



16 Gleasondale Rd., Suite 1-1
Stow, Massachusetts 01775
Phone: (978) 461-2350
Fax: (978) 841-4102
www.foresite1.com

STORMWATER REPORT

FOR

Construction of a Dwelling at

**LOT 3 PACKARD ROAD
STOW, MASSACHUSETTS**

Assessors Map R-17 Parcel 20D



August 7, 2023

Prepared for:

The Metacom Realty Trust
PO Box 415
Stow, Massachusetts 01775

Prepared by:

FORESITE Engineering Associates, Inc.
16 Gleasondale Road, Suite 1-1
Stow, Massachusetts 01775

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I. Introduction

Lot 3 Packard Road (Stow Assessor's Map R-17 Parcel 20D) is a 2.77-acre lot located on the west side of Packard Road approximately 0.2 miles north of the intersection of Packard Road and Great Road. The land is currently developed and utilized for agricultural purposes (an apple orchard). The grade across the site is gentle to rolling with soil conditions observed in the field by test pits to be well drained with a relatively deep water table (estimated seasonal high groundwater at approximately 7-8 feet at the dwelling build site). These are favorable site characteristics for development of the site for the intended single-family dwelling use.

The site is traversed by a stream that enters the lot from the northwest and flows southeasterly through the lot to a culvert under Packard Road at the southeast corner. There is a bordering vegetated wetland adjacent to the stream. These two resource areas were delineated with numbered flags by Caron Environmental Consulting LLC in September of 2022 and surveyed for location. An Order of Conditions was issued by the Stow Conservation Commission for proposed construction activities within the Wetland Protection Act and Stow Wetland Bylaw jurisdiction (Ref. DEP File No. 299-735).

The development proposal involves improvement of an existing orchard path from Packard Road that crosses the intermittent stream with a culvert and headwalls sufficient in width to support a driveway for a single-family dwelling. The access point at Packard Road requires widening for maneuverable roundings and safe sight lines at the intersection. This widening will require removal of approximately 6 feet of existing stone wall on either side of the driveway at the entrance. The proposed driveway is to be constructed in the same location as the orchard path and is proposed to be widened to 12 feet with a compacted gravel surface from the street to the dwelling site. Placement of steel plates for tracking heavy trucks required for construction is proposed to protect the culverts during construction. There is a paved apron proposed at the driveway terminus at the dwelling garage (approximately 35-ft x 24-ft with a turnout by the garage proposed to be paved).

Electric and telecom utilities are proposed to be brought overhead from Packard Road to a new utility pole on the dwelling side of the stream at the driveway edge, thence run underground from the new utility pole along the south driveway edge to the dwelling. Only a small portion of the proposed dwelling encroaches into the 100-ft buffer zone with most of the work within the buffer zone being driveway construction and installation of electric and telecom utilities to the dwelling from the public way.

A staked straw wattle erosion control barrier is proposed to be installed along the down-gradient limit of work within the buffer zone as shown on the proposed Notice of Intent Plan. This erosion control barrier is to be maintained in place, inspected regularly, and replaced as necessary during construction until all site work is complete, and all areas disturbed by construction activities have been established with stabilizing surface cover, vegetation, mulch, or wood chips. Two temporary stockpile areas have been proposed, #1 on the south side of the driveway approximately 120 feet from Packard Rd

(approximately 65-ft from adjacent wetlands, and #2 at the end of the driveway in front of the proposed dwelling (outside the 100-ft buffer zone) – see plan for proposed locations of the proposed stockpile areas.

Although most of the dwelling roof impervious area is outside the 100-ft buffer zone, runoff from the roof is proposed to be infiltrated on site with an HDPE chamber drywell system that will collect and infiltrate roof runoff outside the 100-ft buffer zone. Although this system is outside the 100-ft wetland buffer zone, it is important to note that it is being proposed to offset impervious cover increases generated by that portion of the proposed roof and paved driveway apron which are within the buffer zone. By minimizing grade alterations to the site, infiltrating roof runoff and constructing most of the driveway of permeable gravel rather than paving, drainage will not be significantly impacted by site development.

Erosion and sediment from construction activities will be mitigated by installation of a staked straw wattle erosion control barrier surrounding the down-gradient limit of work to prevent soil erosion and sediment migration during construction until disturbed areas are stabilized with vegetation. The temporary and permanent mitigating measures proposed will protect the site from erosion during construction and mitigate changes to drainage conditions with the proposed on-site infiltration system.

The site development plan and stormwater calculations demonstrate the proposed drainage system and erosion control measures will adequately mitigate stormwater and erosion from lot development and satisfy the requirements of Stow Zoning Bylaw Section 3.8.1.9 (Drainage) and 3.8.10 (Erosion Control).

II. Methodology & References

Methodology:

SCS TR-55 & SCS TR-20 utilizing HydroCAD (ver. 10) software.

References:

A Guide to Hydrologic Analysis Using SCS Methods, Richard McCuen, copyright 1982, Prentice Hall, Inc.

USGS Quadrangle Hudson, Massachusetts, 1987

Natural Resources Conservation Service (NRCS), Web Soil Survey

Rawls (1982) Infiltration Rates

Northeast Regional Climate Center (NRCC) Rainfall Frequency Intensity Data

III. Results

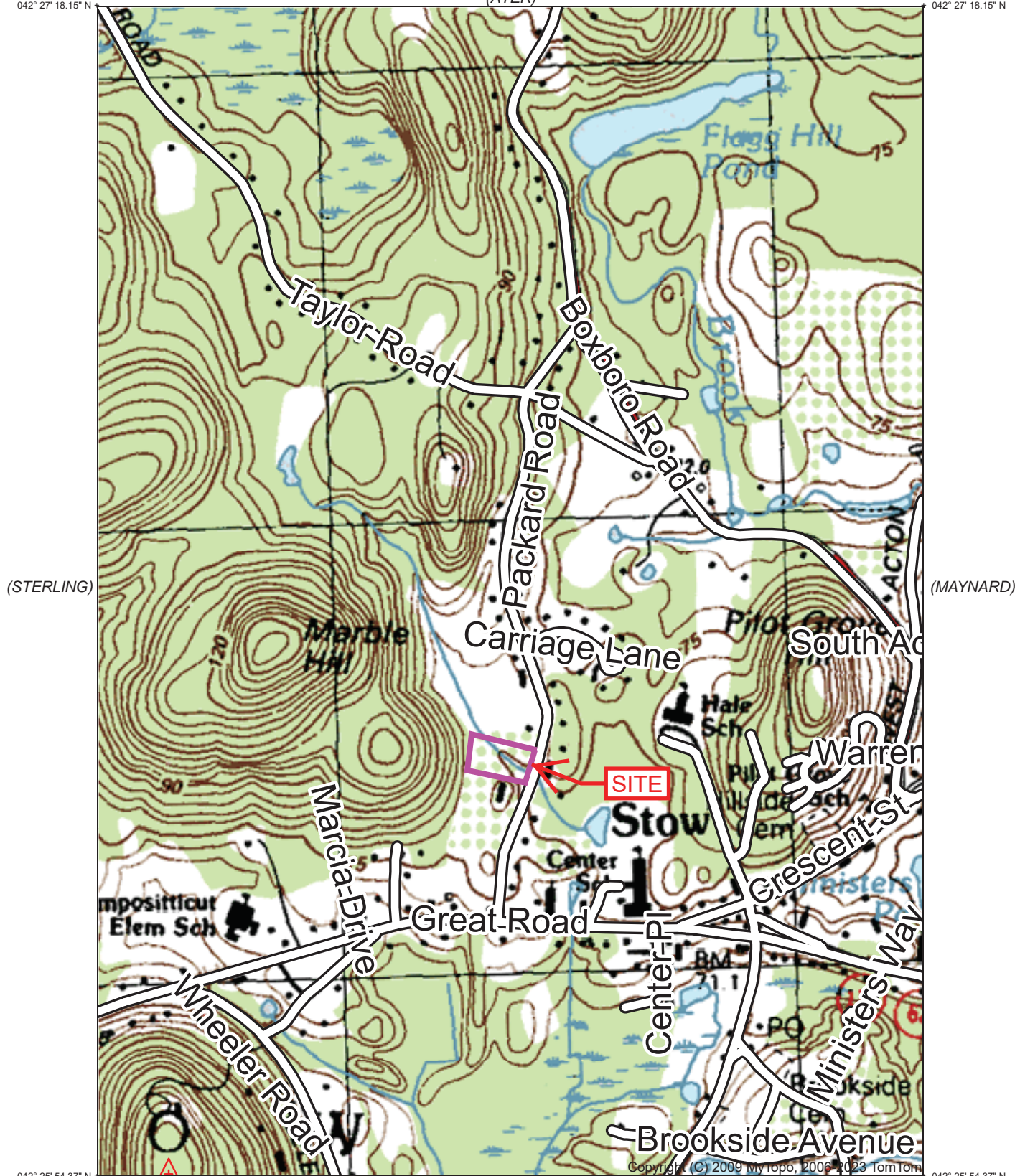
The drainage study area is limited to the effect of the increase in proposed impervious roof area since all other characteristics of the site (lawn/yard area, driveway, etc.) are not being substantially altered by the project. Increase in roof impervious area is the only substantial change occurring in site surface cover. The proposed roof area is approximately 1,824 sq.ft., if unmitigated, would substantially increase off-site runoff rates and volumes from the site.

The proposed roof area is represented as Subcatchment (1S) in the HydroCAD model. This area is directed to the modeled subsurface roof infiltration bed (Pond 10P) which has been sized to detain and infiltrate fully a 100-yr, 24-hr rainfall event and effectively reduce the rate and volume of runoff from the site.

The off-site areas were analyzed for rate and volume of runoff under existing conditions for the 2-yr, 10-yr, 25-yr and 100-yr, 24-hr design storms. Under post-development conditions, runoff from the proposed roof area is fully infiltrated in the proposed roof drywell system for all design storms analyzed up to and including the 100-yr design rainfall event.

Conclusions

The calculations and site development plan demonstrate that the proposed drainage system for Lot 3 Packard Road adequately mitigates increases in rate and volume of runoff and meet the requirements of Stow Zoning Bylaw Sections 3.8.1.9 (Drainage) and 3.18.10 (Erosion Control).

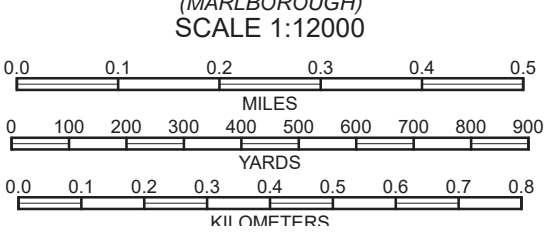


(WORCESTER NORTH)

Produced by MyTopo Terrain Navigator
Topography based on USGS 1:24,000
Maps

North American 1983 Datum (NAD83)
Universal Transverse Mercator Projection

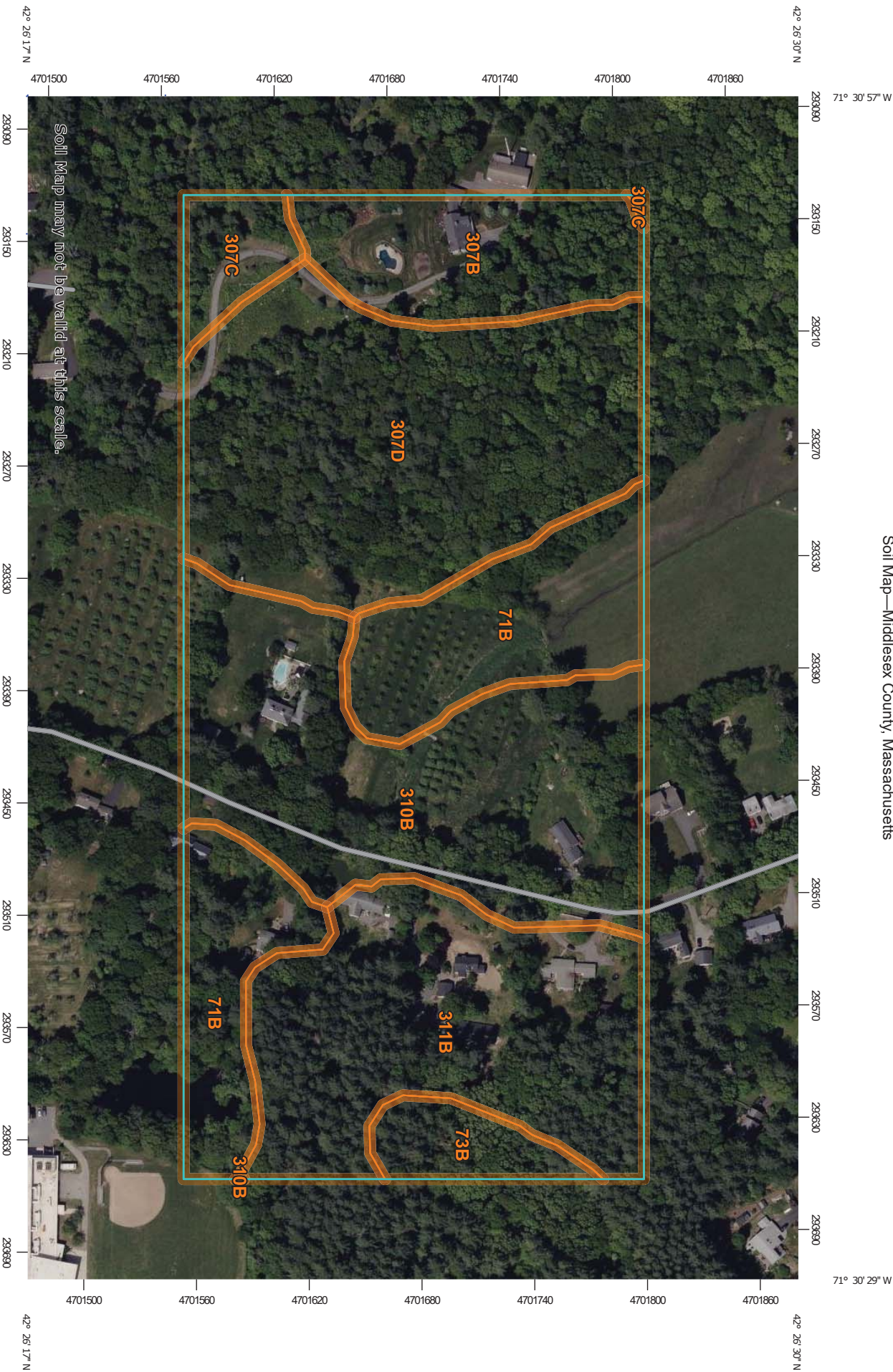
To place on the predicted North American
1927 move the projection lines 10M N and
40M E



CONTOUR INTERVAL 3 METERS
NATIONAL GEODETIC VERTICAL DATUM 1929

HUDSON, MA
1999

Soil Map—Middlesex County, Massachusetts



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	5.1	15.9%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	0.9	2.9%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	2.8	8.7%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	0.9	2.8%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	8.4	26.4%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	7.5	23.4%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	6.3	19.8%
Totals for Area of Interest		32.0	100.0%

Table D.13.1 Hydrologic Soil Properties Classified by Soil Texture*

Texture Class	Effective Water Capacity (C_w) (inch per inch)	Minimum Infiltration Rate (f) (inches per hour)	Hydrologic Soil Grouping
Sand	0.35	8.27	A
Loamy Sand	0.31	2.41	A
Sandy Loam	0.25	1.02	A
Loam	0.19	0.52	B
Silt Loam	0.17	0.27	B
Sandy Clay Loam	0.14	0.17	C
Clay Loam	0.14	0.09	D
Silty Clay Loam	0.11	0.06	D
Sandy Clay	0.09	0.05	D
Silty Clay	0.09	0.04	D
Clay	0.08	0.02	D

* Source: Rawls, Brakensiek and Saxton, 1982

Based on the soil textural classes and the corresponding minimum infiltration rates, a restriction is established to eliminate unsuitable soil conditions. Soil textures with minimum infiltration rates less than 0.52 inches per hour are not suitable for usage of infiltration practices. These include soils that have a 30 percent clay content, making these soils susceptible to frost heaving and structurally unstable, in addition to having a poor capacity to percolate runoff. Soil textures that are recommended for infiltration systems include those soils with infiltration rates of 0.52 inches per hour or greater, which include loam, sandy loam, loamy sand, and sand.



CULTEC Recharger® 330XLHD Stormwater Chamber

The Recharger® 330XLHD is a 30.5" (775 mm) tall, high capacity chamber. Typically when using this model, fewer chambers are required resulting in less labor and a smaller installation area. The Recharger® 330XLHD has the side portal internal manifold feature. HVLV® FC-24 Feed Connectors are inserted into the side portals to create the internal manifold.



Size (L x W x H)	8.5' x 52" x 30.5" 2.59 m x 1321 mm x 775 mm
Installed Length	7' 2.13 m
Length Adjustment per Run	1.50' 0.46 m
Chamber Storage	7.46 ft ³ /ft 0.69 m ³ /m 52.21 ft ³ /unit 1.48 m ³ /unit
Min. Installed Storage	11.32 ft ³ /ft 1.05 m ³ /m 79.26 ft ³ /unit 2.24 m ³ /unit
Min. Area Required	33.83 ft ² 3.14 m ²
Chamber Weight	73.0 lbs 33.11 kg
Shipping	30 chambers/skid 2,335 lbs/skid 10 skids/48' flatbed
Min. Center-to-Center Spacing	4.83' 1.47 m
Max. Allowable Cover	12' 3.66 m
Max. Inlet Opening in End Wall	24" HDPE, PVC 600 mm HDPE, PVC
Max. Allowable O.D. in Side Portal	10" HDPE, 12" PVC 250 mm HDPE, 300 mm PVC
Compatible Feed Connector	HVLV FC-24 Feed Connector

Calculations are based on installed chamber length.
All above values are nominal.
Min. installed storage includes 6" (152 mm) stone base, 6" (152 mm) stone above crown of chamber and typical stone surround at 58" (1473 mm) center-to-center spacing.

	Stone Foundation Depth		
	6" 152 mm	12" 305 mm	18" 457 mm
Chamber and Stone Storage Per Chamber	79.26 ft ³ 2.24 m ³	86.03 ft ³ 2.44 m ³	92.79 ft ³ 2.63 m ³
Min. Effective Depth	3.54' 1.08 m	4.04' 1.23 m	4.54' 1.38 m
Stone Required Per Chamber	2.50 yd ³ 1.91 m ³	3.13 yd ³ 2.39 m ³	3.76 yd ³ 2.87 m ³

Calculations are based on installed chamber length.
Includes 6" (305 mm) stone above crown of chamber and typical stone surround at 58" (1473 mm) center-to-center spacing and stone foundation as listed in table.
Stone void calculated at 40%.

Recharger® 330XLHD Bare Chamber Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft ³ /ft	m ³ /m	ft ³	m ³	ft ³	m ³
30.5	775	0.000	0.000	0.000	0.000	52.213	1.479
30	762	0.019	0.002	0.133	0.004	52.213	1.479
29	737	0.051	0.005	0.357	0.010	52.080	1.475
28	711	0.084	0.008	0.588	0.017	51.723	1.465
27	686	0.124	0.012	0.868	0.025	51.135	1.448
26	660	0.150	0.014	1.05	0.030	50.267	1.424
25	635	0.173	0.016	1.211	0.034	49.217	1.394
24	609	0.191	0.018	1.337	0.038	48.006	1.360
23	584	0.207	0.019	1.449	0.041	46.669	1.322
22	559	0.221	0.021	1.547	0.044	45.220	1.281
21	533	0.233	0.022	1.631	0.046	43.673	1.237
20	508	0.244	0.023	1.708	0.048	42.042	1.191
19	483	0.254	0.024	1.778	0.050	40.334	1.142
18	457	0.264	0.025	1.848	0.052	38.556	1.092
17	432	0.271	0.025	1.897	0.054	36.708	1.040
16	406	0.283	0.026	1.981	0.056	34.811	0.986
15	381	0.294	0.027	2.058	0.058	32.830	0.930
14	356	0.296	0.027	2.072	0.059	30.772	0.871
13	330	0.299	0.028	2.093	0.059	28.700	0.813
12	305	0.301	0.028	2.107	0.060	26.607	0.754
11	279	0.303	0.028	2.121	0.060	24.500	0.694
10	254	0.304	0.028	2.128	0.060	22.379	0.634
9	229	0.306	0.028	2.142	0.061	20.251	0.574
8	203	0.313	0.029	2.191	0.062	18.109	0.513
7	178	0.321	0.030	2.247	0.064	15.918	0.451
6	152	0.322	0.030	2.254	0.064	13.671	0.387
5	127	0.323	0.030	2.261	0.064	11.417	0.323
4	102	0.324	0.030	2.268	0.064	9.156	0.259
3	76	0.325	0.030	2.275	0.064	6.888	0.195
2	51	0.327	0.030	2.289	0.065	4.613	0.131
1	25	0.332	0.031	2.324	0.066	2.324	0.066
Total		7.459	0.693	52.213	1.479	52.213	1.479

Calculations are based on installed chamber length.

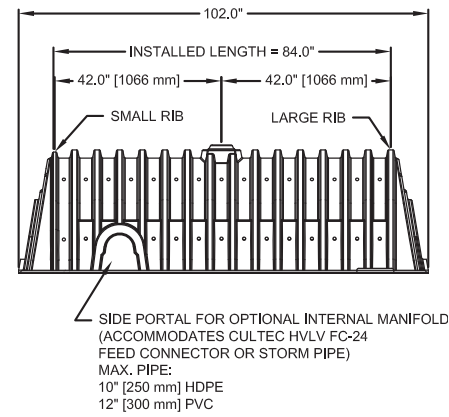
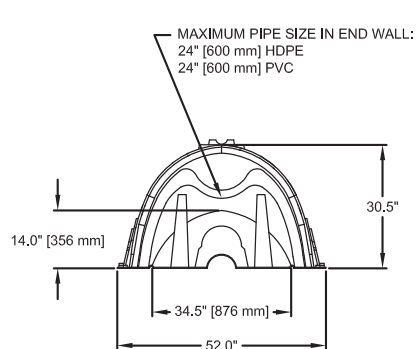
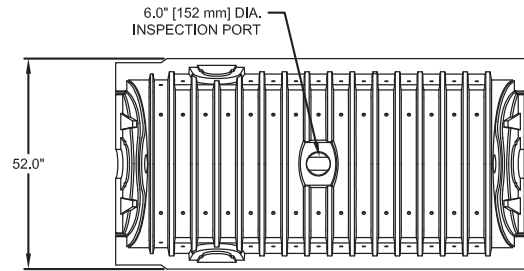
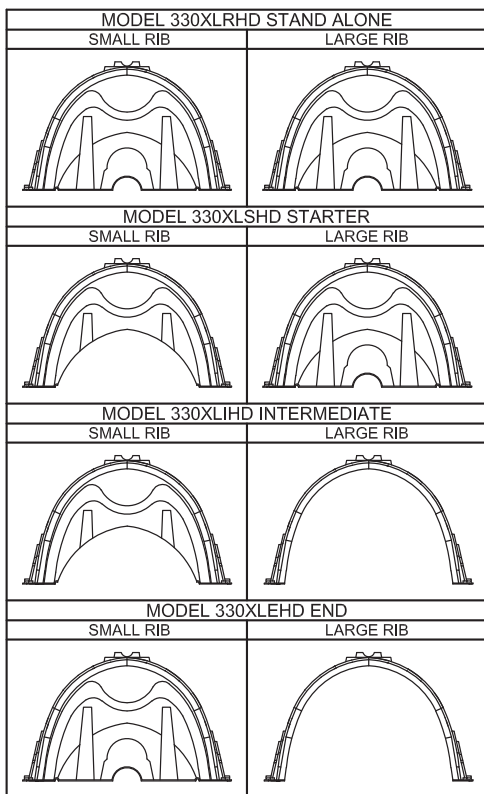
Visit <http://cultec.com/downloads/> for Product Downloads and CAD details.

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.



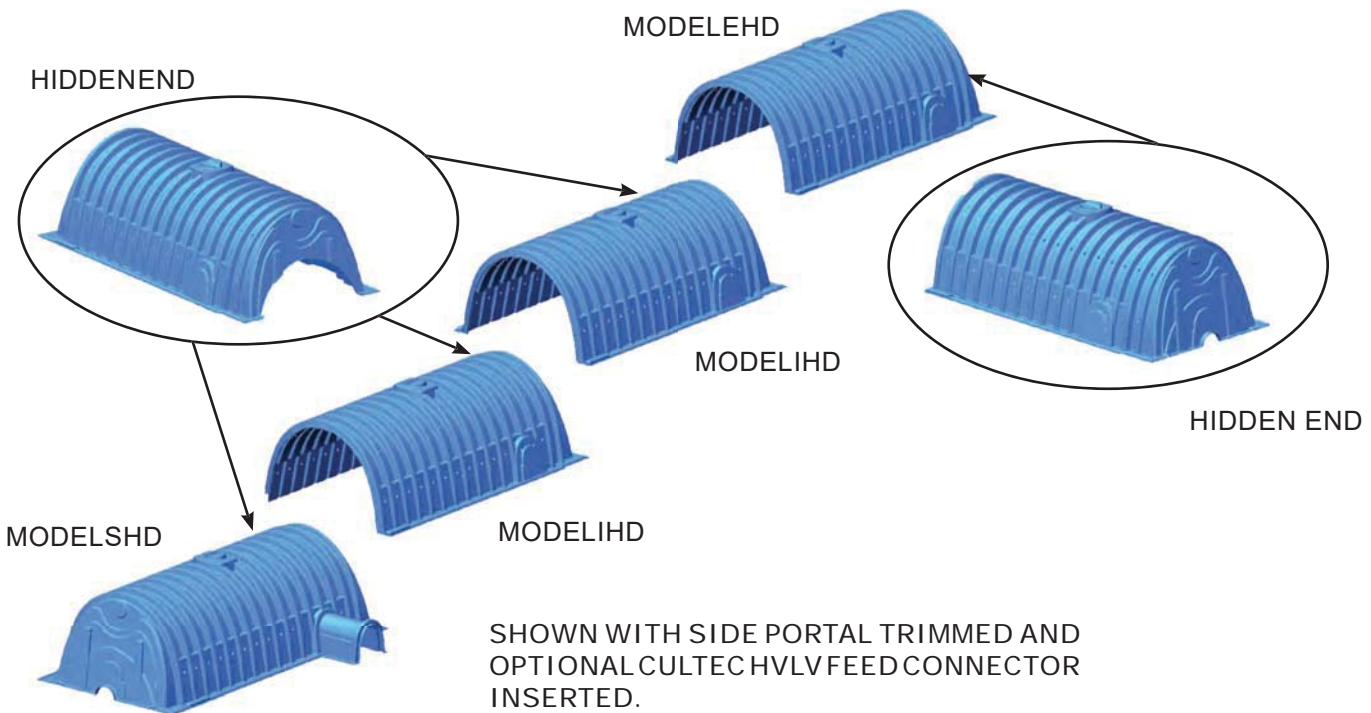
CULTEC Recharger® 330XLHD Stormwater Chamber

Three View Drawing



CULTEC RECHARGER 330XLHD CHAMBER STORAGE = 7.459 CF/FT [0.693 m³/m]
 INSTALLED LENGTH ADJUSTMENT = 1.5" [0.46 m]
 SIDE PORTAL ACCEPTS CULTEC HVLV FC-24 FEED CONNECTOR

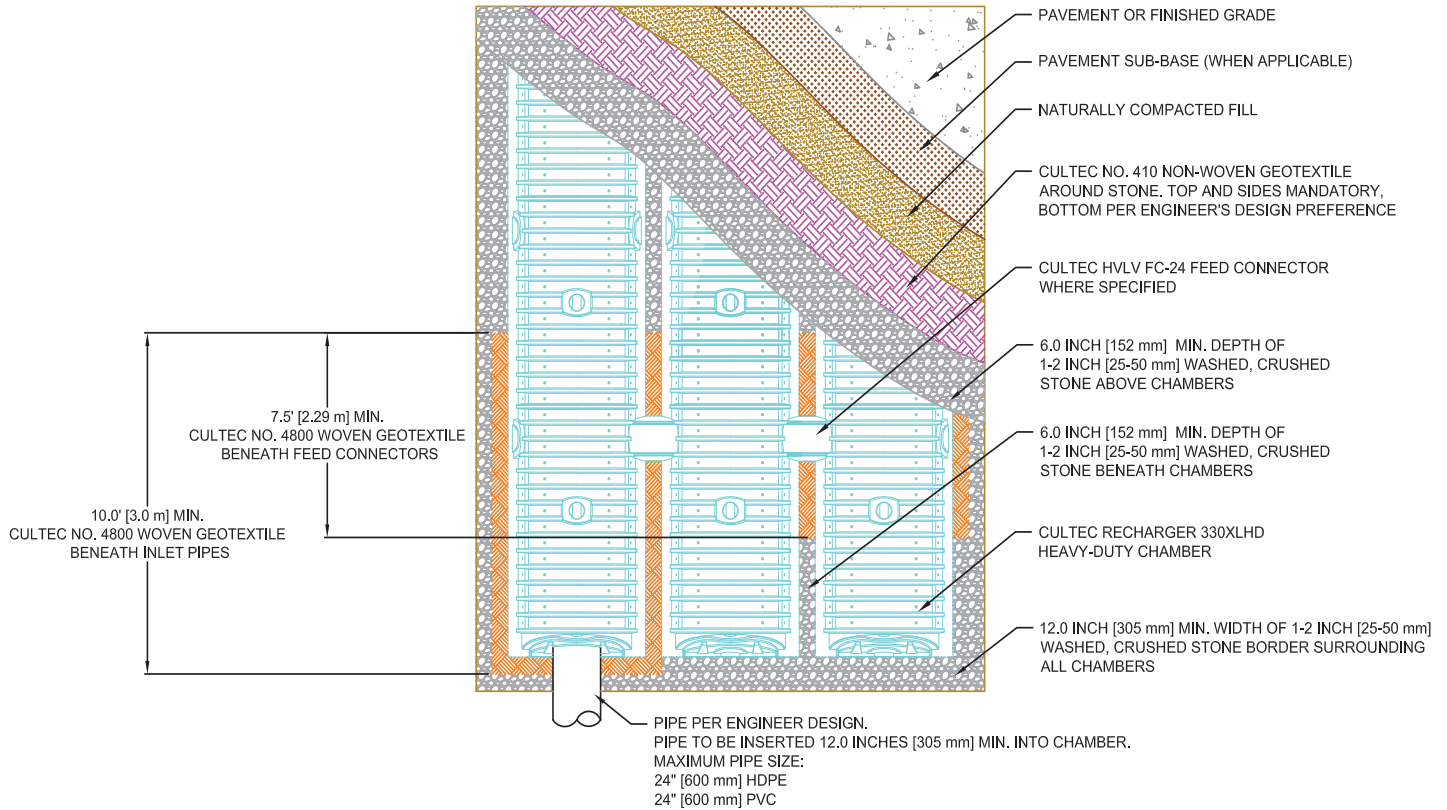
Typical Interlock Installation



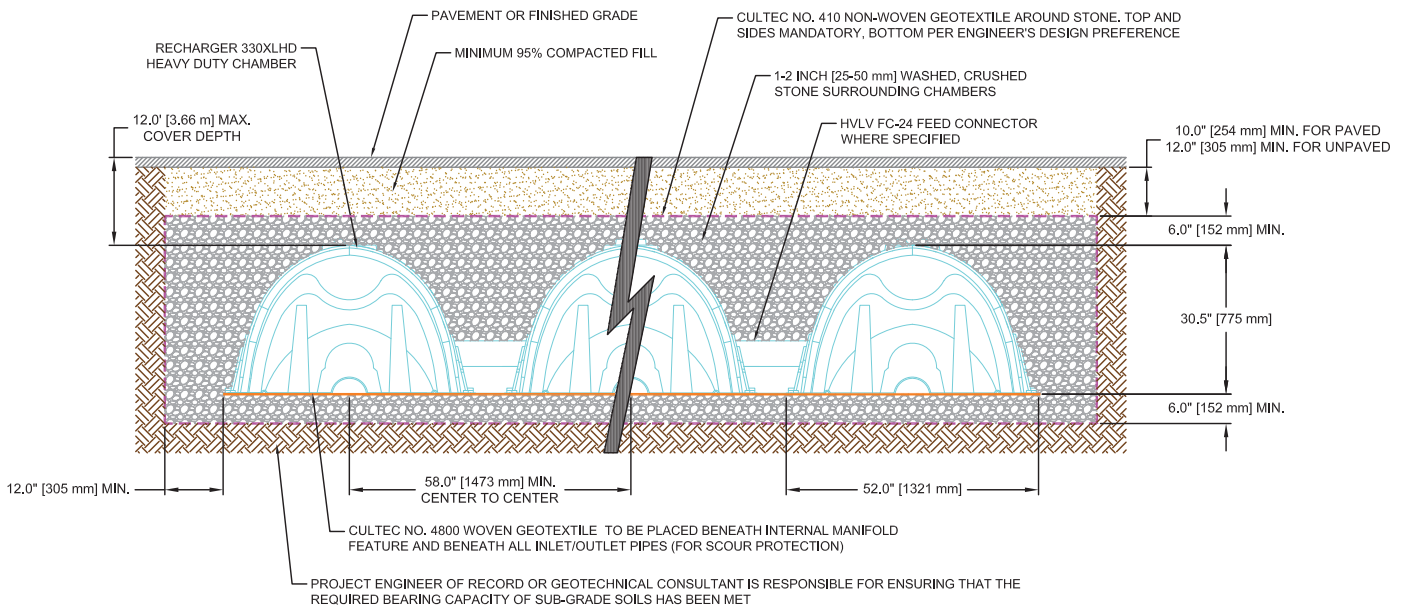
For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.



Plan View Drawing



Typical Cross Section for Traffic Application





CULTEC Recharger® 330XLHD Specifications

GENERAL

CULTEC Recharger® 330XLHD chambers are designed for underground stormwater management. The chambers may be used for retention, recharging, detention or controlling the flow of on-site stormwater runoff.

CHAMBER PARAMETERS

1. The chambers shall be manufactured in the U.S.A. by CULTEC, Inc. of Brookfield, CT (cultec.com, 203-775-4416).
2. The chamber shall be vacuum thermoformed of polyethylene with a black interior and blue exterior.
3. The chamber shall be arched in shape.
4. The chamber shall be open-bottomed.
5. The chamber shall be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings or separate end walls.
6. The nominal chamber dimensions of the CULTEC Recharger® 330XLHD shall be 30.5 inches (775 mm) tall, 52 inches (1321 mm) wide and 8.5 feet (2.59 m) long. The installed length of a joined Recharger® 330XLHD shall be 7 feet (2.13 m).
7. Maximum inlet opening on the chamber end wall is 24 inches (600 mm) HDPE, PVC.
8. The chamber shall have two side portals to accept CULTEC HVLV® FC-24 Feed Connectors to create an internal manifold. Maximum allowable O.D. in the side portal is 10 inches (250 mm) HDPE and 12 inches (300 mm) PVC.
9. The nominal chamber dimensions of the CULTEC HVLV® FC-24 Feed Connector shall be 12 inches (305 mm) tall, 16 inches (406 mm) wide and 24.2 inches (614 mm) long.
10. The nominal storage volume of the Recharger® 330XLHD chamber shall be 7.459 ft³ / ft (0.693 m³ / m) - without stone. The nominal storage volume of a single Recharger® 330XLHD Stand Alone unit shall be 63.40 ft³ (1.80 m³) - without stone. The nominal storage volume of a joined Recharger® 330XLHD Intermediate unit shall be 52.213 ft³ (1.478 m³) - without stone. The nominal storage volume of the length adjustment amount per run shall be 11.19 ft³ (1.04 m³) - without stone.
11. The nominal storage volume of the HVLV® FC-24 Feed Connector shall be 0.913 ft³ / ft (0.026 m³ / m) - without stone.
12. The Recharger® 330XLHD chamber shall have fifty-six discharge holes bored into the sidewalls of the unit's core to promote lateral conveyance of water.
13. The Recharger® 330XLHD chamber shall have 16 corrugations.
14. The end wall of the chamber, when present, shall be an integral part of the continuously formed unit. Separate end plates cannot be used with this unit.
15. The Recharger® 330XLHD Stand Alone unit must be formed as a whole chamber having two fully formed integral end walls and having no separate end plates or separate end walls.
16. The Recharger® 330XLHD Starter unit must be formed as a whole chamber having one fully formed integral end wall and one partially formed integral end wall with a lower transfer opening of 14 inches (356 mm) high x 34.5 inches (876 mm) wide.
17. The Recharger® 330XLHD Intermediate unit must be formed as a whole chamber having one fully open end wall and one partially formed integral end wall with a lower transfer opening of 14 inches (356 mm) high x 34.5 inches (876 mm) wide.
18. The Recharger® 330XLHD End unit must be formed as a whole chamber having one fully formed integral end wall and one fully open end wall and having no separate end plates or end walls.
19. The HVLV® FC-24 Feed Connector must be formed as a whole chamber having two open end walls and having no separate end plates or separate end walls. The unit shall fit into the side portals of the Recharger® 330XLHD and act as cross feed connections.
20. Chambers must have horizontal stiffening flex reduction steps between the ribs.
21. The chamber shall have a raised integral cap at the top of the arch in the center of each unit to be used as an optional inspection port or clean-out.
22. The units may be trimmed to custom lengths by cutting back to any corrugation on the large rib end.
23. The chamber shall be manufactured in an ISO 9001:2015 certified facility.
24. The chamber shall be designed and manufactured to meet the material and structural requirements of IAPMO PS 63-2019, including resistance to AASHTO H-10 and H-20 highway live loads, when installed in accordance with CULTEC's installation instructions.
25. The chamber shall be designed and manufactured in accordance with the specifications of NSAI Irish Agreement Board Certificate for Cultec Attenuation and Infiltration.
26. Maximum allowable cover over the top of the chamber shall be 12' (3.66 m).
27. The chamber shall be designed to withstand traffic loads when installed according to CULTEC's recommended installation instructions.

Drywell Operation & Maintenance Plan

The property owner of record shall be responsible for the design, performance, operation, and maintenance of the drywell system proposed for this site. Drywells that cease to drain in a 48-hour period due to clogging shall be replaced by the owner.

Drywell Inspection

Drywell inspections are to be performed annually by the owner or whenever ponding is still evident 48 hours after a storm. The inspection procedure should include visual inspection of roof gutter for accumulation of debris and removal of the inspection port cover and inspection of the interior of the system. Inspections shall be documented with a written report and kept on file by the drywell facility owner. Annual inspection reports should also be sent to the Weston Stormwater Engineer.

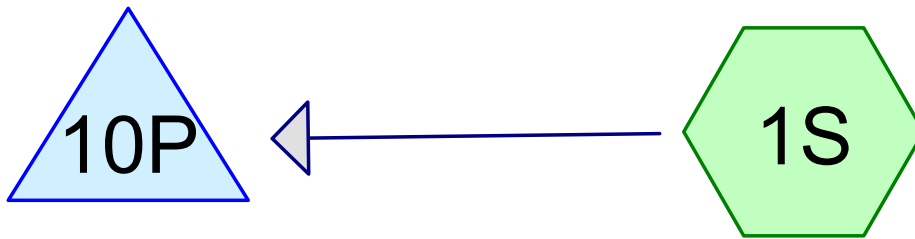
Should inspection reveal that the system is no longer effective and cannot be returned to effective use, a new system should be installed. Drywell maintenance should occur when inspection shows:

- Drainage time has increased beyond 48 hours
- A non-stormwater discharge has entered the system
- Upon change of ownership of the system

Drywell Maintenance

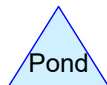
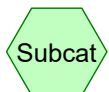
Drywell maintenance may include, but is not limited to;

- Removal of sediment, trash, and debris from the system
- Purging of accumulated silt out of the aggregate fill by jetting, surging, or pumping
- Clearing gutters of accumulated debris



CULTEC R330 ROOF
INF BED

ROOF AREA



2154_Lot 3 Packard Road, Stow

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.09	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	4.65	2
3	25-Year	NRCC 24-hr	D	Default	24.00	1	5.87	2
4	100-Year	NRCC 24-hr	D	Default	24.00	1	8.36	2

2154_Lot 3 Packard Road, Stow

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
1,824	98	Roofs, HSG D (1S)
1,824	98	TOTAL AREA

2154_Lot 3 Packard Road, Stow

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
1,824	HSG D	1S
0	Other	
1,824		TOTAL AREA

2154_Lot 3 Packard Road, Stow

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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	Subcatchment Numbers
0	0	0	1,824	0	1,824	Roofs	1S
0	0	0	1,824	0	1,824	TOTAL AREA	

2154_Lot 3 Packard Road, Stow

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LOT 3 PACKARD RD STOW

NRCC 24-hr D 2-Year Rainfall=3.09"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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: ROOF AREA

Runoff Area=1,824 sf 100.00% Impervious Runoff Depth>2.85"
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.12 cfs 434 cf

Pond 10P: CULTEC R330 ROOF INF BED

Peak Elev=241.47' Storage=43 cf Inflow=0.12 cfs 434 cf
Outflow=0.04 cfs 434 cf

Total Runoff Area = 1,824 sf Runoff Volume = 434 cf Average Runoff Depth = 2.85"
0.00% Pervious = 0 sf 100.00% Impervious = 1,824 sf

2154_Lot 3 Packard Road, Stow

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LOT 3 PACKARD RD STOW
 NRCC 24-hr D 2-Year Rainfall=3.09"
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Summary for Subcatchment 1S: ROOF AREA

Runoff = 0.12 cfs @ 12.13 hrs, Volume= 434 cf, Depth> 2.85"
 Routed to Pond 10P : CULTEC R330 ROOF INF BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
1,824	98	Roofs, HSG D
1,824		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.5000	3.61		Sheet Flow, IMP SHEET FLOW Smooth surfaces n= 0.011 P2= 3.20"
0.1	20	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 10P: CULTEC R330 ROOF INF BED

Inflow Area = 1,824 sf, 100.00% Impervious, Inflow Depth > 2.85" for 2-Year event
 Inflow = 0.12 cfs @ 12.13 hrs, Volume= 434 cf
 Outflow = 0.04 cfs @ 11.97 hrs, Volume= 434 cf, Atten= 63%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.97 hrs, Volume= 434 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 241.47' @ 12.27 hrs Surf.Area= 225 sf Storage= 43 cf

Plug-Flow detention time= 3.7 min calculated for 433 cf (100% of inflow)
 Center-of-Mass det. time= 3.5 min (763.9 - 760.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	241.00'	243 cf	18.00'W x 12.50'L x 3.54'H Field A 797 cf Overall - 190 cf Embedded = 607 cf x 40.0% Voids
#2A	241.50'	190 cf	Cultec R-330XLHD x 3 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		433 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	241.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.04 cfs @ 11.97 hrs HW=241.04' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

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LOT 3 PACKARD RD STOW

NRCC 24-hr D 10-Year Rainfall=4.65"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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: ROOF AREA

Runoff Area=1,824 sf 100.00% Impervious Runoff Depth>4.41"
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.18 cfs 670 cf

Pond 10P: CULTEC R330 ROOF INF BED

Peak Elev=241.84' Storage=96 cf Inflow=0.18 cfs 670 cf
Outflow=0.04 cfs 670 cf

Total Runoff Area = 1,824 sf Runoff Volume = 670 cf Average Runoff Depth = 4.41"
0.00% Pervious = 0 sf 100.00% Impervious = 1,824 sf

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LOT 3 PACKARD RD STOW
NRCC 24-hr D 10-Year Rainfall=4.65"

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Summary for Subcatchment 1S: ROOF AREA

Runoff = 0.18 cfs @ 12.13 hrs, Volume= 670 cf, Depth> 4.41"
Routed to Pond 10P : CULTEC R330 ROOF INF BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
1,824	98	Roofs, HSG D
1,824		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.5000	3.61		Sheet Flow, IMP SHEET FLOW Smooth surfaces n= 0.011 P2= 3.20"
0.1	20	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 10P: CULTEC R330 ROOF INF BED

Inflow Area = 1,824 sf, 100.00% Impervious, Inflow Depth > 4.41" for 10-Year event
 Inflow = 0.18 cfs @ 12.13 hrs, Volume= 670 cf
 Outflow = 0.04 cfs @ 11.86 hrs, Volume= 670 cf, Atten= 76%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.86 hrs, Volume= 670 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 241.84' @ 12.36 hrs Surf.Area= 225 sf Storage= 96 cf

Plug-Flow detention time= 8.9 min calculated for 670 cf (100% of inflow)
 Center-of-Mass det. time= 8.7 min (759.7 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	241.00'	243 cf	18.00'W x 12.50'L x 3.54'H Field A 797 cf Overall - 190 cf Embedded = 607 cf x 40.0% Voids
#2A	241.50'	190 cf	Cultec R-330XLHD x 3 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		433 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	241.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.04 cfs @ 11.86 hrs HW=241.04' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

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LOT 3 PACKARD RD STOW

NRCC 24-hr D 25-Year Rainfall=5.87"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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: ROOF AREA

Runoff Area=1,824 sf 100.00% Impervious Runoff Depth>5.62"

Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.22 cfs 855 cf

Pond 10P: CULTEC R330 ROOF INF BED

Peak Elev=242.17' Storage=146 cf Inflow=0.22 cfs 855 cf

Outflow=0.04 cfs 855 cf

Total Runoff Area = 1,824 sf Runoff Volume = 855 cf Average Runoff Depth = 5.62"
0.00% Pervious = 0 sf 100.00% Impervious = 1,824 sf

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LOT 3 PACKARD RD STOW
 NRCC 24-hr D 25-Year Rainfall=5.87"
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Summary for Subcatchment 1S: ROOF AREA

Runoff = 0.22 cfs @ 12.13 hrs, Volume= 855 cf, Depth> 5.62"
 Routed to Pond 10P : CULTEC R330 ROOF INF BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 NRCC 24-hr D 25-Year Rainfall=5.87"

Area (sf)	CN	Description
1,824	98	Roofs, HSG D
1,824		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.5000	3.61		Sheet Flow, IMP SHEET FLOW Smooth surfaces n= 0.011 P2= 3.20"
0.1	20	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 10P: CULTEC R330 ROOF INF BED

Inflow Area = 1,824 sf, 100.00% Impervious, Inflow Depth > 5.62" for 25-Year event
 Inflow = 0.22 cfs @ 12.13 hrs, Volume= 855 cf
 Outflow = 0.04 cfs @ 11.78 hrs, Volume= 855 cf, Atten= 81%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.78 hrs, Volume= 855 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 242.17' @ 12.43 hrs Surf.Area= 225 sf Storage= 146 cf

Plug-Flow detention time= 14.7 min calculated for 855 cf (100% of inflow)
 Center-of-Mass det. time= 14.5 min (761.1 - 746.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	241.00'	243 cf	18.00'W x 12.50'L x 3.54'H Field A 797 cf Overall - 190 cf Embedded = 607 cf x 40.0% Voids
#2A	241.50'	190 cf	Cultec R-330XLHD x 3 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		433 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	241.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.04 cfs @ 11.78 hrs HW=241.04' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

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LOT 3 PACKARD RD STOW

NRCC 24-hr D 100-Year Rainfall=8.36"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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: ROOF AREA

Runoff Area=1,824 sf 100.00% Impervious Runoff Depth>8.11"

Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.32 cfs 1,233 cf

Pond 10P: CULTEC R330 ROOF INF BED

Peak Elev=243.01' Storage=265 cf Inflow=0.32 cfs 1,233 cf

Outflow=0.04 cfs 1,232 cf

Total Runoff Area = 1,824 sf Runoff Volume = 1,233 cf Average Runoff Depth = 8.11"
0.00% Pervious = 0 sf 100.00% Impervious = 1,824 sf

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NRCC 24-hr D 100-Year Rainfall=8.36"

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Summary for Subcatchment 1S: ROOF AREA

Runoff = 0.32 cfs @ 12.13 hrs, Volume= 1,233 cf, Depth> 8.11"
 Routed to Pond 10P : CULTEC R330 ROOF INF BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
1,824	98	Roofs, HSG D
1,824		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.5000	3.61		Sheet Flow, IMP SHEET FLOW Smooth surfaces n= 0.011 P2= 3.20"
0.1	20	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 10P: CULTEC R330 ROOF INF BED

Inflow Area = 1,824 sf, 100.00% Impervious, Inflow Depth > 8.11" for 100-Year event
 Inflow = 0.32 cfs @ 12.13 hrs, Volume= 1,233 cf
 Outflow = 0.04 cfs @ 11.57 hrs, Volume= 1,232 cf, Atten= 86%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.57 hrs, Volume= 1,232 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 243.01' @ 12.64 hrs Surf.Area= 225 sf Storage= 265 cf

Plug-Flow detention time= 31.0 min calculated for 1,232 cf (100% of inflow)
 Center-of-Mass det. time= 30.8 min (772.0 - 741.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	241.00'	243 cf	18.00'W x 12.50'L x 3.54'H Field A 797 cf Overall - 190 cf Embedded = 607 cf x 40.0% Voids
#2A	241.50'	190 cf	Cultec R-330XLHD x 3 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		433 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	241.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.04 cfs @ 11.57 hrs HW=241.04' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)