DRAINAGE ANALYSIS

FOR
Site Plan
60 Earls Way

LOCATED IN
FRANKLIN, MASSACHUSETTS

PREPARED FOR
LGK, LLC
60 Earls Way
Franklin, MA 02038

PREPARED BY
UNITED CONSULTANTS, INC.
850 FRANKLIN STREET, SUITE 11D
WRENTHAM, MA. 02093

DATE: March 17, 2025

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APPENDIX A

I. DESCRIPTION

This report is offered in support of the stormwater management system designed for the "Site Plan – For 60 Earls Way" in Franklin, Massachusetts. The primary goals of this system are to collect the stormwater runoff generated from the proposed parking area and building roof which are located to the rear of the existing building.
The storm water will be captured in deep sump hooded catch basins or water quality units with inlets and the piped to drain manholes and or water quality units and then will be direct it to the underground infiltration pond. Both the pre-development and post-development conditions flowing offsite are summarized in Appendix B.

II. Purpose

The purpose of this report is to examine the hydrological and hydraulic aspects of the proposed 60 Earls Way" Site Plan. This report was developed for review by the Town of Franklin Planning Board to obtain the necessary permits to allow the project to proceed.

This report considers the overall hydrological impact of proposed additional development upon the local watersheds with specific emphasis directed toward the adjacent and immediate downstream areas. The hydrology and criteria are consistent with the Town of Franklin Planning Board, and MASS DEP Storm Water Management Policies.

III. Pre-Development Conditions

The site consists of two parcels of land. The existing 60 Earls Way site contains 44,384 +/- square feet of land, when combined, Parcel A the total site area is 182,077 +/- sq. ft. The 60 Earls Way parcel is currently developed with an existing building and paved parking areas, utilities, and landscaping. The Parcel A portion of the project is currently wooded and un-developed. The upland soils for the site were taken from the soil survey of Norfolk and Suffolk counties. The soils are shown on the plan set. The A majority of the site soil type is classified as a hydrologic soil group A with a small section classified as a hydrologic soil group B. Soil testing was conducted on the site to determine soil types and permeability rates. See the soil logs and permeability test results located in Appendix F. Permeability tests were completed on site and the infiltration rate was calculated using 50 percent of the slowest rate.
Utilizing a Hydrocad computer model the pre-development and post development conditions were calculated. This included an analysis of the watershed utilizing Hydrologic soil groups A and B. A comparison of the pre-development vs. post development rate and volume of runoff can be found in Appendix B.

IV. Post Development Conditions

The proposed development will consist of the construction of a building with a footprint of 44,460 +/- sq. ft. on Parcel A. The existing paved driveway and parking areas will be utilized for the existing and the proposed buildings. New parking areas will be constructed.
Curbing will be added and the storm-water runoff will be directed to the proposed drainage system.
The sites storm-water will be captured in deep sump hooded catch basing or grated water quality units. The storm water from the deep sump hooded catch basins will be directed to water quality units and will then be directed to three underground infiltration areas. The proposed infiltration system will promote groundwater re-charge as required by the Town of Franklin Stormwater Regulations. Municipal utility connections are also included in the project. The proposal is to service the buildings with town water and a septic system. The drainage system for the building and parking area consists of a closed drainage system.
TSS removal will be accomplished by a treatment train. The site will be treated by either deep sump hooded catch basins, water quality unite and infiltration or water quality units and infiltration. Utilizing

the same computer model as the existing conditions we have modeled the changes in surfaces and ground cover and have calculated the post development conditions.
All calculations for the above have been included in this report. Pre-development calculations are in Appendix C. Post-development calculations are located in Appendix D.

V. Conclusion

Stormwater from the existing and proposed parking areas will be captured by the catch basins and a water quality unit for TSS removal which will then be directed to the three underground infiltration ponds. The proposed roof will be captured and directed to a underground infiltration ponds. The comparison in Appendix B summarizes the rate and volumes of runoff leaving the site in both the pre-development and post-development conditions. This comparison indicates that there is not an increase in the rate or volume of runoff during the 10-year or 100-year storm events. There is a slight increase during the 2-year storm event for the existing site area. This area is directed to the street drainage system and an infiltration basin so the slight increase will be directed to the existing infiltration basin.

VI. Stormwater Management Standards

Refer to Checklist for Stormwater Report in Appendix H

Town of Franklin Stormwater Management Bylaw – Chapter 153 – Bylaw Amendment 21-867

Impervious Coverage 60 Earls Way site =

1" x 144,184 sq. ft. impervious = 12,015 cubic feet (Required)

Storage in Pond 1 = 9,089 cubic feet

Storage in Pond 2 = 16,929cubic feet

Storage in Pond 3 = 691 cubic feet

Total Storage Provided = 26,709

This narrative is for the 60 Earls Way site

LID Measures

- No disturbance is proposed to any Wetland Resource Area.

Standard 1: No New Untreated Discharges
No new untreated discharges are proposed.
The existing site currently drains to the existing roadway stormwater system.. A stormwater system has been proposed to provide the required TSS removal which includes the installation of deep sump hooded catch basins, water quality units and infiltration basins.

Standard 2: Peak Rate Attenuation
The drainage system has been designed to match or reduce the rate and volume of storm-water runoff from the site when comparing the pre-development conditions to the post development conditions*. See Appendix B of this report for a summary of the design storms.
* The 2-yr storm has an increase to the street stormwater system which discharges to an infiltration basin.

Standard 3: Recharge

- Soil testing has been completed. See Appendix F or this report for permeability test results and sheet 4 for soil testing information.

- Drawdown within 72 hours
  Storage Volume below outlet = 4,306 cubic feet
  Pond 1
  Time = (9,089) / (2.63"/hr x 1'/12" x 6,097 sf. = 6.8 hours < 72 hours

  Pond 2
  Time = (16,929) / (11.15"/hr x 1'/12" x 9,132 sf. = 2.0 hours < 72 hours

  Pond 3
  Time = (691) / (2.63"/hr x 1'/12" x 366 sf. = 8.6 hours < 72 hours

Standard 4: Water Quality

- The owner will be responsible for compliance with standard four requirements.
- Refer to the Operation and Maintenance Plan and the Storm-water Facilities Plan for the Inspection and Maintenance Schedule and the Operation and Maintenance Schedule.
- See Appendix E for the Manufactures TSS removal rate. The site is not located within a zone II. The Infiltration Pond has been designed with an infiltration rate between 2.63 and 11.15 inches per hour. This led to the Water Quality unit being modeled with a 1" WQV.
- The proposed project will include deep sump hooded catch basins and six Water Quality Units, which will provide TSS removal. The summary of the Manufacturers' Predicted Net Annual results as well as the TSS Removal Worksheet are included.

Standard 5: Land uses with higher potential pollutant loads

None proposed.

Standard 6: Critical Areas

N/A

Standard 7: Re-developments and Other Projects

A portion of the site is being re-developed. The storm-water standards have been met for the entire site.

Standard 8: Construction Period Pollution Prevention and Erosion Sedimentation Control

- Refer to sheet 6 for the Inspection and Maintenance Schedule and the Operation and Maintenance Schedule.
- The project will be covered by a NPDES Construction General Permit. A SWPPP will be completed and a storm-water permit will be filed for with the Town of Franklin DPW prior to commencing with work.

Standard 9: Operation and Maintenance Plan

- Refer to sheet 6 for the Inspection and Maintenance Schedule and the Operation and Maintenance Schedule.
- The owner will be responsible for the storm-water management system, implementation of the operation and maintenance, the maintenance costs, and completion of the maintenance logs.

- Refer to sheet 6 for the Inspection and Maintenance Schedule and the Operation and Maintenance Schedule.

- Refer to the Operation and Maintenance Plan.

Standard 10: Prohibition of Illicit Discharges

- Owner to be responsible for compliance with avoiding illicit discharges.
- The site will be connected to the town sewer system.

Stage-Area-Storage for Pond 1P: Infiltration pond-1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
168.56	6,097	0
168.57	6,100	24
168.58	6,104	49
168.59	6,107	73
168.60	6,110	98
168.61	6,114	122
168.62	6,117	146
168.63	6,121	171
168.64	6,124	195
168.65	6,128	219
168.66	6,131	244
168.67	6,135	268
168.68	6,138	293
168.69	6,142	317
168.70	6,145	341
168.71	6,149	366
168.72	6,152	390
168.73	6,156	415
168.74	6,159	439
168.75	6,162	463
168.76	6,166	488
168.77	6,169	512
168.78	6,173	536
168.79	6,176	561
168.80	6,180	585
168.81	6,183	610
168.82	6,187	634
168.83	6,190	658
168.84	6,194	683
168.85	6,197	707
168.86	6,201	732
168.87	6,204	756
168.88	6,208	780
168.89	6,211	805
168.90	6,215	829
168.91	6,218	854
168.92	6,221	878
168.93	6,225	902
168.94	6,228	927
168.95	6,232	951
168.96	6,235	975
168.97	6,239	1,000
168.98	6,242	1,024
168.99	6,246	1,049
169.00	6,249	1,073
169.01	6,253	1,097
169.02	6,256	1,122
169.03	6,260	1,146
169.04	6,263	1,171
169.05	6,267	1,195
169.06	6,270	1,219
169.07	6,273	1,274
169.08	6,277	1,329
169.09	6,280	1,384
169.10	6,284	1,439
169.11	6,287	1,494
169.12	6,291	1,549
169.13	6,294	1,603
169.14	6,298	1,658
169.15	6,301	1,713
169.16	6,305	1,767
169.17	6,308	1,821
169.18	6,312	1,876
169.19	6,315	1,930
169.20	6,319	1,984
169.21	6,322	2,039
169.22	6,325	2,093
169.23	6,329	2,147
169.24	6,332	2,201
169.25	6,336	2,255
169.26	6,339	2,308
169.27	6,343	2,362
169.28	6,346	2,416
169.29	6,350	2,470
169.30	6,353	2,523
169.31	6,357	2,577
169.32	6,360	2,630
169.33	6,364	2,684
169.34	6,367	2,737
169.35	6,371	2,790
169.36	6,374	2,843
169.37	6,378	2,897
169.38	6,381	2,950
169.39	6,384	3,003
169.40	6,388	3,056
169.41	6,391	3,109
169.42	6,395	3,161
169.43	6,398	3,214
169.44	6,402	3,267
169.45	6,405	3,319
169.46	6,409	3,372
169.47	6,412	3,424
169.48	6,416	3,477
169.49	6,419	3,529
169.50	6,423	3,581
169.51	6,426	3,634
169.52	6,430	3,686
169.53	6,433	3,738
169.54	6,436	3,790
169.55	6,440	3,842
169.56	6,443	3,894
169.57	6,447	3,946
169.58	6,450	3,997
169.59	6,454	4,049

Stage-Area-Storage for Pond 1P: Infiltration pond-1 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
169.60	6,457	4,101	170.12	6,638	6,683
169.61	6,461	4,152	170.13	6,641	6,731
169.62	6,464	4,204	170.14	6,645	6,779
169.63	6,468	4,255	170.15	6,648	6,826
169.64	6,471	4,306	170.16	6,652	6,873
169.65	6,475	4,357	170.17	6,655	6,921
169.66	6,478	4,409	170.18	6,658	6,968
169.67	6,482	4,460	170.19	6,662	7,015
169.68	6,485	4,511	170.20	6,665	7,062
169.69	6,489	4,562	170.21	6,669	7,109
169.70	6,492	4,613	170.22	6,672	7,156
169.71	6,495	4,663	170.23	6,676	7,203
169.72	6,499	4,714	170.24	6,679	7,250
169.73	6,502	4,765	170.25	6,683	7,296
169.74	6,506	4,816	170.26	6,686	7,343
169.75	6,509	4,866	170.27	6,690	7,389
169.76	6,513	4,917	170.28	6,693	7,436
169.77	6,516	4,967	170.29	6,697	7,482
169.78	6,520	5,017	170.30	6,700	7,528
169.79	6,523	5,067	170.31	6,704	7,574
169.80	6,527	5,118	170.32	6,707	7,620
169.81	6,530	5,168	170.33	6,710	7,666
169.82	6,534	5,218	170.34	6,714	7,712
169.83	6,537	5,268	170.35	6,717	7,758
169.84	6,541	5,318	170.36	6,721	7,804
169.85	6,544	5,367	170.37	6,724	7,849
169.86	6,547	5,417	170.38	6,728	7,895
169.87	6,551	5,467	170.39	6,731	7,940
169.88	6,554	5,516	170.40	6,735	7,986
169.89	6,558	5,566	170.41	6,738	8,031
169.90	6,561	5,615	170.42	6,742	8,076
169.91	6,565	5,665	170.43	6,745	8,121
169.92	6,568	5,714	170.44	6,749	8,166
169.93	6,572	5,763	170.45	6,752	8,211
169.94	6,575	5,812	170.46	6,756	8,256
169.95	6,579	5,861	170.47	6,759	8,300
169.96	6,582	5,910	170.48	6,763	8,345
169.97	6,586	5,959	170.49	6,766	8,390
169.98	6,589	6,008	170.50	6,769	8,434
169.99	6,593	6,057	170.51	6,773	8,478
170.00	6,596	6,105	170.52	6,776	8,523
170.01	6,599	6,154	170.53	6,780	8,567
170.02	6,603	6,203	170.54	6,783	8,611
170.03	6,606	6,251	170.55	6,787	8,655
170.04	6,610	6,299	170.56	6,790	8,698
170.05	6,613	6,348	170.57	6,794	8,742
170.06	6,617	6,396	170.58	6,797	8,786
170.07	6,620	6,444	170.59	6,801	8,829
170.08	6,624	6,492	170.60	6,804	8,873
170.09	6,627	6,540	170.61	6,808	8,916
170.10	6,631	6,588	170.62	6,811	8,960
170.11	6,634	6,636	170.63	6,815	9,003

Stage-Area-Storage for Pond 1P: Infiltration pond-1 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
170.64	6,818	9,046
170.65	6,821	9,089
170.66	6,825	9,132
170.67	6,828	9,174
170.68	6,832	9,217
170.69	6,835	9,259
170.70	6,839	9,302
170.71	6,842	9,344
170.72	6,846	9,386
170.73	6,849	9,429
170.74	6,853	9,471
170.75	6,856	9,513
170.76	6,860	9,554
170.77	6,863	9,596
170.78	6,867	9,638
170.79	6,870	9,679
170.80	6,874	9,720
170.81	6,877	9,762
170.82	6,880	9,803
170.83	6,884	9,844
170.84	6,887	9,885
170.85	6,891	9,926
170.86	6,894	9,966
170.87	6,898	10,007
170.88	6,901	10,047
170.89	6,905	10,088
170.90	6,908	10,128
170.91	6,912	10,168
170.92	6,915	10,208
170.93	6,919	10,248
170.94	6,922	10,287
170.95	6,926	10,327
170.96	6,929	10,367
170.97	6,932	10,406
170.98	6,936	10,445
170.99	6,939	10,484
171.00	6,943	10,523
171.01	6,946	10,562
171.02	6,950	10,601
171.03	6,953	10,639
171.04	6,957	10,678
171.05	6,960	10,716
171.06	6,964	10,754
171.07	6,967	10,792
171.08	6,971	10,830
171.09	6,974	10,868
171.10	6,978	10,906
171.11	6,981	10,943
171.12	6,984	10,981
171.13	6,988	11,018
171.14	6,991	11,055
171.15	6,995	11,092
171.16	6,998	11,128
171.17	7,002	11,165
171.18	7,005	11,201
171.19	7,009	11,238
171.20	7,012	11,274
171.21	7,016	11,310
171.22	7,019	11,346
171.23	7,023	11,381
171.24	7,026	11,417
171.25	7,030	11,452
171.26	7,033	11,487
171.27	7,037	11,522
171.28	7,040	11,557
171.29	7,043	11,591
171.30	7,047	11,626
171.31	7,050	11,660
171.32	7,054	11,694
171.33	7,057	11,728
171.34	7,061	11,761
171.35	7,064	11,795
171.36	7,068	11,828
171.37	7,071	11,861
171.38	7,075	11,893
171.39	7,078	11,926
171.40	7,082	11,958
171.41	7,085	11,990
171.42	7,089	12,022
171.43	7,092	12,054
171.44	7,095	12,085
171.45	7,099	12,116
171.46	7,102	12,146
171.47	7,106	12,177
171.48	7,109	12,207
171.49	7,113	12,237
171.50	7,116	12,266
171.51	7,120	12,295
171.52	7,123	12,323
171.53	7,127	12,351
171.54	7,130	12,379
171.55	7,134	12,406
171.56	**7,137**	**12,431**

Stage-Area-Storage for Pond 2P: Infiltration pond-2

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
166.50	9,132	0
166.51	9,137	37
166.52	9,141	73
166.53	9,146	110
166.54	9,150	146
166.55	9,154	183
166.56	9,159	219
166.57	9,163	256
166.58	9,168	292
166.59	9,172	329
166.60	9,177	365
166.61	9,181	402
166.62	9,186	438
166.63	9,190	475
166.64	9,195	511
166.65	9,199	548
166.66	9,204	584
166.67	9,208	621
166.68	9,213	658
166.69	9,217	694
166.70	9,222	731
166.71	9,226	767
166.72	9,231	804
166.73	9,235	840
166.74	9,239	877
166.75	9,244	913
166.76	9,248	950
166.77	9,253	986
166.78	9,257	1,023
166.79	9,262	1,059
166.80	9,266	1,096
166.81	9,271	1,132
166.82	9,275	1,169
166.83	9,280	1,205
166.84	9,284	1,242
166.85	9,289	1,278
166.86	9,293	1,315
166.87	9,298	1,352
166.88	9,302	1,388
166.89	9,307	1,425
166.90	9,311	1,461
166.91	9,316	1,498
166.92	9,320	1,534
166.93	9,324	1,571
166.94	9,329	1,607
166.95	9,333	1,644
166.96	9,338	1,680
166.97	9,342	1,717
166.98	9,347	1,753
166.99	9,351	1,790
167.00	9,356	1,826
167.01	9,360	1,908
167.02	9,365	1,990
167.03	9,369	2,071
167.04	9,374	2,153
167.05	9,378	2,234
167.06	9,383	2,315
167.07	9,387	2,396
167.08	9,392	2,478
167.09	9,396	2,559
167.10	9,401	2,639
167.11	9,405	2,720
167.12	9,409	2,801
167.13	9,414	2,882
167.14	9,418	2,962
167.15	9,423	3,042
167.16	9,427	3,123
167.17	9,432	3,203
167.18	9,436	3,283
167.19	9,441	3,363
167.20	9,445	3,443
167.21	9,450	3,523
167.22	9,454	3,603
167.23	9,459	3,682
167.24	9,463	3,762
167.25	9,468	3,842
167.26	9,472	3,921
167.27	9,477	4,000
167.28	9,481	4,079
167.29	9,485	4,158
167.30	9,490	4,237
167.31	9,494	4,316
167.32	9,499	4,395
167.33	9,503	4,474
167.34	9,508	4,553
167.35	9,512	4,631
167.36	9,517	4,709
167.37	9,521	4,788
167.38	9,526	4,866
167.39	9,530	4,944
167.40	9,535	5,022
167.41	9,539	5,100
167.42	9,544	5,178
167.43	9,548	5,256
167.44	9,553	5,333
167.45	9,557	5,411
167.46	9,562	5,488
167.47	9,566	5,566
167.48	9,570	5,643
167.49	9,575	5,720
167.50	9,579	5,797
167.51	9,584	5,874
167.52	9,588	5,951
167.53	9,593	6,027

Stage-Area-Storage for Pond 2P: Infiltration pond-2 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
167.54	9,597	6,104
167.55	9,602	6,181
167.56	9,606	6,257
167.57	9,611	6,333
167.58	9,615	6,410
167.59	9,620	6,486
167.60	9,624	6,562
167.61	9,629	6,638
167.62	9,633	6,713
167.63	9,638	6,789
167.64	9,642	6,865
167.65	9,647	6,940
167.66	9,651	7,015
167.67	9,655	7,091
167.68	9,660	7,166
167.69	9,664	7,241
167.70	9,669	7,316
167.71	9,673	7,391
167.72	9,678	7,466
167.73	9,682	7,540
167.74	9,687	7,615
167.75	9,691	7,689
167.76	9,696	7,763
167.77	9,700	7,838
167.78	9,705	7,912
167.79	9,709	7,986
167.80	9,714	8,060
167.81	9,718	8,133
167.82	9,723	8,207
167.83	9,727	8,281
167.84	9,732	8,354
167.85	9,736	8,427
167.86	9,740	8,501
167.87	9,745	8,574
167.88	9,749	8,647
167.89	9,754	8,720
167.90	9,758	8,792
167.91	9,763	8,865
167.92	9,767	8,937
167.93	9,772	9,010
167.94	9,776	9,082
167.95	9,781	9,154
167.96	9,785	9,226
167.97	9,790	9,298
167.98	9,794	9,370
167.99	9,799	9,442
168.00	9,803	9,514
168.01	9,808	9,585
168.02	9,812	9,657
168.03	9,816	9,728
168.04	9,821	9,799
168.05	9,825	9,870
168.06	9,830	9,941
168.07	9,834	10,012
168.08	9,839	10,082
168.09	9,843	10,153
168.10	9,848	10,223
168.11	9,852	10,294
168.12	9,857	10,364
168.13	9,861	10,434
168.14	9,866	10,504
168.15	9,870	10,574
168.16	9,875	10,643
168.17	9,879	10,713
168.18	9,884	10,782
168.19	9,888	10,852
168.20	9,893	10,921
168.21	9,897	10,990
168.22	9,901	11,059
168.23	9,906	11,128
168.24	9,910	11,197
168.25	9,915	11,265
168.26	9,919	11,334
168.27	9,924	11,402
168.28	9,928	11,470
168.29	9,933	11,538
168.30	9,937	11,606
168.31	9,942	11,674
168.32	9,946	11,741
168.33	9,951	11,809
168.34	9,955	11,876
168.35	9,960	11,944
168.36	9,964	12,011
168.37	9,969	12,078
168.38	9,973	12,145
168.39	9,978	12,211
168.40	9,982	12,278
168.41	9,986	12,344
168.42	9,991	12,411
168.43	9,995	12,477
168.44	10,000	12,543
168.45	10,004	12,609
168.46	10,009	12,675
168.47	10,013	12,740
168.48	10,018	12,806
168.49	10,022	12,871
168.50	10,027	12,936
168.51	10,031	13,001
168.52	10,036	13,066
168.53	10,040	13,131
168.54	10,045	13,196
168.55	10,049	13,260
168.56	10,054	13,325
168.57	10,058	13,389

Stage-Area-Storage for Pond 2P: Infiltration pond-2 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
168.58	10,063	13,453
168.59	10,067	13,517
168.60	10,071	13,580
168.61	10,076	13,644
168.62	10,080	13,707
168.63	10,085	13,771
168.64	10,089	13,834
168.65	10,094	13,897
168.66	10,098	13,960
168.67	10,103	14,022
168.68	10,107	14,085
168.69	10,112	14,147
168.70	10,116	14,209
168.71	10,121	14,271
168.72	10,125	14,333
168.73	10,130	14,395
168.74	10,134	14,456
168.75	10,139	14,518
168.76	10,143	14,579
168.77	10,147	14,640
168.78	10,152	14,701
168.79	10,156	14,762
168.80	10,161	14,822
168.81	10,165	14,883
168.82	10,170	14,943
168.83	10,174	15,003
168.84	10,179	15,063
168.85	10,183	15,122
168.86	10,188	15,182
168.87	10,192	15,241
168.88	10,197	15,300
168.89	10,201	15,359
168.90	10,206	15,418
168.91	10,210	15,477
168.92	10,215	15,535
168.93	10,219	15,593
168.94	10,224	15,651
168.95	10,228	15,709
168.96	10,232	15,767
168.97	10,237	15,824
168.98	10,241	15,882
168.99	10,246	15,939
169.00	10,250	15,995
169.01	10,255	16,052
169.02	10,259	16,109
169.03	10,264	16,165
169.04	10,268	16,221
169.05	10,273	16,277
169.06	10,277	16,332
169.07	10,282	16,388
169.08	10,286	16,443
169.09	10,291	16,498
169.10	10,295	16,553
169.11	10,300	16,607
169.12	10,304	16,661
169.13	10,309	16,715
169.14	10,313	16,769
169.15	10,317	16,823
169.16	10,322	16,876
169.17	10,326	16,929
169.18	10,331	16,982
169.19	10,335	17,035
169.20	10,340	17,087
169.21	10,344	17,139
169.22	10,349	17,191
169.23	10,353	17,242
169.24	10,358	17,294
169.25	10,362	17,344
169.26	10,367	17,395
169.27	10,371	17,446
169.28	10,376	17,496
169.29	10,380	17,545
169.30	10,385	17,595
169.31	10,389	17,644
169.32	10,394	17,693
169.33	10,398	17,741
169.34	10,402	17,790
169.35	10,407	17,837
169.36	10,411	17,885
169.37	10,416	17,932
169.38	10,420	17,978
169.39	10,425	18,025
169.40	10,429	18,070
169.41	10,434	18,116
169.42	10,438	18,161
169.43	10,443	18,205
169.44	10,447	18,249
169.45	10,452	18,292
169.46	10,456	18,335
169.47	10,461	18,377
169.48	10,465	18,418
169.49	10,470	18,458
169.50	**10,474**	**18,496**

Stage-Area-Storage for Pond 3P: Infiltration pond-3

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
161.56	366	0
161.57	367	1
161.58	368	3
161.59	369	4
161.60	369	6
161.61	370	7
161.62	371	9
161.63	372	10
161.64	372	12
161.65	373	13
161.66	374	15
161.67	375	16
161.68	376	18
161.69	376	19
161.70	377	21
161.71	378	22
161.72	379	23
161.73	379	25
161.74	380	26
161.75	381	28
161.76	382	29
161.77	383	31
161.78	383	32
161.79	384	34
161.80	385	35
161.81	386	37
161.82	386	38
161.83	387	40
161.84	388	41
161.85	389	42
161.86	390	44
161.87	390	45
161.88	391	47
161.89	392	48
161.90	393	50
161.91	393	51
161.92	394	53
161.93	395	54
161.94	396	56
161.95	397	57
161.96	397	59
161.97	398	60
161.98	399	62
161.99	400	63
162.00	401	64
162.01	401	66
162.02	402	67
162.03	403	69
162.04	404	70
162.05	404	72
162.06	405	73
162.07	406	75
162.08	407	76
162.09	408	79
162.10	408	82
162.11	409	85
162.12	410	88
162.13	411	92
162.14	411	95
162.15	412	98
162.16	413	101
162.17	414	104
162.18	415	107
162.19	415	110
162.20	416	113
162.21	417	116
162.22	418	119
162.23	418	122
162.24	419	125
162.25	420	128
162.26	421	131
162.27	422	134
162.28	422	137
162.29	423	140
162.30	424	143
162.31	425	146
162.32	425	149
162.33	426	152
162.34	427	155
162.35	428	158
162.36	429	161
162.37	429	164
162.38	430	167
162.39	431	170
162.40	432	173
162.41	432	176
162.42	433	179
162.43	434	182
162.44	435	185
162.45	436	188
162.46	436	191
162.47	437	194
162.48	438	197
162.49	439	200
162.50	440	203
162.51	440	206
162.52	441	209
162.53	442	212
162.54	443	215
162.55	443	218
162.56	444	221
162.57	445	224
162.58	446	226
162.59	447	229

Stage-Area-Storage for Pond 3P: Infiltration pond-3 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
162.60	447	232	163.12	488	378
162.61	448	235	163.13	489	381
162.62	449	238	163.14	489	384
162.63	450	241	163.15	490	387
162.64	450	244	163.16	491	389
162.65	451	247	163.17	492	392
162.66	452	250	163.18	493	395
162.67	453	253	163.19	493	397
162.68	454	255	163.20	494	400
162.69	454	258	163.21	495	403
162.70	455	261	163.22	496	405
162.71	456	264	163.23	496	408
162.72	457	267	163.24	497	411
162.73	457	270	163.25	498	413
162.74	458	273	163.26	499	416
162.75	459	276	163.27	500	419
162.76	460	278	163.28	500	421
162.77	461	281	163.29	501	424
162.78	461	284	163.30	502	426
162.79	462	287	163.31	503	429
162.80	463	290	163.32	503	432
162.81	464	293	163.33	504	434
162.82	464	295	163.34	505	437
162.83	465	298	163.35	506	440
162.84	466	301	163.36	507	442
162.85	467	304	163.37	507	445
162.86	468	307	163.38	508	447
162.87	468	309	163.39	509	450
162.88	469	312	163.40	510	453
162.89	470	315	163.41	510	455
162.90	471	318	163.42	511	458
162.91	471	321	163.43	512	460
162.92	472	323	163.44	513	463
162.93	473	326	163.45	514	465
162.94	474	329	163.46	514	468
162.95	475	332	163.47	515	470
162.96	475	335	163.48	516	473
162.97	476	337	163.49	517	476
162.98	477	340	163.50	518	478
162.99	478	343	163.51	518	481
163.00	479	346	163.52	519	483
163.01	479	348	163.53	520	486
163.02	480	351	163.54	521	488
163.03	481	354	163.55	521	491
163.04	482	357	163.56	522	493
163.05	482	359	163.57	523	496
163.06	483	362	163.58	524	498
163.07	484	365	163.59	525	501
163.08	485	368	163.60	525	503
163.09	486	370	163.61	526	506
163.10	486	373	163.62	527	508
163.11	487	376	163.63	528	511

Stage-Area-Storage for Pond 3P: Infiltration pond-3 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
163.64	528	513
163.65	529	515
163.66	530	518
163.67	531	520
163.68	532	523
163.69	532	525
163.70	533	528
163.71	534	530
163.72	535	533
163.73	535	535
163.74	536	537
163.75	537	540
163.76	538	542
163.77	539	545
163.78	539	547
163.79	540	549
163.80	541	552
163.81	542	554
163.82	542	556
163.83	543	559
163.84	544	561
163.85	545	564
163.86	546	566
163.87	546	568
163.88	547	571
163.89	548	573
163.90	549	575
163.91	549	577
163.92	550	580
163.93	551	582
163.94	552	584
163.95	553	587
163.96	553	589
163.97	554	591
163.98	555	593
163.99	556	596
164.00	557	598
164.01	557	600
164.02	558	602
164.03	559	605
164.04	560	607
164.05	560	609
164.06	561	611
164.07	562	614
164.08	563	616
164.09	564	618
164.10	564	620
164.11	565	622
164.12	566	624
164.13	567	627
164.14	567	629
164.15	568	631
164.16	569	633
164.17	570	635
164.18	571	637
164.19	571	639
164.20	572	641
164.21	573	644
164.22	574	646
164.23	574	648
164.24	575	650
164.25	576	652
164.26	577	654
164.27	578	656
164.28	578	658
164.29	579	660
164.30	580	662
164.31	581	664
164.32	581	666
164.33	582	668
164.34	583	670
164.35	584	672
164.36	585	674
164.37	585	676
164.38	586	678
164.39	587	680
164.40	588	682
164.41	588	683
164.42	589	685
164.43	590	687
164.44	591	689
164.45	592	691
164.46	592	693
164.47	593	695
164.48	594	696
164.49	595	698
164.50	596	700
164.51	596	702
164.52	597	703
164.53	598	705
164.54	599	707
164.55	599	708
164.56	600	710
164.57	601	712
164.58	602	713
164.59	603	715
164.60	603	716
164.61	604	718
164.62	605	719
164.63	606	720
164.64	606	722
164.65	607	723
164.66	608	725
164.67	609	726

Stage-Area-Storage for Pond 3P: Infiltration pond-3 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
164.68	610	728
164.69	610	729
164.70	611	731
164.71	612	732
164.72	613	734
164.73	613	735
164.74	614	737
164.75	615	738
164.76	616	740
164.77	617	741
164.78	617	742
164.79	618	744
164.80	619	745
164.81	620	747
164.82	620	748
164.83	621	750
164.84	622	751
164.85	623	753
164.86	624	754
164.87	624	756
164.88	625	757
164.89	626	759
164.90	627	760
164.91	627	762
164.92	628	763
164.93	629	764
164.94	630	766
164.95	631	767
164.96	631	769
164.97	632	770
164.98	633	772
164.99	634	773
165.00	635	775
165.01	635	776
165.02	636	778
165.03	637	779
165.04	638	781
165.05	638	782
165.06	**639**	**783**

APPENDIX B

Pre-Development vs. Post Development Rate and Volume of Runoff

This analysis was prepared to show the summary of the pre-development and post development rate and volume of runoff as required by the Town of Franklin Storm-water Requirements.

The pre-development watershed area SP1 is located easterly from the northeast corner of the proposed development. The post-development comparison of this area is pond 4.

A comparison of the rate and volume for pre-development area SP1 and post-development Pond 4 is provided below:

2-year storm event (CFS)			2 year storm event (A.F.)		
Pre		Post	Pre		Post
SP1	vs	Pond 4P	SP1	vs	Pond 4P
0.00		0.00	0.000		0.000
10 year storm event (CFS)			10 year storm event (A.F.)		
Pre		Post	Pre		Post
SP1	vs	Pond 4P	SP1	vs	Pond 4P
0.05		0.00	0.029		0.000
100 year storm event (CFS)			100 year storm event (A.F.)		
Pre		Post	Pre		Post
SP1	vs	Pond 4P	SP1	vs	Pond 4P
1.25		0.48	0.264		0.020

The westerly portion of the site is currently developed and in the pre-development conditions is SP2 and in the post-development conditions is also SP2. In both the pre-development and pos-development SP2 is directed to the Earls Way drainage system which discharges into a detention basin.

A comparison of the rate and volume for pre-development area SP2 and post-development SP2 is provided below:

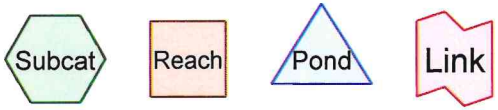
2-year storm event (CFS)			2 year storm event (A.F.)		
Pre		Post	Pre		Post
SP2	vs	SP2	SP2	vs	SP2
1.53		1.65	0.128		0.134
10 year storm event (CFS)			10 year storm event (A.F.)		
Pre		Post	Pre		Post
SP2	vs	SP2	SP2	vs	SP2
3.32		3.18	0.270		0.260
100 year storm event (CFS)			100 year storm event (A.F.)		
Pre		Post	Pre		Post
SP2	vs	SP2	SP2	vs	SP2
6.39		5.68	0.524		0.474

With the exception of the two year storm at study point SP2 there is a reduction in both the rate of runoff and volume of runoff. As noted above, the existing site is directed to the street stormwater system.

APPENDIX C

Northeast - SP1

WEST TO EARLS WAY
- SP2



Drainage Diagram for UC1598-PRE
Prepared by {enter your company name here} 5/12/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
3.571	30	Woods, Good, HSG A (SP1,SP2)
0.189	39	>75% Grass cover, Good, HSG A (SP2)
0.692	55	Woods, Good, HSG B (SP1)
0.768	98	Paved parking & roofs (SP2)
5.222		

2 YR PRE-DEVELOPMENT

Subcatchment SP1: Northeast - SP1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
146,952	30	Woods, Good, HSG A
30,158	55	Woods, Good, HSG B
177,110	34	Weighted Average
177,110		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	46	0.0769	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.0	7	0.2860	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.2	64	0.0317	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	22	0.1818	2.13		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.9	88	0.0230	0.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	33	0.0610	1.23		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	75	0.0267	0.82		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	57	0.1754	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	138	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	172	0.0058	0.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.0	702	Total			

Subcatchment SP2: WEST TO EARLS WAY - SP2

Runoff = 1.53 cfs @ 12.15 hrs, Volume= 0.128 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
33,471	98	Paved parking & roofs
8,247	39	>75% Grass cover, Good, HSG A
8,621	30	Woods, Good, HSG A
50,339	77	Weighted Average
16,868		Pervious Area
33,471		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.2833	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
4.7	20	0.0339	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	39	0.0339	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	48	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	145	0.0156	2.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	282	Total			

10 YR PRE-DEVELOPMENT

Subcatchment SP1: Northeast - SP1

Runoff = 0.05 cfs @ 15.42 hrs, Volume= 0.029 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-noaa Rainfall=5.22"

Area (sf)	CN	Description
146,952	30	Woods, Good, HSG A
30,158	55	Woods, Good, HSG B
177,110	34	Weighted Average
177,110		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	46	0.0769	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.0	7	0.2860	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.2	64	0.0317	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	22	0.1818	2.13		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.9	88	0.0230	0.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	33	0.0610	1.23		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	75	0.0267	0.82		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	57	0.1754	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	138	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	172	0.0058	0.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.0	702	Total			

Subcatchment SP2: WEST TO EARLS WAY - SP2

Runoff = 3.32 cfs @ 12.14 hrs, Volume= 0.270 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-noaa Rainfall=5.22"

Area (sf)	CN	Description
33,471	98	Paved parking & roofs
8,247	39	>75% Grass cover, Good, HSG A
8,621	30	Woods, Good, HSG A
50,339	77	Weighted Average
16,868		Pervious Area
33,471		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.2833	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
4.7	20	0.0339	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	39	0.0339	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	48	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	145	0.0156	2.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	282	Total			

100 YR PRE-DEVELOPMENT

Subcatchment SP1: Northeast - SP1

Runoff = 1.25 cfs @ 12.54 hrs, Volume= 0.264 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR-noaa Rainfall=8.18"

Area (sf)	CN	Description
146,952	30	Woods, Good, HSG A
30,158	55	Woods, Good, HSG B
177,110	34	Weighted Average
177,110		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	46	0.0769	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.0	7	0.2860	2.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.2	64	0.0317	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	22	0.1818	2.13		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.9	88	0.0230	0.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	33	0.0610	1.23		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	75	0.0267	0.82		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	57	0.1754	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	138	0.0435	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	172	0.0058	0.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.0	702	Total			

Subcatchment SP2: WEST TO EARLS WAY - SP2

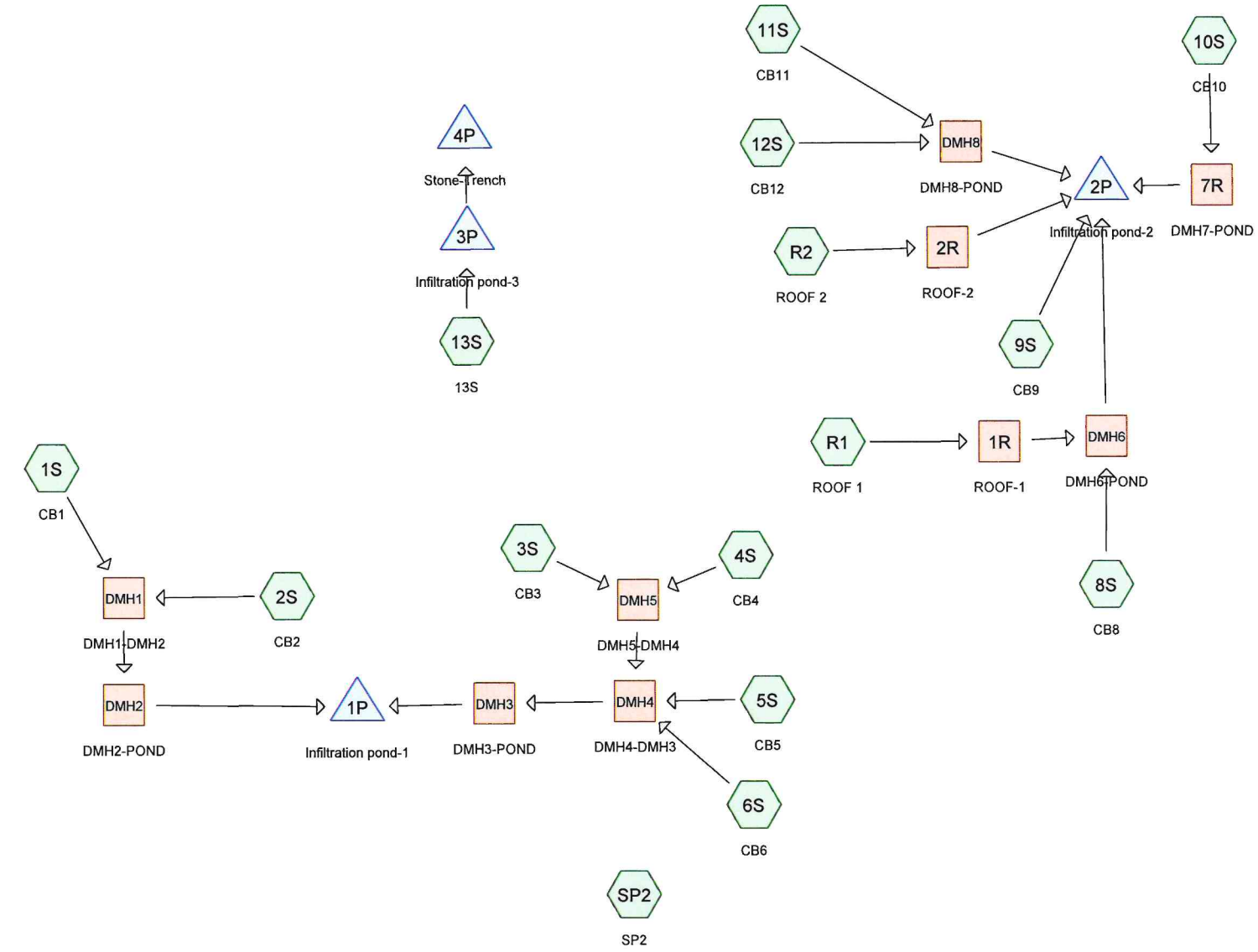
Runoff = 6.39 cfs @ 12.14 hrs, Volume= 0.524 af, Depth= 5.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR-noaa Rainfall=8.18"

Area (sf)	CN	Description
33,471	98	Paved parking & roofs
8,247	39	>75% Grass cover, Good, HSG A
8,621	30	Woods, Good, HSG A
50,339	77	Weighted Average
16,868		Pervious Area
33,471		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.2833	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
4.7	20	0.0339	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	39	0.0339	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	48	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	145	0.0156	2.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	282	Total			

APPENDIX D



Drainage Diagram for UC1598-post

Prepared by {enter your company name here} 5/12/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
0.669	30	Woods, Good, HSG A (9S,10S,13S,SP2)
1.043	39	>75% Grass cover, Good, HSG A (1S,2S,3S,4S,5S,6S,8S,9S,10S,11S,12S,13S,SP2)
0.048	55	Woods, Good, HSG B (13S)
0.174	61	>75% Grass cover, Good, HSG B (1S,2S,12S,13S)
3.390	98	Paved parking & roofs (1S,2S,3S,4S,5S,6S,8S,9S,10S,11S,12S,R1,R2,SP2)
5.323		

2 YR POST-DEVELOPMENT

Subcatchment 1S: CB1

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
5,965	98	Paved parking & roofs
633	39	>75% Grass cover, Good, HSG A
49	61	>75% Grass cover, Good, HSG B
6,647	92	Weighted Average
682		Pervious Area
5,965		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.5	110	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.5	110	Total			

Subcatchment 2S: CB2

Runoff = 0.53 cfs @ 12.09 hrs, Volume= 0.038 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
8,673	98	Paved parking & roofs
3,083	39	>75% Grass cover, Good, HSG A
144	61	>75% Grass cover, Good, HSG B
11,900	82	Weighted Average
3,227		Pervious Area
8,673		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	16	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	16	Total			

Subcatchment 3S: CB3

Runoff = 0.34 cfs @ 12.09 hrs, Volume= 0.025 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
4,950	98	Paved parking & roofs
1,070	39	>75% Grass cover, Good, HSG A
6,020	88	Weighted Average
1,070		Pervious Area
4,950		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.2	46	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.2	46	Total			

Subcatchment 4S: CB4

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
3,896	98	Paved parking & roofs
704	39	>75% Grass cover, Good, HSG A
4,600	89	Weighted Average
704		Pervious Area
3,896		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	18	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	18	Total			

Subcatchment 5S: CB5

Runoff = 0.19 cfs @ 12.11 hrs, Volume= 0.016 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
4,960	98	Paved parking & roofs
5,637	39	>75% Grass cover, Good, HSG A
10,597	67	Weighted Average
5,637		Pervious Area
4,960		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.5	99	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.5	99	Total			

Subcatchment 6S: CB6

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
1,656	98	Paved parking & roofs
633	39	>75% Grass cover, Good, HSG A
2,289	82	Weighted Average
633		Pervious Area
1,656		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	53	0.0400	9.83	7.72	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	53	Total			

Subcatchment 8S: CB8

Runoff = 0.17 cfs @ 12.11 hrs, Volume= 0.015 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
5,201	98	Paved parking & roofs
6,492	39	>75% Grass cover, Good, HSG A
11,693	65	Weighted Average
6,492		Pervious Area
5,201		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.0	7	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.0	7	Total			

Subcatchment 9S: CB9

Runoff = 0.01 cfs @ 13.63 hrs, Volume= 0.006 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
4,943	98	Paved parking & roofs
10,748	39	>75% Grass cover, Good, HSG A
8,627	30	Woods, Good, HSG A
24,318	48	Weighted Average
19,375		Pervious Area
4,943		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	21	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	21	Total			

Subcatchment 10S: CB10

Runoff = 0.42 cfs @ 12.11 hrs, Volume= 0.040 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
16,148	98	Paved parking & roofs
5,374	39	>75% Grass cover, Good, HSG A
13,750	30	Woods, Good, HSG A
35,272	63	Weighted Average
19,124		Pervious Area
16,148		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	51	0.0330	8.93	7.01	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	51	Total			

Subcatchment 11S: CB11

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.035 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
7,467	98	Paved parking & roofs
1,893	39	>75% Grass cover, Good, HSG A
9,360	86	Weighted Average
1,893		Pervious Area
7,467		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	33	0.0300	8.51	6.69	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	33	Total			

Subcatchment 12S: CB12

Runoff = 0.62 cfs @ 12.10 hrs, Volume= 0.047 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
8,589	98	Paved parking & roofs
500	39	>75% Grass cover, Good, HSG A
398	61	>75% Grass cover, Good, HSG B
9,487	93	Weighted Average
898		Pervious Area
8,589		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.8	208	0.0081	4.42	3.47	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.8	208	Total			

Subcatchment 13S: 13S

Runoff = 0.01 cfs @ 12.55 hrs, Volume= 0.005 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
2,889	39	>75% Grass cover, Good, HSG A
6,968	61	>75% Grass cover, Good, HSG B
2,994	30	Woods, Good, HSG A
2,081	55	Woods, Good, HSG B
14,932	50	Weighted Average
14,932		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	20	0.3000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
3.0	20	0.1000	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.2	10	0.0530	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.4	29	0.0530	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	111	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	114	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.4	304	Total			

Subcatchment R1: ROOF 1

Runoff = 1.61 cfs @ 12.10 hrs, Volume= 0.133 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
22,230	98	Paved parking & roofs
22,230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, MIN TC**
1.0	342	0.0100	5.90	4.63	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
7.0	342	Total			

Subcatchment R2: ROOF 2

Runoff = 1.61 cfs @ 12.10 hrs, Volume= 0.133 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
22,230	98	Paved parking & roofs
22,230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, MIN TC**
1.0	337	0.0100	5.90	4.63	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
7.0	337	Total			

Subcatchment SP2: SP2

Runoff = 1.65 cfs @ 12.14 hrs, Volume= 0.134 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR-NOAA Rainfall=3.36"

Area (sf)	CN	Description
30,745	98	Paved parking & roofs
5,792	39	>75% Grass cover, Good, HSG A
3,756	30	Woods, Good, HSG A
40,293	83	Weighted Average
9,548		Pervious Area
30,745		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.2833	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
4.7	20	0.0339	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	39	0.0339	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	48	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	145	0.0156	2.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	282	Total			

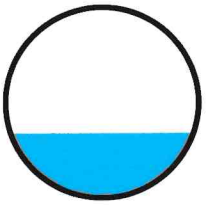
Reach 1R: ROOF-1

Inflow Area = 0.510 ac, Inflow Depth = 3.13" for 2YR-NOAA event
Inflow = 1.61 cfs @ 12.10 hrs, Volume= 0.133 af
Outflow = 1.61 cfs @ 12.10 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.90 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 6.55 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0200 '/'
Inlet Invert= 169.57', Outlet Invert= 168.97'



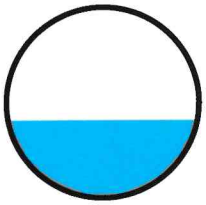
Reach 2R: ROOF-2

Inflow Area = 0.510 ac, Inflow Depth = 3.13" for 2YR-NOAA event
Inflow = 1.61 cfs @ 12.10 hrs, Volume= 0.133 af
Outflow = 1.61 cfs @ 12.10 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.36 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 4.63 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 169.22', Outlet Invert= 169.13'



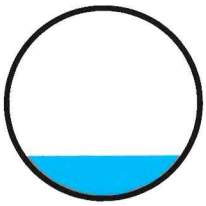
Reach 7R: DMH7-POND

Inflow Area = 0.810 ac, Inflow Depth = 0.59" for 2YR-NOAA event
Inflow = 0.42 cfs @ 12.11 hrs, Volume= 0.040 af
Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.23 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.11 hrs, Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 168.22', Outlet Invert= 168.13'



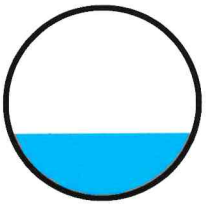
Reach DMH1: DMH1-DMH2

Inflow Area = 0.426 ac, Inflow Depth = 1.97" for 2YR-NOAA event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 0.070 af
Outflow = 0.96 cfs @ 12.09 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.08 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 0.2 min

Peak Storage= 3 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 13.0' Slope= 0.0100 '/'
Inlet Invert= 170.35', Outlet Invert= 170.22'



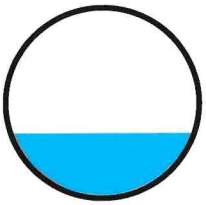
Reach DMH2: DMH2-POND

Inflow Area = 0.426 ac, Inflow Depth = 1.97" for 2YR-NOAA event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 0.070 af
Outflow = 0.96 cfs @ 12.09 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.08 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 3.0' Slope= 0.0100 '/'
Inlet Invert= 170.22', Outlet Invert= 170.19'



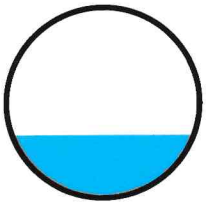
Reach DMH3: DMH3-POND

Inflow Area = 0.540 ac, Inflow Depth = 1.50" for 2YR-NOAA event
Inflow = 0.90 cfs @ 12.10 hrs, Volume= 0.067 af
Outflow = 0.90 cfs @ 12.10 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 3.0' Slope= 0.0100 '/'
Inlet Invert= 170.22', Outlet Invert= 170.19'



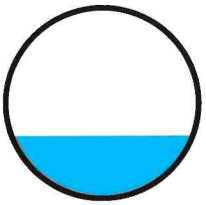
Reach DMH4: DMH4-DMH3

Inflow Area = 0.540 ac, Inflow Depth = 1.50" for 2YR-NOAA event
Inflow = 0.90 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.90 cfs @ 12.10 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 170.31', Outlet Invert= 170.22'



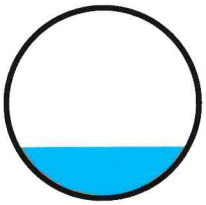
Reach DMH5: DMH5-DMH4

Inflow Area = 0.244 ac, Inflow Depth = 2.18" for 2YR-NOAA event
Inflow = 0.62 cfs @ 12.09 hrs, Volume= 0.044 af
Outflow = 0.62 cfs @ 12.09 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.60 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 170.61', Outlet Invert= 170.51'



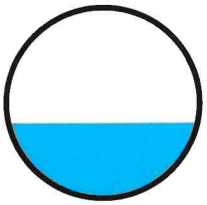
Reach DMH6: DMH6-POND

Inflow Area = 0.779 ac, Inflow Depth = 2.28" for 2YR-NOAA event
Inflow = 1.78 cfs @ 12.10 hrs, Volume= 0.148 af
Outflow = 1.78 cfs @ 12.10 hrs, Volume= 0.148 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.22 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 0.3 min

Peak Storage= 11 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 5.46 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 37.0' Slope= 0.0200 '/'
Inlet Invert= 168.87', Outlet Invert= 168.13'



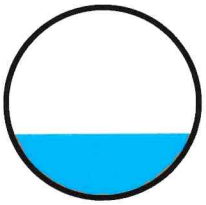
Reach DMH8: DMH8-POND

Inflow Area = 0.433 ac, Inflow Depth = 2.29" for 2YR-NOAA event
Inflow = 1.12 cfs @ 12.09 hrs, Volume= 0.083 af
Outflow = 1.12 cfs @ 12.09 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.85 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.58 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 4.63 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 168.22', Outlet Invert= 168.13'



Pond 1P: Infiltration pond-1

Inflow Area = 0.965 ac, Inflow Depth = 1.70" for 2YR-NOAA event
Inflow = 1.86 cfs @ 12.09 hrs, Volume= 0.137 af
Outflow = 0.38 cfs @ 12.54 hrs, Volume= 0.137 af, Atten= 79%, Lag= 26.9 min
Discarded = 0.38 cfs @ 12.54 hrs, Volume= 0.137 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 169.11' @ 12.54 hrs Surf.Area= 6,097 sf Storage= 1,510 cf

Plug-Flow detention time= 24.4 min calculated for 0.137 af (100% of inflow)
Center-of-Mass det. time= 24.4 min (848.3 - 823.9)

Volume	Invert	Avail.Storage	Storage Description
#1	168.56'	3,906 cf	**49.00'W x 124.42'L x 3.00'H Prismatoid**
			18,290 cf Overall - 8,526 cf Embedded = 9,764 cf x 40.0% Voids
#2	169.06'	8,526 cf	**51.0"W x 30.0"H x 7.08'L Parabolic Arch** x 170 Inside #1
		12,431 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	168.50'	**2.630 in/hr Exfiltration over Wetted area above invert**
			Excluded Wetted area = 0 sf

Discarded OutFlow Max=0.38 cfs @ 12.54 hrs HW=169.11' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.38 cfs)

Pond 2P: Infiltration pond-2

Inflow Area = 3.090 ac, Inflow Depth = 1.59" for 2YR-NOAA event
Inflow = 4.92 cfs @ 12.10 hrs, Volume= 0.409 af
Outflow = 2.40 cfs @ 12.28 hrs, Volume= 0.409 af, Atten= 51%, Lag= 10.7 min
Discarded = 2.40 cfs @ 12.28 hrs, Volume= 0.409 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 166.90' @ 12.28 hrs Surf.Area= 9,132 sf Storage= 1,448 cf

Plug-Flow detention time= 2.7 min calculated for 0.409 af (100% of inflow)
Center-of-Mass det. time= 2.7 min (791.4 - 788.7)

Volume	Invert	Avail.Storage	Storage Description
#1	166.50'	5,934 cf	**53.75'W x 169.90'L x 3.00'H Prismatoid**
			27,396 cf Overall - 12,563 cf Embedded = 14,834 cf x 40.0% Voids
#2	167.00'	12,563 cf	**51.0"W x 30.0"H x 7.01'L Parabolic Arch** x 253 Inside #1
		18,496 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.40'	**11.150 in/hr Exfiltration over Wetted area above invert**
			Excluded Wetted area = 0 sf

Discarded OutFlow Max=2.40 cfs @ 12.28 hrs HW=166.90' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.40 cfs)

Pond 3P: Infiltration pond-3

Inflow Area = 0.343 ac, Inflow Depth = 0.16" for 2YR-NOAA event
Inflow = 0.01 cfs @ 12.55 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 12.61 hrs, Volume= 0.005 af, Atten= 5%, Lag= 4.0 min
Discarded = 0.01 cfs @ 12.61 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 161.58' @ 12.61 hrs Surf.Area= 366 sf Storage= 3 cf

Plug-Flow detention time= 3.8 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 3.8 min (1,004.6 - 1,000.8)

Volume	Invert	Avail.Storage	Storage Description
#1	161.56'	332 cf	**15.75'W x 23.25'L x 3.50'H Prismatoid** 1,282 cf Overall - 451 cf Embedded = 830 cf x 40.0% Voids
#2	162.08'	451 cf	**51.0"W x 30.0"H x 7.08'L Parabolic Arch** x 9 Inside #1
		783 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	161.50'	**2.630 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 0 sf
#2	Primary	164.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 12.61 hrs HW=161.58' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=161.56' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 4P: Stone-Trench

Inflow Area = 0.343 ac, Inflow Depth = 0.00" for 2YR-NOAA event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 163.00' @ 0.00 hrs Surf.Area= 0.003 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	0.003 af	**3.00'W x 38.00'L x 3.00'H Prismatoid** 0.008 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.630 in/hr Exfiltration over Surface area**
#2	Primary	165.00'	**38.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**1=Exfiltration** (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

10 YR POST-DEVELOPMENT

Subcatchment 1S: CB1

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 4.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
5,965	98	Paved parking & roofs
633	39	>75% Grass cover, Good, HSG A
49	61	>75% Grass cover, Good, HSG B
6,647	92	Weighted Average
682		Pervious Area
5,965		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.5	110	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.5	110	Total			

Subcatchment 2S: CB2

Runoff = 1.04 cfs @ 12.09 hrs, Volume= 0.075 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
8,673	98	Paved parking & roofs
3,083	39	>75% Grass cover, Good, HSG A
144	61	>75% Grass cover, Good, HSG B
11,900	82	Weighted Average
3,227		Pervious Area
8,673		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	16	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	16	Total			

Subcatchment 3S: CB3

Runoff = 0.61 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 3.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
4,950	98	Paved parking & roofs
1,070	39	>75% Grass cover, Good, HSG A
6,020	88	Weighted Average
1,070		Pervious Area
4,950		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.2	46	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.2	46	Total			

Subcatchment 4S: CB4

Runoff = 0.48 cfs @ 12.09 hrs, Volume= 0.035 af, Depth= 3.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
3,896	98	Paved parking & roofs
704	39	>75% Grass cover, Good, HSG A
4,600	89	Weighted Average
704		Pervious Area
3,896		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	18	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	18	Total			

Subcatchment 5S: CB5

Runoff = 0.53 cfs @ 12.10 hrs, Volume= 0.040 af, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
4,960	98	Paved parking & roofs
5,637	39	>75% Grass cover, Good, HSG A
10,597	67	Weighted Average
5,637		Pervious Area
4,960		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.5	99	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.5	99	Total			

Subcatchment 6S: CB6

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
1,656	98	Paved parking & roofs
633	39	>75% Grass cover, Good, HSG A
2,289	82	Weighted Average
633		Pervious Area
1,656		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	53	0.0400	9.83	7.72	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	53	Total			

Subcatchment 8S: CB8

Runoff = 0.54 cfs @ 12.09 hrs, Volume= 0.040 af, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
5,201	98	Paved parking & roofs
6,492	39	>75% Grass cover, Good, HSG A
11,693	65	Weighted Average
6,492		Pervious Area
5,201		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.0	7	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.0	7	Total			

Subcatchment 9S: CB9

Runoff = 0.25 cfs @ 12.13 hrs, Volume= 0.031 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
4,943	98	Paved parking & roofs
10,748	39	>75% Grass cover, Good, HSG A
8,627	30	Woods, Good, HSG A
24,318	48	Weighted Average
19,375		Pervious Area
4,943		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	21	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	21	Total			

Subcatchment 10S: CB10

Runoff = 1.47 cfs @ 12.10 hrs, Volume= 0.111 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
16,148	98	Paved parking & roofs
5,374	39	>75% Grass cover, Good, HSG A
13,750	30	Woods, Good, HSG A
35,272	63	Weighted Average
19,124		Pervious Area
16,148		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	51	0.0330	8.93	7.01	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	51	Total			

Subcatchment 11S: CB11

Runoff = 0.91 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
7,467	98	Paved parking & roofs
1,893	39	>75% Grass cover, Good, HSG A
9,360	86	Weighted Average
1,893		Pervious Area
7,467		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	33	0.0300	8.51	6.69	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	33	Total			

Subcatchment 12S: CB12

Runoff = 1.03 cfs @ 12.09 hrs, Volume= 0.080 af, Depth= 4.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
8,589	98	Paved parking & roofs
500	39	>75% Grass cover, Good, HSG A
398	61	>75% Grass cover, Good, HSG B
9,487	93	Weighted Average
898		Pervious Area
8,589		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.8	208	0.0081	4.42	3.47	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.8	208	Total			

Subcatchment 13S: 13S

Runoff = 0.17 cfs @ 12.25 hrs, Volume= 0.022 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
2,889	39	>75% Grass cover, Good, HSG A
6,968	61	>75% Grass cover, Good, HSG B
2,994	30	Woods, Good, HSG A
2,081	55	Woods, Good, HSG B
14,932	50	Weighted Average
14,932		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	20	0.3000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
3.0	20	0.1000	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.2	10	0.0530	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.4	29	0.0530	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	111	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	114	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.4	304	Total			

Subcatchment R1: ROOF 1

Runoff = 2.52 cfs @ 12.10 hrs, Volume= 0.212 af, Depth= 4.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
22,230	98	Paved parking & roofs
22,230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, MIN TC**
1.0	342	0.0100	5.90	4.63	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
7.0	342	Total			

Subcatchment R2: ROOF 2

Runoff = 2.52 cfs @ 12.10 hrs, Volume= 0.212 af, Depth= 4.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
22,230	98	Paved parking & roofs
22,230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, MIN TC**
1.0	337	0.0100	5.90	4.63	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
7.0	337	Total			

Subcatchment SP2: SP2

Runoff = 3.18 cfs @ 12.14 hrs, Volume= 0.260 af, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR-NOAA Rainfall=5.22"

Area (sf)	CN	Description
30,745	98	Paved parking & roofs
5,792	39	>75% Grass cover, Good, HSG A
3,756	30	Woods, Good, HSG A
40,293	83	Weighted Average
9,548		Pervious Area
30,745		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.2833	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
4.7	20	0.0339	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	39	0.0339	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	48	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	145	0.0156	2.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	282	Total			

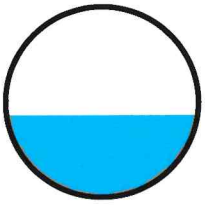
Reach 1R: ROOF-1

Inflow Area = 0.510 ac, Inflow Depth = 4.98" for 10YR-NOAA event
Inflow = 2.52 cfs @ 12.10 hrs, Volume= 0.212 af
Outflow = 2.52 cfs @ 12.10 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.79 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.63 fps, Avg. Travel Time= 0.2 min

Peak Storage= 10 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 6.55 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0200 '/'
Inlet Invert= 169.57', Outlet Invert= 168.97'



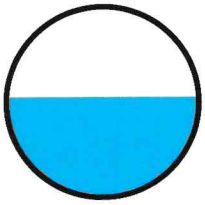
Reach 2R: ROOF-2

Inflow Area = 0.510 ac, Inflow Depth = 4.98" for 10YR-NOAA event
Inflow = 2.52 cfs @ 12.10 hrs, Volume= 0.212 af
Outflow = 2.52 cfs @ 12.10 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.02 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.06 fps, Avg. Travel Time= 0.1 min

Peak Storage= 4 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 4.63 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 169.22', Outlet Invert= 169.13'



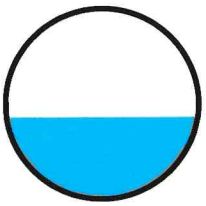
Reach 7R: DMH7-POND

Inflow Area = 0.810 ac, Inflow Depth = 1.65" for 10YR-NOAA event
Inflow = 1.47 cfs @ 12.10 hrs, Volume= 0.111 af
Outflow = 1.47 cfs @ 12.10 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.58 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 168.22', Outlet Invert= 168.13'



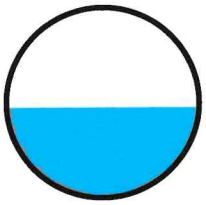
Reach DMH1: DMH1-DMH2

Inflow Area = 0.426 ac, Inflow Depth = 3.64" for 10YR-NOAA event
Inflow = 1.76 cfs @ 12.09 hrs, Volume= 0.129 af
Outflow = 1.76 cfs @ 12.09 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.80 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.55 fps, Avg. Travel Time= 0.1 min

Peak Storage= 5 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 13.0' Slope= 0.0100 '/'
Inlet Invert= 170.35', Outlet Invert= 170.22'



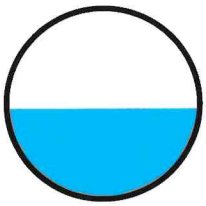
Reach DMH2: DMH2-POND

Inflow Area = 0.426 ac, Inflow Depth = 3.64" for 10YR-NOAA event
Inflow = 1.76 cfs @ 12.09 hrs, Volume= 0.129 af
Outflow = 1.76 cfs @ 12.09 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.80 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.55 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 3.0' Slope= 0.0100 '/'
Inlet Invert= 170.22', Outlet Invert= 170.19'



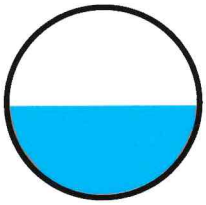
Reach DMH3: DMH3-POND

Inflow Area = 0.540 ac, Inflow Depth = 2.97" for 10YR-NOAA event
Inflow = 1.81 cfs @ 12.09 hrs, Volume= 0.134 af
Outflow = 1.81 cfs @ 12.09 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 3.0' Slope= 0.0100 '/'
Inlet Invert= 170.22', Outlet Invert= 170.19'



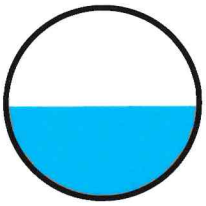
Reach DMH4: DMH4-DMH3

Inflow Area = 0.540 ac, Inflow Depth = 2.97" for 10YR-NOAA event
Inflow = 1.81 cfs @ 12.09 hrs, Volume= 0.134 af
Outflow = 1.81 cfs @ 12.09 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 170.31', Outlet Invert= 170.22'



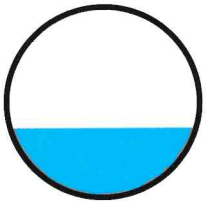
Reach DMH5: DMH5-DMH4

Inflow Area = 0.244 ac, Inflow Depth = 3.92" for 10YR-NOAA event
Inflow = 1.08 cfs @ 12.09 hrs, Volume= 0.080 af
Outflow = 1.08 cfs @ 12.09 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.22 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 170.61', Outlet Invert= 170.51'



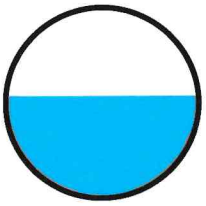
Reach DMH6: DMH6-POND

Inflow Area = 0.779 ac, Inflow Depth = 3.89" for 10YR-NOAA event
Inflow = 3.06 cfs @ 12.10 hrs, Volume= 0.252 af
Outflow = 3.06 cfs @ 12.10 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.15 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.43 fps, Avg. Travel Time= 0.3 min

Peak Storage= 16 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 5.46 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 37.0' Slope= 0.0200 '/'
Inlet Invert= 168.87', Outlet Invert= 168.13'



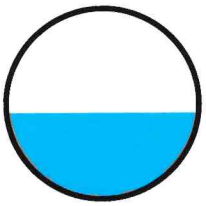
Reach DMH8: DMH8-POND

Inflow Area = 0.433 ac, Inflow Depth = 4.05" for 10YR-NOAA event
Inflow = 1.93 cfs @ 12.09 hrs, Volume= 0.146 af
Outflow = 1.93 cfs @ 12.09 hrs, Volume= 0.146 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.63 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 4.63 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 168.22', Outlet Invert= 168.13'



Pond 1P: Infiltration pond-1

Inflow Area = 0.965 ac, Inflow Depth = 3.27" for 10YR-NOAA event
Inflow = 3.57 cfs @ 12.09 hrs, Volume= 0.263 af
Outflow = 0.39 cfs @ 12.87 hrs, Volume= 0.263 af, Atten= 89%, Lag= 46.7 min
Discarded = 0.39 cfs @ 12.87 hrs, Volume= 0.263 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 169.58' @ 12.87 hrs Surf.Area= 6,097 sf Storage= 4,022 cf

Plug-Flow detention time= 79.1 min calculated for 0.263 af (100% of inflow)
Center-of-Mass det. time= 79.1 min (887.0 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1	168.56'	3,906 cf	**49.00'W x 124.42'L x 3.00'H Prismatoid**
			18,290 cf Overall - 8,526 cf Embedded = 9,764 cf x 40.0% Voids
#2	169.06'	8,526 cf	**51.0"W x 30.0"H x 7.08'L Parabolic Arch** x 170 Inside #1
		12,431 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	168.50'	**2.630 in/hr Exfiltration over Wetted area above invert**
			Excluded Wetted area = 0 sf

Discarded OutFlow Max=0.39 cfs @ 12.87 hrs HW=169.58' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.39 cfs)

Pond 2P: Infiltration pond-2

Inflow Area = 3.090 ac, Inflow Depth = 2.92" for 10YR-NOAA event
Inflow = 9.21 cfs @ 12.10 hrs, Volume= 0.753 af
Outflow = 2.48 cfs @ 12.48 hrs, Volume= 0.753 af, Atten= 73%, Lag= 23.1 min
Discarded = 2.48 cfs @ 12.48 hrs, Volume= 0.753 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 167.53' @ 12.48 hrs Surf.Area= 9,132 sf Storage= 6,029 cf

Plug-Flow detention time= 11.7 min calculated for 0.752 af (100% of inflow)
Center-of-Mass det. time= 11.7 min (798.1 - 786.5)

Volume	Invert	Avail.Storage	Storage Description
#1	166.50'	5,934 cf	**53.75'W x 169.90'L x 3.00'H Prismatoid**
			27,396 cf Overall - 12,563 cf Embedded = 14,834 cf x 40.0% Voids
#2	167.00'	12,563 cf	**51.0"W x 30.0"H x 7.01'L Parabolic Arch** x 253 Inside #1
		18,496 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.40'	**11.150 in/hr Exfiltration over Wetted area above invert**
			Excluded Wetted area = 0 sf

Discarded OutFlow Max=2.48 cfs @ 12.48 hrs HW=167.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.48 cfs)

Pond 3P: Infiltration pond-3

Inflow Area = 0.343 ac, Inflow Depth = 0.78" for 10YR-NOAA event
Inflow = 0.17 cfs @ 12.25 hrs, Volume= 0.022 af
Outflow = 0.03 cfs @ 14.44 hrs, Volume= 0.022 af, Atten= 83%, Lag= 131.2 min
Discarded = 0.03 cfs @ 14.44 hrs, Volume= 0.022 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 162.82' @ 14.44 hrs Surf.Area= 366 sf Storage= 296 cf

Plug-Flow detention time= 110.8 min calculated for 0.022 af (100% of inflow)
Center-of-Mass det. time= 110.8 min (1,027.2 - 916.4)

Volume	Invert	Avail.Storage	Storage Description
#1	161.56'	332 cf	**15.75'W x 23.25'L x 3.50'H Prismatoid** 1,282 cf Overall - 451 cf Embedded = 830 cf x 40.0% Voids
#2	162.08'	451 cf	**51.0"W x 30.0"H x 7.08'L Parabolic Arch** x 9 Inside #1
		783 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	161.50'	**2.630 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 0 sf
#2	Primary	164.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.03 cfs @ 14.44 hrs HW=162.82' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=161.56' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 4P: Stone-Trench

Inflow Area = 0.343 ac, Inflow Depth = 0.00" for 10YR-NOAA event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 163.00' @ 0.00 hrs Surf.Area= 0.003 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	0.003 af	**3.00'W x 38.00'L x 3.00'H Prismatoid** 0.008 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.630 in/hr Exfiltration over Surface area**
#2	Primary	165.00'	**38.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**1=Exfiltration** (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

100 YR POST-DEVELOPMENT

Subcatchment 1S: CB1

Runoff = 1.17 cfs @ 12.09 hrs, Volume= 0.092 af, Depth= 7.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
5,965	98	Paved parking & roofs
633	39	>75% Grass cover, Good, HSG A
49	61	>75% Grass cover, Good, HSG B
6,647	92	Weighted Average
682		Pervious Area
5,965		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.5	110	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.5	110	Total			

Subcatchment 2S: CB2

Runoff = 1.88 cfs @ 12.09 hrs, Volume= 0.137 af, Depth= 6.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
8,673	98	Paved parking & roofs
3,083	39	>75% Grass cover, Good, HSG A
144	61	>75% Grass cover, Good, HSG B
11,900	82	Weighted Average
3,227		Pervious Area
8,673		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	16	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	16	Total			

Subcatchment 3S: CB3

Runoff = 1.03 cfs @ 12.09 hrs, Volume= 0.078 af, Depth= 6.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
4,950	98	Paved parking & roofs
1,070	39	>75% Grass cover, Good, HSG A
6,020	88	Weighted Average
1,070		Pervious Area
4,950		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.2	46	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.2	46	Total			

Subcatchment 4S: CB4

Runoff = 0.80 cfs @ 12.09 hrs, Volume= 0.060 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
3,896	98	Paved parking & roofs
704	39	>75% Grass cover, Good, HSG A
4,600	89	Weighted Average
704		Pervious Area
3,896		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	18	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	18	Total			

Subcatchment 5S: CB5

Runoff = 1.20 cfs @ 12.10 hrs, Volume= 0.087 af, Depth= 4.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
4,960	98	Paved parking & roofs
5,637	39	>75% Grass cover, Good, HSG A
10,597	67	Weighted Average
5,637		Pervious Area
4,960		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.5	99	0.0050	3.47	2.73	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.5	99	Total			

Subcatchment 6S: CB6

Runoff = 0.36 cfs @ 12.09 hrs, Volume= 0.026 af, Depth= 6.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
1,656	98	Paved parking & roofs
633	39	>75% Grass cover, Good, HSG A
2,289	82	Weighted Average
633		Pervious Area
1,656		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	53	0.0400	9.83	7.72	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	53	Total			

Subcatchment 8S: CB8

Runoff = 1.27 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
5,201	98	Paved parking & roofs
6,492	39	>75% Grass cover, Good, HSG A
11,693	65	Weighted Average
6,492		Pervious Area
5,201		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.0	7	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.0	7	Total			

Subcatchment 9S: CB9

Runoff = 1.26 cfs @ 12.10 hrs, Volume= 0.100 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
4,943	98	Paved parking & roofs
10,748	39	>75% Grass cover, Good, HSG A
8,627	30	Woods, Good, HSG A
24,318	48	Weighted Average
19,375		Pervious Area
4,943		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	21	0.0100	4.91	3.86	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	21	Total			

Subcatchment 10S: CB10

Runoff = 3.59 cfs @ 12.09 hrs, Volume= 0.257 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
16,148	98	Paved parking & roofs
5,374	39	>75% Grass cover, Good, HSG A
13,750	30	Woods, Good, HSG A
35,272	63	Weighted Average
19,124		Pervious Area
16,148		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	51	0.0330	8.93	7.01	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	51	Total			

Subcatchment 11S: CB11

Runoff = 1.56 cfs @ 12.09 hrs, Volume= 0.116 af, Depth= 6.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
7,467	98	Paved parking & roofs
1,893	39	>75% Grass cover, Good, HSG A
9,360	86	Weighted Average
1,893		Pervious Area
7,467		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.1	33	0.0300	8.51	6.69	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.1	33	Total			

Subcatchment 12S: CB12

Runoff = 1.66 cfs @ 12.09 hrs, Volume= 0.133 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
8,589	98	Paved parking & roofs
500	39	>75% Grass cover, Good, HSG A
398	61	>75% Grass cover, Good, HSG B
9,487	93	Weighted Average
898		Pervious Area
8,589		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, pavement**
0.8	208	0.0081	4.42	3.47	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.8	208	Total			

Subcatchment 13S: 13S

Runoff = 0.68 cfs @ 12.20 hrs, Volume= 0.067 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
2,889	39	>75% Grass cover, Good, HSG A
6,968	61	>75% Grass cover, Good, HSG B
2,994	30	Woods, Good, HSG A
2,081	55	Woods, Good, HSG B
14,932	50	Weighted Average
14,932		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	20	0.3000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
3.0	20	0.1000	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.2	10	0.0530	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.4	29	0.0530	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	111	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	114	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.4	304	Total			

Subcatchment R1: ROOF 1

Runoff = 3.96 cfs @ 12.10 hrs, Volume= 0.338 af, Depth= 7.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
22,230	98	Paved parking & roofs
22,230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, MIN TC**
1.0	342	0.0100	5.90	4.63	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
7.0	342	Total			

Subcatchment R2: ROOF 2

Runoff = 3.96 cfs @ 12.10 hrs, Volume= 0.338 af, Depth= 7.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
22,230	98	Paved parking & roofs
22,230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, MIN TC**
1.0	337	0.0100	5.90	4.63	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
7.0	337	Total			

Subcatchment SP2: SP2

Runoff = 5.68 cfs @ 12.14 hrs, Volume= 0.474 af, Depth= 6.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR--NOAA Rainfall=8.18"

Area (sf)	CN	Description
30,745	98	Paved parking & roofs
5,792	39	>75% Grass cover, Good, HSG A
3,756	30	Woods, Good, HSG A
40,293	83	Weighted Average
9,548		Pervious Area
30,745		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.2833	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
4.7	20	0.0339	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	39	0.0339	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	48	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	145	0.0156	2.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	282	Total			

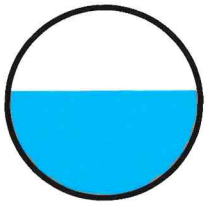
Reach 1R: ROOF-1

Inflow Area = 0.510 ac, Inflow Depth = 7.94" for 100YR--NOAA event
Inflow = 3.96 cfs @ 12.10 hrs, Volume= 0.338 af
Outflow = 3.96 cfs @ 12.10 hrs, Volume= 0.338 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.73 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.03 fps, Avg. Travel Time= 0.2 min

Peak Storage= 14 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 6.55 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0200 '/'
Inlet Invert= 169.57', Outlet Invert= 168.97'



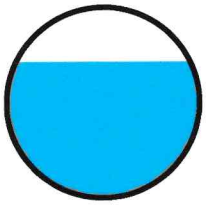
Reach 2R: ROOF-2

Inflow Area = 0.510 ac, Inflow Depth = 7.94" for 100YR--NOAA event
Inflow = 3.96 cfs @ 12.10 hrs, Volume= 0.338 af
Outflow = 3.96 cfs @ 12.10 hrs, Volume= 0.338 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.63 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.38 fps, Avg. Travel Time= 0.1 min

Peak Storage= 5 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 4.63 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 169.22', Outlet Invert= 169.13'



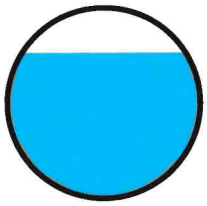
Reach 7R: DMH7-POND

Inflow Area = 0.810 ac, Inflow Depth = 3.81" for 100YR--NOAA event
Inflow = 3.59 cfs @ 12.09 hrs, Volume= 0.257 af
Outflow = 3.58 cfs @ 12.09 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.58 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.20 fps, Avg. Travel Time= 0.1 min

Peak Storage= 6 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.76'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 168.22', Outlet Invert= 168.13'



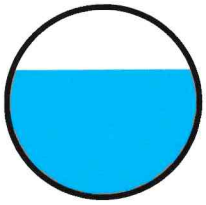
Reach DMH1: DMH1-DMH2

Inflow Area = 0.426 ac, Inflow Depth = 6.46" for 100YR--NOAA event
Inflow = 3.04 cfs @ 12.09 hrs, Volume= 0.229 af
Outflow = 3.04 cfs @ 12.09 hrs, Volume= 0.229 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.45 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.81 fps, Avg. Travel Time= 0.1 min

Peak Storage= 7 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 13.0' Slope= 0.0100 '/'
Inlet Invert= 170.35', Outlet Invert= 170.22'



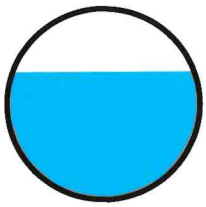
Reach DMH2: DMH2-POND

Inflow Area = 0.426 ac, Inflow Depth = 6.46" for 100YR--NOAA event
Inflow = 3.04 cfs @ 12.09 hrs, Volume= 0.229 af
Outflow = 3.04 cfs @ 12.09 hrs, Volume= 0.229 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.45 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.81 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 3.0' Slope= 0.0100 '/'
Inlet Invert= 170.22', Outlet Invert= 170.19'



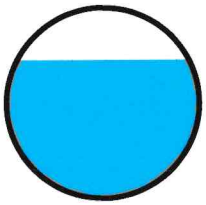
Reach DMH3: DMH3-POND

Inflow Area = 0.540 ac, Inflow Depth = 5.58" for 100YR--NOAA event
Inflow = 3.37 cfs @ 12.09 hrs, Volume= 0.251 af
Outflow = 3.37 cfs @ 12.09 hrs, Volume= 0.251 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.54 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 3.0' Slope= 0.0100 '/'
Inlet Invert= 170.22', Outlet Invert= 170.19'



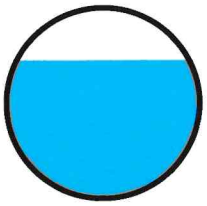
Reach DMH4: DMH4-DMH3

Inflow Area = 0.540 ac, Inflow Depth = 5.58" for 100YR--NOAA event
Inflow = 3.38 cfs @ 12.09 hrs, Volume= 0.251 af
Outflow = 3.37 cfs @ 12.09 hrs, Volume= 0.251 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.54 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 0.1 min

Peak Storage= 5 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 170.31', Outlet Invert= 170.22'



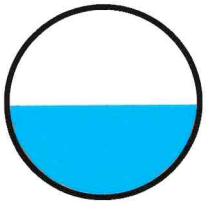
Reach DMH5: DMH5-DMH4

Inflow Area = 0.244 ac, Inflow Depth = 6.80" for 100YR--NOAA event
Inflow = 1.82 cfs @ 12.09 hrs, Volume= 0.138 af
Outflow = 1.82 cfs @ 12.09 hrs, Volume= 0.138 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 0.1 min

Peak Storage= 4 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 3.86 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 170.61', Outlet Invert= 170.51'



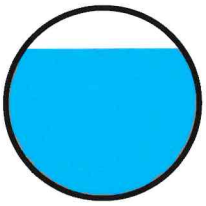
Reach DMH6: DMH6-POND

Inflow Area = 0.779 ac, Inflow Depth = 6.60" for 100YR--NOAA event
Inflow = 5.22 cfs @ 12.10 hrs, Volume= 0.428 af
Outflow = 5.22 cfs @ 12.10 hrs, Volume= 0.428 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.91 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.83 fps, Avg. Travel Time= 0.2 min

Peak Storage= 24 cf @ 12.10 hrs, Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 5.46 cfs

12.0" Diameter Pipe, n= 0.012 Concrete pipe, finished
Length= 37.0' Slope= 0.0200 '/'
Inlet Invert= 168.87', Outlet Invert= 168.13'



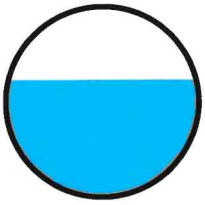
Reach DMH8: DMH8-POND

Inflow Area = 0.433 ac, Inflow Depth = 6.93" for 100YR--NOAA event
Inflow = 3.22 cfs @ 12.09 hrs, Volume= 0.250 af
Outflow = 3.22 cfs @ 12.09 hrs, Volume= 0.250 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.37 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.13 fps, Avg. Travel Time= 0.1 min

Peak Storage= 5 cf @ 12.09 hrs, Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 4.63 cfs

12.0" Diameter Pipe, n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0100 '/'
Inlet Invert= 168.22', Outlet Invert= 168.13'



Pond 1P: Infiltration pond-1

Inflow Area = 0.965 ac, Inflow Depth = 5.97" for 100YR--NOAA event
Inflow = 6.42 cfs @ 12.09 hrs, Volume= 0.480 af
Outflow = 0.42 cfs @ 13.75 hrs, Volume= 0.480 af, Atten= 94%, Lag= 99.7 min
Discarded = 0.42 cfs @ 13.75 hrs, Volume= 0.480 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 170.65' @ 13.75 hrs Surf.Area= 6,097 sf Storage= 9,100 cf

Plug-Flow detention time= 195.3 min calculated for 0.480 af (100% of inflow)
Center-of-Mass det. time= 195.3 min (988.4 - 793.2)

Volume	Invert	Avail.Storage	Storage Description
#1	168.56'	3,906 cf	**49.00'W x 124.42'L x 3.00'H Prismatoid**
			18,290 cf Overall - 8,526 cf Embedded = 9,764 cf x 40.0% Voids
#2	169.06'	8,526 cf	**51.0"W x 30.0"H x 7.08'L Parabolic Arch** x 170 Inside #1
		12,431 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	168.50'	**2.630 in/hr Exfiltration over Wetted area above invert**
			Excluded Wetted area = 0 sf

Discarded OutFlow Max=0.42 cfs @ 13.75 hrs HW=170.65' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Pond 2P: Infiltration pond-2

Inflow Area = 3.090 ac, Inflow Depth = 5.33" for 100YR--NOAA event
Inflow = 17.23 cfs @ 12.10 hrs, Volume= 1.372 af
Outflow = 2.67 cfs @ 12.60 hrs, Volume= 1.372 af, Atten= 85%, Lag= 30.5 min
Discarded = 2.67 cfs @ 12.60 hrs, Volume= 1.372 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 169.17' @ 12.60 hrs Surf.Area= 9,132 sf Storage= 16,950 cf

Plug-Flow detention time= 40.4 min calculated for 1.372 af (100% of inflow)
Center-of-Mass det. time= 40.4 min (822.4 - 782.1)

Volume	Invert	Avail.Storage	Storage Description
#1	166.50'	5,934 cf	**53.75'W x 169.90'L x 3.00'H Prismatoid**
			27,396 cf Overall - 12,563 cf Embedded = 14,834 cf x 40.0% Voids
#2	167.00'	12,563 cf	**51.0"W x 30.0"H x 7.01'L Parabolic Arch** x 253 Inside #1
		18,496 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.40'	**11.150 in/hr Exfiltration over Wetted area above invert**
			Excluded Wetted area = 0 sf

Discarded OutFlow Max=2.67 cfs @ 12.60 hrs HW=169.17' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.67 cfs)

Pond 3P: Infiltration pond-3

Inflow Area = 0.343 ac, Inflow Depth = 2.36" for 100YR--NOAA event
Inflow = 0.68 cfs @ 12.20 hrs, Volume= 0.067 af
Outflow = 0.47 cfs @ 12.41 hrs, Volume= 0.067 af, Atten= 32%, Lag= 12.5 min
Discarded = 0.04 cfs @ 12.41 hrs, Volume= 0.042 af
Primary = 0.43 cfs @ 12.41 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 164.45' @ 12.41 hrs Surf.Area= 366 sf Storage= 692 cf

Plug-Flow detention time= 148.8 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 148.8 min (1,024.9 - 876.0)

Volume	Invert	Avail.Storage	Storage Description
#1	161.56'	332 cf	**15.75'W x 23.25'L x 3.50'H Prismatoid** 1,282 cf Overall - 451 cf Embedded = 830 cf x 40.0% Voids
#2	162.08'	451 cf	**51.0"W x 30.0"H x 7.08'L Parabolic Arch** x 9 Inside #1
		783 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	161.50'	**2.630 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 0 sf
#2	Primary	164.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.04 cfs @ 12.41 hrs HW=164.45' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.43 cfs @ 12.41 hrs HW=164.45' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.43 cfs @ 2.29 fps)

Pond 4P: Stone-Trench

Inflow Area = 0.343 ac, Inflow Depth = 0.88" for 100YR--NOAA event
Inflow = 0.43 cfs @ 12.41 hrs, Volume= 0.025 af
Outflow = 0.49 cfs @ 12.40 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.01 cfs @ 12.31 hrs, Volume= 0.005 af
Primary = 0.48 cfs @ 12.40 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 165.03' @ 12.40 hrs Surf.Area= 0.003 ac Storage= 0.002 af

Plug-Flow detention time= 32.7 min calculated for 0.025 af (100% of inflow)
Center-of-Mass det. time= 32.7 min (831.6 - 798.9)

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	0.003 af	**3.00'W x 38.00'L x 3.00'H Prismatoid** 0.008 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.630 in/hr Exfiltration over Surface area**
#2	Primary	165.00'	**38.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.01 cfs @ 12.31 hrs HW=163.10' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.43 cfs @ 12.40 hrs HW=165.03' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.43 cfs @ 0.41 fps)

APPENDIX E

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

CB 1, CB 2, CB 3, CB 4, CB 5, CB 6, CB 11, CB 12 to DMH 2, DMH 3, + DMH 8

Location: 60 Earls Way

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Contech Vortechnic Separator	0.50	0.75	0.375	0.375

Total TSS Removal = 62.5%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: UC 1598

Prepared By: RJG

Date: 3-2025

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 60 Earls Way CB 8, CB 9 + CB 10

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Contech Hydrodynamic Separator	0.50	1.00	0.50	0.50

Total TSS Removal = 50%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 12-1598

Prepared By: NKL

Date: 3-2025

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 60 Early Way Infiltration Units 1, 2+3

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Cultec Recharger	0.80	1.00	0.80	0.20

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: UC1598

Prepared By: KKL

Date: 3-2025

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

APPENDIX F

GP FIELD DATA SHEET — SECTION 1: SITE INFORMATION

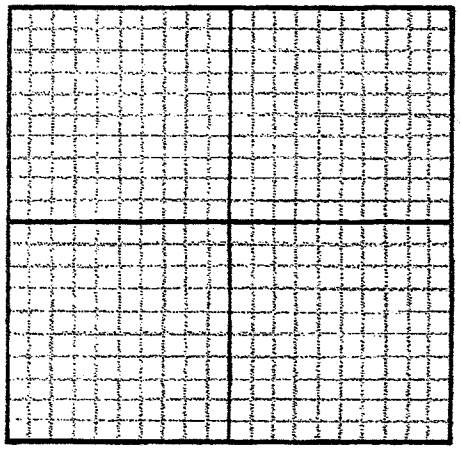
Date 6/7/23 Investigator CARLOS SOLVITAL

Site Location 60 EARLS WAY

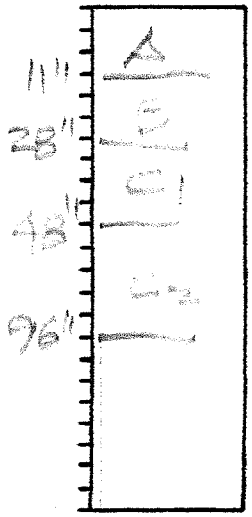
Dominant Soil Type(s) Hanford loamy sand

Site Map:

TP#1



Soil Profile Description (horizon depth, texture, structure, color, etc.):



Depth	Description
	10YR 3/2 S.L.
	10YR 5/4 S.L.
	2.5Y 5/6 GRAVELS
	2.5Y 6/3 L.S.

Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

MOTTLES @ 72" - 10YR 4/4

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025, Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

SOILMOISTURE®

Guelph Permeameter Calculations

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structuredsoils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 3.5700

$\alpha^* =$ 0.12 (cm^{-1})

$C =$ 0.80315
$Q =$ 2.09559

$K_{fs} =$ 3.81E-03 cm/sec
2.29E-01 cm/min
3.81E-05 m/sec
9.00E-02 inch/min
1.50E-03 inch/sec

$\Phi_m =$ 3.18E-02 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 6.8600

$\alpha^* =$ 0.12 (cm^{-1})

$C =$ 1.28754
$Q =$ 3.43982

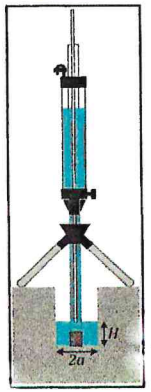
$K_{fs} =$ 3.73E-03 cm/sec
2.24E-01 cm/min
3.73E-05 m/sec
8.80E-02 inch/min
1.47E-03 inch/sec

$\Phi_m =$ 3.11E-02 (cm^2/min)

Average

$K_{fs} =$ 3.77E-03 cm/sec
2.26E-01 cm/min
3.77E-05 m/s
8.90E-02 inch/min
1.48E-03 inch/sec

$\Phi_m =$ 3.14E-02 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 3.5700

Steady State Rate of Water Level Change ("R2" in cm/min): 6.8600

1.95

$Q_1 =$ 0.12852

$Q_2 =$ 0.21096

$C_1 =$ 0.80315

$C_2 =$ 1.28754

$G_1 =$ 0.00498

$G_2 =$ 0.00397

$G_3 =$ 0.05569

$G_4 =$ 0.02415

$K_{fs} =$ 2.01E-04 cm/sec
1.21E-02 cm/min
2.01E-06 m/sec
4.75E-03 inch/min
7.92E-05 inch/sec

$\Phi_m =$ 2.06E-03 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is macroscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils fom clays through loams; also includes unstructured nedium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_3 = \frac{(2H_1^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Guelph Permeameter Data Sheet

Investigator: CARLOS QUINTAL Date: 6/7/23

Location: 60 CARLS WAY Test Id: PT # 1

Depth of hole: 48" Radius: 3cm (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35,22

Water level in well = 5 cm				
Time t (min)	Dt (min)	Water level in reservoir h (cm)	Dh (cm)	Rate of change Dh/ Dt
0		18		
0:20	0,33	20	2	6,0
1:40	1,33	25	5	3,75
2:55	1.25	30	5	4,00
4:15	1.33	35	5	3,75
5:39	1.40	40	5	3,57
7:02	1.38	45	5	3,61
8:26	1.40	50	5	3,57
9:55	1.48	55	5	3,37
11:25	1.50	60	5	3,33
12:53	1.47	65	5	3,41
14:23	1.50	70	5	3,33
Steady rate for 3 consecutive readings (R_1):				3,57

Water level in well = 10 cm				
Time t (min)	Dt (min)	Water level in reservoir h (cm)	Dh (cm)	Rate of change Dh/ Dt
0		24		
0:50	0,83	30	6	7,20
2:30	1.67	40	10	6,0
3:20	0,83	45	5	6,0
4:12	0.87	50	5	5,75
5:02	0.83	55	5	6,0
5:53	0.85	60	5	5,88
7:38	1.75	70	10	5,71
8:31	0.88	75	5	5,66
Steady rate for 3 consecutive readings (R_2):				5,86

Comments:

K_f = 0,089 in/min = 5,34 in/hr

GP FIELD DATA SHEET — SECTION 1: SITE INFORMATION

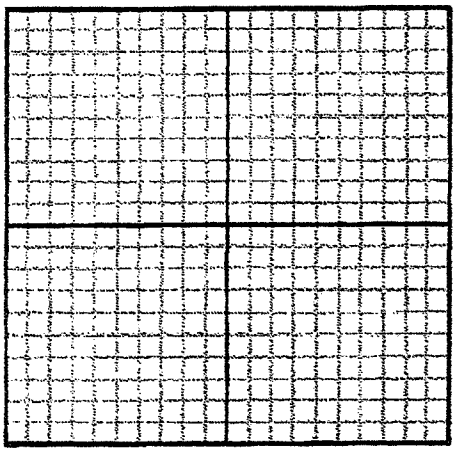
Date 6/2/23 Investigator CARLOS QUINTAL

Site Location 60 EARLS WAY

Dominant Soil Type(s) Hueneme loamy sand

Site Map:

TP #2



Soil Profile Description (horizon depth, texture, structure, color, etc.):

Depth	Description
8" A	10YR 3/2 S.L.
22" B	10YR 5/4 S.L.
C_1	gravel
	7.5Y 5/3
132" C_2	loamy sand

Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

C_2 moist

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025, Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

Guelph Permeameter Calculations

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 2.1100

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 0.80315
$Q =$ 1.23857

$K_{fs} =$ 3.73E-03 cm/sec
2.24E-01 cm/min
3.73E-06 m/sec
8.80E-02 inch/min
1.47E-03 inch/sec

$\Phi_m =$ 1.03E-02 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 4.1000

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 1.28754
$Q =$ 2.4067

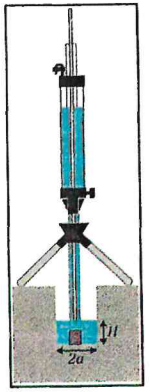
$K_{fs} =$ 3.69E-03 cm/sec
2.22E-01 cm/min
3.69E-05 m/ses
8.72E-02 inch/min
1.45E-03 inch/sec

$\Phi_m =$ 1.03E-02 (cm^2/min)

Average

$K_{fs} =$ 3.71E-03 cm/sec
2.23E-01 cm/min
3.71E-05 m/s
8.76E-02 inch/min
1.46E-03 inch/sec

$\Phi_m =$ 1.03E-02 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 2.1100

Steady State Rate of Water Level Change ("R2" in cm/min): 4.1000

1.95

$Q_1 =$ 0.07598

$Q_2 =$ 0.1476

$C_1 =$ 0.80316

$C_2 =$ 1.28754

$G_1 =$ 0.00496

$G_2 =$ 0.00397

$G_3 =$ 0.05569

$G_4 =$ 0.02415

$K_{fs} =$ 2.10E-04 cm/sec
1.26E-02 cm/min
2.10E-06 m/sec
4.96E-03 inch/min
8.26E-05 inch/sec

$\Phi_m =$ 6.66E-04 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is macroscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.635}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.635}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.653}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.653}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{a^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Guelph Permeameter Data Sheet

Investigator: CARLOS QUINTAL Date: 6/7/23

Location: 50 EARLS WAY Test Id: PT #2

Depth of hole: 30" Radius: 3 cm (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35.22

Water level in well = 5 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		17		
1:10	1.17	20	3	2.57
3:20	2.17	25	5	2.31
5:32	2.20	30	5	2.19
8:01	2.40	35	5	2.08
10:28	2.45	40	5	2.04
12:50	2.37	45	5	2.11
15:45	2.92	51	6	2.06
18:14	2.52	56	5	1.99
20:01	1.75	60	4	2.29
22:32	2.52	65	5	1.99
24:53	2.35	70	5	2.13
27:23	2.50	75	5	2.0
Steady rate for 3 consecutive readings (R_1):				2.11

Water level in well = 10 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		23		
0:13	0.22	25	2	9.23
1:03	0.83	30	5	6.0
2:04	1.02	35	5	4.92
3:08	1.07	40	5	4.69
4:18	1.17	45	5	4.29
5:31	1.22	50	5	4.11
6:43	1.20	55	5	4.17
8:32	1.82	62	7	3.85
10:39	2.12	70	8	3.78
11:59	1.33	75	5	3.75
Steady rate for 3 consecutive readings (R_2):				4.10

Comments:

$K_f = 0.0876$ in/min = 5.26 in/hr

GP FIELD DATA SHEET — SECTION 1: SITE INFORMATION

Date 6/9/23 Investigator [illegible]

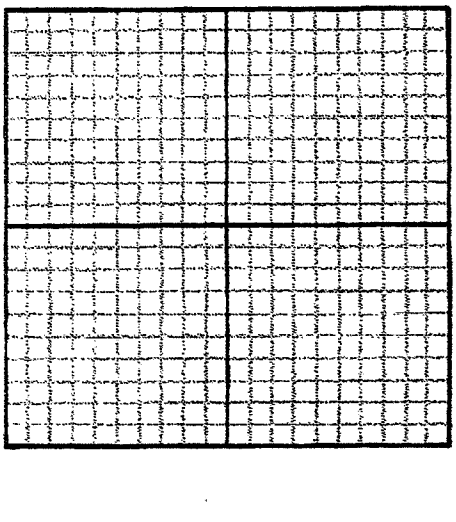
Site Location [illegible]

Dominant Soil Type(s) Hackett loamy Sand

Site Map:

TP #4

Soil Profile Description (horizon depth, texture, structure, color, etc.):



Depth	Description
A	10YR 3/2 SL
B	10YR 5/4 SL
C1	2.5Y 6/2 SAG
C2	2.5Y 5/3 L.S.

Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025. Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

Guelph Permeameter Calculations

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 15.1000

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 0.80315
$Q =$ 8.8637

$K_{fs} =$ 2.67E-02 cm/sec
####### cm/min
2.67E-04 m/sec
9.30E-01 inch/min
1.05E-02 inch/sec

$\Phi_m =$ 7.40E-02 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 19.0000

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 1.28764
$Q =$ 11.153

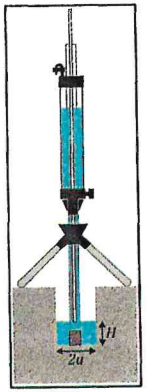
$K_{fs} =$ 1.71E-02 cm/sec
####### cm/min
1.71E-04 m/sec
4.04E-01 inch/min
6.74E-03 inch/sec

$\Phi_m =$ 4.75E-02 (cm^2/min)

Average

$K_{fs} =$ 2.19E-02 cm/sec
1.31E+00 cm/min
2.19E-04 m/s
5.17E-01 inch/min
8.62E-03 inch/sec

$\Phi_m =$ 6.08E-02 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 15.1000

Steady State Rate of Water Level Change ("R2" in cm/min): 19.0000

1.95

$Q_1 =$ 0.5436

$Q_2 =$ 0.884

$C_1 =$ 0.80315

$C_2 =$ 1.28764

$G_1 =$ 0.00496

$G_2 =$ 0.00397

$G_3 =$ 0.05569

$G_4 =$ 0.02415

$K_{fs} =$ 2.31E-05 cm/sec
1.39E-03 cm/min
2.31E-07 m/sec
5.46E-04 inch/min
9.10E-06 inch/sec

$\Phi_m =$ 1.38E-02 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm), and α^* is macroscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zaig et al., 1993).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.635}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.635}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Guelph Permeameter Data Sheet

Investigator: CARLOS DONATO Date: 6/7/23

Location: CO EARLS FARM Test Id: PTH 4

Depth of hole: 40" Radius: 3 CM (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35.22

Water level in well = 5 cm				
Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		27		
0:22	0.37	35	8	21.5
0:39	0.28	40	5	17.6
0:58	0.32	45	5	15.8
1:12	0.32	50	5	15.8
1:36	0.32	55	5	15.8
1:56	0.33	60	5	15.0
2:12	0.35	65	5	14.3
2:32	0.33	70	5	15.0
2:58	0.35	75	5	14.3
Steady rate for 3 consecutive readings (R_1):				15.1

Water level in well = 10 cm				
Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		20		
0:11	0.18	30	10	54.5
0:26	0.25	35	5	20.0
0:40	0.23	40	5	21.4
0:57	0.28	45	5	17.6
1:13	0.27	50	5	18.8
1:28	0.25	55	5	20.0
1:46	0.30	60	5	16.7
2:01	0.25	65	5	20.0
2:17	0.27	70	5	18.8
2:34	0.28	75	5	17.7
Steady rate for 3 consecutive readings (R_2):				19.0

Comments:

K_f = 0.517 in/min = 31.0 in/hr

GP FIELD DATA SHEET — SECTION 1: SITE INFORMATION

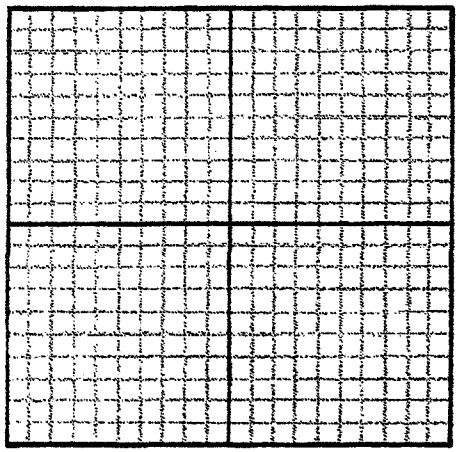
Date 6/7/23 Investigator CHARLES & BRUTSL

Site Location 50 CARLS WAY

Dominant Soil Type(s) Hanford loamy Sand

Site Map:

TP # 5



Soil Profile Description (horizon depth, texture, structure, color, etc.):

Depth	Description
A	10YR 3/2 S.L.
12" B	10YR 5/4 S.L.
40"	2.5Y 5/3
C	MED. SAND
144"	

Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025. Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

SOILMOISTURE®

Guelph Permeameter Calculations

Input

Result

Support: afi@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 9.1100

a^* = 0.36 (cm^{-1})

C = 0.80315
Q = 5.34757

K_{fs} = 1.61E-02 cm/sec
9.65E-01 cm/min
1.61E-04 m/sec
3.80E-01 inch/min
6.33E-03 inch/sec

Φ_m = 4.47E-02 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 17.1000

a^* = 0.36 (cm^{-1})

C = 1.28754
Q = 10.0377

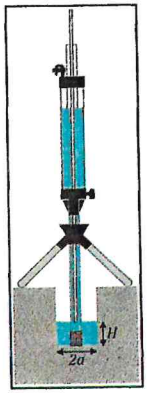
K_{fs} = 1.54E-02 cm/sec
9.24E-01 cm/min
1.54E-04 m/ses
3.64E-01 inch/min
6.06E-03 inch/sec

Φ_m = 4.28E-02 (cm^2/min)

Average

K_{fs} = 1.57E-02 cm/sec
9.44E-01 cm/min
1.57E-04 m/s
3.72E-01 inch/min
6.20E-03 inch/sec

Φ_m = 4.37E-02 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

a^* = 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 9.1100

Steady State Rate of Water Level Change ("R2" in cm/min): 17.1000

1.95

Q_1 = 0.32796

Q_2 = 0.6156

C_1 = 0.80315

C_2 = 1.28754

G_1 = 0.00498

G_2 = 0.00397

G_3 = 0.05569

G_4 = 0.02415

K_{fs} = 8.20E-04 cm/sec
4.92E-02 cm/min
8.20E-06 m/sec
1.94E-02 inch/min
3.23E-04 inch/sec

Φ_m = 3.40E-03 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and a^* is macroscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$a^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.603}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.603}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s). K_{fs} is Soil saturated hydraulic conductivity (cm/s). Φ_m is Soil matric flux potential (cm^2/s), a^* is Macroscopic capillary length parameter (from Table 2). a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{a^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Guelph Permeameter Data Sheet

Investigator: CARLOS QUINTAL Date: 6/2/23

Location: GOLDEN VALLEY Test Id: PT #5

Depth of hole: 60" Radius: 3 cm (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35.22

Water level in well = 5 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		18		
0:16	0.27	20	2	7.50
0:41	0.42	25	5	12.0
1:14	0.55	30	5	9.09
1:42	0.55	35	5	9.09
2:13	0.52	40	5	9.68
2:54	0.60	45	5	8.33
3:29	0.58	50	5	8.57
3:59	0.50	55	5	10.0
4:34	0.58	60	5	8.57
5:08	0.57	65	5	8.82
5:40	0.53	70	5	9.38
6:16	0.60	75	5	8.33

Steady rate for 3 consecutive readings (R_1): 9.11

Water level in well = 10 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		25		
0:11	0.18	30	5	27.3
0:25	0.23	35	5	21.4
0:39	0.23	40	5	21.4
0:58	0.32	45	5	15.8
1:13	0.25	50	5	20.0
1:29	0.27	55	5	18.8
1:46	0.28	60	5	17.6
2:04	0.30	65	5	16.7
2:22	0.30	70	5	16.7
2:41	0.32	75	5	15.8

Steady rate for 3 consecutive readings (R_2): 17.1

Comments:

$K_f = 0.372$ in/min = 22.3 in/hr

GP FIELD DATA SHEET

SECTION 1: SITE INFORMATION

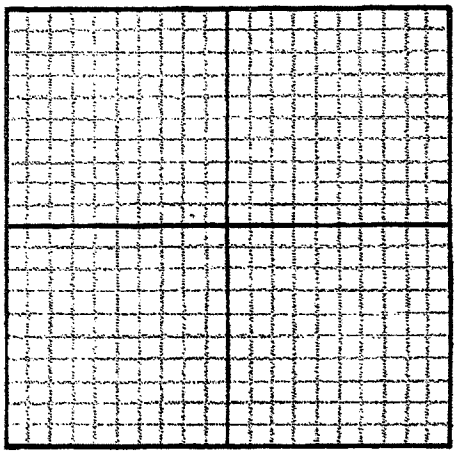
Date 5/2/23 Investigator CARLOS QUINTAL

Site Location GOLETA LOAM

Dominant Soil Type(s) [illegible] loamy Sand

Site Map:

TP-H 8



Soil Profile Description (horizon depth, texture, structure, color, etc.):

Depth	Description
12" A	10 YR 3/2 S, L.
22" B	10 YR 3/4 S, L.
C1	2.5 Y 5/3 L. S
84"	
C2	2.5 Y 5/4 S L
108"	

Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

MOTTLES @ 43"

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025. Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

SOILMOISTURE

Guelph Permeameter Calculations

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.6600

$\alpha^* =$ 0.12 (cm^{-1})

$C =$ 0.80315
$Q =$ 0.38742

$K_{fs} =$ 7.05E-04 cm/sec
4.23E-02 cm/min
7.05E-06 m/sec
1.66E-02 inch/min
2.77E-04 inch/sec

$\Phi_m =$ 5.87E-03 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 1.1400

$\alpha^* =$ 0.12 (cm^{-1})

$C =$ 1.28754
$Q =$ 0.66918

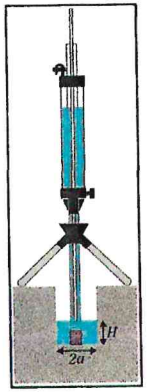
$K_{fs} =$ 7.25E-04 cm/sec
4.35E-02 cm/min
7.25E-06 m/sec
1.71E-02 inch/min
2.85E-04 inch/sec

$\Phi_m =$ 6.04E-03 (cm^2/min)

Average

$K_{fs} =$ 7.15E-04 cm/sec
4.29E-02 cm/min
7.15E-06 m/s
1.69E-02 inch/min
2.81E-04 inch/sec

$\Phi_m =$ 5.96E-03 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 0.6600

Steady State Rate of Water Level Change ("R2" in cm/min): 1.1400

1.95

$Q_1 =$ 0.02376

$Q_2 =$ 0.04104

$C_1 =$ 0.80315

$C_2 =$ 1.28754

$G_1 =$ 0.00498

$G_2 =$ 0.00397

$G_3 =$ 0.05569

$G_4 =$ 0.02415

$K_{fs} =$ 4.53E-05 cm/sec
2.72E-03 cm/min
4.53E-07 m/sec
1.07E-03 inch/min
1.78E-05 inch/sec

$\Phi_m =$ 3.32E-04 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is macroscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.635}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.653}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.635}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.653}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

Guelph Permeameter Data Sheet

Investigator: CARLOS QUINTE Date: 6/7/23

Location: 60 FIELDS WAY Test Id: PT # B

Depth of hole: 36" Radius: 3cm (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35.22

Water level in well = 5 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		15		
6:08	6.13	20	5	0.82
13:25	7.28	25	5	0.69
21:50	8.42	30	5	0.59
28:49	7.0	35	5	0.71
36:32	7.72	40	5	0.65
44:25	7.88	45	5	0.63
54:43	10.3	52	7	0.68
59:26	4.72	55	3	0.64
1:07:00	7.57	60	5	0.66
1:14:17	7.28	65	5	0.69
1:21:52	7.55	70	5	0.66

Steady rate for 3 consecutive readings (R_1): 0.66

Water level in well = 10 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		15		
4:45	4.75	20	5	1.05
9:08	4.38	25	5	1.14
13:37	4.48	30	5	1.12
18:03	4.43	35	5	1.13
23:24	5.35	41	6	1.12
26:50	3.43	45	4	1.17
31:09	4.32	50	5	1.16
35:26	4.28	55	5	1.17
39:35	4.20	60	5	1.19
44:13	4.58	65	5	1.09
48:30	4.28	70	5	1.17

Steady rate for 3 consecutive readings (R_2): 1.14

Comments:

$K_{fs} = 0.0169$ in/min = 68.2 in/hr

GP FIELD DATA SHEET

SECTION 1: SITE INFORMATION

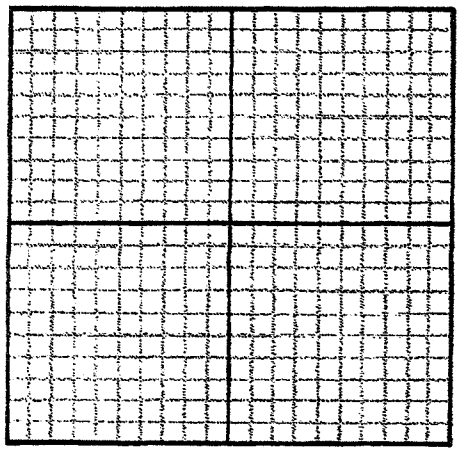
Date 6/9/22 Investigator CARLOS SOLANTAL

Site Location EDWARDS WAY

Dominant Soil Type(s) Loamy Sand

Site Map:

TP #2



Soil Profile Description (horizon depth, texture, structure, color, etc.):

Depth	Description
A	10YR 3/2 SL
B	10YR 5/4 SL
C_1	2.5Y 5/3 L, S.
	2.5Y 5/1 SL
C_2	WET

Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

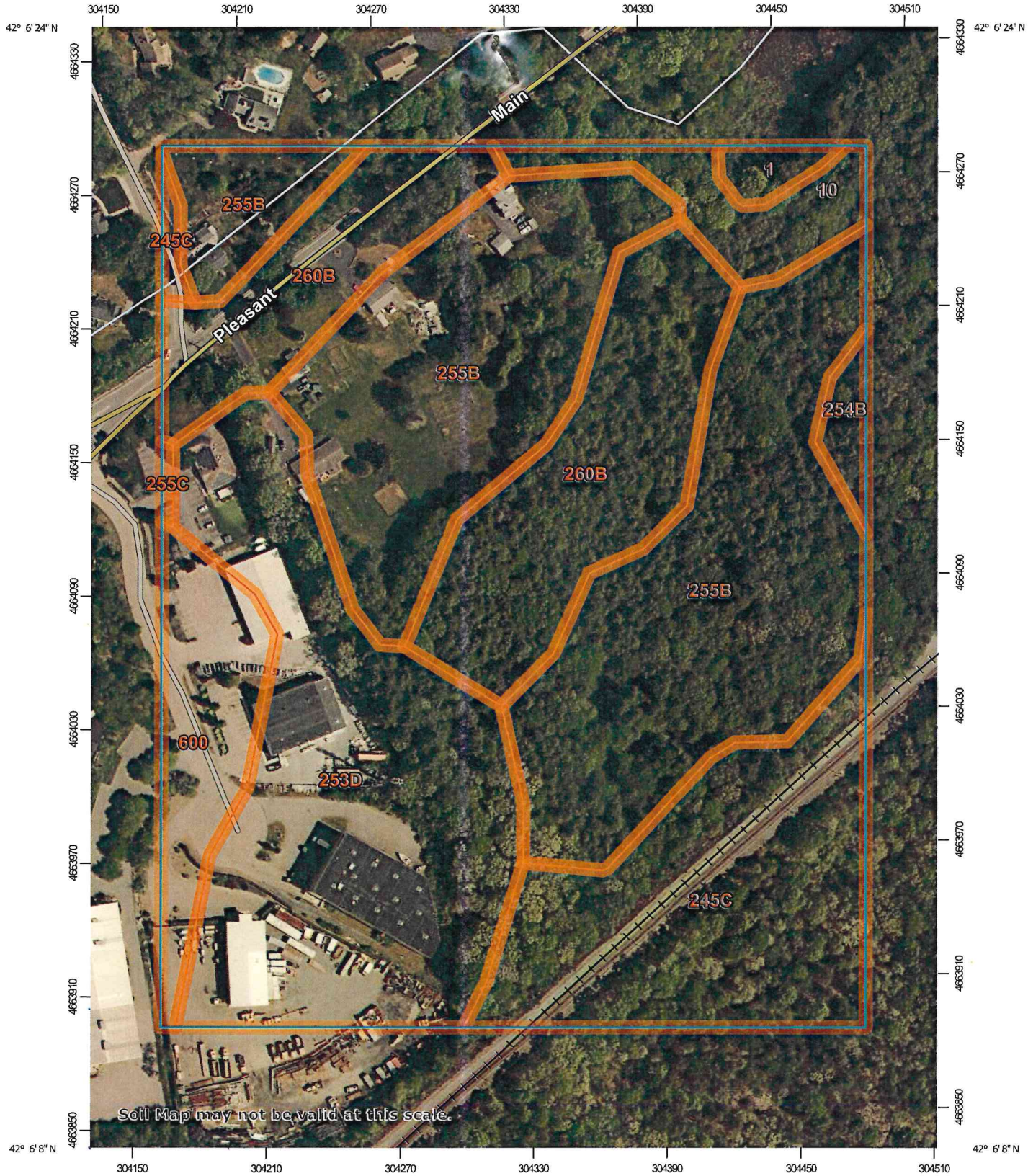
Mottling @ 56"

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025, Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

SOILMOISTURE®

Soil Map—Norfolk and Suffolk Counties, Massachusetts
(60 Earls Way Franklin)



Map Scale: 1:2,450 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 19, Sep 10, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	0.3	0.8%
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	1.1	3.4%
245C	Hinckley loamy sand, 8 to 15 percent slopes	4.5	14.5%
253D	Hinckley loamy sand, 15 to 35 percent slopes	6.7	21.4%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	0.3	1.0%
255B	Windsor loamy sand, 3 to 8 percent slopes	11.3	36.3%
255C	Windsor loamy sand, 8 to 15 percent slopes	0.0	0.1%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	5.3	17.0%
600	Pits, sand and gravel	1.7	5.3%
Totals for Area of Interest		**31.1**	**100.0%**

Norfolk and Suffolk Counties, Massachusetts

253D—Hinckley loamy sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmd
Elevation: 0 to 860 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 10 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Kame terraces, outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Outwash deltas, outwash plains, kame terraces, outwash terraces, moraines
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 19, Sep 10, 2023

Norfolk and Suffolk Counties, Massachusetts

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or schist and/or gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A

Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley
Percent of map unit: 10 percent
Landform: Eskers
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Deerfield, loamy sand
Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 19, Sep 10, 2023

Norfolk and Suffolk Counties, Massachusetts

245C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Kames, outwash plains, outwash terraces, moraines, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 19, Sep 10, 2023

Norfolk and Suffolk Counties, Massachusetts

260B—Sudbury fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky4
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 22 inches: sandy loam
H3 - 22 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash

Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 19, Sep 10, 2023

APPENDIX G

CHECKLIST FOR DESIGNERS

GOALS and NEEDS addressed:

1. Create a visually appealing community
2. Stabilize and increase property values
3. Encourage low impact development
4. Preserve the Town's historic and cultural heritage
5. Protect Franklin's natural environment, including habitat, water resources, and ecosystem services

FRANKLIN POLICY:
Subdivision plans and site plans for all forms of development shall adhere to the principles of environmental and aesthetic compatibility and energy-efficient design.

BEST DEVELOPMENT PRACTICES The site plan should be designed to address the following to the maximum extent practicable	Incorporated into Project?
Unique natural features have been preserved *(the development program should either avoid altering or showcase significant natural features)*	☐ N/A
Native vegetation planted in disturbed areas as needed to enhance or restore habitat	☑
Historic and cultural resources have been preserved *(the development program should either avoid altering or showcase significant historic and cultural features)*	☐ N/A
Clearing, grading, and building placement consider viewsheds	☑
Cut and fill have been minimized	☑
Buildings blend into the natural topography	☑
Buildings are oriented to the sun and wind for maximum energy efficiency *Vegetated protection from northwest (winter) winds is provided* *Deciduous species planted or retained close to the East, South and West building edges*	☑
Conforms to §185-31 of the Town of Franklin Zoning Code and/ or Chapter 300 of the Town of Franklin Subdivision Regulations	☑ With Waivers

GOALS and NEEDS addressed:

1. Protect local and regional wetlands and water bodies
2. Maximize groundwater recharge to retain a viable local groundwater supply
3. Minimize pollutants in stormwater runoff

FRANKLIN POLICIES:

(A) All new development and redevelopment projects in Franklin shall meet the following stormwater management performance standards.

i. Post-development peak discharge rates and volumes from the site shall not exceed pre-development peak discharge rates and volumes from the site.

ii. The stormwater management system shall remove at least 80% of the average annual load of total suspended solids (TSS), at least 80% of the phosphorus loading, and at least 60% of nitrogen loading from the post-development stormwater created on site.

iii. All drainage facilities proposed shall utilize best management practices as outlined in the Massachusetts Stormwater Management Standards.

iv. All sites will have an Operation and Maintenance plan to insure future compliance.

(B) Non-structural stormwater management systems should be used wherever site conditions allow.

BEST DEVELOPMENT PRACTICES The site plan should be designed to address the following to the maximum extent practicable	Incorporated into Project?
Vegetated swales *(recommended to convey runoff from roadways & parking lots)*	☐
Vegetated filter strips *(recommended to filter and infiltrate runoff from roadways, parking lots, and driveways; use along roadsides and parking lots)*	☐
Constructed wetlands *(preferred method for stormwater retention & pollutant removal)*	☐
Bioretention cells *(rain gardens) (recommended on residential lots and parking lot islands)*	☐
Pervious paving surfaces *(recommended in overflow parking and low-traffic areas)*	☑ walk ring
Sediment Forebays *(use in combination with other BDP)*	☐
Roof gardens *(encouraged on flat or gently sloped commercial and industrial rooftops)*	☐
Retention/Detention basins *(may be used in series with other practices to provide pre-treatment)*	☐
Recharge Systems *(suitable for all areas of development)*	☑
Drain pipe/catch basin systems *(as required to collect runoff when other systems are not practical)*	☑
If utilizing drain pipe and/or catch basin systems, have you documented that other systems are infeasible?	☑

Erosion and Sedimentation Control

Checklist for Designers

GOALS and NEEDS addressed:

1. Minimize clearing and regrading;
2. Prevent erosion and sedimentation.

FRANKLIN POLICIES:

(A) Any proposed project on a previously undeveloped site shall accommodate the development program in a way that minimizes clearing and re-grading, especially in areas of steep slopes, erosion-prone soils, or sensitive vegetation. For redevelopment projects, the site plan shall concentrate development in previously-disturbed areas to the extent possible.

(B) As a condition of approval, every proposed project shall submit and adhere to an erosion control plan that addresses soil stabilization, sediment retention, perimeter protection, construction scheduling, traffic area stabilization and dust control.

(C) If the proposed project is in an area under conservation jurisdiction, the project will require permitting deemed appropriate by the Conservation Commission.

BEST DEVELOPMENT PRACTICES The site plan should be designed to address the following to the maximum extent practicable.	Incorporated into Project?
Clearing and re-grading have been minimized	☑
Plan identifies sensitive areas to be protected and areas that are suitable for development	☑
Conservation Permits have been obtained *(when applicable)*	☐ N/A
The erosion and sedimentation control plan addresses:	
• **Soil stabilization** *(cover or stabilize erodible surfaces not in immediate use)*	☑
• **Sediment retention** *(runoff interceptors and sediment traps/ponds)*	☑
• **Perimeter protection** *(vegetated buffers, compost socks or straw wattles at limit of work)*	☑
• **Construction scheduling** *(minimize disturbed area at any given time)*	☑
• **Traffic area stabilization** *(crushed rock or similar at construction vehicle entrance and parking areas)*	☑
• **Dust control** *(plan for stabilizing dry, dust-prone surfaces when necessary)*	☑
• **Vegetation** *(preserve existing vegetation and/or identify areas to be revegetated including proposed planting species, quantity and planting specifications)*	☑

Landscape Design

Checklist for Designers

GOALS and NEEDS addressed:

1. Stabilize water use at a sustainable level
2. Create landscapes that minimize habitat destruction and maximize habitat value
3. Encourage the development of landscapes that provide environmental quality and visual relief through the planting of native or naturalized species

FRANKLIN POLICIES:

(A) Site plans and landscape plans for all proposed projects shall take appropriate steps, as outlined in the Guidebook, to minimize water use for irrigation and to allow for natural recharge of groundwater. Landscape plans shall follow the guidelines in the Guidebook for selecting species that are most appropriate to the site conditions.

(B) Native and habitat-creating species shall be used in all landscape plans to the maximum extent possible while still meeting the site's landscaping needs. Invasive species may not be planted in Franklin under any condition. Refer to the Massachusetts Prohibited Plant list for more information.

(C) Actively promote the Town of Franklin's Water Conservation Measures.

BEST DEVELOPMENT PRACTICES The site plan must address all of the following principles.	Incorporated into Project?
Retain and Recharge water on site *(install bio-retention cells, vegetated filter strips and minimize lawn areas where feasible)*	☑
Preserve natural vegetation to the maximum extent practicable	☑
Irrigation system is water efficient *(if an in-ground irrigation system is proposed, it is a water efficient system with timers and automatic sensors to prevent overwatering)*	☐ N/A
Preserve soil permeability *(minimize disturbing existing landscapes. Prepare new planting beds in accordance to the Planting Bed Guidelines on p. 13, and install 1-2" of shredded pine bark mulch on new planting areas)*	☑
Minimize the use of turf grass *(when applicable, reduce the size of the lawn area; instead, plant a bio-retention cell, use alternative, drought tolerant groundcover)*	☑
Specify variety of native and naturalized species *(species from the plant list have been incorporated into the landscape design, and no invasive species are used. Refer to the Plant Species Section and the Massachusetts Prohibited Plant List)*	☑
Species are appropriate to the soil, site, and microclimate conditions *(select appropriate species from the plant list in this guidebook)*	☑

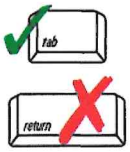
APPENDIX H

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

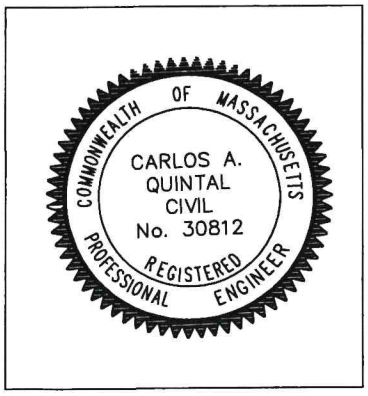
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date 5/13/25

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☒ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX I

APPENDIX J

Operation and Maintenance Plan

FOR
Site Plan
60 Earls Way

LOCATED IN
FRANKLIN, MASSACHUSETTS

PREPARED FOR
LGK, LLC
60 Earls Way
Franklin, MA 02038

PREPARED BY
UNITED CONSULTANTS, INC.
850 FRANKLIN STREET, SUITE 11D
WRENTHAM, MA. 02093

DATE: March 17, 2025

Operation and Maintenance Plan

Good House Keeping Measures

1. The parking area and driveway will receive the minimum amount of sand and salt. Snow will be stored at the locations shown on the site plan.
2. The site landscaping will consist of mulch with trees, shrubs, turf lawn and existing wooded areas. These areas will be assessed by the owner's landscape professional to determine the minimum amounts of fertilizers, herbicides and pesticides necessary and shall only apply the minimums necessary.
3. The site will be stabilized with landscaped areas with mulch and native seed mixes. This will improve the existing site coverage.

Long Term Pollution Prevention Plan

The owner shall employ good housekeeping measures, which include removing trash and debris from the site, keeping trash in receptacles and complying with the long-term operation and maintenance plan.
The owner does not plan to store materials or waste products on the site.
The owner will not allow vehicles to be washed outside of the building.
The owner will have routine inspections and maintenance completed for the Storm-water BMP's. See the Operation and Maintenance Plan Stormwater Facilities Plan for details and schedule.
No hazardous materials for the businesses are anticipated. If hazardous materials are proposed in the future they will be stored within the building.
The owner will employ a landscape professional to determine and apply the minimum amounts of fertilizers, herbicides and pesticides. No storage of landscape materials on site is proposed.
The site is serviced by Town water and sewer.
A dumpster is proposed to provide refuse storage and will be emptied and disposed of offsite.
The owner will designate an emergency contact person prior to commencing construction.
Snow will be placed in the snow storage areas provided on the site plan. If necessary, excess parking spaces could be used to store snow.
The owner will apply the minimum amount of sand and salt necessary. The parking area will be swept four per year with one sweeping being immediately following the last winter sanding.
Sand piles will not be stored on site.

Operation and Maintenance Plan

An operation and maintenance schedule for the construction period and the post-development period has been provided on the Operation and Maintenance Plan Stormwater Facilities Plan.
During the construction period and after completion the Owner, LGK, LLC shall be responsible for the operation and maintenance of the site and the drainage system.
Upon completion of the construction work the property owner shall be responsible for the maintenance of the drainage facilities.
The yearly estimated operation and maintenance budget is $4,500.

The owner will provide documentation which will be submitted to the Franklin DPW confirming when maintenance has been satisfactorily completed.

The owner of the stormwater management system will notify the Director of changes in ownership or assignment of financial responsibility.

LGK, LLC is the responsible party.

_____

Name Title

Yearly Inspection and Maintenance Log

Page 1

60 Earls Way
Franklin, Massachusetts

Parking Lot Sweeping and Curb Inspection – Four Times Per Year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Notes:

Water Quality Unit - 4 Times per year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Cleaning Performed – 4 Times per year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Notes:

Catch Basins - 4 Times per year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Cleaning Performed – When Sediment Depth reaches 18"

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Notes:

Underground Infiltration Ponds – 4 times per year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Cleaning Performed:

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Notes:

Landscape Area Inspection – 4 times per year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Work Performed Repairs completed:

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Stone Trench – 4 times per year

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

Work Performed Repairs completed:

Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____
Date: _____ Performed By: _____

CONTECH®
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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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800.925.5240
www.ContechES.com

CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.

SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

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APPENDIX K

In Compliance with DEP Storm-water Management Standard 10

100 and 110 East Central Street Site

No Illicit discharges to the storm-water management system, including wastewater discharges and discharges of storm-water contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease are proposed and shall not be allowed.

The site map located in Appendix J shall be part of this Illicit Discharge Compliance Statement.

LGK, LLC is the responsible party.

_____

Name Title

APPENDIX L