



down cape engineering, inc.

CIVIL ENGINEERS & LAND SURVEYORS

939 MAIN ST / ROUTE 6A YARMOUTHPORT, MA 02675

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DRAINAGE CALCULATIONS:

Fish & Game Drive and Wildlife Circle
Proposed Subdivision
Harwich, MA

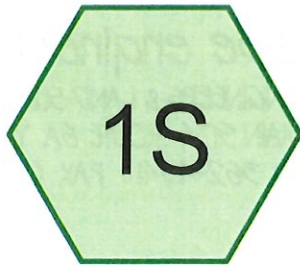
DATE: 9-16-2022

PREPARED FOR: Chris Our

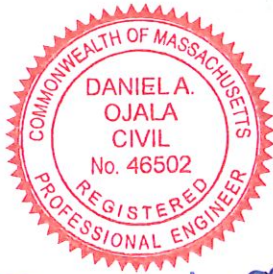
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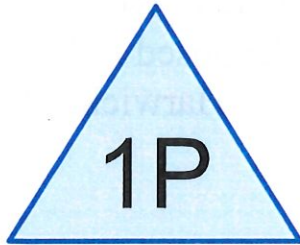
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HARWICH, MA



Drainage Area DA1



D. Ojala
9-16-22



Drainage Infiltration Model



17-198 RBOUR SUB DA1

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	Barn Cty 10 Yr	Type III 24-hr		Default	24.00	1	4.95	2
2	Barn Cty 2 Yr	Type III 24-hr		Default	24.00	1	3.39	2
3	Barn Cty 25 Yr	Type III 24-hr		Default	24.00	1	5.92	2
4	Barn Cty 50 yr.	Type III 24-hr		Default	24.00	1	6.65	2

17-198 RBOUR SUB DA1

Prepared by down cape engineering, inc.

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
49,364	98	Pavement and front Roof Area (1S)
116,801	32	Woods/grass comb., Good, HSG A (1S)
166,165	52	TOTAL AREA

17-198 RBOUR SUB DA1

Prepared by down cape engineering, inc.

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
116,801	HSG A	1S
0	HSG B	
0	HSG C	
0	HSG D	
49,364	Other	1S
166,165		TOTAL AREA

17-198 RBOUR SUB DA1

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	0	49,364	49,364	Pavement and front Roof Area
116,801	0	0	0	0	116,801	Woods/grass comb., Good
116,801	0	0	0	49,364	166,165	TOTAL AREA

17-198 RBOUR SUB DA1

Type III 24-hr Barn Cty 10 Yr Rainfall=4.95"

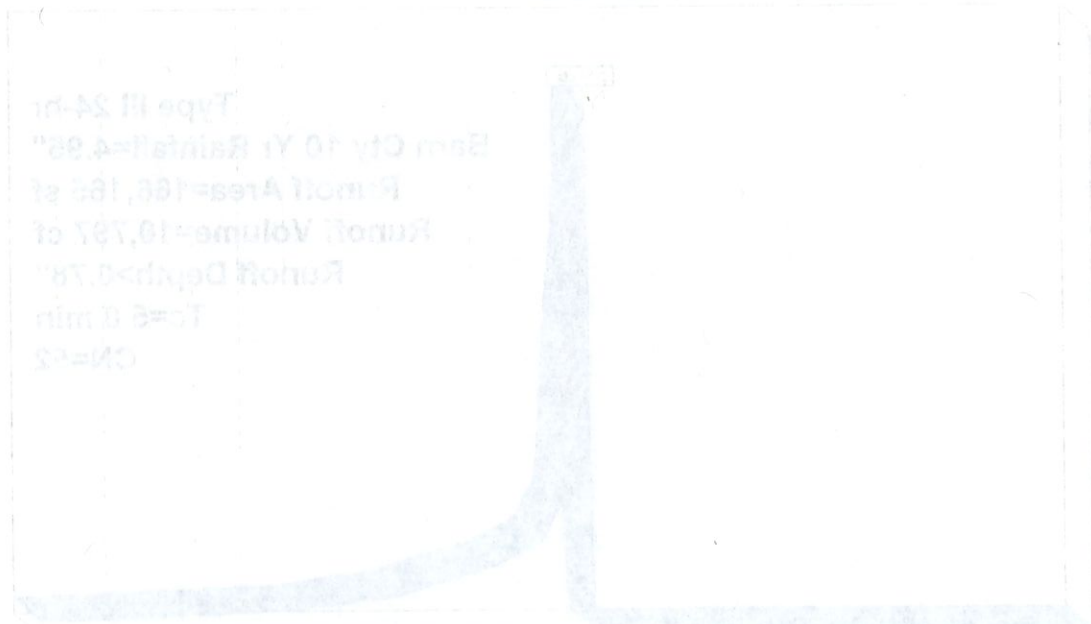
Prepared by down cape engineering, inc.

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Drainage Area DA1 Runoff Area=166,165 sf 29.71% Impervious Runoff Depth>0.78"
Tc=5.0 min CN=52 Runoff=2.54 cfs 10,797 cf

Pond 1P: Drainage Infiltration Model Peak Elev=36.20' Storage=912 cf Inflow=2.54 cfs 10,797 cf
Outflow=1.52 cfs 10,751 cf

Total Runoff Area = 166,165 sf Runoff Volume = 10,797 cf Average Runoff Depth = 0.78"
70.29% Pervious = 116,801 sf 29.71% Impervious = 49,364 sf



17-198 RBOUR SUB DA1

Type III 24-hr Barn Cty 10 Yr Rainfall=4.95"

Prepared by down cape engineering, inc.

Summary for Subcatchment 1S: Drainage Area DA1

Time of Concentration

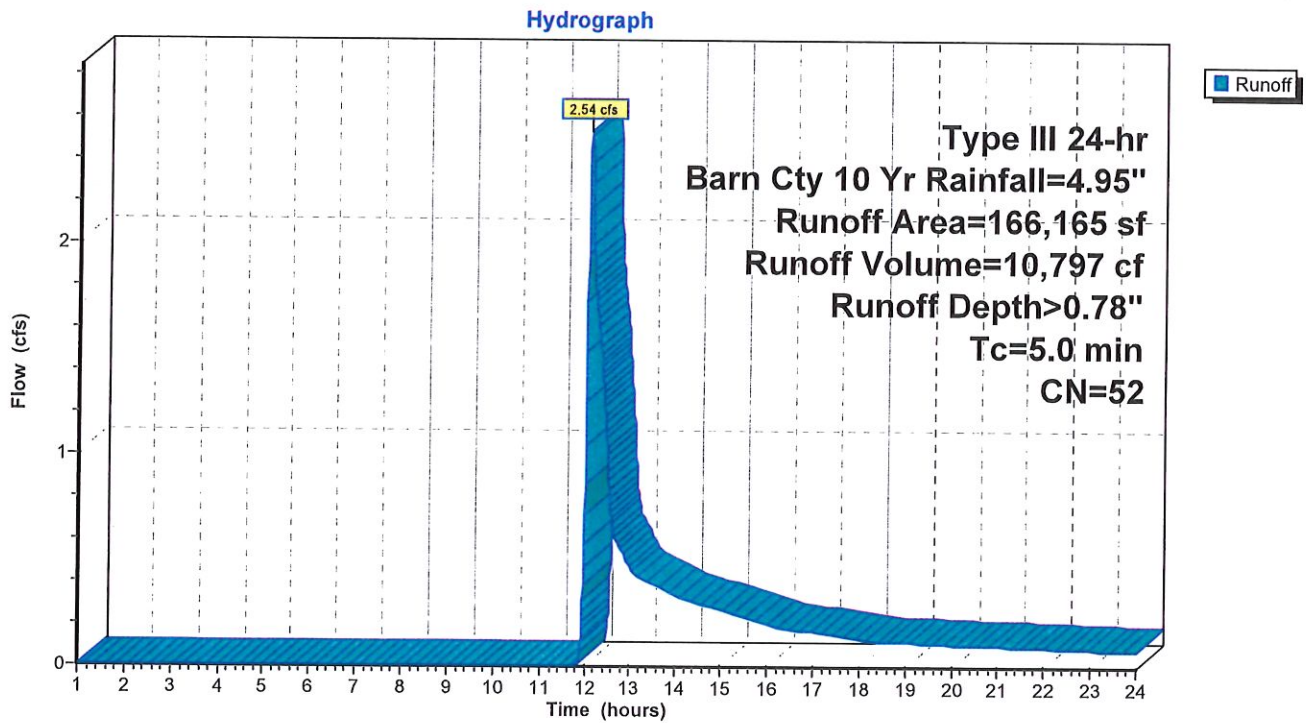
Runoff = 2.54 cfs @ 12.10 hrs, Volume= 10,797 cf, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr Barn Cty 10 Yr Rainfall=4.95"

Area (sf)	CN	Description
116,801	32	Woods/grass comb., Good, HSG A
* 49,364	98	Pavement and front Roof Area
166,165	52	Weighted Average
116,801		70.29% Pervious Area
49,364		29.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Time Concentration

Subcatchment 1S: Drainage Area DA1



Summary for Pond 1P: Drainage Infiltration Model

3 Leach pits with overflow to low area- Storage/Infiltration Model

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 166,165 sf, 29.71% Impervious, Inflow Depth > 0.78" for Barn Cty 10 Yr event
 Inflow = 2.54 cfs @ 12.10 hrs, Volume= 10,797 cf
 Outflow = 1.52 cfs @ 12.33 hrs, Volume= 10,751 cf, Atten= 40%, Lag= 13.8 min
 Primary = 1.52 cfs @ 12.33 hrs, Volume= 10,751 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 36.20' @ 12.33 hrs Storage= 912 cf

Plug-Flow detention time= 9.3 min calculated for 10,746 cf (100% of inflow)
 Center-of-Mass det. time= 7.1 min (911.6 - 904.5)

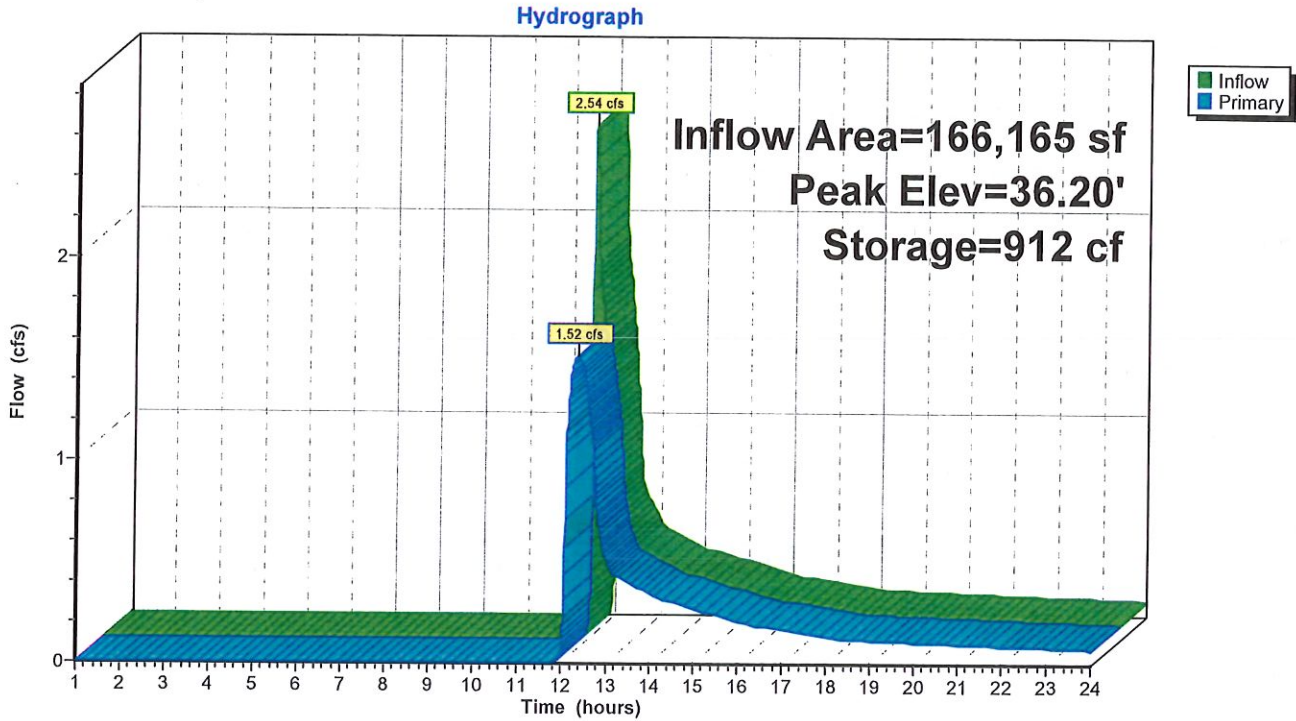
Volume	Invert	Avail.Storage	Storage Description
#1	32.00'	5,894 cf	Infiltration System Storage Model Listed below

Elevation (feet)	Cum.Store (cubic-feet)
32.00	0
33.00	157
34.00	393
35.00	629
36.00	864
37.00	1,100
38.00	1,335
39.00	1,571
40.00	2,742
42.00	5,894

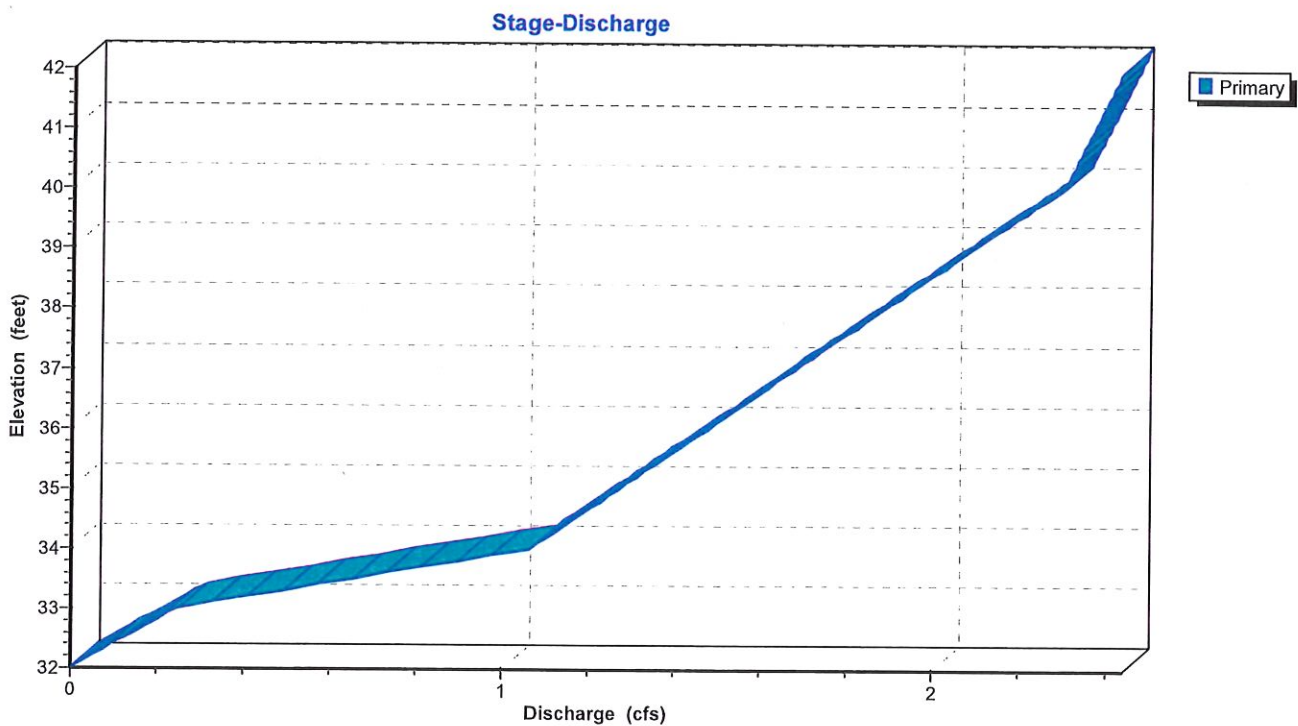
Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model
			Elev. (feet) 0.00 32.00 33.00 34.00 35.00 36.00 37.00 39.00 40.00 42.00
			Disch. (cfs) 0.000 0.000 0.250 1.060 1.270 1.480 1.680 2.090 2.300 2.440

Primary OutFlow Max=1.52 cfs @ 12.33 hrs HW=36.20' (Free Discharge)
 ↑1=Infiltration Model (Custom Controls 1.52 cfs)

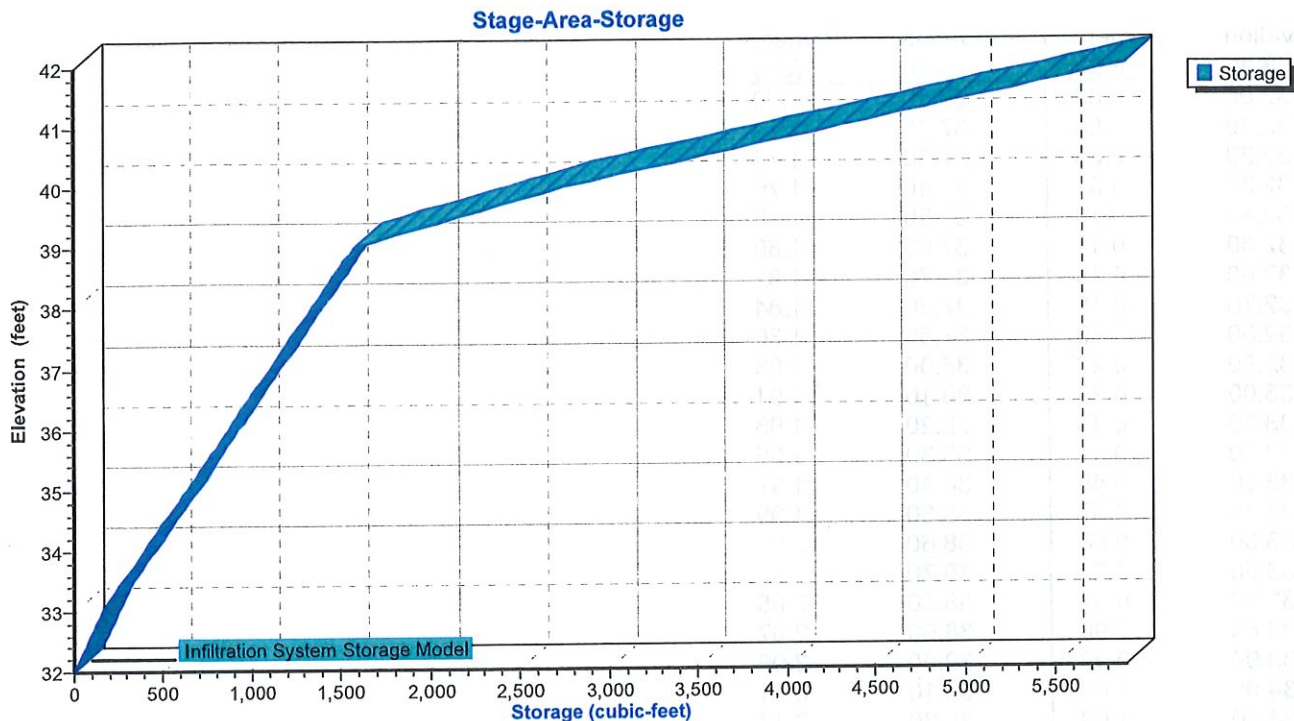
Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Stage-Discharge for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
32.00	0.00	37.10	1.70
32.10	0.03	37.20	1.72
32.20	0.05	37.30	1.74
32.30	0.07	37.40	1.76
32.40	0.10	37.50	1.78
32.50	0.13	37.60	1.80
32.60	0.15	37.70	1.82
32.70	0.18	37.80	1.84
32.80	0.20	37.90	1.86
32.90	0.22	38.00	1.88
33.00	0.25	38.10	1.91
33.10	0.33	38.20	1.93
33.20	0.41	38.30	1.95
33.30	0.49	38.40	1.97
33.40	0.57	38.50	1.99
33.50	0.66	38.60	2.01
33.60	0.74	38.70	2.03
33.70	0.82	38.80	2.05
33.80	0.90	38.90	2.07
33.90	0.98	39.00	2.09
34.00	1.06	39.10	2.11
34.10	1.08	39.20	2.13
34.20	1.10	39.30	2.15
34.30	1.12	39.40	2.17
34.40	1.14	39.50	2.20
34.50	1.17	39.60	2.22
34.60	1.19	39.70	2.24
34.70	1.21	39.80	2.26
34.80	1.23	39.90	2.28
34.90	1.25	40.00	2.30
35.00	1.27	40.10	2.31
35.10	1.29	40.20	2.31
35.20	1.31	40.30	2.32
35.30	1.33	40.40	2.33
35.40	1.35	40.50	2.33
35.50	1.38	40.60	2.34
35.60	1.40	40.70	2.35
35.70	1.42	40.80	2.36
35.80	1.44	40.90	2.36
35.90	1.46	41.00	2.37
36.00	1.48	41.10	2.38
36.10	1.50	41.20	2.38
36.20	1.52	41.30	2.39
36.30	1.54	41.40	2.40
36.40	1.56	41.50	2.41
36.50	1.58	41.60	2.41
36.60	1.60	41.70	2.42
36.70	1.62	41.80	2.43
36.80	1.64	41.90	2.43
36.90	1.66	42.00	2.44
37.00	1.68		

Stage-Area-Storage for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
32.00	0	37.10	1,124
32.10	16	37.20	1,147
32.20	31	37.30	1,170
32.30	47	37.40	1,194
32.40	63	37.50	1,218
32.50	79	37.60	1,241
32.60	94	37.70	1,265
32.70	110	37.80	1,288
32.80	126	37.90	1,311
32.90	141	38.00	1,335
33.00	157	38.10	1,359
33.10	181	38.20	1,382
33.20	204	38.30	1,406
33.30	228	38.40	1,429
33.40	251	38.50	1,453
33.50	275	38.60	1,477
33.60	299	38.70	1,500
33.70	322	38.80	1,524
33.80	346	38.90	1,547
33.90	369	39.00	1,571
34.00	393	39.10	1,688
34.10	417	39.20	1,805
34.20	440	39.30	1,922
34.30	464	39.40	2,039
34.40	487	39.50	2,157
34.50	511	39.60	2,274
34.60	535	39.70	2,391
34.70	558	39.80	2,508
34.80	582	39.90	2,625
34.90	605	40.00	2,742
35.00	629	40.10	2,900
35.10	653	40.20	3,057
35.20	676	40.30	3,215
35.30	699	40.40	3,372
35.40	723	40.50	3,530
35.50	747	40.60	3,688
35.60	770	40.70	3,845
35.70	794	40.80	4,003
35.80	817	40.90	4,160
35.90	840	41.00	4,318
36.00	864	41.10	4,476
36.10	888	41.20	4,633
36.20	911	41.30	4,791
36.30	935	41.40	4,948
36.40	958	41.50	5,106
36.50	982	41.60	5,264
36.60	1,006	41.70	5,421
36.70	1,029	41.80	5,579
36.80	1,053	41.90	5,736
36.90	1,076	42.00	5,894
37.00	1,100		

Summary for Subcatchment 1S: Drainage Area DA1

Time of Concentration

Runoff = 0.30 cfs @ 12.35 hrs, Volume= 3,055 cf, Depth> 0.22"

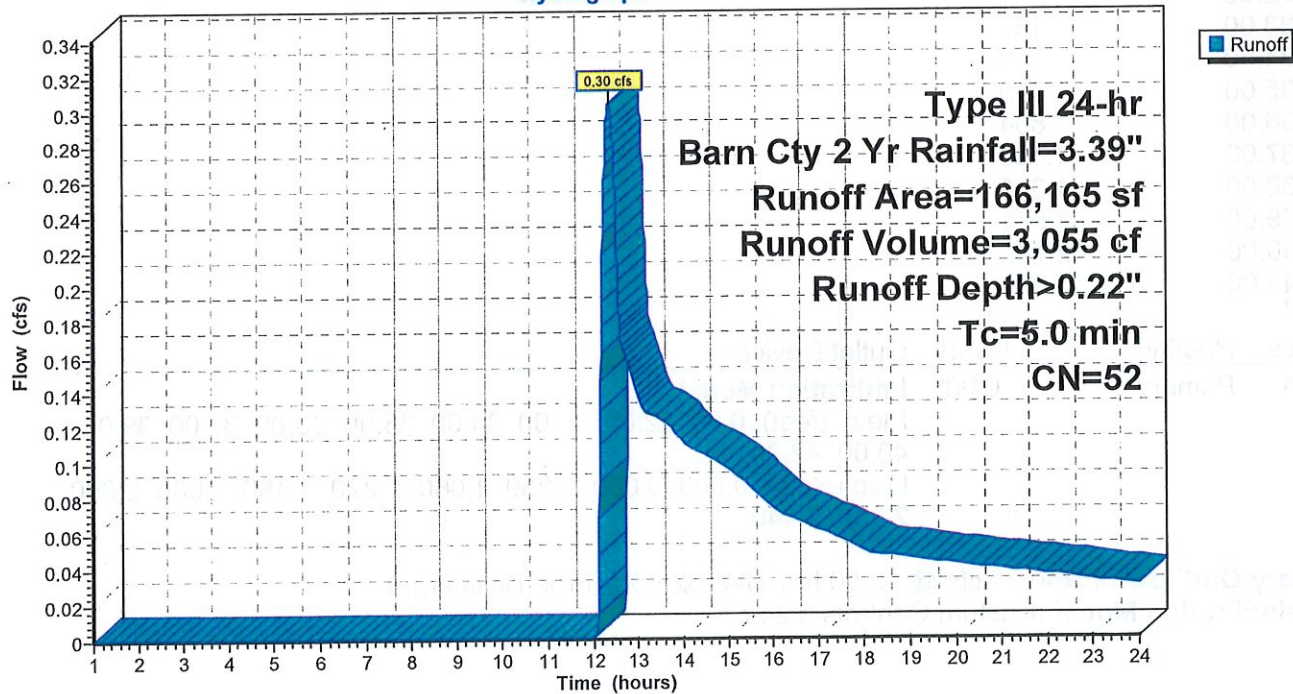
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr Barn Cty 2 Yr Rainfall=3.39"

Area (sf)	CN	Description
116,801	32	Woods/grass comb., Good, HSG A
* 49,364	98	Pavement and front Roof Area
166,165	52	Weighted Average
116,801		70.29% Pervious Area
49,364		29.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Time Concentration

Subcatchment 1S: Drainage Area DA1

Hydrograph



Summary for Pond 1P: Drainage Infiltration Model

3 Leach pits with overflow to low area- Storage/Infiltration Model

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 166,165 sf, 29.71% Impervious, Inflow Depth > 0.22" for Barn Cty 2 Yr event
 Inflow = 0.30 cfs @ 12.35 hrs, Volume= 3,055 cf
 Outflow = 0.24 cfs @ 12.50 hrs, Volume= 3,036 cf, Atten= 22%, Lag= 8.8 min
 Primary = 0.24 cfs @ 12.50 hrs, Volume= 3,036 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 32.95' @ 12.50 hrs Storage= 150 cf

Plug-Flow detention time= 10.4 min calculated for 3,035 cf (99% of inflow)
 Center-of-Mass det. time= 7.5 min (975.0 - 967.5)

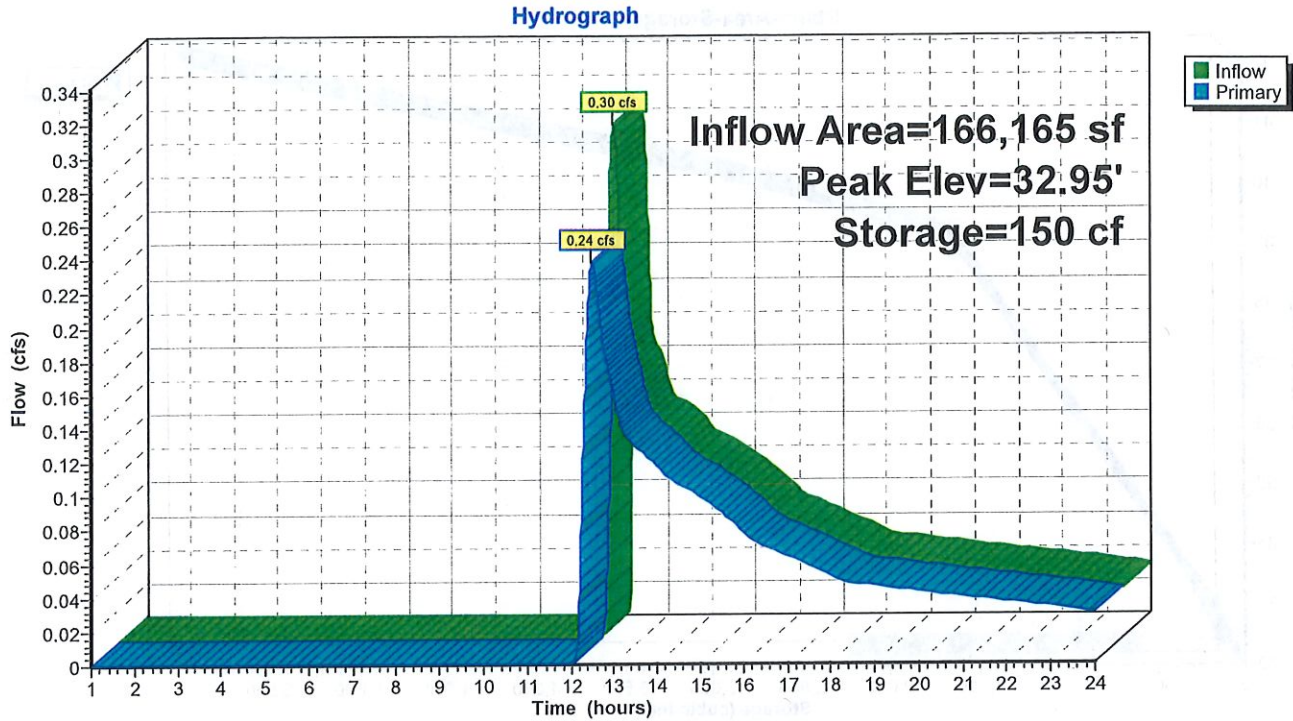
Volume	Invert	Avail.Storage	Storage Description
#1	32.00'	5,894 cf	Infiltration System Storage Model Listed below

Elevation (feet)	Cum.Store (cubic-feet)
32.00	0
33.00	157
34.00	393
35.00	629
36.00	864
37.00	1,100
38.00	1,335
39.00	1,571
40.00	2,742
42.00	5,894

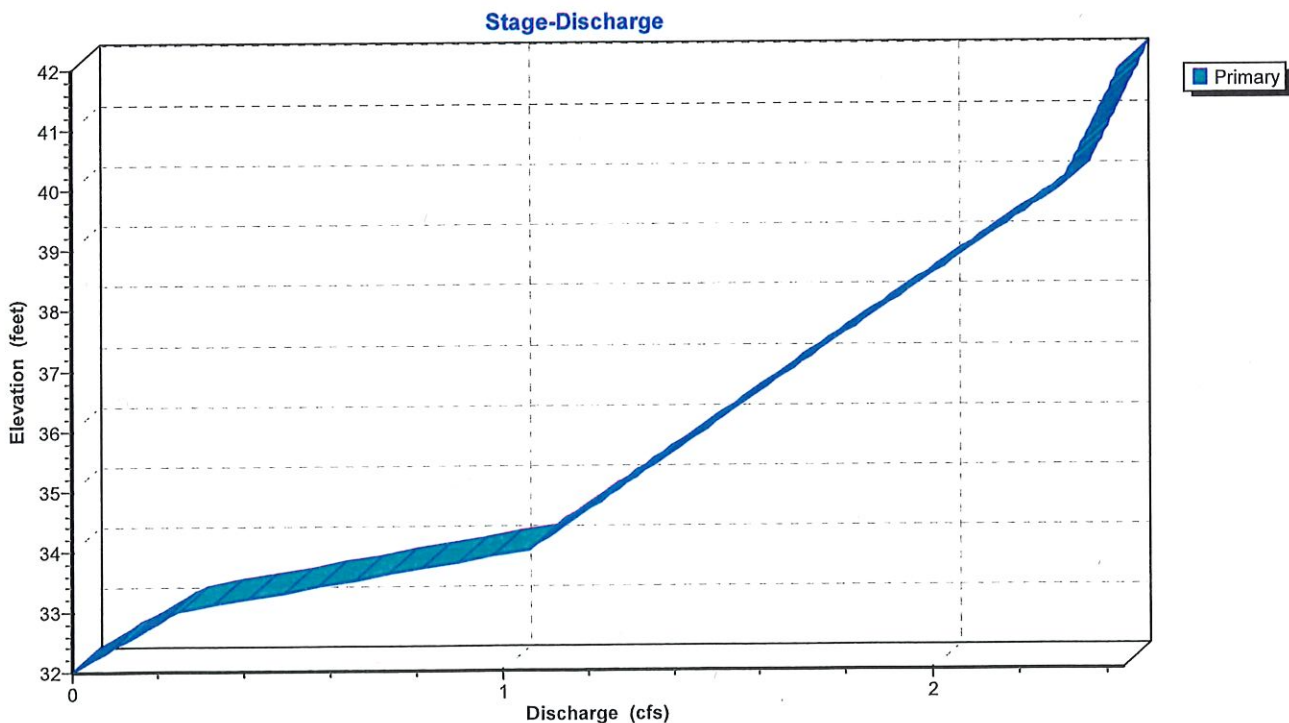
Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model
			Elev. (feet) 0.00 32.00 33.00 34.00 35.00 36.00 37.00 39.00 40.00 42.00
			Disch. (cfs) 0.000 0.000 0.250 1.060 1.270 1.480 1.680 2.090 2.300 2.440

Primary OutFlow Max=0.24 cfs @ 12.50 hrs HW=32.95' (Free Discharge)
 ↳1=Infiltration Model (Custom Controls 0.24 cfs)

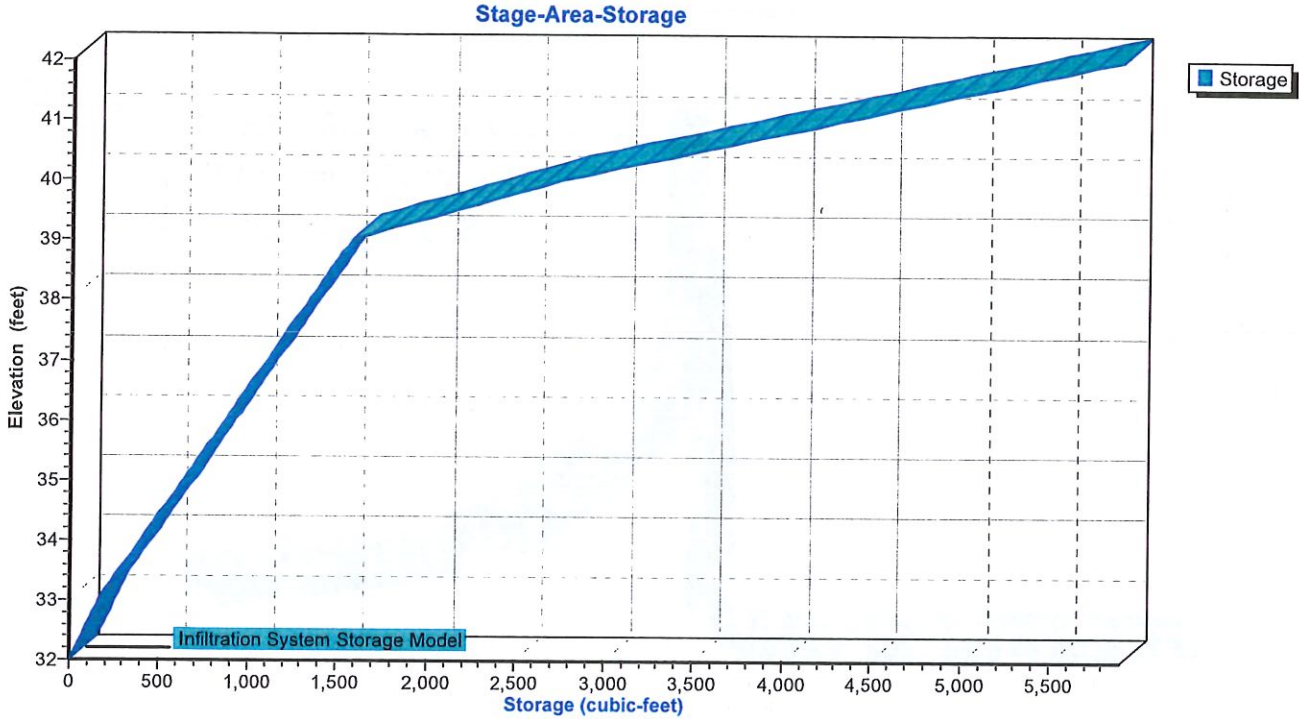
Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Stage-Discharge for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
32.00	0.00	37.10	1.70
32.10	0.03	37.20	1.72
32.20	0.05	37.30	1.74
32.30	0.07	37.40	1.76
32.40	0.10	37.50	1.78
32.50	0.13	37.60	1.80
32.60	0.15	37.70	1.82
32.70	0.18	37.80	1.84
32.80	0.20	37.90	1.86
32.90	0.22	38.00	1.88
33.00	0.25	38.10	1.91
33.10	0.33	38.20	1.93
33.20	0.41	38.30	1.95
33.30	0.49	38.40	1.97
33.40	0.57	38.50	1.99
33.50	0.66	38.60	2.01
33.60	0.74	38.70	2.03
33.70	0.82	38.80	2.05
33.80	0.90	38.90	2.07
33.90	0.98	39.00	2.09
34.00	1.06	39.10	2.11
34.10	1.08	39.20	2.13
34.20	1.10	39.30	2.15
34.30	1.12	39.40	2.17
34.40	1.14	39.50	2.20
34.50	1.17	39.60	2.22
34.60	1.19	39.70	2.24
34.70	1.21	39.80	2.26
34.80	1.23	39.90	2.28
34.90	1.25	40.00	2.30
35.00	1.27	40.10	2.31
35.10	1.29	40.20	2.31
35.20	1.31	40.30	2.32
35.30	1.33	40.40	2.33
35.40	1.35	40.50	2.33
35.50	1.38	40.60	2.34
35.60	1.40	40.70	2.35
35.70	1.42	40.80	2.36
35.80	1.44	40.90	2.36
35.90	1.46	41.00	2.37
36.00	1.48	41.10	2.38
36.10	1.50	41.20	2.38
36.20	1.52	41.30	2.39
36.30	1.54	41.40	2.40
36.40	1.56	41.50	2.41
36.50	1.58	41.60	2.41
36.60	1.60	41.70	2.42
36.70	1.62	41.80	2.43
36.80	1.64	41.90	2.43
36.90	1.66	42.00	2.44
37.00	1.68		

Stage-Area-Storage for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
32.00	0	37.10	1,124
32.10	16	37.20	1,147
32.20	31	37.30	1,170
32.30	47	37.40	1,194
32.40	63	37.50	1,218
32.50	79	37.60	1,241
32.60	94	37.70	1,265
32.70	110	37.80	1,288
32.80	126	37.90	1,311
32.90	141	38.00	1,335
33.00	157	38.10	1,359
33.10	181	38.20	1,382
33.20	204	38.30	1,406
33.30	228	38.40	1,429
33.40	251	38.50	1,453
33.50	275	38.60	1,477
33.60	299	38.70	1,500
33.70	322	38.80	1,524
33.80	346	38.90	1,547
33.90	369	39.00	1,571
34.00	393	39.10	1,688
34.10	417	39.20	1,805
34.20	440	39.30	1,922
34.30	464	39.40	2,039
34.40	487	39.50	2,157
34.50	511	39.60	2,274
34.60	535	39.70	2,391
34.70	558	39.80	2,508
34.80	582	39.90	2,625
34.90	605	40.00	2,742
35.00	629	40.10	2,900
35.10	653	40.20	3,057
35.20	676	40.30	3,215
35.30	699	40.40	3,372
35.40	723	40.50	3,530
35.50	747	40.60	3,688
35.60	770	40.70	3,845
35.70	794	40.80	4,003
35.80	817	40.90	4,160
35.90	840	41.00	4,318
36.00	864	41.10	4,476
36.10	888	41.20	4,633
36.20	911	41.30	4,791
36.30	935	41.40	4,948
36.40	958	41.50	5,106
36.50	982	41.60	5,264
36.60	1,006	41.70	5,421
36.70	1,029	41.80	5,579
36.80	1,053	41.90	5,736
36.90	1,076	42.00	5,894
37.00	1,100		

17-198 RBOUR SUB DA1

Type III 24-hr Barn Cty 25 Yr Rainfall=5.92"

Prepared by down cape engineering, inc.

HydroCAD® 10.10-4b s/n 11505 © 2020 HydroCAD Software Solutions LLC

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

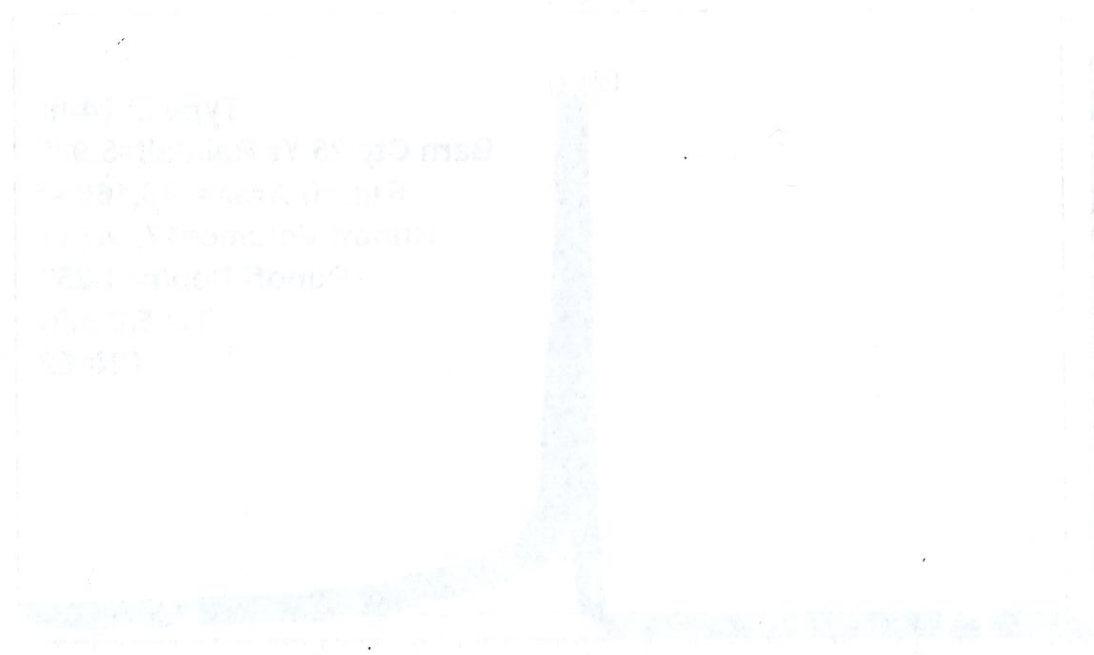
Subcatchment 1S: Drainage Area DA1

Runoff Area=166,165 sf 29.71% Impervious Runoff Depth>1.25"
Tc=5.0 min CN=52 Runoff=4.80 cfs 17,247 cf

Pond 1P: Drainage Infiltration Model

Peak Elev=39.57' Storage=2,236 cf Inflow=4.80 cfs 17,247 cf
Outflow=2.21 cfs 17,182 cf

Total Runoff Area = 166,165 sf Runoff Volume = 17,247 cf Average Runoff Depth = 1.25"
70.29% Pervious = 116,801 sf 29.71% Impervious = 49,364 sf



Summary for Subcatchment 1S: Drainage Area DA1

Time of Concentration

Runoff = 4.80 cfs @ 12.09 hrs, Volume= 17,247 cf, Depth> 1.25"

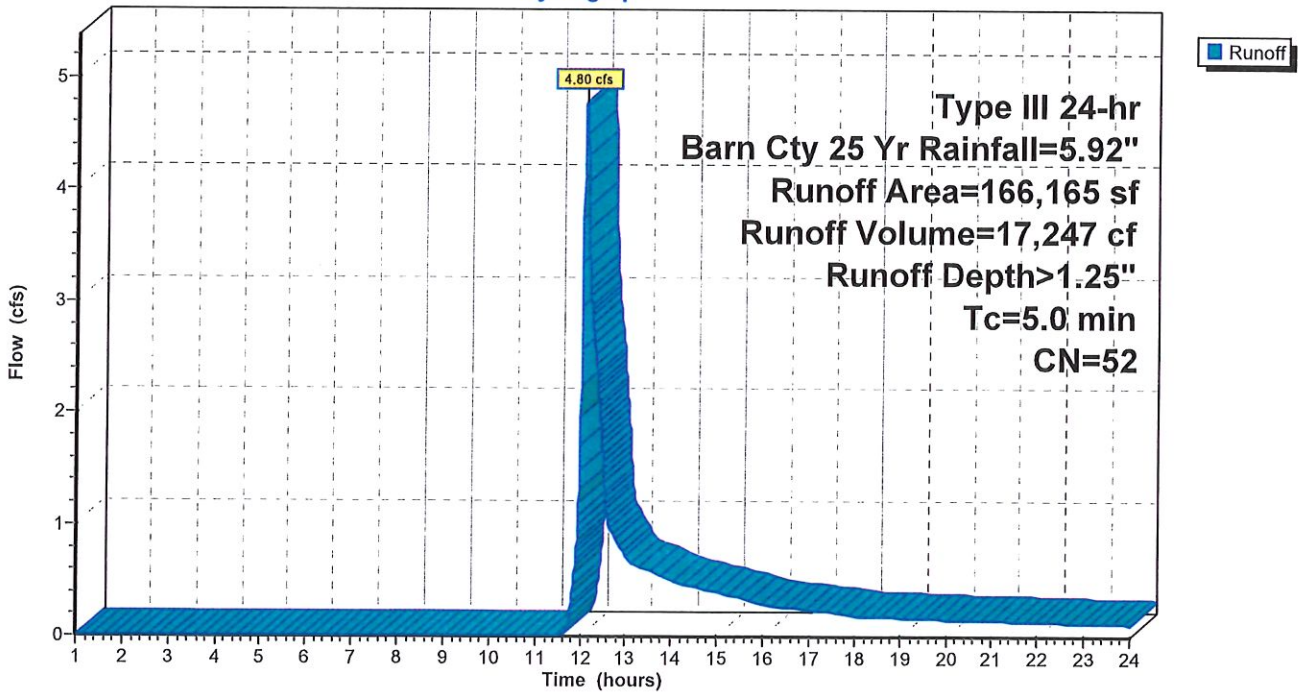
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr Barn Cty 25 Yr Rainfall=5.92"

Area (sf)	CN	Description
116,801	32	Woods/grass comb., Good, HSG A
* 49,364	98	Pavement and front Roof Area
166,165	52	Weighted Average
116,801		70.29% Pervious Area
49,364		29.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Time Concentration

Subcatchment 1S: Drainage Area DA1

Hydrograph



Summary for Pond 1P: Drainage Infiltration Model

3 Leach pits with overflow to low area- Storage/Infiltration Model

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 166,165 sf, 29.71% Impervious, Inflow Depth > 1.25" for Barn Cty 25 Yr event
 Inflow = 4.80 cfs @ 12.09 hrs, Volume= 17,247 cf
 Outflow = 2.21 cfs @ 12.38 hrs, Volume= 17,182 cf, Atten= 54%, Lag= 17.3 min
 Primary = 2.21 cfs @ 12.38 hrs, Volume= 17,182 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 39.57' @ 12.38 hrs Storage= 2,236 cf

Plug-Flow detention time= 10.7 min calculated for 17,174 cf (100% of inflow)
 Center-of-Mass det. time= 8.7 min (895.1 - 886.4)

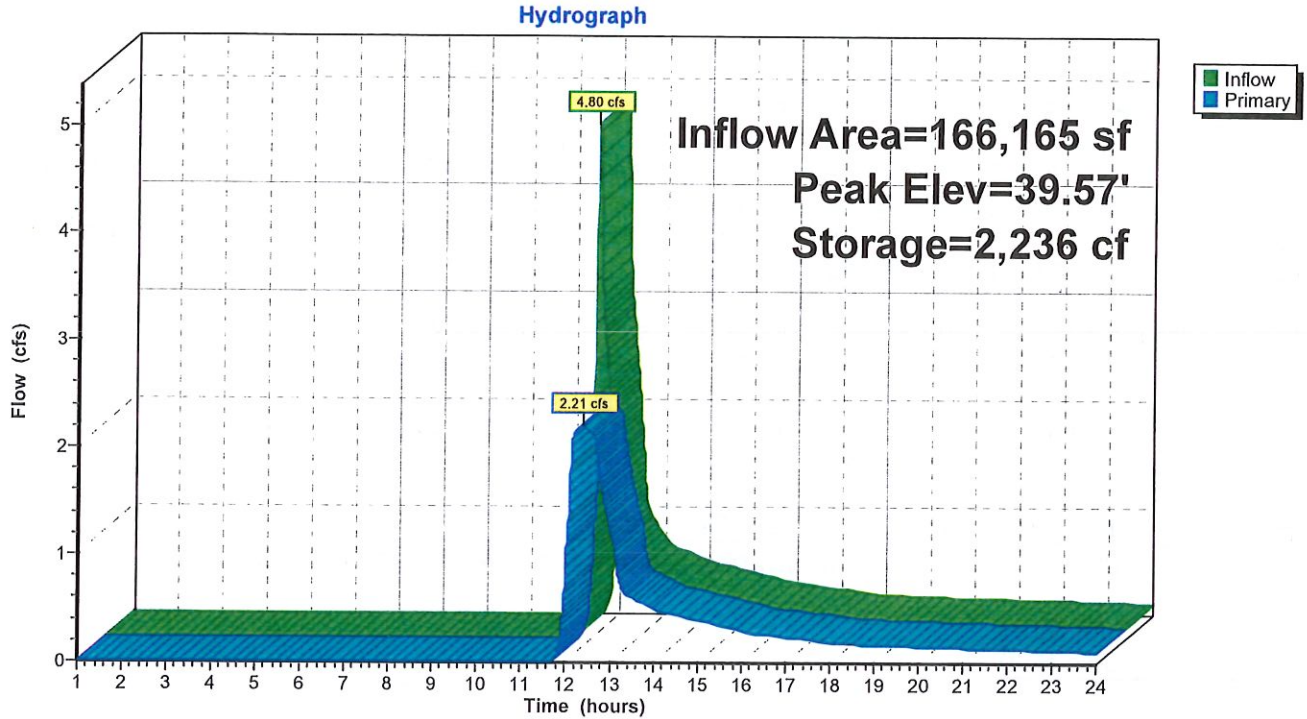
Volume	Invert	Avail.Storage	Storage Description
#1	32.00'	5,894 cf	Infiltration System Storage Model Listed below

Elevation (feet)	Cum.Store (cubic-feet)
32.00	0
33.00	157
34.00	393
35.00	629
36.00	864
37.00	1,100
38.00	1,335
39.00	1,571
40.00	2,742
42.00	5,894

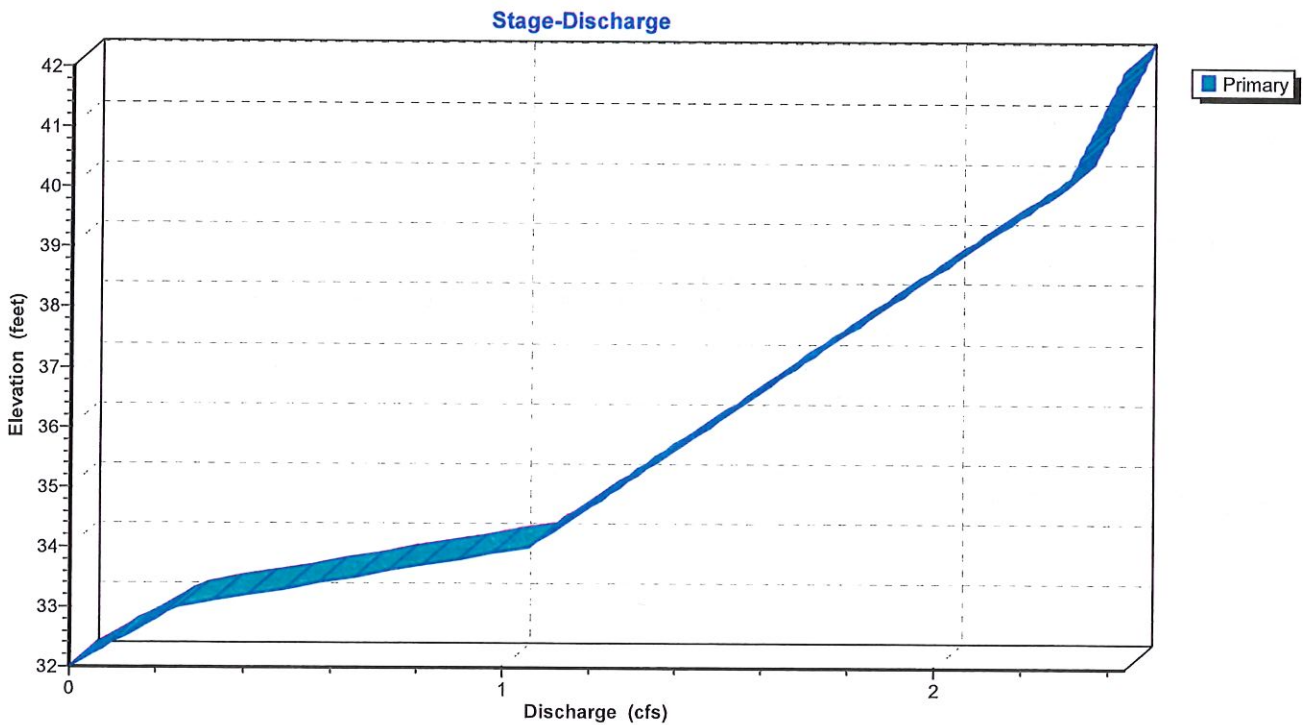
Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model
			Elev. (feet) 0.00 32.00 33.00 34.00 35.00 36.00 37.00 39.00 40.00 42.00
			Disch. (cfs) 0.000 0.000 0.250 1.060 1.270 1.480 1.680 2.090 2.300 2.440

Primary OutFlow Max=2.21 cfs @ 12.38 hrs HW=39.57' (Free Discharge)
 ↑1=Infiltration Model (Custom Controls 2.21 cfs)

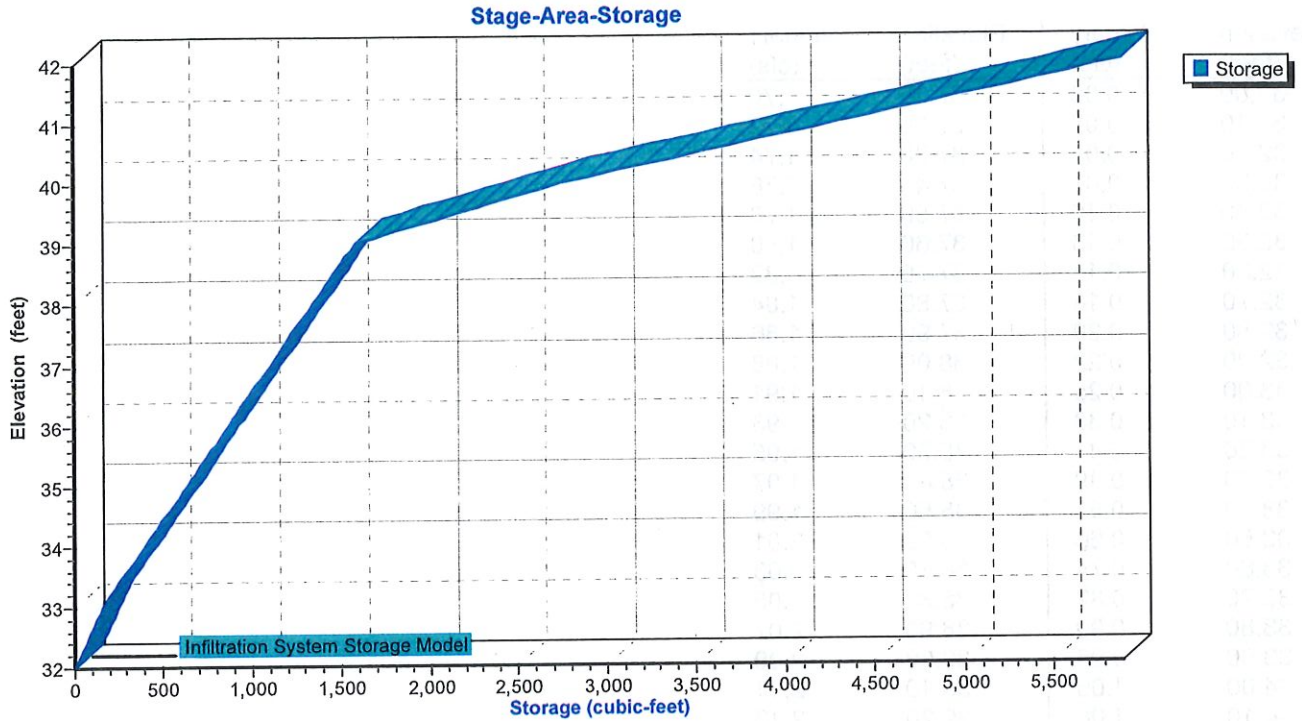
Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Stage-Discharge for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
32.00	0.00	37.10	1.70
32.10	0.03	37.20	1.72
32.20	0.05	37.30	1.74
32.30	0.07	37.40	1.76
32.40	0.10	37.50	1.78
32.50	0.13	37.60	1.80
32.60	0.15	37.70	1.82
32.70	0.18	37.80	1.84
32.80	0.20	37.90	1.86
32.90	0.22	38.00	1.88
33.00	0.25	38.10	1.91
33.10	0.33	38.20	1.93
33.20	0.41	38.30	1.95
33.30	0.49	38.40	1.97
33.40	0.57	38.50	1.99
33.50	0.66	38.60	2.01
33.60	0.74	38.70	2.03
33.70	0.82	38.80	2.05
33.80	0.90	38.90	2.07
33.90	0.98	39.00	2.09
34.00	1.06	39.10	2.11
34.10	1.08	39.20	2.13
34.20	1.10	39.30	2.15
34.30	1.12	39.40	2.17
34.40	1.14	39.50	2.20
34.50	1.17	39.60	2.22
34.60	1.19	39.70	2.24
34.70	1.21	39.80	2.26
34.80	1.23	39.90	2.28
34.90	1.25	40.00	2.30
35.00	1.27	40.10	2.31
35.10	1.29	40.20	2.31
35.20	1.31	40.30	2.32
35.30	1.33	40.40	2.33
35.40	1.35	40.50	2.33
35.50	1.38	40.60	2.34
35.60	1.40	40.70	2.35
35.70	1.42	40.80	2.36
35.80	1.44	40.90	2.36
35.90	1.46	41.00	2.37
36.00	1.48	41.10	2.38
36.10	1.50	41.20	2.38
36.20	1.52	41.30	2.39
36.30	1.54	41.40	2.40
36.40	1.56	41.50	2.41
36.50	1.58	41.60	2.41
36.60	1.60	41.70	2.42
36.70	1.62	41.80	2.43
36.80	1.64	41.90	2.43
36.90	1.66	42.00	2.44
37.00	1.68		

Stage-Area-Storage for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
32.00	0	37.10	1,124
32.10	16	37.20	1,147
32.20	31	37.30	1,170
32.30	47	37.40	1,194
32.40	63	37.50	1,218
32.50	79	37.60	1,241
32.60	94	37.70	1,265
32.70	110	37.80	1,288
32.80	126	37.90	1,311
32.90	141	38.00	1,335
33.00	157	38.10	1,359
33.10	181	38.20	1,382
33.20	204	38.30	1,406
33.30	228	38.40	1,429
33.40	251	38.50	1,453
33.50	275	38.60	1,477
33.60	299	38.70	1,500
33.70	322	38.80	1,524
33.80	346	38.90	1,547
33.90	369	39.00	1,571
34.00	393	39.10	1,688
34.10	417	39.20	1,805
34.20	440	39.30	1,922
34.30	464	39.40	2,039
34.40	487	39.50	2,157
34.50	511	39.60	2,274
34.60	535	39.70	2,391
34.70	558	39.80	2,508
34.80	582	39.90	2,625
34.90	605	40.00	2,742
35.00	629	40.10	2,900
35.10	653	40.20	3,057
35.20	676	40.30	3,215
35.30	699	40.40	3,372
35.40	723	40.50	3,530
35.50	747	40.60	3,688
35.60	770	40.70	3,845
35.70	794	40.80	4,003
35.80	817	40.90	4,160
35.90	840	41.00	4,318
36.00	864	41.10	4,476
36.10	888	41.20	4,633
36.20	911	41.30	4,791
36.30	935	41.40	4,948
36.40	958	41.50	5,106
36.50	982	41.60	5,264
36.60	1,006	41.70	5,421
36.70	1,029	41.80	5,579
36.80	1,053	41.90	5,736
36.90	1,076	42.00	5,894
37.00	1,100		

17-198 RBOUR SUB DA1

Type III 24-hr Barn Cty 50 yr. Rainfall=6.65"

Prepared by down cape engineering, inc.

Summary for Subcatchment 1S: Drainage Area DA1

Time of Concentration

Runoff = 6.73 cfs @ 12.09 hrs, Volume= 22,736 cf, Depth> 1.64"

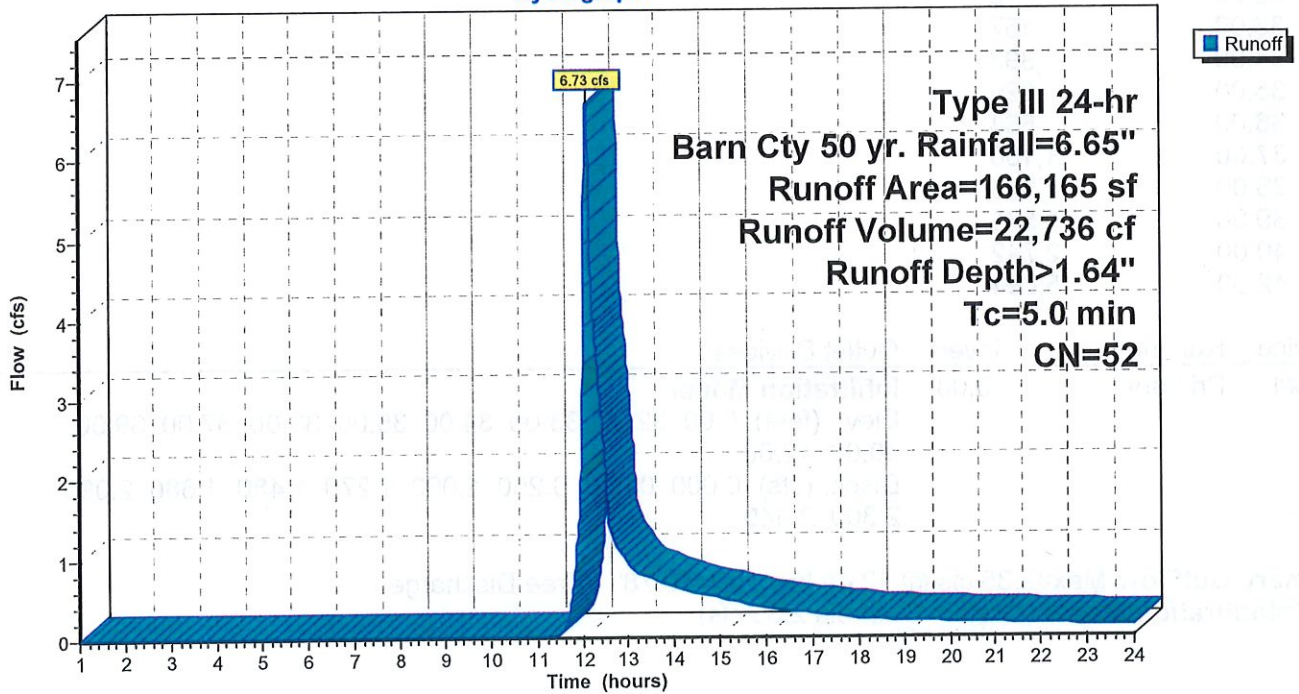
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr Barn Cty 50 yr. Rainfall=6.65"

Area (sf)	CN	Description
116,801	32	Woods/grass comb., Good, HSG A
* 49,364	98	Pavement and front Roof Area
166,165	52	Weighted Average
116,801		70.29% Pervious Area
49,364		29.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Time Concentration

Subcatchment 1S: Drainage Area DA1

Hydrograph



Summary for Pond 1P: Drainage Infiltration Model

3 Leach pits with overflow to low area- Storage/Infiltration Model

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 166,165 sf, 29.71% Impervious, Inflow Depth > 1.64" for Barn Cty 50 yr. event
 Inflow = 6.73 cfs @ 12.09 hrs, Volume= 22,736 cf
 Outflow = 2.35 cfs @ 12.45 hrs, Volume= 22,657 cf, Atten= 65%, Lag= 21.8 min
 Primary = 2.35 cfs @ 12.45 hrs, Volume= 22,657 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 40.78' @ 12.45 hrs Storage= 3,969 cf

Plug-Flow detention time= 13.9 min calculated for 22,647 cf (100% of inflow)
 Center-of-Mass det. time= 11.9 min (888.7 - 876.7)

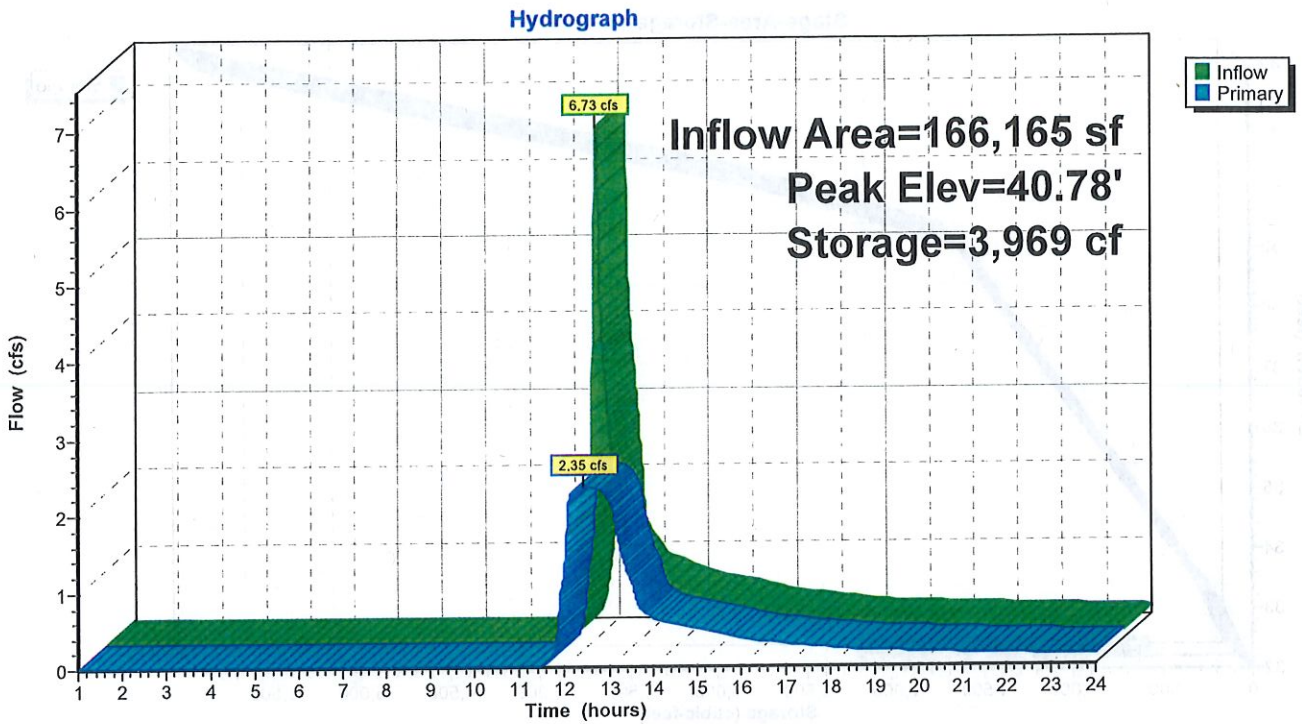
Volume	Invert	Avail.Storage	Storage Description
#1	32.00'	5,894 cf	Infiltration System Storage Model Listed below

Elevation (feet)	Cum.Store (cubic-feet)
32.00	0
33.00	157
34.00	393
35.00	629
36.00	864
37.00	1,100
38.00	1,335
39.00	1,571
40.00	2,742
42.00	5,894

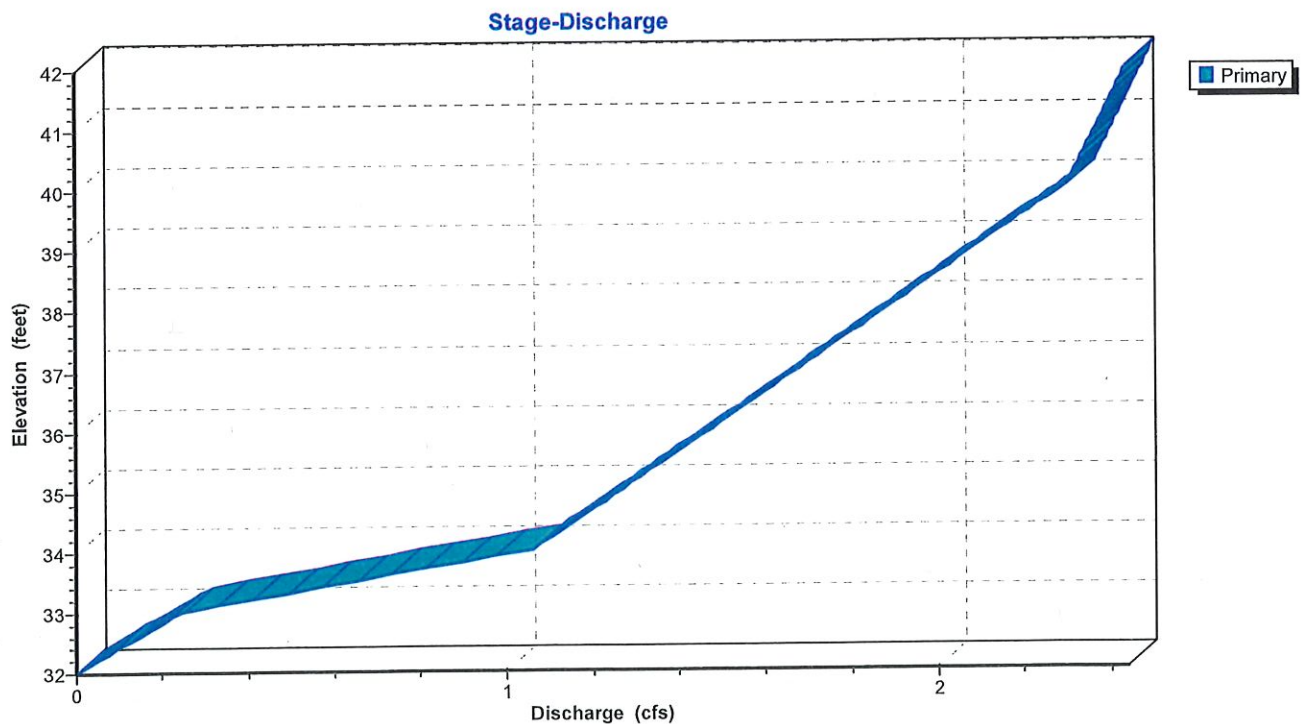
Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model
Elev. (feet) 0.00 32.00 33.00 34.00 35.00 36.00 37.00 39.00			
40.00 42.00			
Disch. (cfs) 0.000 0.000 0.250 1.060 1.270 1.480 1.680 2.090			
2.300 2.440			

Primary OutFlow Max=2.35 cfs @ 12.45 hrs HW=40.78' (Free Discharge)
 ↑ **1=Infiltration Model** (Custom Controls 2.35 cfs)

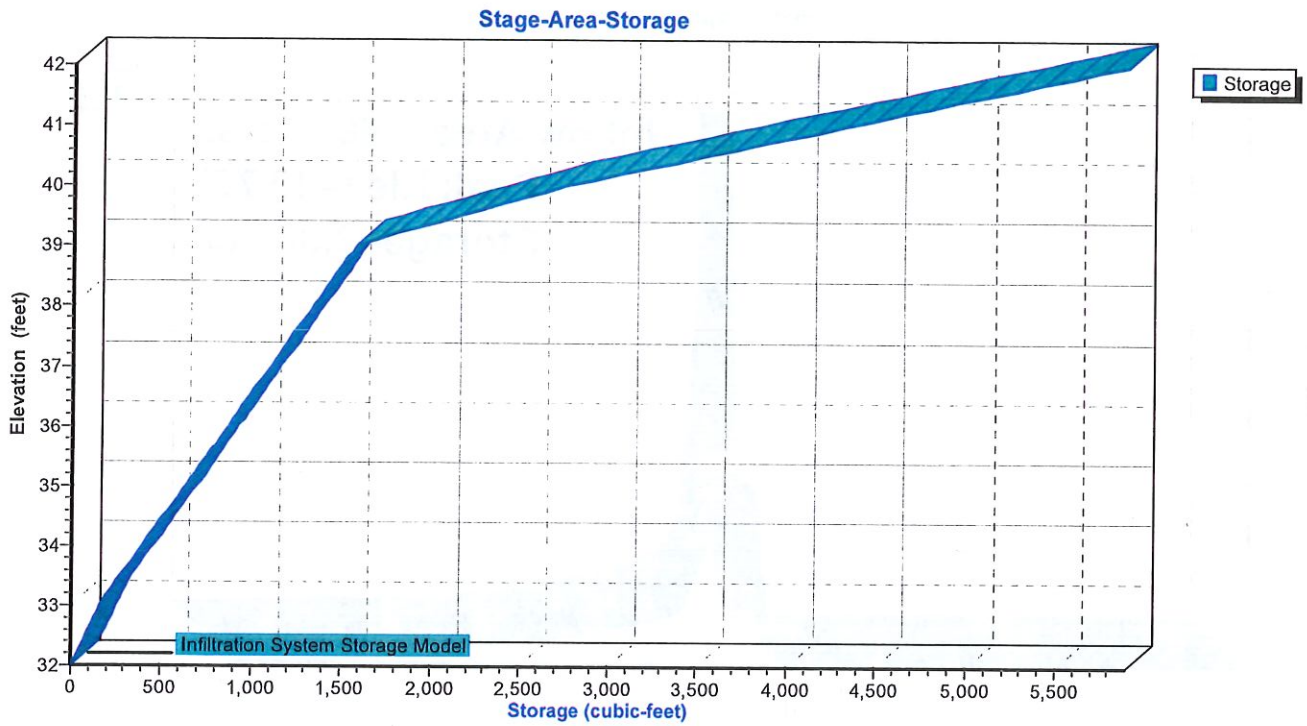
Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Pond 1P: Drainage Infiltration Model



Stage-Discharge for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
32.00	0.00	37.10	1.70
32.10	0.03	37.20	1.72
32.20	0.05	37.30	1.74
32.30	0.07	37.40	1.76
32.40	0.10	37.50	1.78
32.50	0.13	37.60	1.80
32.60	0.15	37.70	1.82
32.70	0.18	37.80	1.84
32.80	0.20	37.90	1.86
32.90	0.22	38.00	1.88
33.00	0.25	38.10	1.91
33.10	0.33	38.20	1.93
33.20	0.41	38.30	1.95
33.30	0.49	38.40	1.97
33.40	0.57	38.50	1.99
33.50	0.66	38.60	2.01
33.60	0.74	38.70	2.03
33.70	0.82	38.80	2.05
33.80	0.90	38.90	2.07
33.90	0.98	39.00	2.09
34.00	1.06	39.10	2.11
34.10	1.08	39.20	2.13
34.20	1.10	39.30	2.15
34.30	1.12	39.40	2.17
34.40	1.14	39.50	2.20
34.50	1.17	39.60	2.22
34.60	1.19	39.70	2.24
34.70	1.21	39.80	2.26
34.80	1.23	39.90	2.28
34.90	1.25	40.00	2.30
35.00	1.27	40.10	2.31
35.10	1.29	40.20	2.31
35.20	1.31	40.30	2.32
35.30	1.33	40.40	2.33
35.40	1.35	40.50	2.33
35.50	1.38	40.60	2.34
35.60	1.40	40.70	2.35
35.70	1.42	40.80	2.36
35.80	1.44	40.90	2.36
35.90	1.46	41.00	2.37
36.00	1.48	41.10	2.38
36.10	1.50	41.20	2.38
36.20	1.52	41.30	2.39
36.30	1.54	41.40	2.40
36.40	1.56	41.50	2.41
36.50	1.58	41.60	2.41
36.60	1.60	41.70	2.42
36.70	1.62	41.80	2.43
36.80	1.64	41.90	2.43
36.90	1.66	42.00	2.44
37.00	1.68		

Stage-Area-Storage for Pond 1P: Drainage Infiltration Model

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
32.00	0	37.10	1,124
32.10	16	37.20	1,147
32.20	31	37.30	1,170
32.30	47	37.40	1,194
32.40	63	37.50	1,218
32.50	79	37.60	1,241
32.60	94	37.70	1,265
32.70	110	37.80	1,288
32.80	126	37.90	1,311
32.90	141	38.00	1,335
33.00	157	38.10	1,359
33.10	181	38.20	1,382
33.20	204	38.30	1,406
33.30	228	38.40	1,429
33.40	251	38.50	1,453
33.50	275	38.60	1,477
33.60	299	38.70	1,500
33.70	322	38.80	1,524
33.80	346	38.90	1,547
33.90	369	39.00	1,571
34.00	393	39.10	1,688
34.10	417	39.20	1,805
34.20	440	39.30	1,922
34.30	464	39.40	2,039
34.40	487	39.50	2,157
34.50	511	39.60	2,274
34.60	535	39.70	2,391
34.70	558	39.80	2,508
34.80	582	39.90	2,625
34.90	605	40.00	2,742
35.00	629	40.10	2,900
35.10	653	40.20	3,057
35.20	676	40.30	3,215
35.30	699	40.40	3,372
35.40	723	40.50	3,530
35.50	747	40.60	3,688
35.60	770	40.70	3,845
35.70	794	40.80	4,003
35.80	817	40.90	4,160
35.90	840	41.00	4,318
36.00	864	41.10	4,476
36.10	888	41.20	4,633
36.20	911	41.30	4,791
36.30	935	41.40	4,948
36.40	958	41.50	5,106
36.50	982	41.60	5,264
36.60	1,006	41.70	5,421
36.70	1,029	41.80	5,579
36.80	1,053	41.90	5,736
36.90	1,076	42.00	5,894
37.00	1,100		

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Project Reports

- 1 Routing Diagram
- 2 Rainfall Events Listing (selected events)
- 3 Area Listing (all nodes)
- 4 Soil Listing (all nodes)
- 5 Ground Covers (all nodes)

Barn Cty 10 Yr Event

- 6 Node Listing
- 7 Subcat 1S: Drainage Area DA1
- 8 Pond 1P: Drainage Infiltration Model

Barn Cty 2 Yr Event

- 13 Node Listing
- 14 Subcat 1S: Drainage Area DA1
- 15 Pond 1P: Drainage Infiltration Model

Barn Cty 25 Yr Event

- 20 Node Listing
- 21 Subcat 1S: Drainage Area DA1
- 22 Pond 1P: Drainage Infiltration Model

Barn Cty 50 yr. Event

- 27 Node Listing
- 28 Subcat 1S: Drainage Area DA1
- 29 Pond 1P: Drainage Infiltration Model

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

DATE: 10-8-2021
Prepared by: down cape engineering, inc.
939 Route 6a Yarmouthport, MA 02675
Ph. 1-508-362-4541
Fax 1-508-362-9880

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

TABLE OF CONTENTS

1. Owner of Stormwater System and Responsible Party for Operation and Maintenance
2. Overview of Stormwater Management System
3. Source Control Best Management Practices
4. Schedule of Inspection and Maintenance of System
5. Plan of Stormwater BMPs location for maintenance (see attached Site Plans)
6. Estimated operations and maintenance budget
7. Operations and maintenance Log Form
8. Emergency Spill Contingency Plan

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

**OWNER OF STORMWATER SYSTEM AND
RESPONSIBLE PARTY FOR OPERATIONS AND
MAINTENANCE:**

OWNER/RESPONSIBLE PARTY:

Chris Our
56 Obed Brooks Road
Harwich, MA
508-432-0530

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

OVERVIEW OF STORMWATER MANAGEMENT SYSTEM:

The drainage systems specified for proposed development area have been designed in accordance with Town of Harwich Subdivision Rules and Regulations and engineering department guidelines. The system has been designed to fully comply with the Stormwater Management Guidelines.

The drainage system utilizes deep sump hooded catch basins leading to leaching pits and a natural overflow drainage basin. The proposed use is a residential subdivision and is not a "Land Use with Higher Potential Pollutant Load" per the State Stormwater Management Guidelines, and onsite infiltration of the full design storm is utilized. The underlying material is sand, hydrologic group A under the guidelines.

During construction the installation of silt controls near the down gradient border will provide protection. The erosion control fence is to be inspected after every 1/4" rain event and is to be maintained until the site is stabilized.

The systems are designed to contain and infiltrate the design storm event onsite. The parking lot is to be swept free of sand each spring, on or about April 1st.

Best Management Practices incorporated in the project are as follows:

- Rain Gardens / Bioinfiltration areas (90% TSS Removal)
- Deep Sump Hooded Manholes offline (44% TSS Removal)
- Infiltration Trenches/Pit (80% TSS Removal)

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

SCHEDULE OF INSPECTION AND MAINTENANCE OF STORMWATER MANAGEMENT SYSTEM:

SCHEDULE OF INSPECTION AND MAINTENANCE:

The stormwater management system proposed for the site requires regular inspection and maintenance to ensure proper operation and effectiveness.

1. It is recommended that the stormwater system proposed for the site be inspected annually, and sediment removed from the catch basins as required. The inspection should involve physical inspection of the catch basins and manholes for sediment buildup and inspecting the drywells for solids carryover. If significant solids are found in the basins (more than 2'), basins shall be mechanically cleaned, and the sediment disposed of offsite in compliance with all local, state, and federal regulations. If slow infiltration is noted during storm events, the bottom of the bioretention area should be scarified to restore infiltration, and if required the infiltration pits should be repaired or rebuilt as necessary to restore function.
2. The roadway shall be swept free of sand after the last snowfall of each season, generally on or about April 1st.
3. Repair any damage to paved aprons, overflow spillways, reset/rebuild as required.
4. Operations and maintenance reports are to be maintained by owner for 5 year history

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

SOURCE CONTROL BEST MANAGEMENT PRACTICES:

1. The pavement should be swept after the last snowfall of the season (sweep on or about April 1st) and when necessary to remove accumulated debris, drywells to be inspected annually.
2. No illicit discharges of any type are allowed into the storm water drainage system or sewer system. Personnel should be instructed in proper disposal of any cleaning materials, paints, chemicals, or other potentially harmful substances utilized on or about the property. Soaps and other deliveries shall be at the loading dock only, to minimize lifting and potential drops of heavier items.

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

#195 Queen Anne Road, Harwich, MA

EMERGENCY SPILL CONTINGENCY PLAN:

1. The owner of the facility shall have a designated person with overall responsibility for spill response.
2. A summary of this plan shall be posted in a prominent location in the building. The Summary shall identify the phone numbers of regulatory agencies and individuals to be contacted in the event of a spill.
3. In the event of a spill, the following shall be notified: (emergencies dial 911)
 - a) Harwich Fire Department 1-508-430-7546
(For a gasoline or hazardous materials spill)
 - b) Department of Environmental Protection 1-508-946-2850
Emergency Response
 - c) Harwich Water Department 1-508-432-0304
 - d) Harwich Board of Health 1-508-430-7509
4. Notification of authorities for the cleanup of spills shall be done immediately upon discovery of a spill, except for minor spills inside the building which can be managed by onsite personnel. Any release to the environment must be reported immediately.

STORMWATER OPERATIONS AND MAINTENANCE PLAN:

#195 Queen Anne Road, Harwich, MA

ESTIMATED OPERATIONS AND MAINTENANCE BUDGET:

Inspections: Annual inspection of drainage system:

**Visual inspection, probe sediment depth, review for signs of drainage issues, ...Est.
\$150/visit = \$150/year.**

**Maintenance of retention areas- mowing to be part of regular yardwork, removal
of sediment retilling bottom once per 8 years at \$1600 = \$200/yr**

Catch basin cleaning: Est. once every 2 years - \$150/year.

Street Sweeping: Est. \$400/visit.

INSPECTION AND MAINTENANCE LOG FORM-
Long Term Pollution Prevention and Erosion and Sedimentation
Control

Project Name: Our Subdivision

Owner: Chris Our

Contractor:

Date Description of Inspection or Maintenance Person Comments
(Sweep road, apron maintenance, silt fence, etc.)

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

DATE: 10-8-2021

Prepared by: down cape engineering, inc.

939 Route 6a Yarmouthport, MA 02675

Ph. 1-508-362-4541

Fax 1-508-362-9880

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

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1. Narrative
2. Construction Period Operation and Maintenance Plan
3. Responsible Party for Plan Compliance
4. Erosion and Sedimentation Control Plan Drawings (see separate full-size plans install silt fence at downgradient proposed fenceline)
5. Detail drawings and specifications for erosion control BMP's (see separate sheets)
6. Vegetation Planning (see separate sheets)
7. Site Development Plans (see separate sheets/contract documents)
8. Construction Sequencing Plan
9. Sequencing of Erosion and Sedimentation Controls
10. Schedule of Inspection
11. Schedule of Maintenance
12. Inspection and Maintenance Log Form

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

RESPONSIBLE PARTY FOR PLAN COMPLIANCE:

OWNER/RESPONSIBLE PARTY:

Chris Our
56 Obed Brooks Road
Harwich, MA
508-432-0530

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

NARRATIVE OF CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

The development proposal for Fish & Game Drive and Wildlife Circle, Harwich consists of a seven-lot residential subdivision and roadway. Erosion control consisting of silt fencing will be utilized to reduce the chance of any storm water pollution resulting from silt washing from the subject property. The underlying base soil material is clean sand, hydrologic group A. The drainage system utilizes deep sump hooded catch basins leading to leaching pits and a natural overflow drainage basin. The proposed work will generate a small potential for construction silt to leave the site. Temporary haybales are to be utilized where required near the daily construction areas, and silt fencing installed on the downgradient edges is to be installed prior to any other work on the site.

During construction, the natural sandy perimeter of the site, natural drainage areas, and the installation of a silt fence near the downgradient borders will provide protection from off site runoff. The rain garden areas will be excavated and utilized for stormwater infiltration during construction. Any construction silt is to be removed from the bottom of the natural drainage areas prior to final construction of the drainage structures. The erosion control fence is to be inspected after every ¼" rain event and is to be maintained until the site is stabilized and a certificate of compliance obtained. A dedicated stone construction apron is planned.

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

CONSTRUCTION PERIOD OPERATION AND MAINTENANCE PLAN:

Construction Period Operation and Maintenance shall consist of installation and maintenance of appropriate erosion and sedimentation controls and best management practices such as litter pickup. The Operations and Maintenance will be per the schedule attached to this plan. The sediment barriers will be inspected after every rain event in excess of ¼" of precipitation. The inspection should involve physical inspection the silt fence for sediment buildup or solids carryover. If significant sediments are found against the silt fence the silt shall be mechanically removed. The crushed stone entrance apron shall be maintained, and the paved roadway shall be inspected for vehicle tracking and swept as required to prevent sediment from reaching the street infiltration systems. The proposed natural drainage areas will be utilized for stormwater control during the construction process. If siltation slows the infiltration of the temporary infiltration area, the bottom of the drainage area shall be cleaned of silt such that the infiltration capacity is restored.

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

Fish & Game Drive and Wildlife Circle, Harwich, MA

Construction Sequencing Plan:

The site will proceed continuously from silt fence installation, stone apron installation, site clearing, to utility and drainage installation, construction roadway base layers, paving, and then final landscaping work.

The silt fence installed at the downgradient proposed work limit line will not be removed until the site is fully stabilized after construction.

SEQUENCING OF EROSION AND SEDIMENTATION CONTROLS:

The erosion and sedimentation controls will be placed per plan as follows:

1. Work limit lines shall be staked in the field under the supervision of a Licensed Professional Land Surveyor to ensure accurate placement.
2. The silt fence line shall be installed as shown on the plans.
3. The washed stone construction apron shall be installed at the entrance of the site
4. The natural drainage areas shall be utilized for stormwater control during the construction process.

CONSTRUCTION PERIOD POLLUTION AND EROSION AND SEDIMENTATION CONTROL PLAN:

#195 Queen Anne Road, Harwich, MA

SCHEDULE OF INSPECTION AND MAINTENANCE OF STORMWATER MANAGEMENT SYSTEM:

SCHEDULE OF INSPECTION AND SCHEDULE OF MAINTENANCE:

The erosion and sediment control plan proposed for the site requires regular inspection and maintenance to ensure proper operation and effectiveness.

1. The sediment barriers should be inspected after every rain event in excess of one-quarter inch of precipitation.
2. The inspection should involve physical inspection the silt fence for sediment buildup or solids carryover.
3. If significant sediments are found against the silt fence (more than 6" buildup measured from grade) the silt shall be mechanically removed.
4. The natural drainage areas shall be inspected, and any significant buildup of silt shall be removed. The infiltration pits shall not be utilized until the site is paved and stable.
5. The roadway shall be inspected for vehicle tracking and swept as required to prevent sediment from reaching the roadway drainage system, the operator shall monitor weather forecasts regularly to ensure timely sweeping prior to large rain events.



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STORMWATER NARRATIVE:

Fish & Game Drive & Wildlife Circle, Harwich, MA.

Date: 10-8-2021 © 2021 down cape engineering, inc.

OVERVIEW OF STORMWATER MANAGEMENT SYSTEM/ NARRATIVE INDICATING STORMWATER STANDARDS COMPLIANCE:

The drainage systems specified for proposed development have been designed in accordance with Town of Harwich Subdivision Rules and Regulations. The project consists of a seven-lot residential subdivision. Full compliance with all Stormwater Standards is met by the design. The site is within the Residential (RR) zoning district. The site is not a "Land Use with Higher Potential Pollutant Load" per the State Stormwater Management Guidelines, so infiltration after pretreatment is utilized. The underlying material is sand, hydrologic group A under the guidelines.

During construction, the installation of a silt controls where needed and a stone construction apron will provide full protection of the abutters and roadway. The erosion control fence is to be inspected after every rain event and is to be maintained until the site is stabilized and the permission obtained for removal. The stone drive apron will be utilized in the roadway entrance area during the work. There are no wetlands near the work areas.

The proposed offline deep sump hooded catch basins overflow to secondary deep sump hooded manholes installed prior to the infiltration units, so the design meets the 44% TSS removal prior to infiltration as required by the Standards. A natural drainage overflow area is proposed to help remove nitrogen and phosphorus. The infiltration system is sized per the subdivision guidelines using hydrocad calculations, which shows a 25 year storm event is contained and infiltrated onsite and provides the required Total Suspended Solids (TSS) removal mandated by the State Stormwater Management Guidelines.

Best Management Practices incorporated in the project are as follows:

- Rain Gardens / Bioinfiltration areas (90% TSS Removal)
- Deep Sump Hooded Catch Basins offline (25% TSS Removal)
- Secondary Deep Sump Hooded Manholes (25% TSS Removal)
- Infiltration pits (80% TSS Removal)

Compliance with the 10 State Stormwater Standards (in order in bold with explanation in lighter font following the numbered Standards is as follows:

1. **No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.**
The project prevents existing stormwater from entering waters of the Commonwealth, and no new outfalls are proposed, so this standard is met and exceeded. The local regulation require a 25 year storm be infiltrated 100% onsite, exceeding the State requirements.
2. **Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.**
The sandy soils permit onsite infiltration, the proposed drainage system will infiltrate a 25 year storm event onsite per the attached calculations, so this Standard is easily met by the proposal. Since the majority of a 100 year storm with Type III distribution (high peak) is also infiltrated onsite no greater impact to abutters than existing is assured.
3. **Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.**
Local Town of Harwich requirements call for all stormwater to be infiltrated onsite for proposed subdivisions, and the proposed development complies with this standard, so the annual recharge is easily met.
4. **Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:**
 - a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
 - b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
 - c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

A long term pollution prevention plan is to be attached, in excess of the correct volumes are captured, and pretreatment is provided per the Handbook, so compliance with #4 is assured.
5. **For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00. The standard residential lots and roadway are not applicable to higher potential pollutant loads per the Handbook, so this standard is "Not Applicable" for this site. (note that 44% TSS removal pretreatment is provided prior to infiltration).**

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply. The site is not within a Zone I, Zone A, or Zone II

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions. This project fully complies with the standards.

8. A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented. The plans are to be provided under separate cover.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed. The plan to be attached.

10. All illicit discharges to the stormwater management system are prohibited. No illicit discharges are allowed or planned related to this site. Additional documentation will be filed per the stormwater instructions.

As shown above and in the following calculations, the proposed site will be compliant with the State Stormwater Management Guidelines.