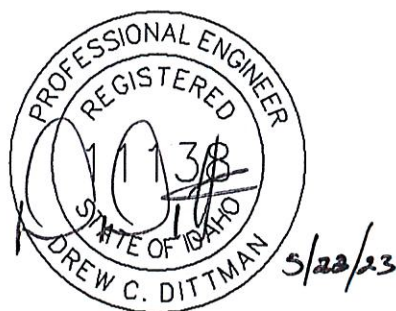


The Vault

Stormwater Management Report

Sandpoint, Idaho

May, 2023



126 East Poplar Avenue

Coeur d'Alene, Idaho 83814

Phone: 208-676-0230

PROJECT: Triangle Commercial Park
 JOB NAME: 22-066
 DATE: 5/19/2023
RATIONAL METHOD $Q=CiA$
 Basin: **A**
 Design Type: **208 Design**
 Design Event: **25 yr**
 Case: **Post developed**

Description	"C" Factor	Area		A * C
		(ft2)	(acres)	
Paved/Sidewalks	0.90	29,775	0.68	0.615
Roof	0.90	27,791	0.64	0.574
Res. / Unimproved	0.25	28,252	0.65	0.162

Total Basin Area = 85,818 SF 1.97 ac
 Calculated Composite "C" 0.69
 Total Impervious Area = 57,566 SF

Time of Concentration (TR-55)					
Sheet Flow < 300 LF, Shallow Concentrated Flow (Ditch Flow) > 300LF, N=Roughness Coefficient, Ct = 0.15 Overland or 0.40 for Drainage Ditch, P2= ITD Isoplival map,	Data	Sheet Flow	Sheet Flow	Sheet Flow	Other
	P2(in)=	1.6			
	L (ft) =	175			
	S (ft/ft)=	0.0200			
	Ct =	0.40			
	N =	0.011			
	Vavg=				
	Tc (min) =	2.68			

TC-Sheet Flow= $(0.007(L*N)0.8)/(P20.5)*(S0.4)$

TC-Ditch Flow= $L/(3600*VAvg)$

TC-Storm Drain= $L/(3600*VAvg)$, where Velocity is calculated using Manning's Equation

Calculated Total Tc = 2.68 min

Calculated Peak Runoff using the Rational Method		
Estimated Rainfall Intensity based on Tc=	2.80	in/hr
Calculated Peak Runoff Rate (Q)=	3.78	cfs

BOWSTRING METHOD

Basin: A

Drywell Outflow (cfs):	0.00
Swale Outflow (cfs):	0.01
Swale Depth (ft):	3.00

Shallow Injection Well Type:	-
Typical Infiltration Rate:	2.0
Swale Bottom Area (SF):	1290

Time (min)	Time (sec)	Intensity (in/hr)	QDEV (cfs)	VIN (ft3)	VOUT (ft3)	Storage (ft3)
5	300	2.80	3.78	1342	3	1339
10	600	2.10	2.84	1858	6	1852
15	900	1.70	2.30	2194	9	2185
20	1200	1.60	2.16	2713	12	2701
25	1500	1.40	1.89	2942	15	2927
30	1800	1.20	1.62	3008	18	2990
35	2100	1.10	1.49	3203	21	3182
40	2400	0.95	1.28	3152	24	3128
45	2700	0.90	1.22	3351	27	3324
50	3000	0.87	1.18	3592	30	3562
55	3300	0.85	1.15	3854	33	3821
60	3600	0.78	1.05	3853	36	3817
65	3900	0.75	1.01	4009	39	3970
70	4200	0.70	0.95	4025	42	3983
75	4500	0.69	0.93	4247	45	4202
80	4800	0.67	0.91	4396	48	4348
85	5100	0.65	0.88	4528	51	4477
90	5400	0.63	0.85	4644	54	4590
95	5700	0.60	0.81	4667	57	4610
100	6000	0.59	0.80	4828	60	4768
105	6300	0.58	0.78	4981	63	4918
110	6600	0.55	0.74	4947	66	4881
115	6900	0.52	0.70	4888	69	4819
120	7200	0.50	0.68	4902	72	4830

GIA A

Storage Volume Required = 4918 ft3

208 Swale Volume = 5321 ft3

Drywell Volume = 0 ft3

Total Volume Provided = 5321 ft3

DDDW= 115CF

SDDW=80CF

Required Treatment Volume = 2,401 ft3

Volume (CF)= $A_{imp} * 0.0417 \text{ (ft)} (0.5"/12")$

Treatment Volume Provided = 5,321 ft3

PROJECT: Triangle Commercial Park

JOB NAME: 22-066

DATE: 5/19/2023

RATIONAL METHOD $Q=CiA$

Basin: **PORTION TO PIPE NETWORK**

Design Type: 208 Design

Design Event: 25 yr

Case: Post developed

Description	"C" Factor	Area		A * C
		(ft2)	(acres)	
Paved/Sidewalks	0.90	29,775	0.68	0.615
Roof	0.90	27,791	0.64	0.574
Res. / Unimproved	0.30	-	0.00	0.000

Total Basin Area = 57,566 SF 1.32 ac
Calculated Composite "C" 0.90
Total Impervious Area = 57,566 SF

Time of Concentration (TR-55)					
Sheet Flow < 300 LF, Shallow Concentrated Flow (Ditch Flow) > 300 LF, N=Roughness Coefficient, Ct = 0.15 Overland or 0.40 for Drainage Ditch, P2= ITD Isoplival map,	Data	Sheet Flow	Sheet Flow	Sheet Flow	Other
	P2(in)=	1.6			
	L (ft) =	175			
	S (ft/ft)=	0.0200			
	Ct =	0.40			
	N =	0.011			
	Vavg=				
	Tc (min) =	2.68			

TC-Sheet Flow= $(0.007(L*N)^{0.8})/(P^{20.5})^{(S^{0.4})}$

TC-Ditch Flow= $L/(3600*V_{Avg})$

TC-Storm Drain= $L/(3600*V_{Avg})$, where Velocity is calculated using Manning's Equation

Calculated Total Tc = 2.68 min

Calculated Peak Runoff using the Rational Method	
Estimated Rainfall Intensity based on Tc=	2.80 in/hr
Calculated Peak Runoff Rate (Q)=	3.33 cfs

BOWSTRING METHOD

Basin: V TO PIPE NETWORK

Drywell Outflow (cfs):	0.00	Shallow Injection Well Type:	-
Swale Outflow (cfs):	0.01	Typical Infiltration Rate:	2.0
Swale Depth (ft):	3.00	Swale Bottom Area (SF):	1290

Time (min)	Time (sec)	Intensity (in/hr)	QDEV (cfs)	VIN (ft3)	VOUT (ft3)	Storage (ft3)
5	300	2.80	3.33	1181	3	1178
10	600	2.10	2.50	1635	6	1629
15	900	1.70	2.02	1930	9	1921
20	1200	1.60	1.90	2388	12	2376
25	1500	1.40	1.67	2589	15	2574
30	1800	1.20	1.43	2647	18	2629
35	2100	1.10	1.31	2819	21	2798
40	2400	0.95	1.13	2774	24	2750
45	2700	0.90	1.07	2949	27	2922
50	3000	0.87	1.03	3161	30	3131
55	3300	0.85	1.01	3392	33	3359
60	3600	0.78	0.93	3391	36	3355
65	3900	0.75	0.89	3528	39	3489
70	4200	0.70	0.83	3542	42	3500
75	4500	0.69	0.82	3738	45	3693
80	4800	0.67	0.80	3869	48	3821
85	5100	0.65	0.77	3985	51	3934
90	5400	0.63	0.75	4087	54	4033
95	5700	0.60	0.71	4107	57	4050
100	6000	0.59	0.70	4249	60	4189
105	6300	0.58	0.69	4384	63	4321
110	6600	0.55	0.65	4353	66	4287
115	6900	0.52	0.62	4301	69	4232
120	7200	0.50	0.59	4314	72	4242

GIA PORTION TO PIPE NETWORK

Storage Volume Required = 4321 ft³

208 Swale Volume = 5321 ft³

Drywell Volume = 0 ft³

Total Volume Provided = 5321 ft³

DDDW= 115CF

SDDW=80CF

Required Treatment Volume = 2,401 ft³

Volume (CF)= A_{imp} * 0.0417 (ft) (0.5"/12")

Treatment Volume Provided = 5,321 ft³

PROJECT: Triangle Commercial Park

JOB NAME: 22-066

DATE: 5/19/2023

RATIONAL METHOD $Q=CiA$

Basin: **LARGEST TYP. ROOF (BLDGS A-C)**

Design Type: 208 Design

Design Event: 25 yr

Case: Post developed

Description	"C" Factor	Area		A * C
		(ft ²)	(acres)	
Paved/Sidewalks	0.90	-	0.00	0.000
Roof (Largest)	0.90	7,296	0.17	0.151
Res. / Unimproved	0.30	-	0.00	0.000

Total Basin Area = 7,296 SF 0.17 ac
Calculated Composite "C" 0.90
Total Impervious Area = 7,296 SF

Time of Concentration (TR-55)					
Sheet Flow < 300 LF, Shallow Concentrated Flow (Ditch Flow) > 300 LF, N=Roughness Coefficient, Ct = 0.15 Overland or 0.40 for Drainage Ditch, P2= ITD Isoplival map,	Data	Sheet Flow	Sheet Flow	Sheet Flow	Other
	P2(in)=	1.6			
	L (ft) =	175			
	S (ft/ft)=	0.0200			
	Ct =	0.40			
	N =	0.011			
	Vavg=				
	Tc (min) =	2.68			

TC-Sheet Flow= $(0.007(L*N)^{0.8})/(P^{20.5}*(S^{0.4}))$

TC-Ditch Flow= $L/(3600*V_{Avg})$

TC-Storm Drain= $L/(3600*V_{Avg})$, where Velocity is calculated using Manning's Equation

Calculated Total Tc = 2.68 min

Calculated Peak Runoff using the Rational Method		
Estimated Rainfall Intensity based on Tc=	2.80	in/hr
Calculated Peak Runoff Rate (Q)=	0.42	cfs

BOWSTRING METHOD

Basin: YP. ROOF (BLDGS A-C)

Drywell Outflow (cfs):	0.00
Swale Outflow (cfs):	0.00
Swale Depth (ft):	3.00

Shallow Injection Well Type:	-
Typical Infiltration Rate:	2.0
Swale Bottom Area (SF):	1290

Time (min)	Time (sec)	Intensity (in/hr)	QDEV (cfs)	VIN (ft3)	VOUT (ft3)	Storage (ft3)
5	300	2.80	0.42	150	0	150
10	600	2.10	0.32	207	0	207
15	900	1.70	0.26	245	0	245
20	1200	1.60	0.24	303	0	303
25	1500	1.40	0.21	328	0	328
30	1800	1.20	0.18	336	0	336
35	2100	1.10	0.17	357	0	357
40	2400	0.95	0.14	352	0	352
45	2700	0.90	0.14	374	0	374
50	3000	0.87	0.13	401	0	401
55	3300	0.85	0.13	430	0	430
60	3600	0.78	0.12	430	0	430
65	3900	0.75	0.11	447	0	447
70	4200	0.70	0.11	449	0	449
75	4500	0.69	0.10	474	0	474
80	4800	0.67	0.10	490	0	490
85	5100	0.65	0.10	505	0	505
90	5400	0.63	0.09	518	0	518
95	5700	0.60	0.09	520	0	520
100	6000	0.59	0.09	538	0	538
105	6300	0.58	0.09	556	0	556
110	6600	0.55	0.08	552	0	552
115	6900	0.52	0.08	545	0	545
120	7200	0.50	0.08	547	0	547

GIA LARGEST TYP. ROOF (BLDGS A-C)

Storage Volume Required = 556 ft3

208 Swale Volume = 5321 ft3

DDDW= 115CF

Drywell Volume = 0 ft3

SDDW=80CF

Total Volume Provided = 5321 ft3

Required Treatment Volume = 304 ft3

Volume (CF)= $A_{imp} * 0.0417 \text{ (ft)} (0.5"/12")$

Treatment Volume Provided = 5,321 ft3