.09	7.19	0.36
18.50	7.53	5.18	7.29	0.35
19.00	7.63	5.28	7.39	0.33
19.50	7.72	5.36	7.48	0.32
20.00	**7.81**	**5.45**	**7.57**	0.30

APPENDIX C

USGS SOIL SURVEY MAP



Map Scale: 1:7,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Santa Barbara County, California, South Coastal Part
Survey Area Data: Version 14, Sep 9, 2021

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

Date(s) aerial images were photographed: Nov 10, 2020—Nov 16, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AC	Aquents, fill areas		118.8	54.3%
BE	Beaches		26.9	12.3%
Ca	Camarillo fine sandy loam	C	29.9	13.7%
GcA	Goleta fine sandy loam, 0 to 2 percent slopes	B	31.6	14.5%
MeC	Milpitas-Positas fine sandy loams, 2 to 9 percent slopes	D	0.6	0.3%
Totals for Area of Interest			**218.7**	**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

APPENDIX D

STORM WATER TREATMENT BMP SIZING WORKSHEETS – PROJECT PARCEL

Area A - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one-inch}$, calculated using the SBUH method, Appendix C	$V_{one-inch}$=	317	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one-inch}$ and is the volume to be retained onsite	$V_{reduction}$=	317	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one-inch}$)	V_{wq}=	317	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	317	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	0.63	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	101	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.001467	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.3	ft
sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	3.25	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.63	in/hr

Area B - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	454	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	454	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	454	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	454	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1.05	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	87	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.002104	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	8	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	1.05	in/hr

Area C - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	669	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	669	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	669	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	669	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1.05	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	127	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.003095	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	15	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	1.05	in/hr

Area D - Planter Box Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	254	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	254	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	254	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	254	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	51	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.001176	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	2.5	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr

Area E - Permeable Paving Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	592	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	592	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	592	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If no infiltration (i.e. impermeable liner with underdrains, $V_{design}=V_{wq}$	V_{design}=	592	ft^3
3-2. If partial infiltration (i.e. permeable liner with underdrains) is used, $V_{design}=1.2V_{wq}$	V_{design}=	N/A	ft^3
3-1. If full infiltration, $V_{design}=V_{reduction}$	V_{design}=	592	ft^3
Step 4: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	13	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr
Step 5: Detemine maximum depth that can be infiltrated			
5-1. Enter drawdown time (72 hours max.), t	t=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated withing the t, $d_{max}=k_{design}t/12$	d_{max}=	1.05	ft
Step 6: Determine infiltrating surface area (gravel drainage area)			
6-1. Enter gravel drainage layer porosity, n	n=	0.32	
6-2. Enter depth of gravel drainage layer, d	l=	6	in
6-3. Enter the time to fill the gravel drainage layer with water (use 2 hours for most designs), T	T=	2	hrs
6-4. Calculated infiltrating surface area: $A=V_{design}/(Tk_{design}/12)+n*l))$	A=	303.56	ft^3

Area F - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	139	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	139	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	139	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	139	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1.05	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	27	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.000644	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	15	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	1.05	in/hr

Area G - Bioretention Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	15	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	15	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	15	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	15	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	0.175	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	17	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	6.72E-05	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	1.5	
Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g=4*D/W+0.05	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr

Area I - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one-inch}$, calculated using the SBUH method, Appendix C	$V_{one-inch}$=	1633	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one-inch}$ and is the volume to be retained onsite	$V_{reduction}$=	1633	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one-inch}$)	V_{wq}=	1633	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1633	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1.05	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	311	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.007559	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	15	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	1.05	in/hr

Area K - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	395	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	395	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	395	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	395	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1.05	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	75	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.00183	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	8	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	1.05	in/hr

Area L - Permeable Paving Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	1089	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	1089	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1089	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If no infiltration (i.e. impermeable liner with underdrains, $V_{design}=V_{wq}$	V_{design}=	1089	ft^3
3-2. If partial infiltration (i.e. permeable liner with underdrains) is used, $V_{design}=1.2V_{wq}$	V_{design}=	N/A	ft^3
3-1. If full infiltration, $V_{design}=V_{reduction}$	V_{design}=	1089	ft^3
Step 4: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	13	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr
Step 5: Detemine maximum depth that can be infiltrated			
5-1. Enter drawdown time (72 hours max.), t	t=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated withing the t, $d_{max}=k_{design}t/12$	d_{max}=	1.05	ft
Step 6: Determine infiltrating surface area (gravel drainage area)			
6-1. Enter gravel drainage layer porosity, n	n=	0.32	
6-2. Enter depth of gravel drainage layer, d	I=	6	in
6-3. Enter the time to fill the gravel drainage layer with water (use 2 hours for most designs), T	T=	2	hrs
6-4. Calculated infiltrating surface area: $A=V_{design}/(Tk_{design}/12)+n*I))$	A=	558.57	ft^3

Area **M-** *Permeable Paving Sizing Worksheet*			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	59	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	59	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	59	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If no infiltration (i.e. impermeable liner with underdrains, $V_{design}=V_{wq}$	V_{design}=	59	ft^3
3-2. If partial infiltration (i.e. permeable liner with underdrains) is used, $V_{design}=1.2V_{wq}$	V_{design}=	N/A	ft^3
3-1. If full infiltration, $V_{design}=V_{reduction}$	V_{design}=	59	ft^3
Step 4: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	13	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr
Step 5: Detemine maximum depth that can be infiltrated			
5-1. Enter drawdown time (72 hours max.), t	t=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated withing the t, $d_{max}=k_{design}t/12$	d_{max}=	1.05	ft
Step 6: Determine infiltrating surface area (gravel drainage area)			
6-1. Enter gravel drainage layer porosity, n	n=	0.32	
6-2. Enter depth of gravel drainage layer, d	l=	6	in
6-3. Enter the time to fill the gravel drainage layer with water (use 2 hours for most designs), T	T=	2	hrs
6-4. Calculated infiltrating surface area: $A=V_{design}/(Tk_{design}/12)+n*l))$	A=	30.39	ft^3

Area N - Planter Box Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one-inch}$, calculated using the SBUH method, Appendix C	$V_{one-inch}$=	355	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one-inch}$ and is the volume to be retained onsite	$V_{reduction}$=	355	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one-inch}$)	V_{wq}=	355	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	355	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Entre thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	71	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.001645	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	

Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	2.5	
Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g=4*D/W+0.05	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr

Area O - Planter Box Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one-inch}$, calculated using the SBUH method, Appendix C	$V_{one-inch}$=	224	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one-inch}$ and is the volume to be retained onsite	$V_{reduction}$=	224	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one-inch}$)	V_{wq}=	224	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	224	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Entre thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	45	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.001036	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	

Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	2.5	
Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g=4*D/W+0.05	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr

Area P - Planter Box Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one-inch}$, calculated using the SBUH method, Appendix C	$V_{one-inch}$=	97	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one-inch}$ and is the volume to be retained onsite	$V_{reduction}$=	97	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one-inch}$)	V_{wq}=	97	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	97	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Entre thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	19	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.000447	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	0.5	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	

Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	2.5	
Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g=4*D/W+0.05	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.175	in/hr

Area X - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one-inch}$, calculated using the SBUH method, Appendix C	$V_{one-inch}$=	86	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one-inch}$ and is the volume to be retained onsite	$V_{reduction}$=	86	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one-inch}$)	V_{wq}=	86	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	86	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1.05	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	16	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.000396	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.5	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	

Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	4	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	1.05	in/hr

Area BA - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	164	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	164	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	164	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	164	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	0.63	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	52	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.000761	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.3	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	7.5	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.63	in/hr

Area CA - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post- development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	1385	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	1385	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1385	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1385	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	0.63	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, $A_{st} = (V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	440	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.006411	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Step 8: Calculate design infiltration rate			
Enter soil infiltration rate (0.5 in/hr min.), $K_{measured}$	$K_{measured}$=	3	in/hr
Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.3	ft
Enter correction factor for plugging (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sandy-cobbles, F_p	F_p=	0.7	
Enetr the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less, D	D=	5	ft
Enter the estimated width of the facility	W=	7	
Calculate the correction factor of geometry (0.25 min, 1.0 max), $F_g=4*D/W+0.05$	F_g=	1	
Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.63	in/hr

APPENDIX E

STORM WATER TREATMENT BMP SIZING WORKSHEETS – PUBLIC RIGHT-OF-WAY

Area 2 - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	N/A	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	N/A	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	N/A	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	210	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	210	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	42	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.000973	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Area 4 - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	N/A	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	N/A	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	N/A	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	62	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	62	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	12	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.000287	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Area 6 - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	N/A	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	N/A	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	N/A	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	405	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	405	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	81	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.001873	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Area 7 - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	N/A	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	N/A	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	N/A	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1182	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1182	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	236	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.005474	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Area 8 - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	N/A	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	N/A	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	N/A	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1345	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1345	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	269	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.006226	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

Area 9 - Bioretention Sizing Worksheet			
Step 1: Determine design volume Reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-year, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	N/A	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using the SBUH method, Appendix C	$V_{one\text{-}inch}$=	N/A	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained onsite	$V_{reduction}$=	N/A	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	448	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. If underdrain system is used, $V_{design}=V_{wq}$; If there is no underdrain system, V_{design}= the larger of $V_{reduction}$ and V_{wq}	V_{design}=	448	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter strip worksheet, Appendix C			
Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), l	l=	24	in
5-2. Enter storage depth (12" max) above the filter, d	d=	6	in
5-3. Enter infiltration rate, k_{design} (Note: inflitration rate of planting soil. If no underdrain, infiltration of native subsoil or fill). If no underdrains, see Step 4 of the infiltration BMP worksheet, Appendix D to calculate k_{design}.	K_{design}=	1	in/hr
5-4. Enter drawdown time, t	t=	48	hr
5-5. Calculate bioretention area, A_{st} = $(V_{design}*l)/[(t*K_{design}/12)*(l+d)]$	A_{st}=	90	ft^2
Step 6: Calculate underdrain system flowrate (if an underdrain is provided)			
6-1. Calculate filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f=k_{design}*A_{sf}/43200$	Q_f=	0.002075	cfs
6-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet, Appendix D, to calculate the underdrain system capacity			
Step 7: Provide conveyance capcity for Flows Higher than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged			

APPENDIX F

CITY OF SANTA BARBARA DESIGN FLOOD ELEVATION DETERMINATION

Building & Safety Division
Design Flood Elevation (DFE) Determination
+ Base Flood Elevation (BFE)

Please reproduce this letter onto the Cover sheet of the plans

Date of Evaluation: March 27, 2019
Structure Address: 101 Garden Street
Applicant: Michael Caccese, MAC Design Asso

Building Permit: BLD2019-05226
APN: 017-630-018
Email: bterry@macdesignsb.com

Santa Barbara County Panel: 1387 of 1835
FEMA NFIP Community: Number • Panel • Suffix
City of Santa Barbara: 060335 • 1387 • J

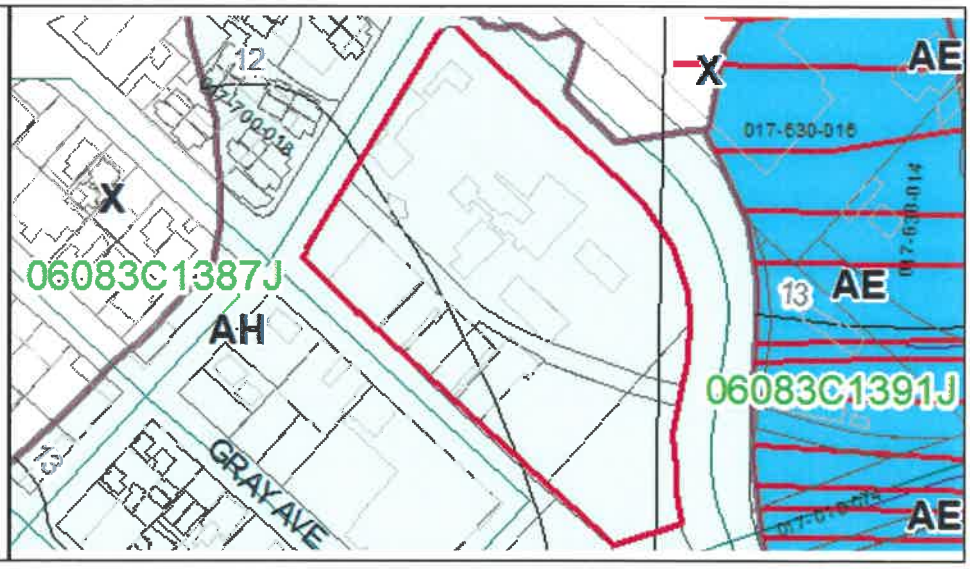
Version Number: 2.3.3.3
Map Number: 06083C1387J
Map Revised: September 28, 2018

Building Use	☒ Proposed Hotel	☐ Mixed use S1, 2/Com/Res	☐ Accessory
FIRM Zone(s)	☒ FloodPlain SFHA AH	☐ Floodway SFHA AE	☐ Pre-FIRM
BFE Source:	☒ Digital FIRM Map	☐ FIS Profile	☐ Historical

FEMA
Flood Water Elevations
NAVD 1988 Datum

Design Flood Elevation
DFE = 13.0'
DFE = BFE + 1 foot

Base Flood Elevation
BFE = 12.0'



COMMERCIAL BUILDING(S)
Residential buildings containing habitable spaces are required to be elevated at or above the DFE.
All new work shall comply with current FEMA flood mitigation requirements including: flood proofing & elevating mechanical, electrical & plumbing elements & providing water resistant materials where allowed below DFE.
Refer to 2016 CBC 1612, 2016 CRC R322, ASCE 24-14, and ASCE 7-10 Chapter 5.

STRUCTURE(S) shown do not represent the buildings proposed.

BUILDING PERMITS are required before any new work, addition, or remodeling of structures occur in a Special Flood Hazard Area (SFHA) - City of Santa Barbara Municipal Code MC 22.24.

FLOOD INSURANCE is required for Federally Financed structures located in a SFHA 'A', 'AO', 'AH', 'AE' 'D' & 'VE' zones. Flood Insurance is not required in 'X' & Shaded 'X' zones.

Chris Short, Senior Plan Check Engineer & Floodplain Coordinator
(805) 564-5551 cshort@santabarbaraca.gov
Community Development Department, Building & Safety Division
630 Garden Street, Santa Barbara, Ca. 93102

Cc: City Floodplain File, City Street File