STORMWATER MANAGEMENT REPORT
OPERATION & MAINTENANCE

OVERFLOW PARKING PROJECT

TO THE REAR OF
133 QUEEN ANNE ROAD
Assessors' Map 58, Parcel G3-13
Harwich, MA

January 12, 2024

PREPARED FOR:

THE FAMILY PANTRY
133 QUEEN ANNE ROAD
HARWICH, MA

PREPARED BY:

J.M. O'REILLY & ASSOCIATES, INC.
1573 MAIN STREET
P.O. BOX 1773
BREWSTER, MA 02631
508-896-6601

John M. O'Reilly, P.E., P.L.S.
J.M. O'REILLY & ASSOCIATES, INC.

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1. Property Description

Lot Area:	25,425 SF+/-
Parcel Improvements:	The parcel is vacant and is adjacent to the rear garden and parking areas for the Pantry.
Wetlands:	There are no wetlands within 100 feet of project area.
Soils:	The Barnstable Soil Survey (1993) places the parcel within the CdB soil unit, Carver- Medium to Coarse sand, 3 to 8 percent.
Groundwater:	Groundwater elevation is anticipated to be about elevation 22 to 24. Depth to groundwater is estimated to be about 25 to 27 feet below the existing grade of the project site.
Zone II:	The parcel is not located within a Zone II Groundwater Recharge mapped area.
Topography:	The topography of the project area slopes to the north with about a 3 to 4 foot drop on elevation.
Site Conditions:	The project site is vacant woodlands and is a portion of the Town of Harwich's property.

2. Stormwater Management Plan Overview

Stormwater management controls are proposed for the leased portion of the Town of Harwich municipal property which will serve as overflow parking for the Family Pantry of Cape Cod (Pantry) operation. The overflow parking will provide much needed parking space for the staff & clients associated with the Pantry.

The Pantry has obtained a lease with the Town of Harwich to utilize a portion of the Town's land for the parking area. The parking area is located to the east of a previously leased area from the town which is currently the garden area for the Pantry. The project area of land to be developed is 25,425 SF+/-.

The proposed post-development stormwater management plan consists of one dry water quality swale with infiltration below to provide treatment of parking area runoff. The swale is then connected to an underdrain which will allow stormwater from storms greater than the 100 year frequency to discharge to the low point to the north of the project site.

- Subcatchment 1 consists of the proposed entire gravel/T-base parking area. the parking area is graded to match the existing topography which currently slopes to the north. The slope through the parking area is about 3%.
  Along the northern portion of the parking area the project calls for a Bio-Swale with infiltration and an underdrain outlet. The swale is supported by three (3) 12" dia. Overflow inlet pipes. The inlet pipes will be connected to the under drain to alleviate backup during large rain events.\
  The underdrain leaves the Bio-Swale area and connects to the manhole which then discharges to the existing low point to the north via an outfall and rip-rap splash pad.

As shown in the HydroCAD Modeling report, the proposed stormwater controls will reduce the peak discharge rate for storm events up to the 100-year storm. The swale, infiltration and underdrain is designed to handle the 100 year storm event. The outfall pipe is proposed to provide emergency back up in storm event greater than the 100 year storm event. The project area post-development 100-year storm peak discharge rate relative to pre-development conditions has decreased from 0.11 CFS to 0.0 CFS.

Table 1: Peak Discharge Comparison

Storm Event (year)	Total Discharge	
	Pre-Dev. (ft^3/sec)	Post-Dev. (ft^3/sec)
2	0	0
10	0	0
25	0.01	0
100	.11	0

For HydroCAD modeling analysis of the stormwater systems, the following methods and assumptions were used:

- Simple Dynamic

- Rawls Rate of 8.27 in/hr for sands within the subsoil layers for subsurface leaching galleys.
- Rawls Rate of 2.41 in/hr for the loamy sands in the upper soil layers for dry water quality swales.

The proposed stormwater controls also meet the minimum 90% Total Suspended Solids (TSS) removal requirements of the Town of Brewster Stormwater Management Bylaw, as shown in Appendix C: TSS Removal Sheets. The proposed TSS removal rate is 94%

3. Erosion Control Plan - Temporary Siltation Barrier & Silt Socks

Prior to start of construction, the following steps shall be taken to address erosion:

- The erosion controls shall include a row of staked 9-inch straw wattles surrounding the project area. the project area is defined by the property boundaries to the north and south and the leased boundaries to the west and west.
- Once the driveway stormwater systems are installed, a row of staked 9-inch straw wattles shall be set surrounding the swale, to prevent silt and debris from clogging and/or damaging the dry water quality swales and subsurface leaching facilities.
- The erosion controls shall be monitored and corrected during the entire construction phase and until the site has been stabilized with ground cover and/or landscape mulch.
- Contractor shall be required to provide extra siltation controls in case a repair is needed to the straw wattles.

4. Massachusetts Stormwater Management Design Standards

The following is a description of how the proposed project meets the Massachusetts Stormwater Handbook design standards.

Standard 1: No new untreated discharges:
This standard is met since there are no new untreated stormwater discharges proposed. See Standards 4-6 calculations.

Standard 2: Maintain Pre-development peak discharge rate:
This standard has been met. As shown in the HydroCAD Modeling report, the proposed stormwater controls will reduce the site-wide peak discharge rate for the 2-, 10-, 25- and 100-year storms. The site-wide post-development 100-year storm peak discharge rate relative to pre-development conditions has decreased from 0.11 CFS to 0.00 CFS. The discharge rates for the discharge point have also decreased relative to pre-development conditions, as shown on Table 1 in the Stormwater Management Plan Overview section.

Standard 3: Groundwater Recharge:
This standard is met. The proposed stormwater management systems are sized so that the total recharge volume provided exceeds the minimum groundwater recharge volume specified in the handbook and the proposed stormwater recharge galleys will drawdown within 72 hours of a storm event. In accordance with the MA Stormwater Manual, the required recharge volume factor (F) required across the impervious area (A) is 0.6 inches per hour for hydraulic soil group A soils. Coarse Sand (Rawls Rate: 8.27 inches per hour) has been used in the sizing of the stormwater recharge galleys. Refer to the HydroCAD Stormwater Modeling Report in Appendix. The required recharge volume is calculated based on the total parking area

- Required Recharge Volume $R_v = F \times A$ = (0.6 in)(1 ft/12 in)(23,600 sf) = 1,180 cf (parking area)
- Recharge Storage Provided (Subsurface leaching facilities) = 1,444 cf > 1,180 cf
- The drawdown for the subsurface leaching facilities for the parking area is 24 hours < 72 hour maximum allowance.

Standard 4: Water Quality:
This standard has been met. The roof runoff stormwater system will remove 80% of the annual load of Total Suspended Solids (TSS) via subsurface leaching facilities. Driveway area stormwater controls will remove 94% of TSS with the dry water quality swales followed by leaching facilities. TSS removal calculation tables for roadway and roof runoff are included in the Appendix. In accordance with the MA Stormwater Manual, the required water quality depth (Dwq) across the impervious area (A) is 1.0 inches per hour in areas containing soils with rapid infiltration rate greater than 2.4 in/hr. The required water quality volume is based on the total parking area.

- Required Water Quality Volume $V_{wq} = D_{wq} \times A$ = (1.0 in)(1 ft/12 in)(23,425 sf) = 1952 cf (parking area)
- Water Quality Storage Provided (Three dry water quality swales) = 1,180 cf + 2,603 cf > 1952 cf

Standard 5: Land uses with higher potential pollutant loads:
This standard has been met. The proposed use is a single-family residence.

Standard 6: Stormwater discharges within Zone II or Interim Wellhead protection area of a public water supply and stormwater discharges near or to any critical area.
This standard has been met. Not applicable as the site is not within a Zone 2 contributory area.

Standard 7: Redevelopment:
This standard is not applicable, the project is a new development.

Standard 8: Construction Erosion Control Plan:
The project is subject to the proposed Erosion Control Plan as described in this report. Straw wattles and erosion control blankets shall be implemented as required to mitigate soil erosion.

Standard 9: Long Term Operation and Maintenance Plan:
A long-term O&M plan has been submitted with this report, refer to Stormwater Operation and Maintenance Manual. The property owners will operate and maintain the stormwater systems.

Standard 10: Illicit Discharges:
This standard is met since there are no illicit discharges at this site and no illicit discharges proposed.

OPERATION AND MAINTENANCE:

5. Owner and Responsible Party

The owner and responsible party for all Stormwater Pollution Control tasks detailed in this Stormwater Operation & Maintenance Manual for Lot A – 0 Main St, Assessors' Map 138, Parcels 74-81, Brewster, MA:

Owner & Operator:

The Family Pantry of Cape Cod
133 Queen Anne Road
Harwich, MA 02645

508-432-6519

6. Schedule of Inspection and Maintenance of Stormwater Management Systems

Dry Water Quality Swale
The dry water quality swales are to be inspected and maintained by the owner. The following responsibilities are included:

- Inspections:
  - Inspect the swales quarterly.
  - Ensure the swales are operating as designed and completely draining in between storm events.
  - Inspect swales for subsidence, erosion, cracking or tree growth on the embankment and sediment accumulation / erosion within the swale.

- Maintenance:
  - Remove accumulated trash, leaves debris at least monthly.
  - Mulch areas once per year.
  - Remove dead vegetation twice per year.
  - Prune once per year.
  - Do not store snow in swale areas.
  - Check for signs of erosion and repair as needed. After removing sediment, replace any vegetation damaged during clean-out by either reseeding or re-sodding.

- Long Term:
  - Replace entire soil media and all vegetation when the swale and underdrain are experiencing slow drainage and extended ponding within the swale. It would be

recommended that a professional engineer evaluate the swale and then make final corrective action proposal.

7. Long Term Lawn Care & Pollution Prevention Plan

Description of Pollutant Sources:

- Light vehicle traffic

Source Control Best Management Practices

- There shall be no storage of items or materials which will be subject to the weather.
- Good housekeeping measures shall be implemented throughout the site to keep the parking areas clean of debris. Regularly pick up areas as needed.
- The use of winter de-icing sand and salt materials shall be minimized to the maximum extent practicable.
- Winter de-icing sand and salt materials shall be stored indoors.
- Snow storage shall be on paved or gravel surfaces and not within the swale.
- Immediately clean up any spillage on paved areas and dispose of wastes properly.

8. Emergency Spill Cleanup Plan

1. The owner of the facility shall have a designated person with overall responsibility for spill response cleanup.

2. In the event of a spill the following shall be notified:

A. Harwich Fire Department	(508) 430-7546
(for a gasoline or hazardous material spill)	911
B. Massachusetts D.E.P. Emergency Response	(800) 304-1133
C. Harwich Health Department	(508) 430-7509

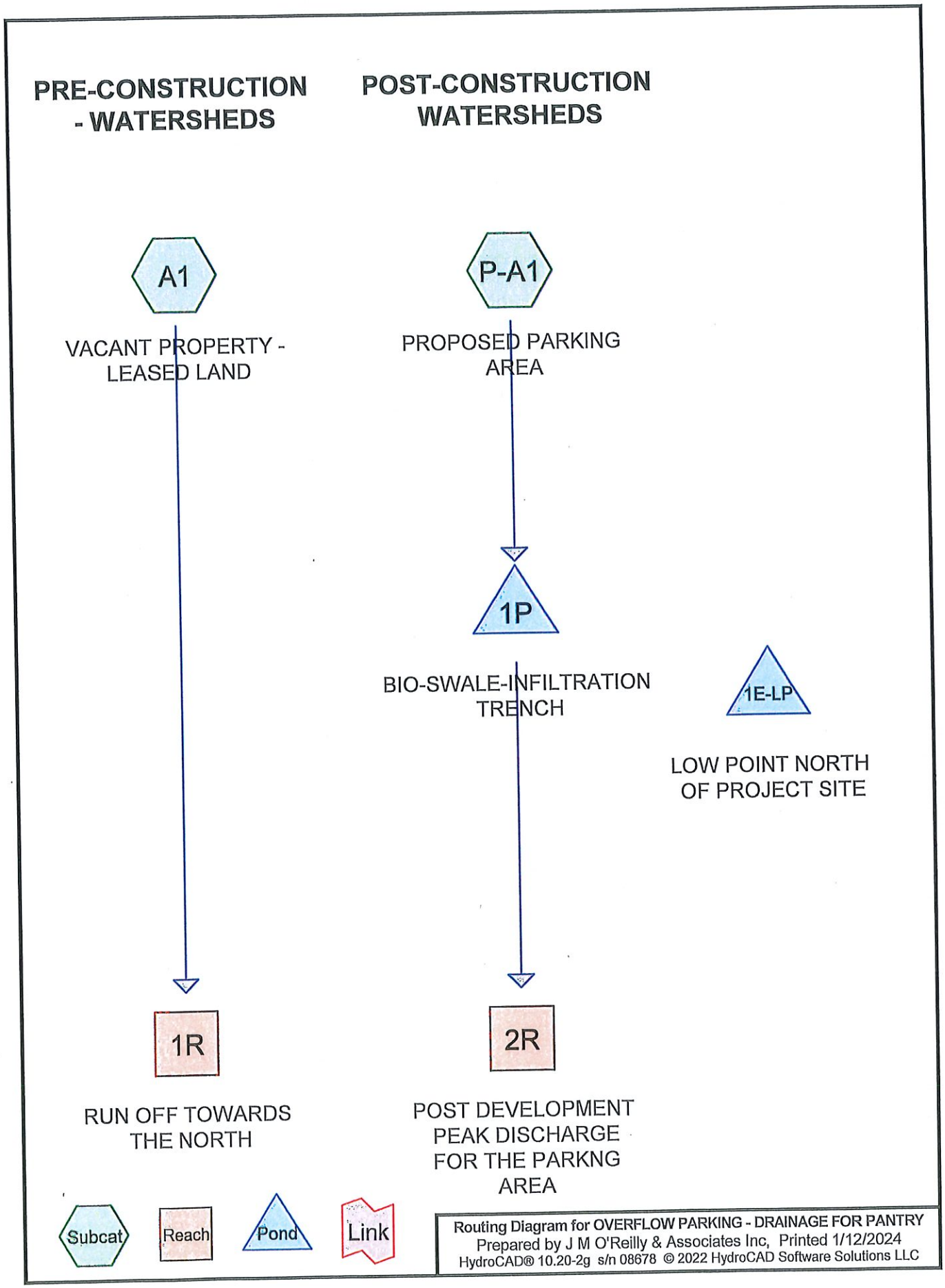
3. Cleanup of spills shall begin immediately.

O&M Log Form

				Condition			
Inspector Initials	Item Inspected	Date	Time	Good	Clean-out Needed	Repair Needed	Repaired Date

O&M Log form records to be maintained by property manager for a minimum of three years

APPENDICES


PRE-CONSTRUCTION - WATERSHEDS
POST-CONSTRUCTION WATERSHEDS
A1
VACANT PROPERTY - LEASED LAND
P-A1
PROPOSED PARKING AREA
1P
BIO-SWALE-INFILTRATION TRENCH
1E-LP
LOW POINT NORTH OF PROJECT SITE
1R
RUN OFF TOWARDS THE NORTH
2R
POST DEVELOPMENT PEAK DISCHARGE FOR THE PARKNG AREA
Subcat
Reach
Pond
Link
Routing Diagram for OVERFLOW PARKING - DRAINAGE FOR PANTRY
Prepared by J M O'Reilly & Associates Inc, Printed 1/12/2024
HydroCAD® 10.20-2g s/n 08678 © 2022 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.542	96	Gravel surface, HSG A (P-A1)
0.584	30	Woods, Good, HSG A (A1)
1.125	**62**	**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.542	0.000	0.000	0.000	0.000	0.542	Gravel surface	P-A1
0.584	0.000	0.000	0.000	0.000	0.584	Woods, Good	A1
1.125	**0.000**	**0.000**	**0.000**	**0.000**	**1.125**	**TOTAL AREA**	

Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Reach 1R: RUN OFF TOWARDS THE NORTH Inflow=0.11 cfs 0.026 af
Outflow=0.11 cfs 0.026 af

Reach 2R: POST DEVELOPMENT PEAK DISCHARGE FOR THE PARKNG Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

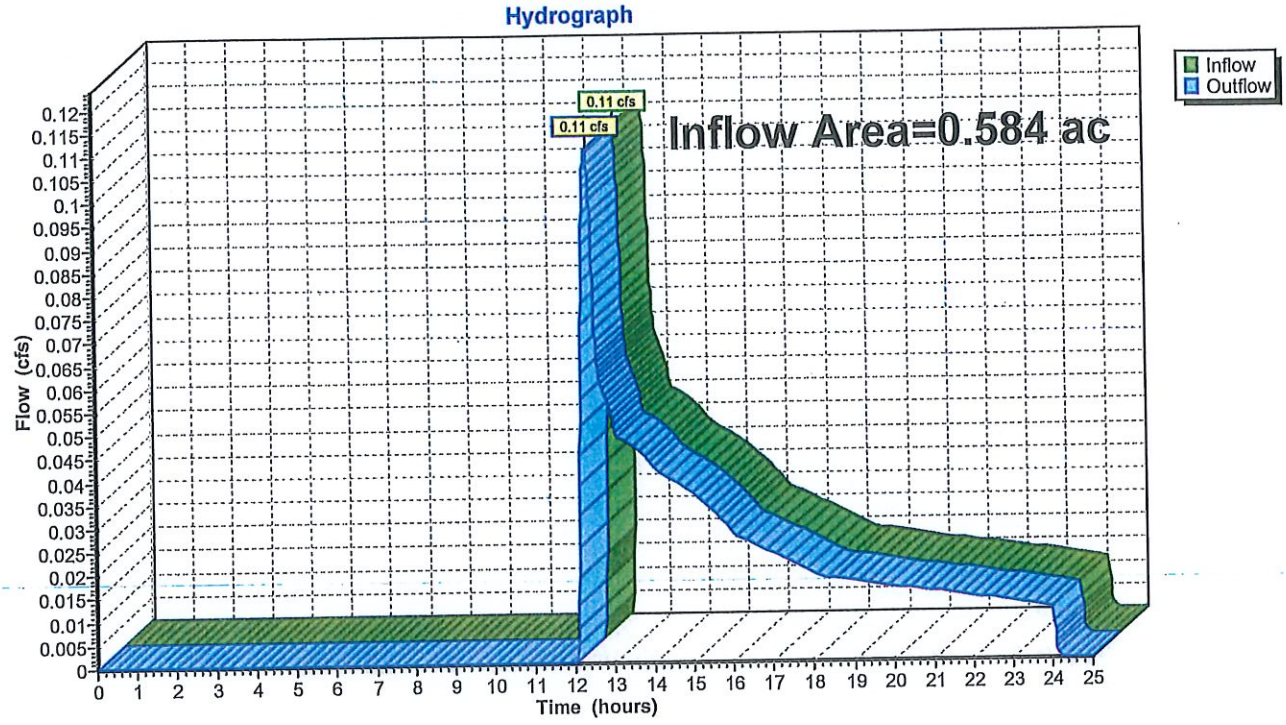
Summary for Reach 1R: RUN OFF TOWARDS THE NORTH

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.584 ac, 0.00% Impervious, Inflow Depth = 0.54" for 100-Year event
Inflow = 0.11 cfs @ 12.38 hrs, Volume= 0.026 af
Outflow = 0.11 cfs @ 12.38 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Reach 1R: RUN OFF TOWARDS THE NORTH



Summary for Pond 1P: BIO-SWALE-INFILTRATION TRENCH

Inflow Area = 0.542 ac, 0.00% Impervious, Inflow Depth = 8.02" for 100-Year event
Inflow = 4.49 cfs @ 12.08 hrs, Volume= 0.362 af
Outflow = 4.49 cfs @ 12.08 hrs, Volume= 0.362 af, Atten= 0%, Lag= 0.0 min
Discarded = 4.49 cfs @ 12.08 hrs, Volume= 0.362 af
Primary = 0.00 cfs @ 12.08 hrs, Volume= 0.000 af
Routed to Reach 2R : POST DEVELOPMENT PEAK DISCHARGE FOR THE PARKNG AREA

Routing by Dyn-Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 46.00' @ 12.08 hrs Surf.Area= 510 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (751.2 - 751.2)

Volume	Invert	Avail.Storage	Storage Description
#1	46.00'	1,737 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

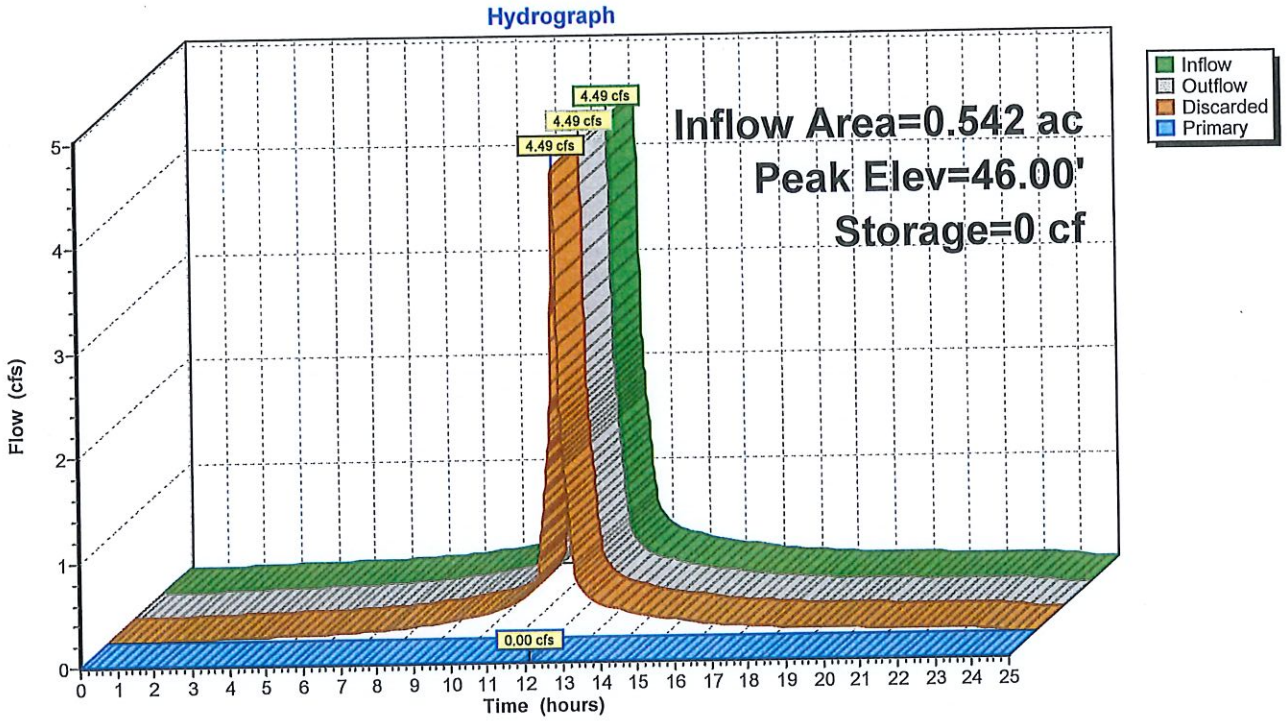
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
46.00	510	215.0	0.0	0	0	510
47.00	510	215.0	45.0	230	230	725
49.00	510	215.0	45.0	459	689	1,155
49.50	592	207.0	100.0	275	964	1,444
50.00	803	214.0	100.0	347	1,311	1,701
50.50	900	220.0	100.0	426	1,737	1,935

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.00'	**8.27 cfs Exfiltration at all elevations**
#2	Primary	46.00'	**6.0" Round Culvert** L= 100.0' Ke= 0.900 Inlet / Outlet Invert= 46.00' / 45.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=8.27 cfs @ 12.08 hrs HW=46.00' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 8.27 cfs)

Primary OutFlow Max=0.00 cfs @ 12.08 hrs HW=46.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Barrel Controls 0.00 cfs)

Pond 1P: BIO-SWALE-INFILTRATION TRENCH



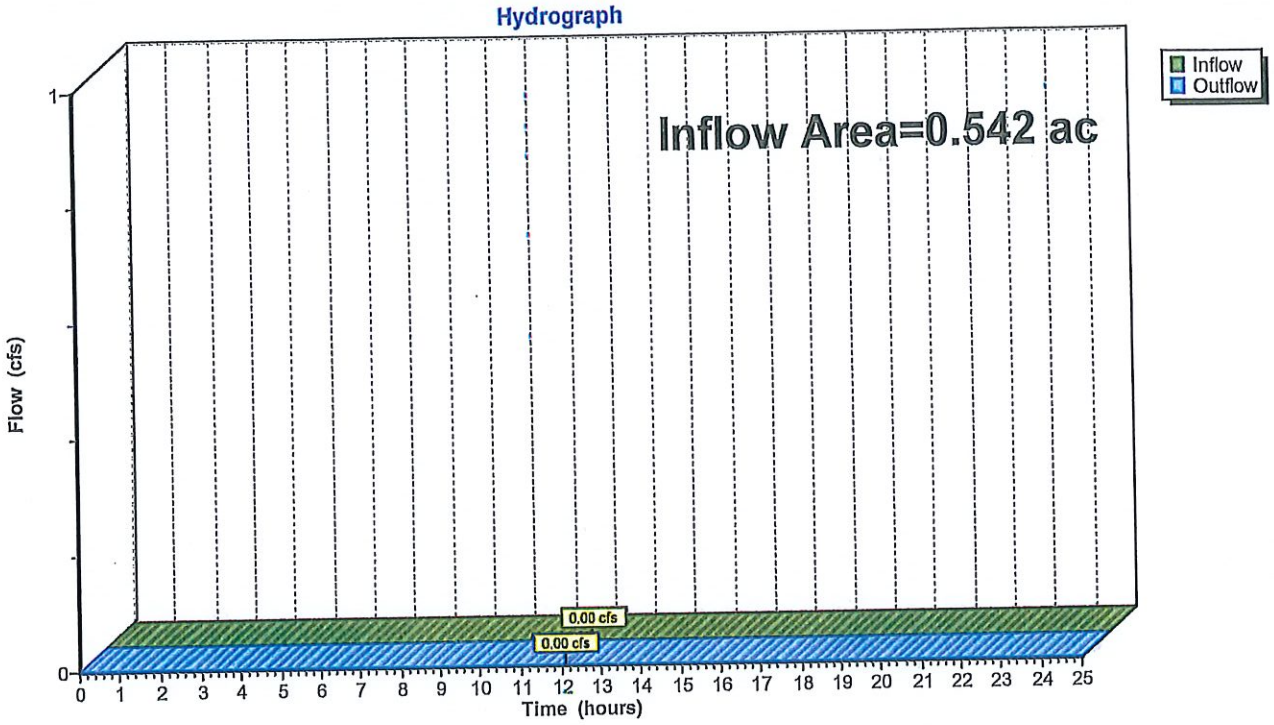
Summary for Reach 2R: POST DEVELOPMENT PEAK DISCHARGE FOR THE PARKNG AREA

[40] Hint: Not Described (Outflow=Inflow)

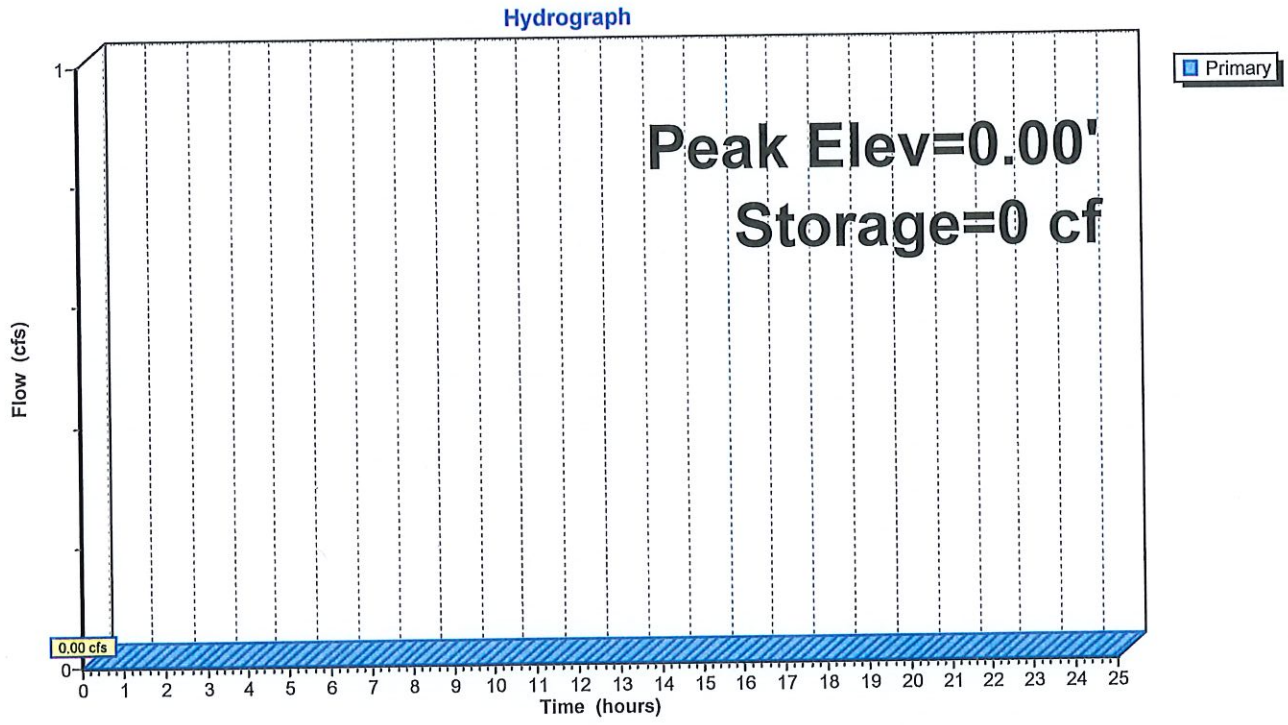
Inflow Area = 0.542 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100-Year event
Inflow = 0.00 cfs @ 12.08 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 12.08 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Reach 2R: POST DEVELOPMENT PEAK DISCHARGE FOR THE PARKNG AREA



Pond 1E-LP: LOW POINT NORTH OF PROJECT SITE



Summary for Pond 1E-LP: LOW POINT NORTH OF PROJECT SITE

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	39.00'	4,518 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
39.00	325	104.0	0.0	0	0	325
40.00	580	128.0	100.0	446	446	783
42.00	1,611	175.0	100.0	2,105	2,551	1,956
43.00	2,344	196.0	100.0	1,966	4,518	2,603

Device	Routing	Invert	Outlet Devices
#1	Primary	43.00'	**10.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Version 1, Automated: Mar. 4, 2008

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: PARKING AREA FOR PANTRY

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Water Quality Swale - Dry	0.70	1.00	0.70	0.30
Subsurface Infiltration Structure	0.80	0.30	0.24	0.06
	0.00	0.06	0.00	0.06
	0.00	0.06	0.00	0.06
	0.00	0.06	0.00	0.06

Total TSS Removal = 94%

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

Project: FAMILY PANTRY 9516
Prepared By: JMO
Date: 1/12/2023

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1