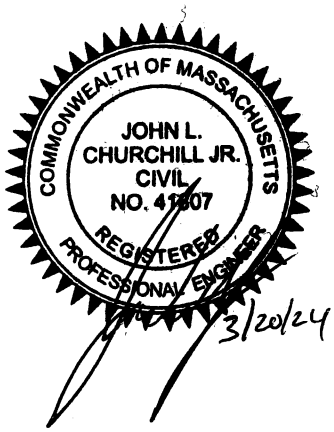
DRAINAGE CALCULATIONS
&
SUPPLEMENTAL INFORMATION

HIDDEN TRAILS
OFF COUNTY ROAD
W. WAREHAM, MA

SEPTEMBER 7, 2023

REV1: FEBRUARY 9, 2024
REV2: MARCH 20, 2024



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HIDDEN TRAILS

W. WAREHAM, MA

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1. Project Description

Narrative

This project involves the development of a residential 56-lot cluster subdivision and its associated roadway, utilities, and stormwater management systems. The site has been developed to meet the Massachusetts Stormwater Standards and applicable Town of Wareham regulations pertaining to Stormwater Management.

Existing Conditions

The project site is accessed off of County Road and comprises of the formerly permitted subdivision known as "The Pond at Fearing Hill" as well as an adjacent 18 acre undeveloped parcel shown as Lot 1013 on Assessors Map 63. The prior development was not constructed, but involved the creation of approximately 11,900 feet of proposed roadways to provide access to 44 conventional sized residential lots and various open space parcels. The total land area of the current project is approximately 153 acres, which includes a 30.5 acre manmade pond centrally located on the property. The manmade pond was created by a former sand mining operation that is no longer active. Besides the alteration that created the pond, there are approximately 27 acres of adjacent bordering vegetated wetlands and approximately 16.5 acres of unvegetated, previously disturbed property. The approximately 79 acres of the remainder of the property, besides some trails and a couple of former sand pits, is undeveloped woodland.

Proposed Conditions

The proposed project has been designed in accordance with *Article 8: Alternative Residential Sie Development* of the Town of Wareham Zoning Bylaw to create a 56-lot residential cluster development. The lots will be accessed from a roadway system that has a total length of approximately 6,700 feet. The roadway and developable lots will utilize approximately 37 acres of the entire property. The remainder of the property will consist of approximately 116 acres of open space, which includes the 30.5 acre manmade pond. The grading has been designed to minimize significant cuts & fills across the site and will follow existing drainage patterns. A Stormwater Management System will capture, treat, and infiltrate runoff up to and including a 100-year storm event.

Soil Description

Existing soil classifications and hydrologic soil groups for the site were obtained from the USDA Soil Conservation Service, Soil Survey of Plymouth County, Massachusetts & The Web Soil Survey. The soil types found within the limits of the drainage analysis are classified as the following:

1.) Windsor Loamy Sand, 3 to 8 percent slopes (255B)
2.) Deerfield Loamy Fine Sand, 0 to 3 percent slopes (256A)
3.) Deerfield Loamy Fine Sand, 3 to 8 percent slopes (256B)
4.) Carver Loamy Coarse Sand, 0 to 3 percent slopes (259A)
5.) Aquepts, 0 to 3 percent slopes (657A)
6.) Udipsamments, 0 to 8 percent slopes (665B)

Besides the Aquepts soils group, which are comprised of the centrally located wetland system, all of the above soil types are within hydrological classification group "A" and is the primary soil type within the portion of the property to be developed.

2. Hydrologic Analysis & Stormwater Management

Methodology

Stormwater runoff was evaluated for the 2-year, 10-year, 25-year, and 100-year, Type III, 24-hour storm for both pre-development and post-development conditions. Pre-development and post-development conditions were modeled using HydroCAD software, which combines USDA Soil Conservation Service hydrology and hydraulic techniques (commonly known as SCS TR-55 and TR-20) to generate hydrographs (calculations are provided in the supplemental section of this report). The rainfall amounts used for calculating runoff for the 2-year, 10-year, 25-year and 100-year storm events were obtained from the NOAA Atlas 14 Volume 10 Frequency Estimates.

Table 1 provided at the end of this report identifies on-site and off-site design points for both existing and proposed conditions. **Table 2** compares the pre-development and post-development peak runoff rates and volumes for the 2-year, 10-year, 25-year, and 100-year storm events at six separate design points for the Type III, 24-hour storm events. The design points were evaluated to ensure post-development peak runoff rates and volumes do not exceed pre-development amounts.

Pre-Development Drainage Conditions

The site was modeled into 7 sub-catchment areas under existing conditions. Four of the existing sub-catchment areas discharge to offsite Design Points, while three existing subcatchment areas drain to onsite depressions or wetlands.

Refer to the EX-DA Plan prepared by this office at the end of this report.

Post-Development Drainage Conditions

Post-development drainage conditions and patterns were maintained to the maximum extent possible. The site was modeled into 6 sub-catchments that correspond with the same offsite and onsite Design Points modeled under pre-development conditions. Three additional sub-catchments were modeled (7S, 8S, and 9S) to evaluate onsite, upland depressions that will collect surface water runoff. These onsite depressions were modeled to determine the peak storage within the depressions for up to and including a 100-year storm, without accounting for any infiltration. To evaluate the Drainage System, subcatchments draining to each catchbasin were utilized to calculate the necessary size of the downstream drainage piping systems and infiltration basins. The drainage piping system was sized for the 25-year storm event, while the infiltration basins were sized to contain up to and including a 100-year storm event.

Refer to the PR-DA Plan and PR-DA for Drainage System Plan prepared by this office at the end of this report.

Results of Stormwater Management Analysis

Table 1 summarizes contributing areas under pre and post development conditions to the design points chosen on the project site. Table 2 summarizes the pre and post development peak rates of runoff and volume for the 2-year, 10-year, 25-year, and 100-year storm events.

Existing Areas	Proposed Areas	Design Point	Description
EX-1	PR-1	DP-1	OFFSITE onto County Road
EX-2	PR-2	DP-2	OFFSITE to East (South of Wishbone Way)
EX-3	PR-3	DP-3	ONSITE (Isolated Wetland)
EX-4	PR-4	DP-4	OFFSITE to West (cranberry bogs)
EX-5	PR-5	DP-5	OFFSITE to North (cranberry bogs)
EX-6	PR-6	DP-6	ONSITE (Manmade Pond)
EX-7	N/A	N/A	ONSITE (Fomer Sand Pit)

Table 1: Existing and Proposed Contributing Areas to Design Points

	Peak Flow		Peak Volume		% Reduction	
	Existing (cfs)	Proposed (cfs)	Existing (af)	Proposed (af)	Flow (cfs)	Volume (af)
DP-1 (offsite)						
2-Yr Event	0.00	0.00	0.000	0.000	0%	0%
10-Yr Event	0.00	0.00	0.000	0.000	0%	0%
25-Yr Event	0.01	0.00	0.004	0.002	100%	50%
100-Yr Event	0.03	0.02	0.015	0.008	50%	47%
DP-2 (offsite)						
2-Yr Event	0.00	0.00	0.000	0.000	0%	0%
10-Yr Event	0.00	0.00	0.002	0.002	0%	0%
25-Yr Event	0.02	0.01	0.014	0.006	50%	57%
100-Yr Event	0.13	0.08	0.050	0.019	38%	62%
DP-3 (onsite)						
2-Yr Event	0.03	0.03	0.018	0.017	0%	5%
10-Yr Event	0.47	0.47	0.096	0.095	0%	1%
25-Yr Event	1.07	1.06	0.168	0.166	1%	1%
100-Yr Event	2.37	2.34	0.307	0.304	1%	1%
DP-4 (offsite)						
2-Yr Event	0.00	0.00	0.000	0.000	0%	0%
10-Yr Event	0.02	0.02	0.013	**0.013**	0%	**0%**
25-Yr Event	0.14	**0.10**	0.087	**0.039**	**29%**	**55%**
100-Yr Event	0.70	**0.53**	0.316	**0.100**	**24%**	**68%**
DP-5 (offsite)						
2-Yr Event	0.00	0.00	0.000	0.000	0%	0%
10-Yr Event	0.04	0.03	0.029	0.019	25%	34%
25-Yr Event	0.22	0.11	0.141	0.064	50%	55%
100-Yr Event	1.04	0.78	0.457	0.176	24%	61%
DP-6 (onsite)						
2-Yr Event	0.02	0.01	0.008	0.007	50%	13%
10-Yr Event	0.50	0.42	0.282	0.135	16%	52%
25-Yr Event	2.03	1.49	0.616	0.282	27%	54%
100-Yr Event	6.54	5.48	1.333	0.590	16%	56%

Table 2: summarizes the pre and post development peak rates of runoff and volume

3. Conformance with Stormwater Management Standards

The stormwater management systems have been designed to comply with the Massachusetts Stormwater Management Policy. The Policy includes the following 10 standards:

1. ***No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.***

   This project does not include any new untreated stormwater conveyances or outfalls that discharge directly to wetlands or waters of the Commonwealth.

   The stormwater management systems utilize a number of BMPs to catch, treat, and infiltrate stormwater runoff for all storms up to and including the 100-year storm event.

2. ***Stormwater managements 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.***

   As can be seen on the Table 1 and 2 of this report and the Drainage Areas Plans at the end of this report, there are (4) offsite Design Points (DP-1, DP-2, DP-4, and DP-5) and (2) onsite Design Points (DP-3 and DP-6). The onsite design points are existing wetland pockets and depressions that were created from prior site mining activities and are not to be altered as part of this project. The results of the 2-year, 10-year, 25-year, and 100-year storm events show that the post-development peak rates and volumes for the offsite and onsite design points are less than the pre-development peak rates and volumes.

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 upon 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.***

   The supplemental information and calculations included with this report show that the minimum volume to recharge of 0.6" of runoff multiplied by the impervious area (per Hydrologic Group A) is far exceeded by the available storage volume within each Infiltration Basin. Further, the attached total suspended solids (TSS) calculations show that a minimum of 44% of the TSS will be removed by the use of deep sump catchbasins and proprietary structures prior to discharge to the infiltration basins. This project must achieve a minimum of 44% TSS removal rates prior to infiltration due to the proposed discharges occurring within areas of rapid infiltration rates (greater than 2.4 inches per hour). Also, the calculations show that each infiltration basin will drain within 72 hours.

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.***

    This project includes the use of numerous BMP's that will achieve a minimum 92.5% TSS removal rates for each stormwater management system. This removal rate is also in compliance with the Town of Wareham Zoning By-Laws, Article 12, Section 1260, which requires a minimum 90% TSS removal rates for newly developed sites. Included with this report are TSS calculations, water quality volume calculations, and a long-term pollution prevention plan.

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….***

    This project does not include any land uses with higher potential pollutant loads.

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…..***

    This project does not occur within a Zone II, Interim Wellhead Protection Area, nor within any other critical areas.

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 is considered new development.

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.***

   Erosion and sediment control methods and prevention plans are included on the Plans and within this report.

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

   An operations and maintenance plan is included with this report.

10. ***All illicit discharges to the stormwater management system are prohibited.***

    An illicit discharge statement has been included within the operation and maintenance plan.

WATER QUALITY VOLUME CALCULATIONS

HIDDEN TRAILS off County Road

WEST WAREHAM, MA

Water Quality Depth: 1 inch For Discharge to an area with an infiltration rate >2.4 in/hr

INFILTRATION BASIN #1:

Impervious Area (I) = 45,807 s.f.

Water Quality Volume (WQV) Required to be Treated (1" of runoff)

- WQV = 1" x I (s.f.)
- WQV = 1"/(12 in/ft) x 45,807 s.f. = **3,817 c.f.** required

Water Quality Volume Provided

- The storage volume is **34,082** c.f. within the infiltration basin below elevation 39.7' (refer to HydroCAD output of "Pond IB1-P" in drainage report)

Conclusion: Total recharge volume of **34,082** c.f. provided is greater than the required recharge volume of **3,817** c.f.; therefore **OK**.

INFILTRATION BASIN #2:

Impervious Area = 84,347 s.f.

Water Quality Volume (WQV) Required to be Treated (1" of runoff)

- WQV = 1" x I (s.f.)
- WQV = 1"/(12 in/ft) x 84,347 s.f. = **7,029 c.f.** required

Water Quality Volume Provided

- The storage volume is **43,350** c.f. within the infiltration basin below elevation 33.5' (refer to HydroCAD output of "Pond IB2-P" in drainage report)

Conclusion: Total recharge volume of **43,350** c.f. provided is greater than the required recharge volume of **7,029** c.f.; therefore **OK**.

INFILTRATION BASIN #3:

Impervious Area = 36,300 s.f.

Water Quality Volume (WQV) Required to be Treated (1" of runoff)

- WQV = 1" x I (s.f.)
- WQV = 1"/(12 in/ft) x 36,300 s.f. = **3,025 c.f.** required

Water Quality Volume Provided

- The storage volume is **27,453** c.f. within the infiltration basin below elevation 37.6' (refer to HydroCAD output of "Pond IB3-P" in drainage report)

Conclusion: Total recharge volume of **27,453** c.f. provided is greater than the required recharge volume of **3,025** c.f.; therefore **OK**.

INFILTRATION BASIN #4:

Impervious Area = 151,870 s.f.

Water Quality Volume (WQV) Required to be Treated (1" of runoff)

- **WQV = 1" x I (s.f.)**
- **WQV = 1"/(12 in/ft) x 151,870 s.f. = 12,656 c.f. required**

Water Quality Volume Provided

- **The storage volume is 79,651 c.f. within the infiltration basin below elevation 35.5' (refer to HydroCAD output of "Pond IB4-P" in drainage report)**

Conclusion: Total recharge volume of 79,651 c.f. provided is greater than the required recharge volume of 12,656 c.f.; therefore OK.

INFILTRATION BASIN #5:

Impervious Area = 23,850 s.f.

Water Quality Volume (WQV) Required to be Treated (1" of runoff)

- WQV = 1" x I (s.f.)
- WQV = 1"/(12 in/ft) x 23,850 s.f. = **1,988 c.f.** required

Water Quality Volume Provided

- The storage volume is **17,080** c.f. within the infiltration basin below elevation 38.0' (refer to HydroCAD output of "Pond IB5-P" in drainage report)

Conclusion: Total recharge volume of **17,080** c.f. provided is greater than the required recharge volume of **1,988** c.f.; therefore **OK**.

HYDRODYNAMIC SEPARATOR SIZING:

Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices (attached with Report):

$$\mathbf{Q_{max} = (qu)*(A)*(D_{WQ})}$$

Q_{max} = peak flow rate associated with first 1-inch of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
D_{WQ} = water quality volume in watershed inches (1.0-inches in this case)

See Table on following page for sizing documentation of Hydrodynamic Separators (CDS) for each contributing drainage area.

- $\mathbf{Q_{max} = (qu)*(A)*(D_{WQ})}$

HIDDEN TRAILS **CDS Sizing Chart**
Off County Road, West Wareham, MA **REV: 3/20/2024**

Standard Method to Convert Required Water Quality Volume to a Dicharge Rate

Water Quality Depth (D_{WQ}) with infiltration rate > 2.4 in/hr = **1** inch

Structure Name	Contributing Imp. Area (A) (s.f.)	Unit Peak Discharge (qu) (csm/in)	Contributing Imp. Area (A) (square miles)	Water Quality Flow (Qmax) (cfs)	Required Treatment Structure*
DMH-5	29,257	795	0.00105	0.83	CDS 2015-4
DMH-7	16,550	795	0.00059	0.47	CDS 2015-5
DMH-22	81,510	795	0.00292	2.32	CDS 2015-4
DMH-25	36,300	795	0.00130	1.04	CDS 2015-4
DMH-32	117,620	795	0.00422	3.35	CDS 2015-5
DMH-13	34,250	795	0.00123	0.98	CDS 2015-4
DMH-16	23,850	795	0.00086	0.68	CDS 2015-4

- $Q_{max} = (qu)*(A)*(D_{WQ})$

Q_{max} = peak flow rate associated with first 1-inch of runoff
qu = the unit peak discharge, in csm/in. (used t_c = 6 min)
A = impervious surface drainage area (in square miles)

*Required Treatment Structure per Hydrodynamic Separation Calculator (see attached results)

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #1 (DMH 5)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.0536	0.0536	7.66%	99.88%	35.26%
0.1600	23.79%	59.09%	23.79%	0.1072	0.1072	15.31%	98.35%	23.40%
0.2400	12.91%	72.00%	12.91%	0.1608	0.1608	22.97%	96.81%	12.50%
0.3200	7.83%	79.83%	7.83%	0.2144	0.2144	30.63%	95.28%	7.46%
0.4000	4.91%	84.74%	4.91%	0.2680	0.2680	38.29%	93.75%	4.60%
0.4800	3.50%	88.24%	3.50%	0.3216	0.3216	45.94%	92.22%	3.23%
0.5600	1.71%	89.95%	1.71%	0.3752	0.3752	53.60%	90.68%	1.55%
0.6400	1.83%	91.78%	1.83%	0.4288	0.4288	61.26%	89.15%	1.63%
0.7200	1.87%	93.65%	1.87%	0.4824	0.4824	68.91%	87.62%	1.64%
0.8000	0.91%	94.56%	0.91%	0.5360	0.5360	76.57%	86.09%	0.78%
1.0000	2.32%	96.88%	2.32%	0.6700	0.6700	95.71%	82.26%	1.91%
2.0000	2.88%	99.76%	1.50%	1.3400	0.7000	100.00%	42.52%	1.22%
3.0000	0.23%	99.99%	0.08%	2.0100	0.7000	100.00%	28.35%	0.07%
								95.25%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	98.46%
							Predicted Net Annual Load Removal Efficiency =	95.25%

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #1 (DMH 7)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.0304	0.0304	4.34%	100.00%	35.30%
0.1600	23.79%	59.09%	23.79%	0.0608	0.0608	8.69%	99.67%	23.71%
0.2400	12.91%	72.00%	12.91%	0.0912	0.0912	13.03%	98.80%	12.76%
0.3200	7.83%	79.83%	7.83%	0.1216	0.1216	17.37%	97.93%	7.67%
0.4000	4.91%	84.74%	4.91%	0.1520	0.1520	21.71%	97.07%	4.77%
0.4800	3.50%	88.24%	3.50%	0.1824	0.1824	26.06%	96.20%	3.37%
0.5600	1.71%	89.95%	1.71%	0.2128	0.2128	30.40%	95.33%	1.63%
0.6400	1.83%	91.78%	1.83%	0.2432	0.2432	34.74%	94.46%	1.73%
0.7200	1.87%	93.65%	1.87%	0.2736	0.2736	39.09%	93.59%	1.75%
0.8000	0.91%	94.56%	0.91%	0.3040	0.3040	43.43%	92.72%	0.84%
1.0000	2.32%	96.88%	2.32%	0.3800	0.3800	54.29%	90.55%	2.10%
2.0000	2.88%	99.76%	2.65%	0.7600	0.7000	100.00%	74.97%	2.16%
3.0000	0.23%	99.99%	0.14%	1.1400	0.7000	100.00%	49.98%	0.11%
								97.90%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	99.67%
							Predicted Net Annual Load Removal Efficiency =	97.90%
1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA								
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.								

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #2 (DMH 22)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.1496	0.1496	21.37%	97.13%	34.29%
0.1600	23.79%	59.09%	23.79%	0.2992	0.2992	42.74%	92.86%	22.09%
0.2400	12.91%	72.00%	12.91%	0.4488	0.4488	64.11%	88.58%	11.44%
0.3200	7.83%	79.83%	7.83%	0.5984	0.5984	85.49%	84.30%	6.60%
0.4000	4.91%	84.74%	4.59%	0.7480	0.7000	100.00%	76.18%	3.74%
0.4800	3.50%	88.24%	2.73%	0.8976	0.7000	100.00%	63.48%	2.22%
0.5600	1.71%	89.95%	1.14%	1.0472	0.7000	100.00%	54.41%	0.93%
0.6400	1.83%	91.78%	1.07%	1.1968	0.7000	100.00%	47.61%	0.87%
0.7200	1.87%	93.65%	0.97%	1.3464	0.7000	100.00%	42.32%	0.79%
0.8000	0.91%	94.56%	0.43%	1.4960	0.7000	100.00%	38.09%	0.35%
1.0000	2.32%	96.88%	0.87%	1.8700	0.7000	100.00%	30.47%	0.71%
2.0000	2.88%	99.76%	0.54%	3.7400	0.7000	100.00%	15.24%	0.44%
3.0000	0.23%	99.99%	0.03%	5.6100	0.7000	100.00%	10.16%	0.02%
								84.49%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	92.20%
							Predicted Net Annual Load Removal Efficiency =	84.49%

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #3 (DMH 25)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.0664	0.0664	9.49%	99.51%	35.13%
0.1600	23.79%	59.09%	23.79%	0.1328	0.1328	18.97%	97.61%	23.22%
0.2400	12.91%	72.00%	12.91%	0.1992	0.1992	28.46%	95.72%	12.36%
0.3200	7.83%	79.83%	7.83%	0.2656	0.2656	37.94%	93.82%	7.35%
0.4000	4.91%	84.74%	4.91%	0.3320	0.3320	47.43%	91.92%	4.51%
0.4800	3.50%	88.24%	3.50%	0.3984	0.3984	56.91%	90.02%	3.15%
0.5600	1.71%	89.95%	1.71%	0.4648	0.4648	66.40%	88.12%	1.51%
0.6400	1.83%	91.78%	1.83%	0.5312	0.5312	75.89%	86.22%	1.58%
0.7200	1.87%	93.65%	1.87%	0.5976	0.5976	85.37%	84.33%	1.58%
0.8000	0.91%	94.56%	0.91%	0.6640	0.6640	94.86%	82.43%	0.75%
1.0000	2.32%	96.88%	1.96%	0.8300	0.7000	100.00%	68.65%	1.59%
2.0000	2.88%	99.76%	1.21%	1.6600	0.7000	100.00%	34.33%	0.99%
3.0000	0.23%	99.99%	0.06%	2.4900	0.7000	100.00%	22.88%	0.05%
								93.77%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	97.79%
							Predicted Net Annual Load Removal Efficiency =	93.77%

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #4 (DMH 13)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.0632	0.0632	9.03%	99.60%	35.16%
0.1600	23.79%	59.09%	23.79%	0.1264	0.1264	18.06%	97.80%	23.27%
0.2400	12.91%	72.00%	12.91%	0.1896	0.1896	27.09%	95.99%	12.39%
0.3200	7.83%	79.83%	7.83%	0.2528	0.2528	36.11%	94.18%	7.37%
0.4000	4.91%	84.74%	4.91%	0.3160	0.3160	45.14%	92.38%	4.54%
0.4800	3.50%	88.24%	3.50%	0.3792	0.3792	54.17%	90.57%	3.17%
0.5600	1.71%	89.95%	1.71%	0.4424	0.4424	63.20%	88.76%	1.52%
0.6400	1.83%	91.78%	1.83%	0.5056	0.5056	72.23%	86.96%	1.59%
0.7200	1.87%	93.65%	1.87%	0.5688	0.5688	81.26%	85.15%	1.59%
0.8000	0.91%	94.56%	0.91%	0.6320	0.6320	90.29%	83.34%	0.76%
1.0000	2.32%	96.88%	2.06%	0.7900	0.7000	100.00%	72.13%	1.67%
2.0000	2.88%	99.76%	1.28%	1.5800	0.7000	100.00%	36.06%	1.04%
3.0000	0.23%	99.99%	0.07%	2.3700	0.7000	100.00%	24.04%	0.06%
								94.13%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	97.97%
							Predicted Net Annual Load Removal Efficiency =	94.13%

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #4 (DMH 32)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.2160	0.2160	30.86%	95.23%	33.62%
0.1600	23.79%	59.09%	23.79%	0.4320	0.4320	61.71%	89.06%	21.19%
0.2400	12.91%	72.00%	12.91%	0.6480	0.6480	92.57%	82.89%	10.70%
0.3200	7.83%	79.83%	6.34%	0.8640	0.7000	100.00%	65.95%	5.16%
0.4000	4.91%	84.74%	3.18%	1.0800	0.7000	100.00%	52.76%	2.59%
0.4800	3.50%	88.24%	1.89%	1.2960	0.7000	100.00%	43.97%	1.54%
0.5600	1.71%	89.95%	0.79%	1.5120	0.7000	100.00%	37.69%	0.64%
0.6400	1.83%	91.78%	0.74%	1.7280	0.7000	100.00%	32.97%	0.60%
0.7200	1.87%	93.65%	0.67%	1.9440	0.7000	100.00%	29.31%	0.55%
0.8000	0.91%	94.56%	0.29%	2.1600	0.7000	100.00%	26.38%	0.24%
1.0000	2.32%	96.88%	0.60%	2.7000	0.7000	100.00%	21.10%	0.49%
2.0000	2.88%	99.76%	0.37%	5.4000	0.7000	100.00%	10.55%	0.30%
3.0000	0.23%	99.99%	0.02%	8.1000	0.7000	100.00%	7.03%	0.02%
								77.64%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	86.89%
							Predicted Net Annual Load Removal Efficiency =	77.64%

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

off County Road, West Wareham, MA

Infiltration Basin #5 (DMH 16)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0800	35.30%	35.30%	35.30%	0.0440	0.0440	6.29%	100.00%	35.30%
0.1600	23.79%	59.09%	23.79%	0.0880	0.0880	12.57%	98.89%	23.53%
0.2400	12.91%	72.00%	12.91%	0.1320	0.1320	18.86%	97.64%	12.61%
0.3200	7.83%	79.83%	7.83%	0.1760	0.1760	25.14%	96.38%	7.55%
0.4000	4.91%	84.74%	4.91%	0.2200	0.2200	31.43%	95.12%	4.67%
0.4800	3.50%	88.24%	3.50%	0.2640	0.2640	37.71%	93.86%	3.29%
0.5600	1.71%	89.95%	1.71%	0.3080	0.3080	44.00%	92.61%	1.58%
0.6400	1.83%	91.78%	1.83%	0.3520	0.3520	50.29%	91.35%	1.67%
0.7200	1.87%	93.65%	1.87%	0.3960	0.3960	56.57%	90.09%	1.68%
0.8000	0.91%	94.56%	0.91%	0.4400	0.4400	62.86%	88.83%	0.81%
1.0000	2.32%	96.88%	2.32%	0.5500	0.5500	78.57%	85.69%	1.99%
2.0000	2.88%	99.76%	1.83%	1.1000	0.7000	100.00%	51.80%	1.49%
3.0000	0.23%	99.99%	0.10%	1.6500	0.7000	100.00%	34.53%	0.08%
								96.25%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	98.81%
							Predicted Net Annual Load Removal Efficiency =	96.25%

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

INFILTRATION DRAIN-DOWN TIME CALCULATIONS

HIDDEN TRAILS off County Road

WEST WAREHAM, MA

INFILTRATION BASIN #1 (Pond IB1-P):

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Storage Volume = 34,082 c.f.

Bottom Area = 8,550 s.f.

= 34,082 c.f. / [(2.4 in/hr) (1ft/12 inches) x 8,550 s.f.]

= **19.9 hours**, which is less than max. drain time of 72 hours, therefore OK.

INFILTRATION BASIN #2 (Pond IB2-P):

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Storage Volume = 43,350 c.f.

Bottom Area = 10,900 s.f.

= 43,350 c.f. / [(2.4 in/hr) (1ft/12 inches) x 10,900 s.f.]

= **19.9 hours**, which is less than max. drain time of 72 hours, therefore OK.

INFILTRATION BASIN #3 (Pond IB3-P):

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Storage Volume = 27,453 c.f.

Bottom Area = 3,200 s.f.

= 27,543 c.f. / [(2.4 in/hr) (1ft/12 inches) x 3,200 s.f.]

= **43.0 hours**, which is less than max. drain time of 72 hours, therefore OK.

INFILTRATION BASIN #4 (Pond IB4-P):

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Storage Volume = 79,651 c.f.

Bottom Area = 13,550 s.f.

= 79,651 c.f. / [(2.4 in/hr) (1ft/12 inches) x 13,550 s.f.]

= 29.4 hours, which is less than max. drain time of 72 hours, therefore OK.

INFILTRATION BASIN #5 (Pond IB5-P):

Maximum Drain Time = 72 hours

Provided Drain Time = Storage Volume / (K x Basin Bottom Area*)

Storage Volume = 17,080 c.f.

Bottom Area = 4,000 s.f.

= 17,080 c.f. / [(2.4 in/hr) (1ft/12 inches) x 4,000 s.f.]

= **21.4 hours**, which is less than max. drain time of 72 hours, therefore OK.

GROUNDWATER MOUNDING CALCULATIONS

HIDDEN TRAILS off County Road

WEST WAREHAM, MA

In accordance with Volume 3 of the Massachusetts Stormwater Handbook, a mounding analysis is required when the vertical separation from the bottom of the exfiltration basin to seasonal high groundwater is less than 4 feet. Further, the mounding analysis must show that the groundwater mound that forms under the recharge system will not break out above the land or water surface of a wetland.

The proposed vertical separation beneath each infiltration basis is as follows:

Infiltration Basin #	Bottom elevation	SHGW elevation (max.)	GW separation (min.)
1	37.0’	35.0’	2.0’
2	31.2’	29.2’	2.0’
3	32.6’	30.6’	2.0’
4	30.7’	28.3’	2.4’
5	35.1’	33.1’	2.0’

Table 1

Mounding analysis spreadsheets based upon the Hantush Method (Hantush,1967) have been utilized to determine the peak groundwater mound that would occur beneath the center of the infiltration basin. Additionally, the spreadsheet depicts the height of mound that would occur at specified distances from the center of the basin. Below is an explanation of the input parameters used for the spreadsheet:

R = the recharge or infiltration rate
Infiltration rate has been determined to be the quantity of water discharged from the basin in a 100-year storm event over the drain time of the system.

R = Volume for 100-yr / (Avg. Basin Area[1] * Infiltration Period[2])

(1) Avg. between basin bottom surface area and peak surface area at 100-year event

(2) Period of time between start and end of outflow on Hydrograph

Infiltration Basin #	Vol. for 100-yr storm (cf)	Avg. Basin Surface Area (sf)	Infiltration Period (hr)	Infiltration Period (t) (days)	Recharge (ft/day)
1	38,438	11,057	27.35 – 6.6 = 20.75	0.87	4.00
2	69,815	14,169	34.6 – 7.95 = 26.65	1.11	4.44
3	32,897	5,006	41.55 – 10.10 = 31.45	1.31	5.02
4	124,669	17,016	45.85 – 6.40 = 39.45	1.64	4.47
5	20,248	5,252	29.02 – 9.0 = 20.02	0.83	4.64

Table 2

Sy = Specific Yield
Per USGS Water Supply Paper 1662-6 (1967), Fine sand has Specific Yield range between 10% and 28%, with the average being held as 21% (0.21 input into Hantush spreadsheet)

K = Horizontal Hydraulic Conductivity
In USGS Soil Investigation Report 2010-5102, The ratio of horizontal hydraulic conductivity to vertical hydraulic conductivity is 10:1. Vertical hydraulic conductivity is estimated to be 8.27 in/hr (or 16.54 ft/day) in sands (Rawls, Brakensick and Saxton, 1982). Horizontal hydraulic conductivity = 10 * 16.54 = 165.4 ft/day

X = 1/2 length of basin (x direction, in feet)

Y = 1/2 width of basin (y direction, in feet)

Infiltration Basin #	Overall length[1] (ft)	Average width[2] (ft)	X (1/2 of length)	Y (1/2 of width)
1	418	26	209	13
2	290	49	145	24.5
3	90	56	45	28
4	168	101	84	50.5
5	164	32	82	16

Table 3

(1) Dimension of longest side of basin at elevation of average basin surface area
(2) Calculated average width (Avg. Basin Surface / Overall Length)

t = duration of infiltration period (days)
Refer to Table 2 above. Duration of infiltration obtained from period of time between start and end of OUTFLOW on attached HydroCAD results

h(0) = Initial thickness of saturated zone (feet)
The thickness of the saturated zone is determined by calculating the difference between the elevation of seasonal high groundwater and the elevation of bedrock. The average elevation of seasonal high groundwater beneath the infiltration basins is elevation 31.5 feet (average between low and high elevations shown in Table 1). The approximate elevation of bedrock obtained from Water Resource Investigation Report 90-4204 (Hansen and Lapham, 1992) is shown as -25.0 feet.
h = 31.5 – (-25.0) = 56.5 feet

Results of Mounding Analysis

Infiltration Basin #	GW separation (min.)	Peak Mound at Center of Basin (100 yr.)	Peak Mound at Nearest Edge of Basin (100 yr.)	Separation between basin bottom and GW mound at edge basin
1	2.0’	0.99’	0.96’	1.04’
2	2.0’	1.83’	1.71’	0.29’
3	2.0’	1.14’	1.01’	0.99’
4	**2.7’**	**2.67’**	**2.31’**	**0.39’**
5	2.0’	0.85’	0.80’	1.20’

Table 4

SEDIMENT FOREBAY SIZING CALCULATIONS

HIDDEN TRAILS off County Road

WEST WAREHAM, MA

INFILTRATION BASIN #1 (Sediment Forebay 1A):

Impervious Area (I) = 29,257 s.f.

Sediment Forebay Volume Required

- (0.10"/12) x I = **244** c.f.

Sediment Forebay Volume Provided

- The storage volume within forebays below spillway elevation 38.0':
  Base area at elevation 37.0' = 2,150 s.f.
  Base area at elevation 38.0' = 3,042 s.f.

  Volume between elevation 37.0' and 38.0' = **2,596 c.f.**

Conclusion: Proposed sediment forebay volume of **2,596** cubic feet provided is greater than **244** cubic feet required; therefore OK.

INFILTRATION BASIN #1 (Sediment Forebay 1B):

Impervious Area (I) = 16,550 s.f.

Sediment Forebay Volume Required

- (0.10"/12) x I = **137** c.f.

Sediment Forebay Volume Provided

- The storage volume within forebays below spillway elevation 38.5':
  Base area at elevation 37.0' = 318 s.f.
  Base area at elevation 38.5' = 732 s.f.

  Volume between elevation 37.0' and 38.5' = **788 c.f.**

Conclusion: Proposed sediment forebay volume of **788** cubic feet provided is greater than **137** cubic feet required; therefore OK.

INFILTRATION BASIN #2:

Impervious Area (I) = 84,347 s.f.

Sediment Forebay Volume Required

- (0.10"/12) x I = **703** c.f.

Sediment Forebay Volume Provided

- The storage volume within forebays below spillway elevation 31.9':
  Base area at elevation 31.2' = 840 s.f.
  Base area at elevation 31.9' = 1,344 s.f.

  Volume between elevation 31.2' and 31.9' = **764 c.f.**

Conclusion: Proposed sediment forebay volume of **764** cubic feet provided is greater than **703** cubic feet required; therefore OK.

INFILTRATION BASIN #3:

Impervious Area (I) = 36,300 s.f.

Sediment Forebay Volume Required

- (0.10"/12) x I = **303** c.f.

Sediment Forebay Volume Provided

- The storage volume within forebays below spillway elevation 33.8':
  Base area at elevation 32.6' = 155 s.f.
  Base area at elevation 33.8' = 414 s.f.

  Volume between elevation 32.6' and 33.8' = **341** c.f.

Conclusion: Proposed sediment forebay volume of **341** cubic feet provided is greater than **303** cubic feet required; therefore OK.

INFILTRATION BASIN #4:

Impervious Area (I) = 151,870 s.f.

Sediment Forebay Volume Required

- **(0.10"/12) x I = 1,266 c.f.**

Sediment Forebay Volume Provided

- **The storage volume within forebays below spillway elevation 31.7':**
  Base area at elevation 31.0' = 1,763 s.f.
  Base area at elevation 31.7' = 2,284 s.f.

  Volume between elevation 31.0' and 31.7' = 1,416 c.f.

Conclusion: **Proposed sediment forebay volume of 1,416 cubic feet provided is greater than 1,266 cubic feet required; therefore OK.**

INFILTRATION BASIN #5:

Impervious Area (I) = 23,850 s.f.

Sediment Forebay Volume Required

- (0.10"/12) x I = **199** c.f.

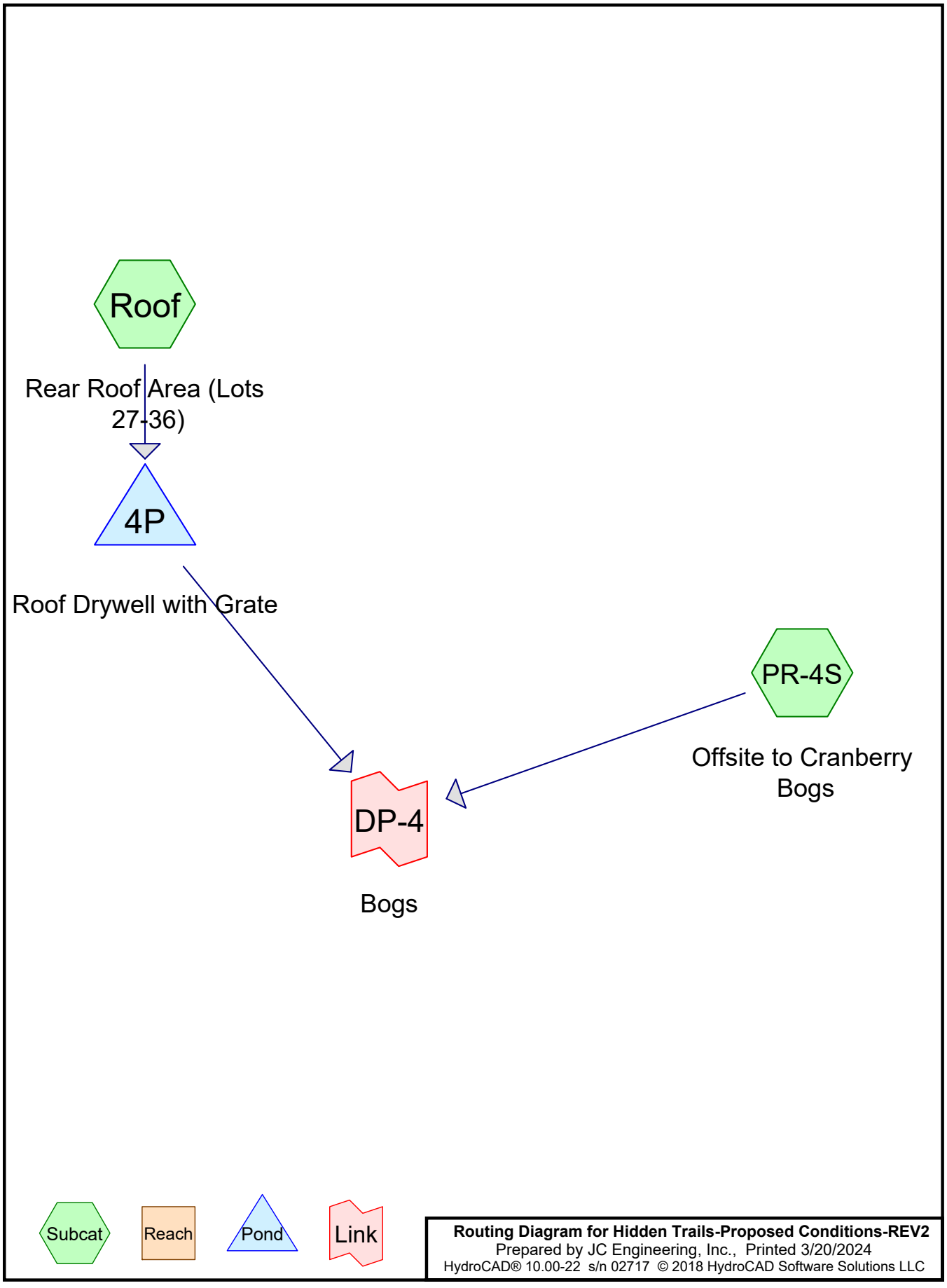
Sediment Forebay Volume Provided

- The storage volume within forebays below spillway elevation 35.6':
  Base area at elevation 35.1' = 1,049 s.f.
  Base area at elevation 35.6' = 1,246 s.f.

  Volume between elevation 35.1' and 35.6' = **574** c.f.

Conclusion: Proposed sediment forebay volume of **574** cubic feet provided is greater than **199** cubic feet required; therefore OK.

PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(DESIGN POINT #4 ONLY)



Routing Diagram for Hidden Trails-Proposed Conditions-REV2
Prepared by JC Engineering, Inc., Printed 3/20/2024

Summary for Subcatchment PR-4S: Offsite to Cranberry Bogs

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
	51,972	30	Woods, Good, HSG A
	21,970	39	>75% Grass cover, Good, HSG A
*	0	98	Roofs, HSG A (use drywells-8000)
*	3,684	76	Gravel roads, HSG A
*	0	98	Rain Garden, HSG A (1,000 s.f per lot)
	77,626	35	Weighted Average
	77,626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	30	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.8	80	Total			

Summary for Subcatchment Roof: Rear Roof Area (Lots 27-36)

Runoff = 0.44 cfs @ 12.10 hrs, Volume= 0.035 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.44"

	Area (sf)	CN	Description
*	10,000	98	1/2 of Roof, HSG A
	10,000	39	>75% Grass cover, Good, HSG A
	20,000	69	Weighted Average
	10,000		50.00% Pervious Area
	10,000		50.00% Impervious Area

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

Summary for Pond 4P: Roof Drywell with Grate

Inflow Area = 0.459 ac, 50.00% Impervious, Inflow Depth = 0.92" for 2-year event
Inflow = 0.44 cfs @ 12.10 hrs, Volume= 0.035 af
Outflow = 0.34 cfs @ 12.17 hrs, Volume= 0.035 af, Atten= 22%, Lag= 4.2 min
Discarded = 0.34 cfs @ 12.17 hrs, Volume= 0.035 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.06' @ 12.17 hrs Surf.Area= 1,760 sf Storage= 41 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.9 min (874.8 - 873.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,205 cf	**Custom Stage Data (Conic)** Listed below (Recalc) x 20 3,553 cf Overall - 540 cf Embedded = 3,013 cf x 40.0% Voids
#2	0.50'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		1,618 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	88	0	0	88
2.00	88	176	176	155
2.01	4	0	176	239
2.33	4	1	178	241

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	2.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.34 cfs @ 12.17 hrs HW=0.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP-4: Bogs

Inflow Area = 2.241 ac, 10.24% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PR-4S: Offsite to Cranberry Bogs

Runoff = 0.02 cfs @ 15.10 hrs, Volume= 0.013 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
	51,972	30	Woods, Good, HSG A
	21,970	39	>75% Grass cover, Good, HSG A
*	0	98	Roofs, HSG A (use drywells-8000)
*	3,684	76	Gravel roads, HSG A
*	0	98	Rain Garden, HSG A (1,000 s.f per lot)
	77,626	35	Weighted Average
	77,626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	30	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.8	80	Total			

Summary for Subcatchment Roof: Rear Roof Area (Lots 27-36)

Runoff = 1.03 cfs @ 12.10 hrs, Volume= 0.076 af, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.05"

	Area (sf)	CN	Description
*	10,000	98	1/2 of Roof, HSG A
	10,000	39	>75% Grass cover, Good, HSG A
	20,000	69	Weighted Average
	10,000		50.00% Pervious Area
	10,000		50.00% Impervious Area

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

Summary for Pond 4P: Roof Drywell with Grate

Inflow Area = 0.459 ac, 50.00% Impervious, Inflow Depth = 1.99" for 10-year event
Inflow = 1.03 cfs @ 12.10 hrs, Volume= 0.076 af
Outflow = 0.42 cfs @ 12.38 hrs, Volume= 0.076 af, Atten= 60%, Lag= 16.8 min
Discarded = 0.42 cfs @ 12.38 hrs, Volume= 0.076 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.62' @ 12.38 hrs Surf.Area= 1,760 sf Storage= 453 cf

Plug-Flow detention time= 6.9 min calculated for 0.076 af (100% of inflow)
Center-of-Mass det. time= 5.9 min (855.6 - 849.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,205 cf	**Custom Stage Data (Conic)** Listed below (Recalc) x 20 3,553 cf Overall - 540 cf Embedded = 3,013 cf x 40.0% Voids
#2	0.50'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		1,618 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	88	0	0	88
2.00	88	176	176	155
2.01	4	0	176	239
2.33	4	1	178	241

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	2.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.42 cfs @ 12.38 hrs HW=0.62' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP-4: Bogs

Inflow Area = 2.241 ac, 10.24% Impervious, Inflow Depth = 0.07" for 10-year event
Inflow = 0.02 cfs @ 15.10 hrs, Volume= 0.013 af
Primary = 0.02 cfs @ 15.10 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PR-4S: Offsite to Cranberry Bogs

Runoff = 0.10 cfs @ 12.49 hrs, Volume= 0.039 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
	51,972	30	Woods, Good, HSG A
	21,970	39	>75% Grass cover, Good, HSG A
*	0	98	Roofs, HSG A (use drywells-8000)
*	3,684	76	Gravel roads, HSG A
*	0	98	Rain Garden, HSG A (1,000 s.f per lot)
	77,626	35	Weighted Average
	77,626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	30	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.8	80	Total			

Summary for Subcatchment Roof: Rear Roof Area (Lots 27-36)

Runoff = 1.44 cfs @ 12.10 hrs, Volume= 0.105 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.05"

	Area (sf)	CN	Description
*	10,000	98	1/2 of Roof, HSG A
	10,000	39	>75% Grass cover, Good, HSG A
	20,000	69	Weighted Average
	10,000		50.00% Pervious Area
	10,000		50.00% Impervious Area

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

Summary for Pond 4P: Roof Drywell with Grate

Inflow Area = 0.459 ac, 50.00% Impervious, Inflow Depth = 2.75" for 25-year event
Inflow = 1.44 cfs @ 12.10 hrs, Volume= 0.105 af
Outflow = 0.48 cfs @ 12.43 hrs, Volume= 0.105 af, Atten= 67%, Lag= 20.2 min
Discarded = 0.48 cfs @ 12.43 hrs, Volume= 0.105 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.09' @ 12.43 hrs Surf.Area= 1,760 sf Storage= 849 cf

Plug-Flow detention time= 11.5 min calculated for 0.105 af (100% of inflow)
Center-of-Mass det. time= 10.3 min (850.5 - 840.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,205 cf	**Custom Stage Data (Conic)** Listed below (Recalc) x 20 3,553 cf Overall - 540 cf Embedded = 3,013 cf x 40.0% Voids
#2	0.50'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		1,618 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	88	0	0	88
2.00	88	176	176	155
2.01	4	0	176	239
2.33	4	1	178	241

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	2.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.48 cfs @ 12.43 hrs HW=1.09' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.48 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP-4: Bogs

Inflow Area = 2.241 ac, 10.24% Impervious, Inflow Depth = 0.21" for 25-year event
Inflow = 0.10 cfs @ 12.49 hrs, Volume= 0.039 af
Primary = 0.10 cfs @ 12.49 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PR-4S: Offsite to Cranberry Bogs

Runoff = 0.53 cfs @ 12.33 hrs, Volume= 0.100 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
	51,972	30	Woods, Good, HSG A
	21,970	39	>75% Grass cover, Good, HSG A
*	0	98	Roofs, HSG A (use drywells-8000)
*	3,684	76	Gravel roads, HSG A
*	0	98	Rain Garden, HSG A (1,000 s.f per lot)
	77,626	35	Weighted Average
	77,626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.43"
0.6	30	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.8	80	Total			

Summary for Subcatchment Roof: Rear Roof Area (Lots 27-36)

Runoff = 2.12 cfs @ 12.09 hrs, Volume= 0.153 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.60"

	Area (sf)	CN	Description
*	10,000	98	1/2 of Roof, HSG A
	10,000	39	>75% Grass cover, Good, HSG A
	20,000	69	Weighted Average
	10,000		50.00% Pervious Area
	10,000		50.00% Impervious Area

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

Summary for Pond 4P: Roof Drywell with Grate

Inflow Area = 0.459 ac, 50.00% Impervious, Inflow Depth = 4.01" for 100-year event
Inflow = 2.12 cfs @ 12.09 hrs, Volume= 0.153 af
Outflow = 0.59 cfs @ 12.47 hrs, Volume= 0.153 af, Atten= 72%, Lag= 22.6 min
Discarded = 0.59 cfs @ 12.47 hrs, Volume= 0.153 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.96' @ 12.47 hrs Surf.Area= 1,760 sf Storage= 1,568 cf

Plug-Flow detention time= 18.4 min calculated for 0.153 af (100% of inflow)
Center-of-Mass det. time= 17.7 min (846.9 - 829.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,205 cf	**Custom Stage Data (Conic)** Listed below (Recalc) x 20 3,553 cf Overall - 540 cf Embedded = 3,013 cf x 40.0% Voids
#2	0.50'	413 cf	**2.50'W x 5.50'L x 1.50'H Prismatoid** x 20 Inside #1 540 cf Overall - 3.0" Wall Thickness = 413 cf
		1,618 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.00	88	0	0	88
2.00	88	176	176	155
2.01	4	0	176	239
2.33	4	1	178	241

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	2.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.59 cfs @ 12.47 hrs HW=1.95' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.59 cfs)

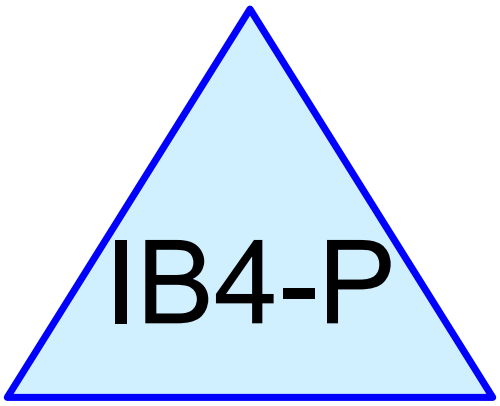
Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP-4: Bogs

Inflow Area = 2.241 ac, 10.24% Impervious, Inflow Depth = 0.53" for 100-year event
Inflow = 0.53 cfs @ 12.33 hrs, Volume= 0.100 af
Primary = 0.53 cfs @ 12.33 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-40.00 hrs, dt= 0.05 hrs

DRAINAGE SYSTEM DRAINAGE CALCULATIONS
(INFILTRATION BASIN 4 ONLY)



Infiltration Basin #4

Subcat Reach Pond Link

Routing Diagram for Hidden Trails-Drainage System-REV2 (Basins 4 and 5)
Prepared by JC Engineering, Inc., Printed 3/20/2024

Summary for Pond IB4-P: Infiltration Basin #4

Inflow Area = 523,288 sf, 32.44% Impervious, Inflow Depth = 0.46" for 2-year event
Inflow = 3.25 cfs @ 12.14 hrs, Volume= 20,272 cf
Outflow = 0.79 cfs @ 13.14 hrs, Volume= 20,272 cf, Atten= 76%, Lag= 59.8 min
Discarded = 0.79 cfs @ 13.14 hrs, Volume= 20,272 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 31.33' @ 13.14 hrs Surf.Area= 14,220 sf Storage= 4,560 cf

Plug-Flow detention time= 53.2 min calculated for 20,255 cf (100% of inflow)
Center-of-Mass det. time= 53.2 min (961.8 - 908.6)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	113,764 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
31.00	13,550	0	0	13,550
32.00	15,640	14,583	14,583	15,683
32.50	16,640	8,069	22,651	16,708
34.00	18,980	26,696	49,347	19,154
35.50	21,450	30,304	79,651	21,737
36.00	22,310	10,939	90,590	22,636
37.00	24,050	23,175	113,764	24,457

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	35.50'	**15.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.79 cfs @ 13.14 hrs HW=31.33' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.79 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=31.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond IB4-P: Infiltration Basin #4

Inflow Area = 523,288 sf, 32.44% Impervious, Inflow Depth = 1.24" for 10-year event
Inflow = 12.82 cfs @ 12.13 hrs, Volume= 53,944 cf
Outflow = 0.95 cfs @ 15.67 hrs, Volume= 53,944 cf, Atten= 93%, Lag= 212.8 min
Discarded = 0.95 cfs @ 15.67 hrs, Volume= 53,944 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 32.67' @ 15.67 hrs Surf.Area= 16,903 sf Storage= 25,559 cf

Plug-Flow detention time= 307.7 min calculated for 53,944 cf (100% of inflow)
Center-of-Mass det. time= 307.5 min (1,183.8 - 876.3)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	113,764 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
31.00	13,550	0	0	13,550
32.00	15,640	14,583	14,583	15,683
32.50	16,640	8,069	22,651	16,708
34.00	18,980	26,696	49,347	19,154
35.50	21,450	30,304	79,651	21,737
36.00	22,310	10,939	90,590	22,636
37.00	24,050	23,175	113,764	24,457

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	35.50'	**15.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.95 cfs @ 15.67 hrs HW=32.67' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.95 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=31.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond IB4-P: Infiltration Basin #4

Inflow Area = 523,288 sf, 32.44% Impervious, Inflow Depth = 1.83" for 25-year event
Inflow = 20.62 cfs @ 12.12 hrs, Volume= 79,659 cf
Outflow = 1.04 cfs @ 16.42 hrs, Volume= 79,659 cf, Atten= 95%, Lag= 257.7 min
Discarded = 1.04 cfs @ 16.42 hrs, Volume= 79,659 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 33.73' @ 16.42 hrs Surf.Area= 18,545 sf Storage= 44,248 cf

Plug-Flow detention time= 480.4 min calculated for 79,592 cf (100% of inflow)
Center-of-Mass det. time= 480.6 min (1,345.2 - 864.6)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	113,764 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
31.00	13,550	0	0	13,550
32.00	15,640	14,583	14,583	15,683
32.50	16,640	8,069	22,651	16,708
34.00	18,980	26,696	49,347	19,154
35.50	21,450	30,304	79,651	21,737
36.00	22,310	10,939	90,590	22,636
37.00	24,050	23,175	113,764	24,457

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	35.50'	**15.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=1.04 cfs @ 16.42 hrs HW=33.73' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.04 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=31.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond IB4-P: Infiltration Basin #4

Inflow Area = 523,288 sf, 32.44% Impervious, Inflow Depth = 2.86" for 100-year event
Inflow = 33.93 cfs @ 12.12 hrs, Volume= 124,669 cf
Outflow = 1.21 cfs @ 17.44 hrs, Volume= 124,669 cf, Atten= 96%, Lag= 318.9 min
Discarded = 1.21 cfs @ 17.44 hrs, Volume= 124,669 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 35.45' @ 17.44 hrs Surf.Area= 21,361 sf Storage= 78,530 cf

Plug-Flow detention time= 727.6 min calculated for 124,669 cf (100% of inflow)
Center-of-Mass det. time= 727.5 min (1,579.3 - 851.8)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	113,764 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
31.00	13,550	0	0	13,550
32.00	15,640	14,583	14,583	15,683
32.50	16,640	8,069	22,651	16,708
34.00	18,980	26,696	49,347	19,154
35.50	21,450	30,304	79,651	21,737
36.00	22,310	10,939	90,590	22,636
37.00	24,050	23,175	113,764	24,457

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	35.50'	**15.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=1.21 cfs @ 17.44 hrs HW=35.45' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.21 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=31.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)