Environmental Services

Engineering Services

Stormwater Report

Proposed Multifamily Residences
#778 Main Street
Leicester, MA

Revised: December 6, 2022

Prepared for:

Charlton Road Realty, LLC.
25 Waterville Lane
Shrewsbury, MA 01545

Prepared by:

CMG Environmental, Inc.
CMG ID 2021-226

67 Hall Road
Sturbridge, MA 01566
Phone (774) 241-0901
Fax (774) 241-0906

TABLE OF CONTENTS

TABLES

ATTACHMENTS

Stormwater Report
Proposed Multifamily Residences
#778 Main Street, Leicester, MA
December 6, 2022

Project Description:

The project Applicant*, Charlton Road Realty, LLC.,* retained *CMG Engineering* to prepare this engineering analysis of pre- and post-development drainage runoff conditions for a proposed **Multifamily Residences Project.** The proposed site improvements are located on assessor's parcel 21A - 11 with a total area of 3.21 Acres, identified as #778 Main Street (Site).

The site is currently a single-family residence with a dwelling, paved parking area, and barn located along the Main Street frontage. The northern property boundary abuts Waite Pond and currently contains undeveloped woodlands. The property also contains approximately 50' of frontage along Waite Street located in the Eastern Portion of the Site. Municipal water and sewer service the existing property with connections located within the Main Street right-of-way.

The current site topography pitches towards the Main Street right-of-way along the front of the site as well as a majority of the site pitching towards the rear property line to Waite Pond. There are currently no existing stormwater BMPs implemented on the site. A portion of the rear of the property is located within the 100' jurisdictional wetland buffer and will require a Notice of Intent filing with the Leicester Conservation Commission. A 25' "No Disturb" Zone associated with the Waite Pond wetlands is also on-site and will not be affected by this proposal. Approximately 32,600 s.f. of the southern portion of the site, which abuts the Main Street right-of-way, lies within the Town of Leicester Water Resources Protection Overlay District.

The applicant is proposing to construct three (3) 2-story residential apartment buildings for a total of 25 units. Associated paved parking areas will be located in the southern and eastern portion of the site. Proposed site access will be proposed along the Main Street right-of-way and the Waite Street right-of-way. In accordance with the MassDEP Stormwater Handbook, an on-site stormwater management system is proposed as part of this project, and will utilize a combination of treatment and infiltration BMP's. The applicant is proposing Low Impact Design BMP's within the limits of the Water Resources Protection Overlay District in order to comply with the intent of the Town of Leicester's Zoning Bylaws.

A copy of the "MA-DEP Checklist for Stormwater Report" is included as **Appendix A**.

Hydrologic Calculation Methodology:

Hydrology

Computer Model: HydroCAD 10.0 © 2015 Applied Microcomputer Systems, drainage modeling software;

Hydrologic Methodology: TR-55 Methodology is used for analysis of peak flow and drywell sizing.

Surface Runoff Conditions

Rainfall Intensity: TR-55 (Type III) – Rainfall Data
2-Year Storm = 3.00 in.
10-Year Storm = 4.50 in
25-Year Storm = 5.30 in.
100-Year Storm = 6.50 in.

Watershed Areas: Watershed areas are calculated using AutoCAD software based on the subcatchment areas delineated on topographic mapping included as "Pre-Development Drainage" and "Post-Development Drainage". The areas shown, times of concentration and runoff coefficients are all consistent with the TR-55 drainage calculation method.

Flood Plain:

FEMA Flood Mapping: A portion of the site is located in the Special Flood Hazard Area – Zone "A" based on Flood Insurance Rate Map (FIRM) Town of Leicester, Worcester County Massachusetts (All Jurisdictions) Map Number 25027C0782E, Effective Date July 04, 2011 (see **Appendix B).**

Soils & Topography:

The Site soils are mapped as and appear to be consistent with Canton Fine Sandy Loam (420B) with 3 ~ 8% slopes classified as Hydrologic Soil Group "B" and modelled as such in the hydrology calculations. However, based upon on-site observatory testing, subsurface soils are classified as "Loamy Sands" per classification by a Massachusetts Licensed Soil Evaluator. Loamy sands correlate to an "A" type soil classification within the Rawls Rate soil permeability table.

A copy of the *National Resources Conservation Service* (NRCS) Soils Map, listed area soil types are included as **Appendix C.**

On-Site Soil Testing:

May 12, 2022 Soil Testing – Avizinis Environmental Services, Inc. (Edward J. Avizinis, LSE)

On May 13, 2022 Avizinis Environmental Services, Inc. completed eight (8) on-site soil test pits within the proposed project area. The purpose of these test pits was to verify the ESHGW and soil conditions within the proposed stormwater management areas.

Depth to Groundwater:

Estimated seasonal high groundwater (ESHGW) elevations based on soil mottling are as follows:

TH - 1	**TH - 2**	**TH - 3**	**TH – 4**
ESHGW = 50"	**ESHGW=73"**	**ESHGW = 77"**	**ESHGW = 79"**
TH-5	**TH-6**	**TH-7**	**TH-8**
ESHGW = 90"	**ESHGW = 90"**	**ESHGW = 76"**	**ESHGW = 80"**

TH – 5 did not contain mottling as the excavator encountered shallow refusal.

Soil Conditions:

Test pit TH – 1 was excavated in close proximity to one of the proposed roof drain infiltration systems to approximately 8 ft. below ground surface (b.g.s.). Soil testing results yielded native loamy sands with an ESHGW located approximately 4.1 ft. b.g.s.

Test pit TH - 2 was excavated in close proximity to the second roof drain infiltration system to approximately 8 ft. b.g.s. Soil testing results yielded loamy sands with an ESHGW located approximately 6' b.g.s.

Test pit TH – 3 was excavated within the proposed access driveway to approximately 8' below grade. Soil testing yielded loamy sands with an ESHGW located approximately 6.4' b.g.s.

Test pit TH – 4 was excavated within the limits of one of the three proposed infiltration basins to approximately 6.5' b.g.s. Soil testing yielded ESHGW located approximately 6.5' b.g.s.

Test pit TH – 5 was excavated within the front parking area to approximately 8' b.g.s. Soil testing yielded native loamy sands with an ESHGW located approximately 7.5' b.g.s.

Test pit TH – 6 was excavated within the front parking area to approximately 8' b.g.s. Soil testing yielded native loamy sands with an ESHGW located approximately 7.5' b.g.s.

Test pit TH – 7 was excavated within the front parking area to approximately 8' b.g.s. Soil testing yielded native loamy sands with an ESHGW located approximately 6.3' b.g.s.

Test pit TH – 8 was excavated within the front parking area to approximately 8' b.g.s. Soil testing yielded native loamy sands with an ESHGW located approximately 6.6' b.g.s.

Copies of Site Soil Investigation Data are also included in **Appendix C**.

Soil Permeability (k):
Based upon on-site classification by a State of Massachusetts Licensed Soil Evaluator Edward Avizinis, site subsurface soils within the development area are classified as a "loamy sand". Loamy sands correlate to a "A" type soil classification within the Rawls Rate soil permeability table; therefore, the drainage design permeability has been identified as follows:

Design permeability (k) values of Type "A" Soils:
***k* = 2.41 in / hr** (Rawls Rate: Type "A" Soils) Loamy Sand

Existing Conditions:

The existing site currently consists of one business zoned property located at #778 Main Street with an area of 3.21 Acres. The parcel consists of a single-family residential home along Main Street and undeveloped woodlands along the rear portion of the property, which abuts Waite Pond. The site topography appears to split in two directions with a small portion of the front of the site pitching towards Main Street and the large majority of the site pitching towards Waite Pond in the rear of the Site. There are two (2) stormwater outfall locations for the site:

Outfall 1S – Main Street Stormwater runoff associated with the existing single-family dwelling, paved driveway, and half of the existing barn roof area drain via overland flow to the Main Street right-of-way as well as a combination of grass and woods totaling approximately 32,400 s.f. No existing stormwater BMPs are present on-site to treat and convey existing stormwater flows. Stormwater runoff entering the Main Street right-of-way is captured and conveyed through the existing Mass DOT owned drainage system.

Outfall 2S – Waite Pond The remaining 127,635 +/- s.f. of the undeveloped woodlands and rear lawn area discharge via overland flow to Waite Pond, which abuts the rear portion of the site. As previously stated, the site does not currently employ stormwater management structures to treat and convey existing stormwater flows. The limits of the Waite Pond resource area were delineated by Goddard Consulting on December 27, 2021.

Proposed Conditions:

The project Applicant is proposing to construct three (3) multifamily apartment buildings with a total combined 25 dwelling units. A paved site access driveway will be located along the Main Street and Waite Street right-of-ways with tenant parking located along the southern and eastern portions of the site. Stormwater runoff from impervious roof areas and impervious paved parking areas and walkways will be captured and conveyed to treatment and infiltration structures throughout the site. CMG is proposing the following Stormwater

Management System for the Site in order to meet the MA-DEP Stormwater Management Standards for a new development project.

Outfall 1S – Main Street Subcatchment 1A consists of a small portion of the paved access driveway and front landscape area located along the Main Street frontage. The proposed curb cut along Main Street is designed to prevent off-site runoff from entering the site, therefore a small portion (approximately 400 s.f.) of paved driveway will discharge directly into the Main Street right-of-way with no conveyance or treatment structures. The remaining drainage area is comprised of pervious proposed landscape areas.

Subcatchment 1B consists of the proposed paved access driveway and paved parking area located along the proposed Main Street curb cut. A deep sump hooded catch basin will collect the approximately 6,500 s.f. of drainage area and discharge via underground piping to an underground infiltration system. The infiltration system consists of Cultec 330 XLHD and will contribute to the entire system's conformance to the infiltration volume requirements. During larger storm events, an overflow pipe will discharge stormwater to the western property boundary which will eventually enter the Main Street drainage system.

Outfall 2S – Waite Pond Subcatchment 2A consists of the proposed resident parking area located in the central portion of the site. The paved parking area will discharge to a deep sump hooded double-grate catch basin which will convey stormwater to a second underground infiltration system. The system will also consist of Cultec 330XLHD chambers to contribute to overall site infiltration volume requirements. During larger storm events. The infiltration system will utilize an overflow pipe to discharge water to the rear of the property to eventually enter Waite Pond.

Subcatchment 2B consists of the paved site access and paved parking area located in close proximity to the proposed Waite Street curb cut. Additional off-site runoff from the abutting properties (#1 Waite Street & #774 Main Street) also contribute to site runoff for this subcatchment. All runoff will be diverted via overland flow to deep sump hooded catch basins located within the paved driveway area. The catch basins will then discharge stormwater flows via underground piping to a third underground infiltration system. An 8" overflow pipe will discharge stormwater to the rear of the property during larger storm events. Please note, a portion of this subcatchment utilizes porous pavement to conform to the regulations associated with the Water Resources Protection Overlay District. More information regarding conformance to the overlay district is included in the next section of this report.

Subcatchment 2C consists of the remaining undeveloped wooded area located along the rear portion of the property as well as the developed landscape and paved areas around the three proposed buildings. The proposed impervious areas located in this subcatchment are associated with patios located between the buildings for passive recreational use and also emergency equipment access. This subcatchment will not utilize stormwater BMP's as treatment is not required per the MassDEP Stormwater Handbook. Therefore, all stormwater runoff will discharge via overland flow to the rare of the property into Waite Pond.

Building roof drains will discharge to two separate underground infiltration systems consisting of Cultec 330XLHD chambers. The systems will utilize overflow pipe to divert stormwater to the rear of the property during larger storm events.

Water Resources Protection Overlay District (Leicester Zoning Bylaws §7.1)

As previously stated, approximately 32,600 s.f. of the front portion of the site is located within the Water Resources Protection Overlay District. The Town of Leicester Zoning Bylaws allow a maximum 30% of impervious area be located within the limits of the overlay and require measures be taken to ensure increase increases in stormwater runoff be artificially recharged. To meet the regulations, the applicant is proposing 29.8% of the overlay district be impervious pavement associated with the

entrance driveway and resident parking. An additional 11,277 s.f. of parking will utilize porous pavement to meet the maximum allowable impervious area requirement. The attached HydroCAD model incorporates the porous pavement in the calculations and utilizes a conservative curve number (CN) of 75 which was obtained from online resources.

The proposed porous asphalt and underground infiltration systems located within the limits of the overlay district will promote artificial recharge to the groundwater exceeding the pre-development condition. A summary of the pre-development and post-development recharge volumes within the limits of the Water Resources Protection Overlay District is included as Table 3.

Proposed Stormwater Management System:

Proposed Multifamily Residence:

- Deep sump hooded catch basins collect runoff for site's impervious and landscaped areas.
- Underground infiltration systems will be utilized to meet the required recharge volume and water quality volume. Infiltration system will be outfitted with Cultec Separator Rows to achieve pre-treatment requirements prior to infiltration.
- Porous pavement will be utilized to reduce impervious surface runoff and promote additional infiltration within the limits of the Water Resources Protection Overlay District.
- Site Long-term Operation and Maintenance plan is provided for the Site.

MA-DEP Stormwater Management Standards:

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

Proposed Full Compliance:

- **Combination of on-site stormwater BMPs including deep sump catch basins with hoods and underground infiltration systems provide treatment for on-site stormwater prior to discharge to Outfall 1S.**

STANDARD 2: (Peak rate control and flood prevention):
Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.

Proposed Full Compliance:

- **There is no proposed increase to Site peak runoff rates at both discharge points.**

STANDARD 3: (Recharge to Groundwater):
Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development conditions based on soil type. This Standard is met when the storm water management system is design to infiltrate the required recharge volume as determined in accordance with the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- **The site will be utilizing multiple underground infiltration chambers to meet the required recharge volume.**
- **Site specific BMPs are utilized to treat stormwater runoff prior to discharging to infiltration practices.**

STANDARD 4: (TSS Removal):

Stormwater management systems must be designed to remove 80% of the average annual post construction load of Total Suspended Solids (TSS).

Proposed Full Compliance:

- **Prior to outfalls, all stormwater will be routed through deep sump catch basins with hoods (25% TSS Removal) which discharges through a Cultec Separator Row (25% TSS Removal), then to infiltration practices (80% TSS Removal), resulting in excess of 80% TSS Removal Annual Load.**

STANDARD 5: (Higher Potential Pollutant Loads (LUHPPL)):

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Storm water Handbook to eliminate or reduce the discharge of storm water runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, or storm water runoff, the proponent shall use the specific storm water BMP's determined by the Department to be suitable for such use as provided in the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- **Not Applicable – Site is not considered a LUHPPL**

STANDARD 6: (Critical Areas)

Storm water discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and storm water discharges near or any other critical area require the use of the specific storm water best management practices determined by the Department to be suitable for managing discharges to such area as provided in the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- **A portion of the site falls within the Town of Leicester Water Resources Protection Overlay District. As a result, site specific BMP's are proposed to reduce impervious area runoff and promote infiltration measures within the overlay district. Additional BMP's are proposed to meet TSS pre-treatment requirements prior to infiltrating stormwater runoff into the ground.**

STANDARD 7: (Redevelopment)

"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."

Proposed Full Compliance:

- **A majority of the Site is considered new development and will meet all applicable Stormwater Management Standards.**

STANDARD 8: (Erosion, Sediment Control):
A plan to control construction related impacts including erosion sedimentation and other pollution prevention sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) must be implemented.

Proposed Full Compliance:

- **The "Erosion and Sedimentation Control Plan" and "Erosion and Sediment Control Details" are incorporated into the Plan Set.**
- **Project will disturb > 1 Acre, therefore an EPA–NPDES Stormwater General Permit is required prior to construction and will be accompanied with a comprehensive SWPP Plan.**

STANDARD 9: (Operation and Maintenance):
A long-term operation and maintenance plan must be developed and implemented to ensure that storm water management systems function as designed.

Proposed Full Compliance:

- **Long Term Operation and Maintenance Plan is included in Stormwater Management Report, Appendix H.**

STANDARD 10: (Illicit Discharges):
All illicit discharges to the stormwater management system are prohibited.

Proposed Full Compliance:

- **A signed "illicit discharge compliance statement" will be provided as part of the final "Storm water Management System Long-Term Operation & Maintenance Plan".**

A copy of the "MA-DEP Checklist for Stormwater Report" is included as **Appendix A**.

Table No. 1 provides a summary of off-site Pre- and Post-Development peak runoff flow rates and volumes**.**

Table No. 2 provides a summary of the subcatchment drainage area calculations.

Appendix D & E includes the complete Pre-Development and Post-Development *HydroCAD* drainage calculation reports and **Figures D-1 and D-2 "Pre- "and "Post-Development Drainage Areas" plans**.

Appendix F provides additional stormwater calculations.

Appendix G provides a Verification Statement associated with the performance of the Cultec Separator Row

Appendix H provides a "Long Term Stormwater Operation & Maintenance Plan"

The complete Site Plans for the **"Proposed Multifamily Residences - #778 Main Street, Leicester, MA" prepared by CMG Engineering, dated 10/24/2022** (or latest version) provide details of the complete storm water management system design**.** Please note these plans are subject to review and approval by two (2) separate Town Boards including: the Leicester Conservation Commission & Planning Board.

TABLE 1

PRE- VS. POST-DEVELOPMENT STORMWATER RUNOFF SUMMARY

TABLE NO. 1

12/7/2022

STORMWATER RUNOFF PEAK FLOW SUMMARY
PROPOSED MULTIFAMILY RESIDENCES
#778 MAIN ST
LEICESTER, MA

Pre-Existing Site Development (Fig D1) Conditions					
		2-Year	10-Year	25-Year	100-Year
1S - MAIN STREET	*Peak Flow (cfs)*	*0.32*	*1.08*	*1.56*	*2.34*
2S - WAITE POND	*Peak Flow (cfs)*	*0.36*	*2.31*	*3.75*	*6.20*

Proposed - Site Development (Fig D2) Conditions					
1S - MAIN STREET	*Peak Flow (cfs)*	*0.06*	*0.25*	*0.37*	*0.77*
2S - WAITE POND	*Peak Flow (cfs)*	*0.22*	*1.41*	*2.23*	*4.96*

TABLE 2

SUBCATCHMENT DRAINAGE AREA CALCULATIONS

TABLE NO. 2
DRAINAGE AREA CALCULATIONS
PROPOSED MULTIFAMILY RESIDENCES
#778 MAIN STREET
LEICESTER, MA

PRE-DEVELOPMENT DRAINAGE AREAS (s.f.)

On-Site	Soil Type B						Watershed
Area	Impervious	Perv. Pav.	Grass/Ldscp	Woods			Total
1	5,992		11,740	14,700			32,432
2	4,027		24,805	98,803			127,635
							Total
	10,019	0	36,545	113,503			**160,067 s.f.**
				Total Site Area=	160,067	s.f.	**3.67** Ac
Total Impervious=	**10,019 s.f.**				3.67	Ac	
Total Open Space =	**150,048 s.f.**						

POST-DEVELOPMENT DRAINAGE AREAS (s.f.)

On-Site	Soil Type B						Watershed
Area	Impervious	Perv. Pav.	Grass/Ldscp	Woods			Total
1a	473		8,117				8,590
2a	6,487						6,487
2b	10,436	11,277	991				22,704
2c	17,871		24,956				42,827
2d	3,349		23,294	38,669			65,312
BLD1	7,000						7,000
BLD2	7,147						7,147
							Total
	52,763	11,277	57,358	38,669			***160,067 s.f.***
				Total Site Area=	160,067	s.f.	**3.67** Ac
Total Impervious=	**52,763 s.f.**				3.67	Ac	
Total Open Space =	**96,027 s.f.**						

Note:

[1] All Drainage Areas are calculated using CAD Software based on Pre- & Post Development Drainage Plans prepared by CMG date 10/24/22

TABLE 3

WATER RESOURCES PROTECTION OVERLAY DISTRICT
COMPARISON TABLE

Pre-Development Conditions (Within WRPOD):

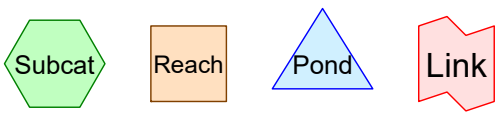
Storm Event	**2-Year** 3.00”	**10-Year** 4.50”	**25-Year** 5.30”	**100-Year** 6.50”
Rainfall Volume (Depth x Area) Area = 32,600 s.f.	8,150 c.f.	12,225 c.f.	14,398 c.f.	17,658 c.f.
Runoff Volume*	1,702 c.f.	4,163 c.f.	5,694 c.f.	8,178 c.f.
Recharge Volume (Rainfall Volume – Runoff Volume)	6,448 c.f.	8,062 c.f.	8,704 c.f.	9,480 c.f.

Post-Development Conditions (Within (WRPOD):

Storm Event	**2-Year** 3.00”	**10-Year** 4.50”	**25-Year** 5.30”	**100-Year** 6.50”
Rainfall Volume (Depth x Area) Area = 32,600 s.f.	8,150 c.f.	12,225 c.f.	14,398 c.f.	17,658 c.f.
Runoff Volume*	2,910 c.f.	6,006 c.f.	7,813 c.f.	10,647 c.f.
Recharge Volume (Surface) (Rainfall Volume – Runoff Volume)	5,240 c.f.	6,219 c.f.	6,585 c.f.	7,011 c.f.
Infiltration Chamber Recharge Volume (Pond 1P & Pond 5P)**	3,390 c.f.	5,747 c.f.	6,499 c.f.	7,275 c.f.
Recharge Volume (Recharge Volume (Surface) + Infil. Volume)	8,630 c.f.	11,966 c.f.	13,084 c.f.	14,286 c.f.

* Runoff volumes are based on HydroCAD modelling of Pre-Development & Post-Development Areas within the limits of the Water Resources Protection Overlay District. Please see attached HydroCAD reports detailing the modelling within the WRPOD.

** The total limits of Pond 5P are located within the WRPOD, therefore; 100% of the infiltration volume for Pond 5P was used for infiltration calculations. Approximately 63% of Pond 1P is located within the WRPOD, therefore; 63% of the infiltration volume was used to for the infiltration calculations.



Routing Diagram for TABLE 3-WRPOD MODEL
Prepared by CMG, Printed 12/8/2022

Summary for Subcatchment 1: Pre-Development

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,702 cf, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
5,927	98	Paved parking, HSG B
26,673	61	>75% Grass cover, Good, HSG B
32,600	68	Weighted Average
26,673		81.82% Pervious Area
5,927		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Post-Development

Runoff = 0.91 cfs @ 12.09 hrs, Volume= 2,910 cf, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
	9,713	98	Paved parking, HSG B
	11,610	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	32,600	77	Weighted Average
	22,887		70.21% Pervious Area
	9,713		29.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 1: Pre-Development

Runoff = 1.29 cfs @ 12.09 hrs, Volume= 4,163 cf, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,927	98	Paved parking, HSG B
26,673	61	>75% Grass cover, Good, HSG B
32,600	68	Weighted Average
26,673		81.82% Pervious Area
5,927		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Post-Development

Runoff = 1.94 cfs @ 12.09 hrs, Volume= 6,006 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	9,713	98	Paved parking, HSG B
	11,610	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	32,600	77	Weighted Average
	22,887		70.21% Pervious Area
	9,713		29.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 1: Pre-Development

Runoff = 1.80 cfs @ 12.09 hrs, Volume= 5,694 cf, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
5,927	98	Paved parking, HSG B
26,673	61	>75% Grass cover, Good, HSG B
32,600	68	Weighted Average
26,673		81.82% Pervious Area
5,927		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Post-Development

Runoff = 2.52 cfs @ 12.09 hrs, Volume= 7,813 cf, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
	9,713	98	Paved parking, HSG B
	11,610	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	32,600	77	Weighted Average
	22,887		70.21% Pervious Area
	9,713		29.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 1: Pre-Development

Runoff = 2.63 cfs @ 12.09 hrs, Volume= 8,178 cf, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
5,927	98	Paved parking, HSG B
26,673	61	>75% Grass cover, Good, HSG B
32,600	68	Weighted Average
26,673		81.82% Pervious Area
5,927		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Post-Development

Runoff = 3.43 cfs @ 12.09 hrs, Volume= 10,647 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	9,713	98	Paved parking, HSG B
	11,610	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	32,600	77	Weighted Average
	22,887		70.21% Pervious Area
	9,713		29.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Appendix A

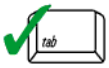
MA-DEP Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

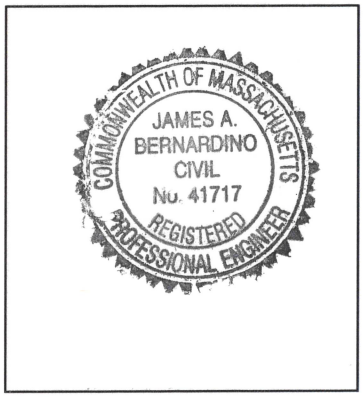
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



12/8/22
Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Porous Pavement

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix B

USGS FIGURE
FEMA Flood Plain Mapping

TOWN LOCATION - LEICESTER, MA

FIGURE 1: SITE LOCATION

778 MAIN STREET
LEICESTER, MA 01524
CMG ID 2021-226

SCALE 1" = 1,000'

1000 FT 0 1000 FT

ENVIRONMENTAL SERVICES
CMG EST. 2002
ENGINEERING SERVICES
67 HALL ROAD. STURBRIDGE MA 01566

National Flood Hazard Layer FIRMette

FEMA

71°54'W 42°14'58"N

71°53'23"W 42°14'31"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

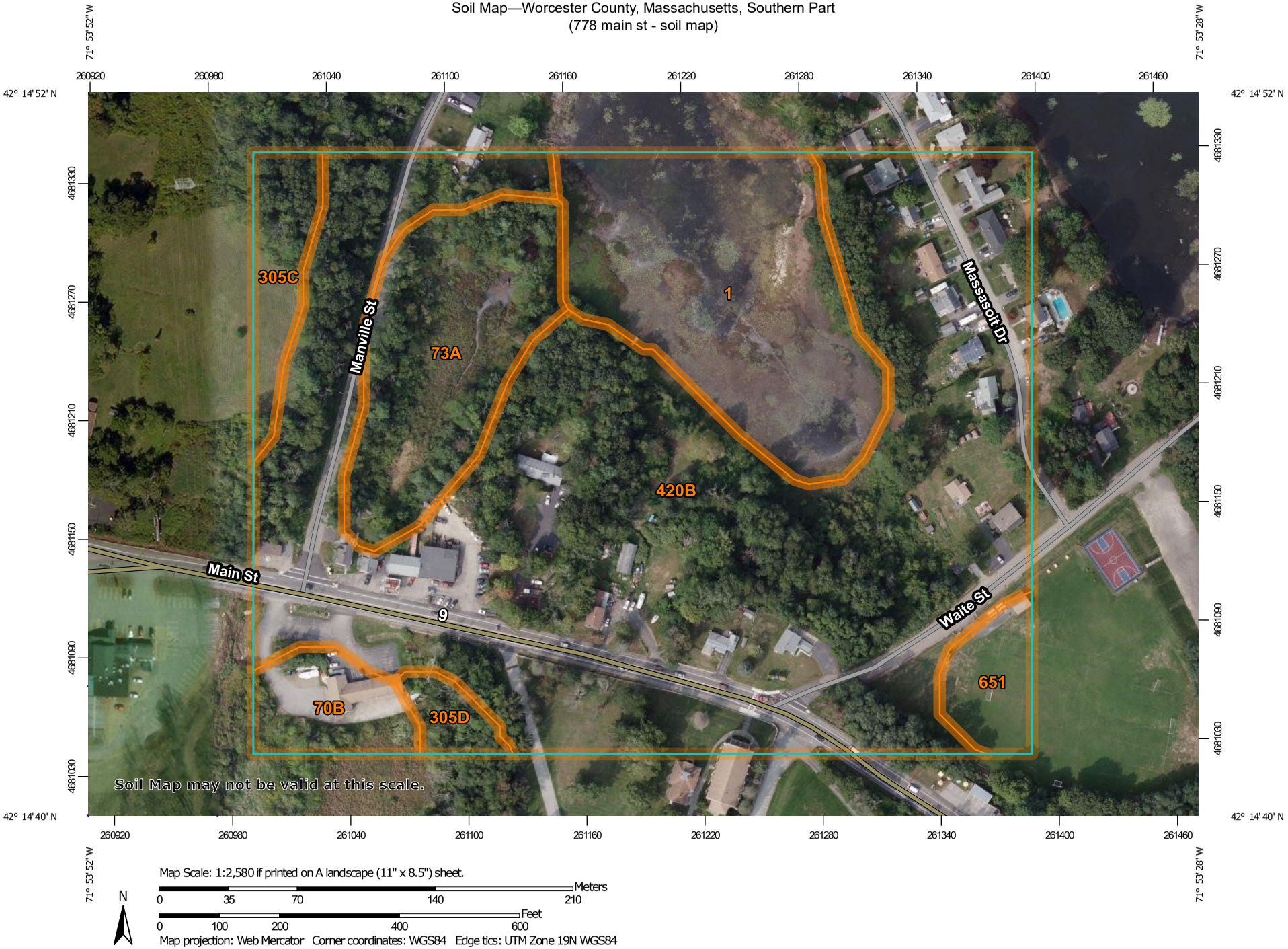
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/3/2021 at 11:48 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix C

NCRS Soil Mapping
&
On-Site Soil Testing Logs

Soil Map—Worcester County, Massachusetts, Southern Part
(778 main st - soil map)



Map Scale: 1:2,580 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 14, Sep 3, 2021

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

Date(s) aerial images were photographed: Apr 8, 2011—Oct 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	4.6	15.5%
70B	Ridgebury fine sandy loam, 3 to 8 percent slopes	0.9	3.1%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	3.1	10.4%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	0.9	2.9%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	0.4	1.3%
420B	Canton fine sandy loam, 3 to 8 percent slopes	19.2	64.2%
651	Udorthents, smoothed	0.7	2.4%
Totals for Area of Interest		**29.9**	**100.0%**

Worcester County, Massachusetts, Southern Part

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate
Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk
Percent of map unit: 5 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton
Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea
Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 14, Sep 3, 2021

AVIZINIS
ENVIRONMENTAL
SERVICES INC

SOIL EVALUATION REPORT

SITE LOCATION:

A.P. 21A, Lot A11

778 Main Street

Leicester, Massachusetts

PREPARED FOR:

James Bernardino, PE

CMG

jbernardino@cmgenv.com

PREPARED (May 24, 2022) BY:

Edward J. Avizinis, CPSS, PWS | President

INTRODUCTION

Avizinis Environmental Services, Inc., (AES), has completed the requested soil evaluations for stormwater mitigation system design purposes at the above referenced address, 778 Main Street in Leicester, Massachusetts. These evaluations were performed in accordance with the Massachusetts Stormwater Handbook, Volume 3, Chapter 1 by a Title 5 certified soil evaluator, Edward J. Avizinis (SE#14250). Eight soil evaluations were performed on this property. Site work was performed and completed on May 12, 2022.

SOIL DATA

The following table outlines the soil data collected onsite. Test hole numbers correspond to the numbering sequence as depicted on the accompanying map. Test holes have been GPS located with a Spectra SP20 submetric GPS/GNSS. This data is not survey quality but generally sufficient for use in showing test hole locations. A copy of this data shall also be forwarded to your office in conjunction with this report.

TH1

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 7	Ap	10YR 3/2	-	FSL	1 M GR	ablation
7 – 15	Bw1	10YR 5/6	-	SL	1 M SBK	ablation
15 - 28	Bw2	10YR 6/4	-	GR SL	1 M SBK	ablation
28 – 96	C	2.5Y 5/3	@50 F, 4, D	ST LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH1	96	-	80	50

TH2

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-13 – 0	^A/^C	-	-	-	-	HTM
0 – 5	Apb	10YR 3/2	-	FSL	1 M GR	ablation
5 – 14	Bwb	10YR 5/4	-	GR FSL	1 M SBK	ablation
14 - 96	C	2.5Y 5/3	@60 F, 4, D	COB LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH2	96	-	dry	60

TH3

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-12 – 0	^A	-	-	-	-	HTM
0 – 4	Ab	10YR 3/2	-	SL	1 M GR	ablation
4 – 27	Bw1	7.5YR 5/6	-	BO SL	1 M SBK	ablation
27 - 49	Bw2	10YR 6/4	-	BO SL	1 M SBK	ablation
49 - 96	C	2.5Y 5/3	@67 F, 3, D	BO SL	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH3	96	-	dry	67

TH4

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-25 – -7	^C	-	-	-	-	HTM/turf
-7 – -3	^Ab	10YR 3/2	-	SL	1 M GR	HTM
-3 – 0	^Bwb	7.5YR 4/6	-	GR SL	1 M SBK	HTM
0 - 11	Apb	10YR 3/2	-	FSL	1 M GR	ablation
11 - 19	Bwb	10YR 4/4	-	ST SL	1 M SBK	ablation
19 - 72	C	2.5Y 5/3	@54 F, 3, D	BO LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH4	72	-	dry	54

TH5

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-18 – 0	^C	-	-	-	-	HTM/turf
0 – 12	Apb	10YR 3/2	-	FSL	1 M GR	ablation
12 – 26	Bwb	10YR 5/6	-	BO SL	1 M SBK	ablation
26 - 96	C	2.5Y 5/3	@72 F, 3, D	ST LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH5	96	-	dry	72

TH6

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-18 – 0	^C	-	-	-	-	HTM/turf
0 – 11	Apb	10YR 3/2	-	FSL	1 M GR	ablation
11 – 21	Bwb	7.5YR 4/6	-	ST SL	1 M SBK	ablation
21 - 96	C	2.5Y 5/3	-	ST LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH6	96	-	dry	Inconclusive; likely around 72

TH7

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-24 – 0	^C	-	-	-	-	HTM
0 – 20	Bwb	10YR 4/4	-	COB SL	1 M SBK	ablation
20 – 96	C	2.5Y 5/3	@52 F, 3, D	BO LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH7	96	-	dry	52

TH8

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
-28 – -18	^A	-	-	-	-	HTM
-18 – 0	^C	-	-	-	-	HTM
0 – 44	C1	10YR 4/3	-	COB LS	0 SG	ablation
44 - 96	C2	2.5Y 5/3	@72	COB LS	0 SG	ablation

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH8	96	-	dry	Inconclusive; likely approx. 52

Notes: CMG NOTE:
Estimated Seasonal High Groundwater Table (SHWT) noted below are taken from depth below natural grade. To achieve a depth coorelated to existing grade, one must add (HTM) depth to SHWT noted below.

SUMMARY TABLE

Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT
TH1	96	-	80	50
TH2	96	-	dry	60
TH3	96	-	dry	67
TH4	72	-	dry	54
TH5	96	-	dry	72
TH6	96	-	dry	Inconclusive; likely around 72
TH7	96	-	dry	52
TH8	96	-	dry	Inconclusive; likely approx. 52

CLOSING

Thank you for giving AES the opportunity to assist you with preliminary planning of this project. AES has completed the onsite soil evaluations for this property. Please review the preceding data tables that describe the explored soils. In addition, the attached map depicts the test hole locations. AES staff has used a Spectra SP20 submetric GPS unit to locate the soil evaluations which are numbered consistent with the numbering of the data tables. This does not constitute a survey but is useful in preliminary planning and is generally sufficient for soil evaluation purposes. Please do not hesitate to let me know if you have any questions and best of luck moving forward.

SITE MAPS

1. 2021 AERIAL PHOTOGRAPH
2. USDA – NRCS SOIL SURVEY MAP
3. USGS TOPOGRAPHIC MAP
4. SOIL EVALUATION LOCATION MAP

AVIZINIS
ENVIRONMENTAL
SERVICES INC

2021 AERIAL MAP
A.P. 21A, Lot A11 | 778 Main Street
Leicester, Massachusetts

LEGEND

Property Line

70 35 0 70 140 210
Feet

General Notes:
1. This map should not be interpreted as a survey quality graphic. It is designed for preliminary planning purposes only. AES recommends consultation with a Professional Land Surveyor for accurate site feature locations.
2. Property lines as depicted on this map have been approximated from plat maps available from the town assessor's online database.
3. 2021 Aerial photograph base map acquired from the Massachusetts OLIVER database.

Map created by: Patrick J. Loveland, GIS Specialist 04/29/2022

AVIZINIS
ENVIRONMENTAL
SERVICES INC

USDA - NRCS SOIL SURVEY MAP
MASSACHUSETTS STATE SOIL SURVEY
A.P. 21A, Lot A11 | 778 Main Street
Leicester, Massachusetts

LEGEND

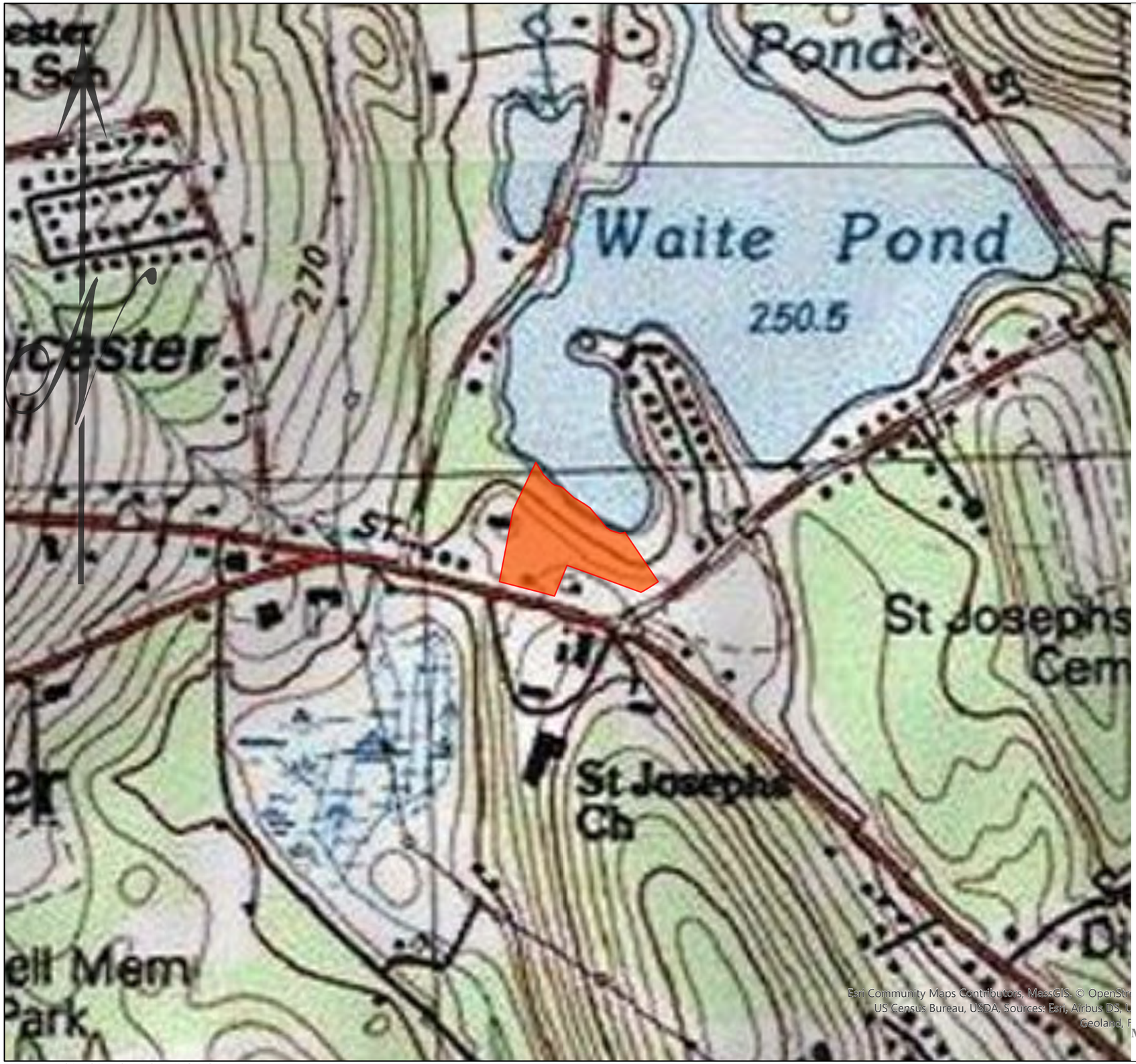
1- Water
70B - Ridgebury fine sandy loam, 0 to 6 percent slopes; Ridgebury fine sandy loam, 3 to 8 percent slopes; Ridgebury gravelly fine sandy loam, 0 to 5 percent slopes
73A - Whitman fine sandy loam, 0 to 5 percent slopes, extremely stony; Whitman sandy loam, 0 to 3 percent slopes, extremely stony; Whitman very stony mucky fine sandy loam, 0 to 3 percent slopes, extremely stony
305D - Paxton fine sandy loam, 15 to 35 percent slopes
420B - Canton very fine sandy loam, 3 to 8 percent slopes

100 50 0 100 200 300
Feet

General Notes:
1. This map should not be interpreted as a survey quality graphic. It is designed for preliminary planning purposes only. AES recommends consultation with a Professional Land Surveyor for accurate site feature locations.
2. Property lines as depicted on this map have been approximated from plat maps available from the town assessor's online database.
3. 2021 Aerial photograph base map acquired from the Massachusetts OLIVER database.

Map created by: Patrick J. Loveland, GIS Specialist 04/29/2022

OneDrive/Desktop/AES/JOBS/22/22-109



AVIZINIS
ENVIRONMENTAL
SERVICES INC

USGS TOPOGRAPHIC MAP
A.P. 21A, Lot A11 | 778 Main Street
Leicester, Massachusetts

LEGEND

Property Line

400 200 0 400 800 1,200
Feet

General Notes:
1. This map should not be interpreted as a survey quality graphic. It is designed for preliminary planning purposes only. AES recommends consultation with a Professional Land Surveyor for accurate site feature locations.
2. Property lines as depicted on this map have been approximated from plat maps available from the town assessor's online database.
3. 2021 Aerial photograph base map acquired from the Massachusetts OLIVER database.

Map created by:
Patrick J. Loveland, GIS Specialist 04/29/2022

OneDrive/Desktop/AES/JOBS/22/22-109

AVIZINIS
ENVIRONMENTAL
SERVICES INC

2022 SOIL EVALUATION MAP
A.P. 21A, Lot A11 | 778 Main Street
Leicester, Massachusetts

LEGEND

Property Line

Soil Evaluation Location

70 35 0 70 140
Feet

General Notes:
1. This map should not be interpreted as a survey quality graphic. It is designed for preliminary planning purposes only. AES recommends consultation with a Professional Land Surveyor for an accurate site plan.
2. Property lines as depicted on this map have been approximated from plat maps available from the town assessor's online database.
3. 2021 Aerial photograph base map acquired from the Massachusetts OLIVER database.
4. Site features located with a Juniper Geode Submetric GNSS receiver with SWmaps data collection software. Non-delineated wetland edges have not been field verified and are depicted for graphic purposes only.

Delineation performed by:
Edward J. Avizinis, CPSS, PWS 05/12/2022

Map created by:
Patrick J. Loveland, GIS Specialist 05/24/2022

OneDrive/Desktop/AES/JOBS/22/22-109

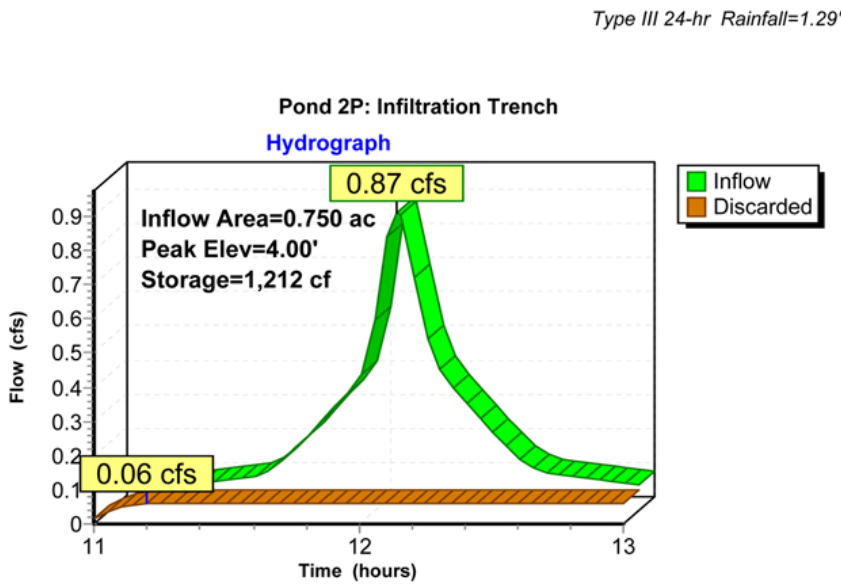


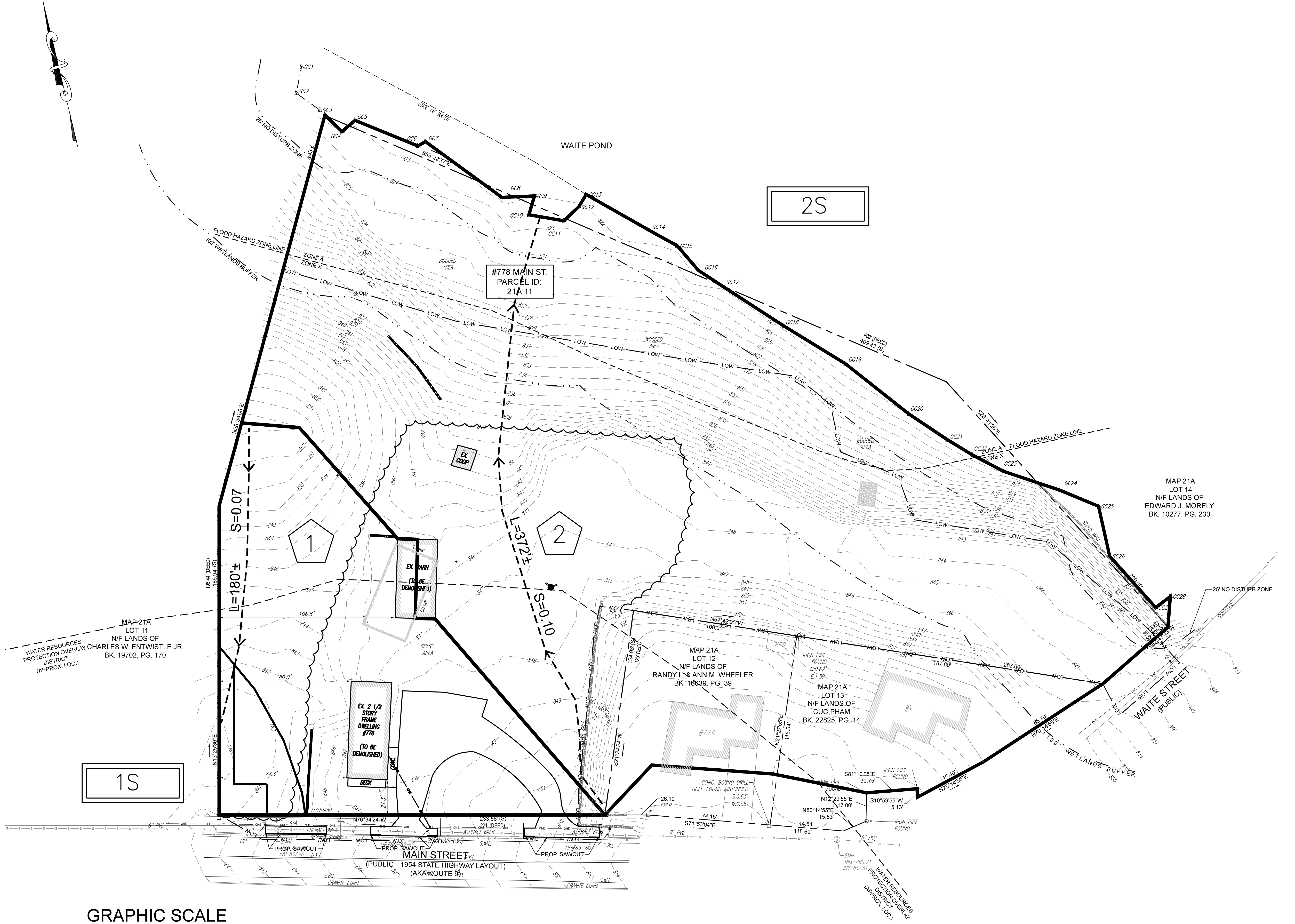
Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

[18] Rawls, Brakensiek and Saxton, 1982

Appendix D

Pre-Development Drainage Calculations


WAITE POND
2S
1S
1
2
#778 MAIN ST.
PARCEL ID:
21A 11
L=372±
S=0.10
L=180±
S=0.07
EX. COOP
EX. BARN
(TO BE DEMOLISHED)
EX. 2 1/2 STORY FRAME DWELLING #778
(TO BE DEMOLISHED)
DECK
GRASS AREA
WOODED AREA
FLOOD HAZARD ZONE LINE
100' WETLANDS BUFFER
25' NO DISTURB ZONE
ZONE A
ZONE X
EDGE OF WATER
MAP 21A
LOT 11
N/F LANDS OF
CHARLES W. ENTWISTLE JR.
BK. 19702, PG. 170
WATER RESOURCES PROTECTION OVERLAY DISTRICT (APPROX. LOC.)
MAP 21A
LOT 12
N/F LANDS OF
RANDY L. & ANN M. WHEELER
BK. 16839, PG. 39
MAP 21A
LOT 13
N/F LANDS OF
CUC PHAM
BK. 22825, PG. 14
MAP 21A
LOT 14
N/F LANDS OF
EDWARD J. MORELY
BK. 10277, PG. 230
#774
#1
WAITE STREET
(PUBLIC)
MAIN STREET
(PUBLIC - 1954 STATE HIGHWAY LAYOUT)
(AKA ROUTE 9)
PROP. SAWCUT
GRANITE CURB
IRON PIPE FOUND
N76°34'24"W
233.56' (S)
221' (DEED)
N67°42'05"W
100.00'
187.60'
287.60'
S71°53'04"E
74.15'
44.54'
118.69'
S81°10'05"E
30.75'
N12°29'55"E
17.00'
N80°14'55"E
15.53'
S10°59'55"W
5.13'
N75°14'55"E
45.40'
N70°14'55"E
85.36'
S53°22'37"E
400' (DEED)
409.43' (S)
S26°41'26"E

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 ft.

NO.	DATE	DESCRIPTION	BY	CK'D
1.	12/6/2022	ZONING BOARD OF APPEALS SUBMISSION	RL	JAB

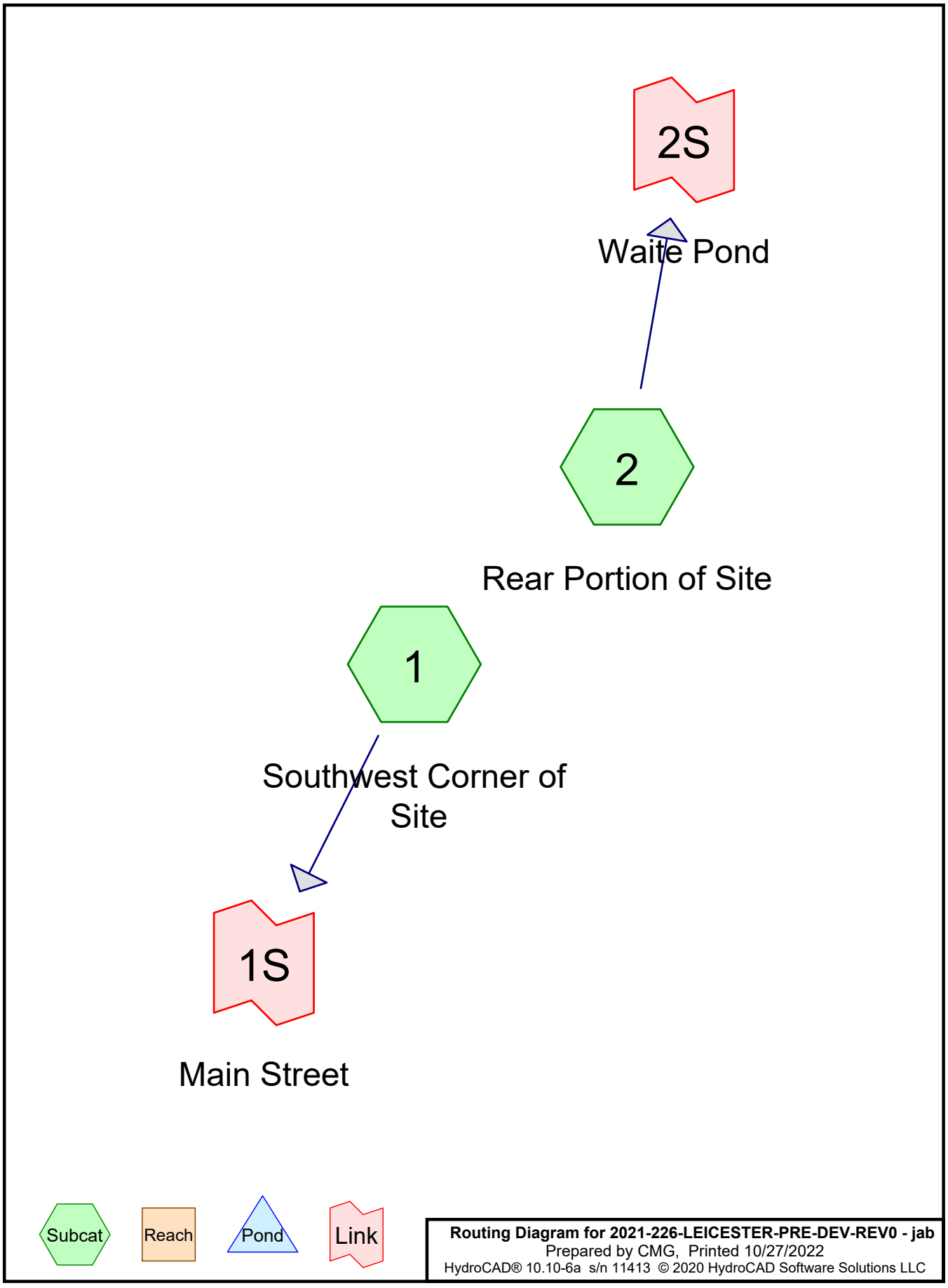
PROFESSIONAL SEAL

PROJECT:
PROPOSED MULTIFAMILY RESIDENCE
#778 MAIN STREET
LEICESTER, MA 01524

PREPARED FOR:
CHARLTON ROAD REALTY, LLC.
25 WATERVILLE LANE
SHREWSBURY, MA 01545

ENGINEERING SERVICES
ENVIRONMENTAL SERVICES
67 Hall Road
Sturbridge, MA 01566
Phone: 774-241-0901
fax: 774-241-0906
CMG EST. 2002

ISSUE DATE: 10/24/2022
DRAWN BY: RL CHECKED BY: JAB
SCALE: 1" = 40'
PROJECT NO.: 2021-225
SHEET NAME:
PRE-DEVELOPMENT DRAINAGE MAP
SHEET NO.:
D - 1.0



Routing Diagram for 2021-226-LEICESTER-PRE-DEV-REV0 - jab
Prepared by CMG, Printed 10/27/2022
HydroCAD® 10.10-6a s/n 11413 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment 1: Southwest Corner of Site

Runoff = 0.32 cfs @ 12.11 hrs, Volume= 1,368 cf, Depth= 0.51"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
5,992	98	Paved parking, HSG B
11,740	61	>75% Grass cover, Good, HSG B
14,700	55	Woods, Good, HSG B
32,432	65	Weighted Average
26,440		81.52% Pervious Area
5,992		18.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	180	0.0700	0.65		**Lag/CN Method,**
4.6	180	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Rear Portion of Site

Runoff = 0.36 cfs @ 12.33 hrs, Volume= 2,913 cf, Depth= 0.27"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
4,027	98	Paved parking, HSG B
24,805	61	>75% Grass cover, Good, HSG B
98,803	55	Woods, Good, HSG B
127,635	58	Weighted Average
123,608		96.84% Pervious Area
4,027		3.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	372	0.1000	0.75		**Lag/CN Method,**

Summary for Link 1S: Main Street

Inflow Area = 32,432 sf, 18.48% Impervious, Inflow Depth = 0.51" for 2-Year event
Inflow = 0.32 cfs @ 12.11 hrs, Volume= 1,368 cf
Primary = 0.32 cfs @ 12.11 hrs, Volume= 1,368 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 127,635 sf, 3.16% Impervious, Inflow Depth = 0.27" for 2-Year event
Inflow = 0.36 cfs @ 12.33 hrs, Volume= 2,913 cf
Primary = 0.36 cfs @ 12.33 hrs, Volume= 2,913 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1: Southwest Corner of Site

Runoff = 1.08 cfs @ 12.10 hrs, Volume= 3,596 cf, Depth= 1.33"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,992	98	Paved parking, HSG B
11,740	61	>75% Grass cover, Good, HSG B
14,700	55	Woods, Good, HSG B
32,432	65	Weighted Average
26,440		81.52% Pervious Area
5,992		18.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	180	0.0700	0.65		**Lag/CN Method,**
4.6	180	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Rear Portion of Site

Runoff = 2.31 cfs @ 12.14 hrs, Volume= 9,623 cf, Depth= 0.90"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,027	98	Paved parking, HSG B
24,805	61	>75% Grass cover, Good, HSG B
98,803	55	Woods, Good, HSG B
127,635	58	Weighted Average
123,608		96.84% Pervious Area
4,027		3.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	372	0.1000	0.75		**Lag/CN Method,**

Summary for Link 1S: Main Street

Inflow Area = 32,432 sf, 18.48% Impervious, Inflow Depth = 1.33" for 10-Year event
Inflow = 1.08 cfs @ 12.10 hrs, Volume= 3,596 cf
Primary = 1.08 cfs @ 12.10 hrs, Volume= 3,596 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 127,635 sf, 3.16% Impervious, Inflow Depth = 0.90" for 10-Year event
Inflow = 2.31 cfs @ 12.14 hrs, Volume= 9,623 cf
Primary = 2.31 cfs @ 12.14 hrs, Volume= 9,623 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1: Southwest Corner of Site

Runoff = 1.56 cfs @ 12.09 hrs, Volume= 5,017 cf, Depth= 1.86"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
5,992	98	Paved parking, HSG B
11,740	61	>75% Grass cover, Good, HSG B
14,700	55	Woods, Good, HSG B
32,432	65	Weighted Average
26,440		81.52% Pervious Area
5,992		18.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	180	0.0700	0.65		**Lag/CN Method,**
4.6	180	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Rear Portion of Site

Runoff = 3.75 cfs @ 12.13 hrs, Volume= 14,225 cf, Depth= 1.34"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
4,027	98	Paved parking, HSG B
24,805	61	>75% Grass cover, Good, HSG B
98,803	55	Woods, Good, HSG B
127,635	58	Weighted Average
123,608		96.84% Pervious Area
4,027		3.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	372	0.1000	0.75		**Lag/CN Method,**

Summary for Link 1S: Main Street

Inflow Area = 32,432 sf, 18.48% Impervious, Inflow Depth = 1.86" for 25-Year event
Inflow = 1.56 cfs @ 12.09 hrs, Volume= 5,017 cf
Primary = 1.56 cfs @ 12.09 hrs, Volume= 5,017 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 127,635 sf, 3.16% Impervious, Inflow Depth = 1.34" for 25-Year event
Inflow = 3.75 cfs @ 12.13 hrs, Volume= 14,225 cf
Primary = 3.75 cfs @ 12.13 hrs, Volume= 14,225 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1: Southwest Corner of Site

Runoff = 2.34 cfs @ 12.09 hrs, Volume= 7,354 cf, Depth= 2.72"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
5,992	98	Paved parking, HSG B
11,740	61	>75% Grass cover, Good, HSG B
14,700	55	Woods, Good, HSG B
32,432	65	Weighted Average
26,440		81.52% Pervious Area
5,992		18.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	180	0.0700	0.65		**Lag/CN Method,**
4.6	180	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2: Rear Portion of Site

Runoff = 6.20 cfs @ 12.13 hrs, Volume= 22,080 cf, Depth= 2.08"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
4,027	98	Paved parking, HSG B
24,805	61	>75% Grass cover, Good, HSG B
98,803	55	Woods, Good, HSG B
127,635	58	Weighted Average
123,608		96.84% Pervious Area
4,027		3.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	372	0.1000	0.75		**Lag/CN Method,**

Summary for Link 1S: Main Street

Inflow Area = 32,432 sf, 18.48% Impervious, Inflow Depth = 2.72" for 100-Year event
Inflow = 2.34 cfs @ 12.09 hrs, Volume= 7,354 cf
Primary = 2.34 cfs @ 12.09 hrs, Volume= 7,354 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

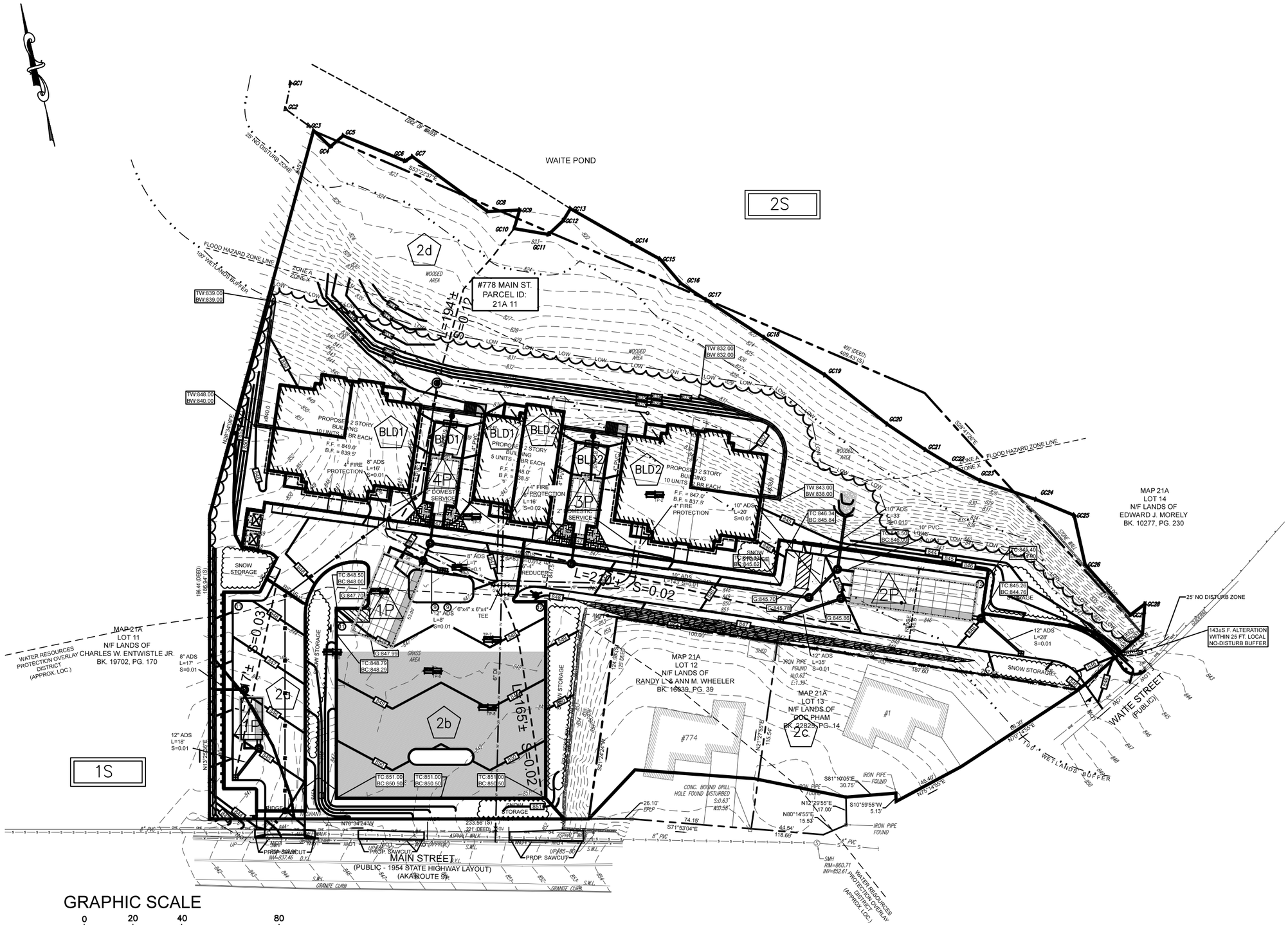
Summary for Link 2S: Waite Pond

Inflow Area = 127,635 sf, 3.16% Impervious, Inflow Depth = 2.08" for 100-Year event
Inflow = 6.20 cfs @ 12.13 hrs, Volume= 22,080 cf
Primary = 6.20 cfs @ 12.13 hrs, Volume= 22,080 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Appendix E

Post-Development Drainage Calculations



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 ft.

REVISIONS

NO.	DATE	DESCRIPTION	BY	CKD
1.	12/6/2022	ZONING BOARD OF APPEALS SUBMISSION	RL	JAB

PROFESSIONAL SEAL

PROJECT:

PROPOSED MULTIFAMILY RESIDENCE
#778 MAIN STREET
LEICESTER, MA 01524

PREPARED FOR:

CHARLTON ROAD REALTY, LLC.
25 WATERVILLE LANE
SHREWSBURY, MA 01545

ENGINEERING SERVICES
ENVIRONMENTAL SERVICES
67 Hall Road
Sturbridge, MA 01566
Phone: 774-241-0901
fax: 774-241-0906

CMG EST. 2002

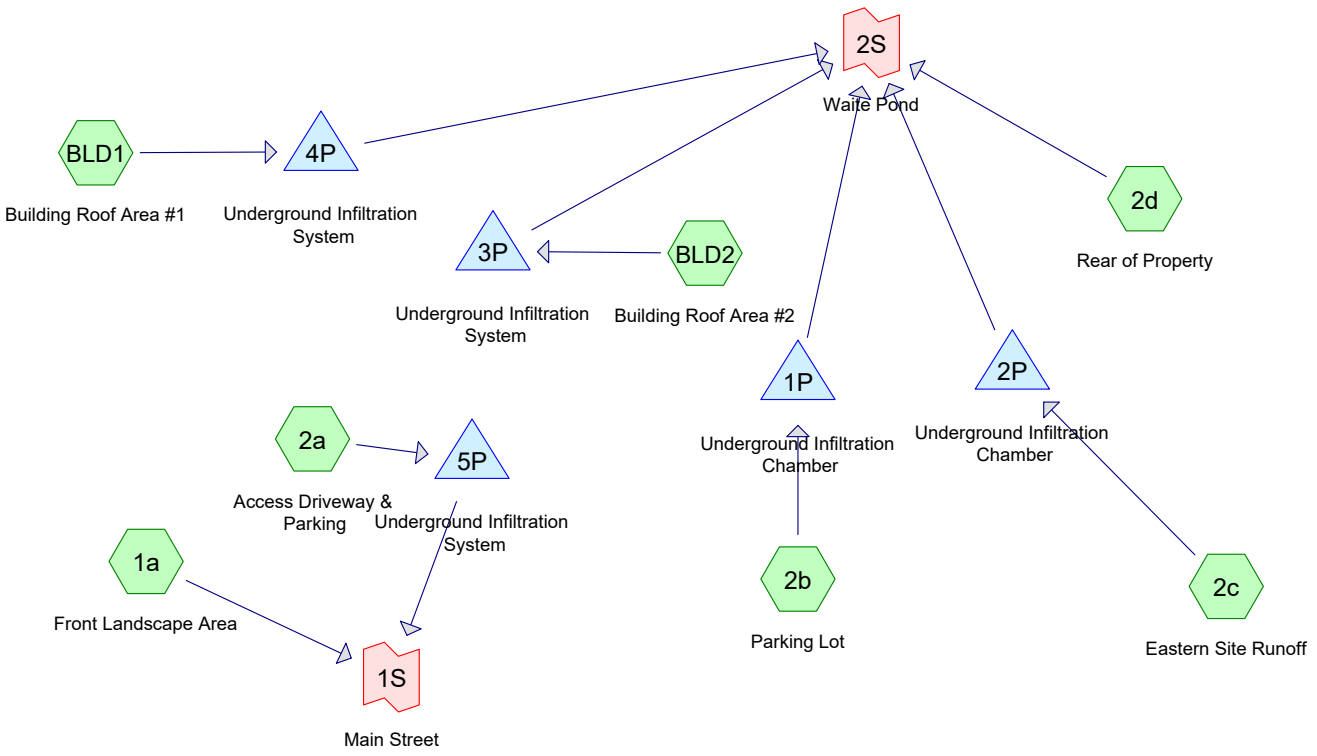
ISSUE DATE:	10/24/2022
DRAWN BY:	RL
CHECKED BY:	JAB
SCALE:	1" = 40'
PROJECT NO.:	2021-225

SHEET NAME:

POST-DEVELOPMENT DRAINAGE MAP

SHEET NO.:

D - 2.0



Subcat Reach Pond Link

Routing Diagram for 2021-226-LEICESTER-POST-DEV-REV1
Prepared by CMG, Printed 12/7/2022

Summary for Subcatchment 1a: Front Landscape Area

Runoff = 0.06 cfs @ 12.12 hrs, Volume= 310 cf, Depth= 0.43"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
473	98	Paved parking, HSG B
8,117	61	>75% Grass cover, Good, HSG B
8,590	63	Weighted Average
8,117		94.49% Pervious Area
473		5.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2a: Access Driveway & Parking

Runoff = 0.43 cfs @ 12.08 hrs, Volume= 1,496 cf, Depth= 2.77"
Routed to Pond 5P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
6,487	98	Paved parking, HSG B
6,487		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2b: Parking Lot

Runoff = 0.97 cfs @ 12.09 hrs, Volume= 3,005 cf, Depth= 1.59"
Routed to Pond 1P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
	10,436	98	Paved parking, HSG B
	991	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	22,704	85	Weighted Average
	12,268		54.03% Pervious Area
	10,436		45.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2c: Eastern Site Runoff

Runoff = 1.07 cfs @ 12.11 hrs, Volume= 3,623 cf, Depth= 1.02"
Routed to Pond 2P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
17,871	98	Paved parking, HSG B
24,956	61	>75% Grass cover, Good, HSG B
42,827	76	Weighted Average
24,956		58.27% Pervious Area
17,871		41.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	210	0.0200	0.48		**Lag/CN Method, Eastern Parking Lot**

Summary for Subcatchment 2d: Rear of Property

Runoff = 0.22 cfs @ 12.15 hrs, Volume= 1,649 cf, Depth= 0.30"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
23,294	61	>75% Grass cover, Good, HSG B
38,669	55	Woods, Good, HSG B
3,349	98	Paved parking, HSG B
65,312	59	Weighted Average
61,963		94.87% Pervious Area
3,349		5.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	194	0.1200	0.74		**Lag/CN Method,**
4.4	194	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD1: Building Roof Area #1

Runoff = 0.47 cfs @ 12.08 hrs, Volume= 1,615 cf, Depth= 2.77"
Routed to Pond 4P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
7,000	98	Roofs, HSG B
7,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD2: Building Roof Area #2

Runoff = 0.48 cfs @ 12.08 hrs, Volume= 1,649 cf, Depth= 2.77"
Routed to Pond 3P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
7,147	98	Roofs, HSG B
7,147		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 1P: Underground Infiltration Chamber

Inflow Area = 22,704 sf, 45.97% Impervious, Inflow Depth = 1.59" for 2-Year event
Inflow = 0.97 cfs @ 12.09 hrs, Volume= 3,005 cf
Outflow = 0.13 cfs @ 12.71 hrs, Volume= 3,006 cf, Atten= 87%, Lag= 37.5 min
Discarded = 0.13 cfs @ 12.71 hrs, Volume= 3,006 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 843.11' @ 12.71 hrs Surf.Area= 1,484 sf Storage= 1,030 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 66.9 min (895.9 - 829.0)

Volume	Invert	Avail.Storage	Storage Description
#1	842.00'	1,323 cf	**28.00'W x 53.00'L x 3.54'H Stone Surround** 5,253 cf Overall - 1,945 cf Embedded = 3,309 cf x 40.0% Voids
#2	842.50'	1,945 cf	**Cultec R-330XLHD** x 36 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 6 rows
		3,268 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	842.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 840.00'
#2	Primary	844.33'	**8.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 844.33' / 834.00' S= 0.1033 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.13 cfs @ 12.71 hrs HW=843.11' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=842.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Underground Infiltration Chamber

Inflow Area = 42,827 sf, 41.73% Impervious, Inflow Depth = 1.02" for 2-Year event
Inflow = 1.07 cfs @ 12.11 hrs, Volume= 3,623 cf
Outflow = 0.16 cfs @ 12.87 hrs, Volume= 3,623 cf, Atten= 85%, Lag= 45.3 min
Discarded = 0.16 cfs @ 12.87 hrs, Volume= 3,623 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 842.53' @ 12.87 hrs Surf.Area= 1,857 sf Storage= 1,161 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 65.1 min (925.8 - 860.7)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	1,668 cf	**23.65'W x 78.50'L x 3.54'H Stone Surround** 6,572 cf Overall - 2,403 cf Embedded = 4,169 cf x 40.0% Voids
#2	842.00'	2,403 cf	**Cultec R-330XLHD** x 45 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 5 rows
		4,071 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.67'	**10.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.67' / 833.00' S= 0.1067 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.16 cfs @ 12.87 hrs HW=842.53' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=841.50' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 3P: Underground Infiltration System

Inflow Area = 7,147 sf,100.00% Impervious, Inflow Depth = 2.77" for 2-Year event
Inflow = 0.48 cfs @ 12.08 hrs, Volume= 1,649 cf
Outflow = 0.06 cfs @ 12.61 hrs, Volume= 1,649 cf, Atten= 87%, Lag= 31.5 min
Discarded = 0.06 cfs @ 12.61 hrs, Volume= 1,649 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 842.71' @ 12.61 hrs Surf.Area= 696 sf Storage= 532 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 59.9 min (817.7 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.06 cfs @ 12.61 hrs HW=842.71' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=841.50' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 4P: Underground Infiltration System

Inflow Area = 7,000 sf,100.00% Impervious, Inflow Depth = 2.77" for 2-Year event
Inflow = 0.47 cfs @ 12.08 hrs, Volume= 1,615 cf
Outflow = 0.06 cfs @ 12.60 hrs, Volume= 1,615 cf, Atten= 87%, Lag= 31.2 min
Discarded = 0.06 cfs @ 12.60 hrs, Volume= 1,615 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 842.68' @ 12.60 hrs Surf.Area= 696 sf Storage= 517 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 58.3 min (816.1 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.06 cfs @ 12.60 hrs HW=842.68' (Free Discharge)
↑**1=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=841.50' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 5P: Underground Infiltration System

Inflow Area = 6,487 sf,100.00% Impervious, Inflow Depth = 2.77" for 2-Year event
Inflow = 0.43 cfs @ 12.08 hrs, Volume= 1,496 cf
Outflow = 0.04 cfs @ 12.93 hrs, Volume= 1,497 cf, Atten= 91%, Lag= 51.0 min
Discarded = 0.04 cfs @ 12.93 hrs, Volume= 1,497 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 1S : Main Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 840.91' @ 12.93 hrs Surf.Area= 413 sf Storage= 581 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 125.6 min (883.4 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	839.50'	941 cf	**15.00'W x 27.50'L x 3.50'H Stone Surround** 1,444 cf Overall - 503 cf Embedded = 941 cf
#2	840.00'	503 cf	**Cultec R-330XLHD** x 9 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
		1,444 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	839.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 837.50'
#2	Primary	841.83'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 841.83' / 839.00' S= 0.1415 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.04 cfs @ 12.93 hrs HW=840.91' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=839.50' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Link 1S: Main Street

Inflow Area = 15,077 sf, 46.16% Impervious, Inflow Depth = 0.25" for 2-Year event
Inflow = 0.06 cfs @ 12.12 hrs, Volume= 310 cf
Primary = 0.06 cfs @ 12.12 hrs, Volume= 310 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 144,990 sf, 31.59% Impervious, Inflow Depth = 0.14" for 2-Year event
Inflow = 0.22 cfs @ 12.15 hrs, Volume= 1,649 cf
Primary = 0.22 cfs @ 12.15 hrs, Volume= 1,649 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1a: Front Landscape Area

Runoff = 0.25 cfs @ 12.10 hrs, Volume= 861 cf, Depth= 1.20"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
473	98	Paved parking, HSG B
8,117	61	>75% Grass cover, Good, HSG B
8,590	63	Weighted Average
8,117		94.49% Pervious Area
473		5.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2a: Access Driveway & Parking

Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,305 cf, Depth= 4.26"
Routed to Pond 5P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
6,487	98	Paved parking, HSG B
6,487		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2b: Parking Lot

Runoff = 1.77 cfs @ 12.09 hrs, Volume= 5,504 cf, Depth= 2.91"
Routed to Pond 1P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	10,436	98	Paved parking, HSG B
	991	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	22,704	85	Weighted Average
	12,268		54.03% Pervious Area
	10,436		45.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2c: Eastern Site Runoff

Runoff = 2.34 cfs @ 12.11 hrs, Volume= 7,601 cf, Depth= 2.13"
Routed to Pond 2P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
17,871	98	Paved parking, HSG B
24,956	61	>75% Grass cover, Good, HSG B
42,827	76	Weighted Average
24,956		58.27% Pervious Area
17,871		41.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	210	0.0200	0.48		**Lag/CN Method, Eastern Parking Lot**

Summary for Subcatchment 2d: Rear of Property

Runoff = 1.41 cfs @ 12.10 hrs, Volume= 5,234 cf, Depth= 0.96"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
23,294	61	>75% Grass cover, Good, HSG B
38,669	55	Woods, Good, HSG B
3,349	98	Paved parking, HSG B
65,312	59	Weighted Average
61,963		94.87% Pervious Area
3,349		5.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	194	0.1200	0.74		**Lag/CN Method,**
4.4	194	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD1: Building Roof Area #1

Runoff = 0.71 cfs @ 12.08 hrs, Volume= 2,487 cf, Depth= 4.26"
Routed to Pond 4P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,000	98	Roofs, HSG B
7,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD2: Building Roof Area #2

Runoff = 0.72 cfs @ 12.08 hrs, Volume= 2,540 cf, Depth= 4.26"
Routed to Pond 3P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,147	98	Roofs, HSG B
7,147		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 1P: Underground Infiltration Chamber

Inflow Area = 22,704 sf, 45.97% Impervious, Inflow Depth = 2.91" for 10-Year event
Inflow = 1.77 cfs @ 12.09 hrs, Volume= 5,504 cf
Outflow = 0.17 cfs @ 12.96 hrs, Volume= 5,504 cf, Atten= 90%, Lag= 52.6 min
Discarded = 0.17 cfs @ 12.96 hrs, Volume= 5,504 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 844.18' @ 12.96 hrs Surf.Area= 1,484 sf Storage= 2,237 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 127.3 min (938.9 - 811.7)

Volume	Invert	Avail.Storage	Storage Description
#1	842.00'	1,323 cf	**28.00'W x 53.00'L x 3.54'H Stone Surround** 5,253 cf Overall - 1,945 cf Embedded = 3,309 cf x 40.0% Voids
#2	842.50'	1,945 cf	**Cultec R-330XLHD** x 36 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 6 rows
		3,268 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	842.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 840.00'
#2	Primary	844.33'	**8.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 844.33' / 834.00' S= 0.1033 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.17 cfs @ 12.96 hrs HW=844.18' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=842.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Underground Infiltration Chamber

Inflow Area = 42,827 sf, 41.73% Impervious, Inflow Depth = 2.13" for 10-Year event
Inflow = 2.34 cfs @ 12.11 hrs, Volume= 7,601 cf
Outflow = 0.32 cfs @ 12.80 hrs, Volume= 7,601 cf, Atten= 86%, Lag= 41.7 min
Discarded = 0.22 cfs @ 12.80 hrs, Volume= 7,343 cf
Primary = 0.09 cfs @ 12.80 hrs, Volume= 259 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 843.84' @ 12.80 hrs Surf.Area= 1,857 sf Storage= 2,996 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 137.3 min (975.8 - 838.6)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	1,668 cf	**23.65'W x 78.50'L x 3.54'H Stone Surround** 6,572 cf Overall - 2,403 cf Embedded = 4,169 cf x 40.0% Voids
#2	842.00'	2,403 cf	**Cultec R-330XLHD** x 45 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 5 rows
		4,071 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.67'	**10.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.67' / 833.00' S= 0.1067 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.22 cfs @ 12.80 hrs HW=843.84' (Free Discharge)
1=Exfiltration (Controls 0.22 cfs)

Primary OutFlow Max=0.09 cfs @ 12.80 hrs HW=843.84' TW=0.00' (Dynamic Tailwater)
2=Culvert (Inlet Controls 0.09 cfs @ 1.12 fps)

Summary for Pond 3P: Underground Infiltration System

Inflow Area = 7,147 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.72 cfs @ 12.08 hrs, Volume= 2,540 cf
Outflow = 0.08 cfs @ 12.76 hrs, Volume= 2,540 cf, Atten= 89%, Lag= 40.7 min
Discarded = 0.08 cfs @ 12.76 hrs, Volume= 2,540 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 843.46' @ 12.76 hrs Surf.Area= 696 sf Storage= 926 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 97.8 min (847.6 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.08 cfs @ 12.76 hrs HW=843.46' (Free Discharge)
1=Exfiltration (Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=841.50' TW=0.00' (Dynamic Tailwater)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 4P: Underground Infiltration System

Inflow Area = 7,000 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.71 cfs @ 12.08 hrs, Volume= 2,487 cf
Outflow = 0.08 cfs @ 12.75 hrs, Volume= 2,488 cf, Atten= 89%, Lag= 40.2 min
Discarded = 0.08 cfs @ 12.75 hrs, Volume= 2,488 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 843.41' @ 12.75 hrs Surf.Area= 696 sf Storage= 901 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 95.6 min (845.5 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.08 cfs @ 12.75 hrs HW=843.41' (Free Discharge)
↑**1=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=841.50' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 5P: Underground Infiltration System

Inflow Area = 6,487 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 2,305 cf
Outflow = 0.06 cfs @ 12.88 hrs, Volume= 2,305 cf, Atten= 90%, Lag= 47.7 min
Discarded = 0.05 cfs @ 12.88 hrs, Volume= 2,280 cf
Primary = 0.01 cfs @ 12.88 hrs, Volume= 25 cf
Routed to Link 1S : Main Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 841.89' @ 12.88 hrs Surf.Area= 413 sf Storage= 988 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 186.0 min (935.8 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	839.50'	941 cf	**15.00'W x 27.50'L x 3.50'H Stone Surround** 1,444 cf Overall - 503 cf Embedded = 941 cf
#2	840.00'	503 cf	**Cultec R-330XLHD** x 9 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
		1,444 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	839.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 837.50'
#2	Primary	841.83'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 841.83' / 839.00' S= 0.1415 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.05 cfs @ 12.88 hrs HW=841.89' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.01 cfs @ 12.88 hrs HW=841.89' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.01 cfs @ 0.68 fps)

Summary for Link 1S: Main Street

Inflow Area = 15,077 sf, 46.16% Impervious, Inflow Depth = 0.70" for 10-Year event
Inflow = 0.25 cfs @ 12.10 hrs, Volume= 885 cf
Primary = 0.25 cfs @ 12.10 hrs, Volume= 885 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 144,990 sf, 31.59% Impervious, Inflow Depth = 0.45" for 10-Year event
Inflow = 1.41 cfs @ 12.10 hrs, Volume= 5,493 cf
Primary = 1.41 cfs @ 12.10 hrs, Volume= 5,493 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1a: Front Landscape Area

Runoff = 0.37 cfs @ 12.10 hrs, Volume= 1,218 cf, Depth= 1.70"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
473	98	Paved parking, HSG B
8,117	61	>75% Grass cover, Good, HSG B
8,590	63	Weighted Average
8,117		94.49% Pervious Area
473		5.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2a: Access Driveway & Parking

Runoff = 0.77 cfs @ 12.08 hrs, Volume= 2,737 cf, Depth= 5.06"
Routed to Pond 5P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
6,487	98	Paved parking, HSG B
6,487		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2b: Parking Lot

Runoff = 2.20 cfs @ 12.09 hrs, Volume= 6,899 cf, Depth= 3.65"
Routed to Pond 1P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
	10,436	98	Paved parking, HSG B
	991	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	22,704	85	Weighted Average
	12,268		54.03% Pervious Area
	10,436		45.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2c: Eastern Site Runoff

Runoff = 3.07 cfs @ 12.11 hrs, Volume= 9,938 cf, Depth= 2.78"
Routed to Pond 2P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
17,871	98	Paved parking, HSG B
24,956	61	>75% Grass cover, Good, HSG B
42,827	76	Weighted Average
24,956		58.27% Pervious Area
17,871		41.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	210	0.0200	0.48		**Lag/CN Method, Eastern Parking Lot**

Summary for Subcatchment 2d: Rear of Property

Runoff = 2.23 cfs @ 12.10 hrs, Volume= 7,663 cf, Depth= 1.41"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
23,294	61	>75% Grass cover, Good, HSG B
38,669	55	Woods, Good, HSG B
3,349	98	Paved parking, HSG B
65,312	59	Weighted Average
61,963		94.87% Pervious Area
3,349		5.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	194	0.1200	0.74		**Lag/CN Method,**
4.4	194	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD1: Building Roof Area #1

Runoff = 0.83 cfs @ 12.08 hrs, Volume= 2,953 cf, Depth= 5.06"
Routed to Pond 4P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
7,000	98	Roofs, HSG B
7,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD2: Building Roof Area #2

Runoff = 0.85 cfs @ 12.08 hrs, Volume= 3,015 cf, Depth= 5.06"
Routed to Pond 3P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
7,147	98	Roofs, HSG B
7,147		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 1P: Underground Infiltration Chamber

Inflow Area = 22,704 sf, 45.97% Impervious, Inflow Depth = 3.65" for 25-Year event
Inflow = 2.20 cfs @ 12.09 hrs, Volume= 6,899 cf
Outflow = 0.45 cfs @ 12.52 hrs, Volume= 6,899 cf, Atten= 79%, Lag= 25.9 min
Discarded = 0.19 cfs @ 12.52 hrs, Volume= 6,413 cf
Primary = 0.26 cfs @ 12.52 hrs, Volume= 487 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 844.66' @ 12.52 hrs Surf.Area= 1,484 sf Storage= 2,697 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 129.7 min (935.0 - 805.3)

Volume	Invert	Avail.Storage	Storage Description
#1	842.00'	1,323 cf	**28.00'W x 53.00'L x 3.54'H Stone Surround** 5,253 cf Overall - 1,945 cf Embedded = 3,309 cf x 40.0% Voids
#2	842.50'	1,945 cf	**Cultec R-330XLHD** x 36 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 6 rows
		3,268 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	842.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 840.00'
#2	Primary	844.33'	**8.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 844.33' / 834.00' S= 0.1033 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.19 cfs @ 12.52 hrs HW=844.66' (Free Discharge)
↑**1=Exfiltration** (Controls 0.19 cfs)

Primary OutFlow Max=0.26 cfs @ 12.52 hrs HW=844.66' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.26 cfs @ 1.53 fps)

Summary for Pond 2P: Underground Infiltration Chamber

Inflow Area = 42,827 sf, 41.73% Impervious, Inflow Depth = 2.78" for 25-Year event
Inflow = 3.07 cfs @ 12.11 hrs, Volume= 9,938 cf
Outflow = 1.02 cfs @ 12.44 hrs, Volume= 9,939 cf, Atten= 67%, Lag= 20.3 min
Discarded = 0.24 cfs @ 12.44 hrs, Volume= 8,296 cf
Primary = 0.78 cfs @ 12.44 hrs, Volume= 1,643 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 844.23' @ 12.44 hrs Surf.Area= 1,857 sf Storage= 3,431 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 123.6 min (954.4 - 830.8)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	1,668 cf	**23.65'W x 78.50'L x 3.54'H Stone Surround** 6,572 cf Overall - 2,403 cf Embedded = 4,169 cf x 40.0% Voids
#2	842.00'	2,403 cf	**Cultec R-330XLHD** x 45 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 5 rows
		4,071 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.67'	**10.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.67' / 833.00' S= 0.1067 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.24 cfs @ 12.44 hrs HW=844.23' (Free Discharge)
↑**1=Exfiltration** (Controls 0.24 cfs)

Primary OutFlow Max=0.78 cfs @ 12.44 hrs HW=844.23' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.78 cfs @ 2.01 fps)

Summary for Pond 3P: Underground Infiltration System

Inflow Area = 7,147 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.85 cfs @ 12.08 hrs, Volume= 3,015 cf
Outflow = 0.10 cfs @ 12.66 hrs, Volume= 3,015 cf, Atten= 88%, Lag= 34.5 min
Discarded = 0.09 cfs @ 12.66 hrs, Volume= 2,993 cf
Primary = 0.02 cfs @ 12.66 hrs, Volume= 23 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 843.90' @ 12.66 hrs Surf.Area= 696 sf Storage= 1,139 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 113.5 min (860.6 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.09 cfs @ 12.66 hrs HW=843.90' (Free Discharge)
↑**1=Exfiltration** (Controls 0.09 cfs)

Primary OutFlow Max=0.02 cfs @ 12.66 hrs HW=843.90' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.02 cfs @ 0.73 fps)

Summary for Pond 4P: Underground Infiltration System

Inflow Area = 7,000 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.83 cfs @ 12.08 hrs, Volume= 2,953 cf
Outflow = 0.09 cfs @ 12.78 hrs, Volume= 2,953 cf, Atten= 90%, Lag= 42.0 min
Discarded = 0.08 cfs @ 12.78 hrs, Volume= 2,951 cf
Primary = 0.00 cfs @ 12.78 hrs, Volume= 3 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 843.86' @ 12.78 hrs Surf.Area= 696 sf Storage= 1,118 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 113.1 min (860.2 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.08 cfs @ 12.78 hrs HW=843.86' (Free Discharge)
↑**1=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 12.78 hrs HW=843.86' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.00 cfs @ 0.45 fps)

Summary for Pond 5P: Underground Infiltration System

Inflow Area = 6,487 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.77 cfs @ 12.08 hrs, Volume= 2,737 cf
Outflow = 0.22 cfs @ 12.42 hrs, Volume= 2,737 cf, Atten= 72%, Lag= 20.1 min
Discarded = 0.05 cfs @ 12.42 hrs, Volume= 2,459 cf
Primary = 0.16 cfs @ 12.42 hrs, Volume= 278 cf
Routed to Link 1S : Main Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 842.08' @ 12.42 hrs Surf.Area= 413 sf Storage= 1,065 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 173.7 min (920.7 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	839.50'	941 cf	**15.00'W x 27.50'L x 3.50'H Stone Surround** 1,444 cf Overall - 503 cf Embedded = 941 cf
#2	840.00'	503 cf	**Cultec R-330XLHD** x 9 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
		1,444 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	839.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 837.50'
#2	Primary	841.83'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 841.83' / 839.00' S= 0.1415 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.05 cfs @ 12.42 hrs HW=842.08' (Free Discharge)
↑**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.16 cfs @ 12.42 hrs HW=842.08' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.16 cfs @ 1.35 fps)

Summary for Link 1S: Main Street

Inflow Area = 15,077 sf, 46.16% Impervious, Inflow Depth = 1.19" for 25-Year event
Inflow = 0.37 cfs @ 12.10 hrs, Volume= 1,497 cf
Primary = 0.37 cfs @ 12.10 hrs, Volume= 1,497 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 144,990 sf, 31.59% Impervious, Inflow Depth = 0.81" for 25-Year event
Inflow = 2.23 cfs @ 12.10 hrs, Volume= 9,819 cf
Primary = 2.23 cfs @ 12.10 hrs, Volume= 9,819 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1a: Front Landscape Area

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 1,813 cf, Depth= 2.53"
Routed to Link 1S : Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
473	98	Paved parking, HSG B
8,117	61	>75% Grass cover, Good, HSG B
8,590	63	Weighted Average
8,117		94.49% Pervious Area
473		5.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2a: Access Driveway & Parking

Runoff = 0.95 cfs @ 12.08 hrs, Volume= 3,385 cf, Depth= 6.26"
Routed to Pond 5P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
6,487	98	Paved parking, HSG B
6,487		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2b: Parking Lot

Runoff = 2.85 cfs @ 12.09 hrs, Volume= 9,036 cf, Depth= 4.78"
Routed to Pond 1P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	10,436	98	Paved parking, HSG B
	991	61	>75% Grass cover, Good, HSG B
*	11,277	75	Porous Pavement
	22,704	85	Weighted Average
	12,268		54.03% Pervious Area
	10,436		45.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2c: Eastern Site Runoff

Runoff = 4.20 cfs @ 12.11 hrs, Volume= 13,617 cf, Depth= 3.82"
Routed to Pond 2P : Underground Infiltration Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
17,871	98	Paved parking, HSG B
24,956	61	>75% Grass cover, Good, HSG B
42,827	76	Weighted Average
24,956		58.27% Pervious Area
17,871		41.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	210	0.0200	0.48		**Lag/CN Method, Eastern Parking Lot**

Summary for Subcatchment 2d: Rear of Property

Runoff = 3.63 cfs @ 12.10 hrs, Volume= 11,786 cf, Depth= 2.17"
Routed to Link 2S : Waite Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
23,294	61	>75% Grass cover, Good, HSG B
38,669	55	Woods, Good, HSG B
3,349	98	Paved parking, HSG B
65,312	59	Weighted Average
61,963		94.87% Pervious Area
3,349		5.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	194	0.1200	0.74		**Lag/CN Method,**
4.4	194	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD1: Building Roof Area #1

Runoff = 1.02 cfs @ 12.08 hrs, Volume= 3,652 cf, Depth= 6.26"
Routed to Pond 4P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,000	98	Roofs, HSG B
7,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment BLD2: Building Roof Area #2

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 3,729 cf, Depth= 6.26"
Routed to Pond 3P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,147	98	Roofs, HSG B
7,147		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 1P: Underground Infiltration Chamber

Inflow Area = 22,704 sf, 45.97% Impervious, Inflow Depth = 4.78" for 100-Year event
Inflow = 2.85 cfs @ 12.09 hrs, Volume= 9,036 cf
Outflow = 1.10 cfs @ 12.33 hrs, Volume= 9,037 cf, Atten= 62%, Lag= 14.4 min
Discarded = 0.21 cfs @ 12.33 hrs, Volume= 7,274 cf
Primary = 0.89 cfs @ 12.33 hrs, Volume= 1,763 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 845.11' @ 12.33 hrs Surf.Area= 1,484 sf Storage= 3,012 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 116.2 min (913.9 - 797.7)

Volume	Invert	Avail.Storage	Storage Description
#1	842.00'	1,323 cf	**28.00'W x 53.00'L x 3.54'H Stone Surround** 5,253 cf Overall - 1,945 cf Embedded = 3,309 cf x 40.0% Voids
#2	842.50'	1,945 cf	**Cultec R-330XLHD** x 36 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 6 rows
		3,268 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	842.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 840.00'
#2	Primary	844.33'	**8.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 844.33' / 834.00' S= 0.1033 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.21 cfs @ 12.33 hrs HW=845.11' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.21 cfs)

Primary OutFlow Max=0.89 cfs @ 12.33 hrs HW=845.11' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.89 cfs @ 2.54 fps)

Summary for Pond 2P: Underground Infiltration Chamber

Inflow Area = 42,827 sf, 41.73% Impervious, Inflow Depth = 3.82" for 100-Year event
Inflow = 4.20 cfs @ 12.11 hrs, Volume= 13,617 cf
Outflow = 2.09 cfs @ 12.29 hrs, Volume= 13,618 cf, Atten= 50%, Lag= 11.0 min
Discarded = 0.28 cfs @ 12.29 hrs, Volume= 9,516 cf
Primary = 1.82 cfs @ 12.29 hrs, Volume= 4,102 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 844.85' @ 12.29 hrs Surf.Area= 1,857 sf Storage= 3,932 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 107.9 min (929.7 - 821.8)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	1,668 cf	**23.65'W x 78.50'L x 3.54'H Stone Surround** 6,572 cf Overall - 2,403 cf Embedded = 4,169 cf x 40.0% Voids
#2	842.00'	2,403 cf	**Cultec R-330XLHD** x 45 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 5 rows
		4,071 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.67'	**10.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.67' / 833.00' S= 0.1067 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.28 cfs @ 12.29 hrs HW=844.85' (Free Discharge)
↑**1=Exfiltration** (Controls 0.28 cfs)

Primary OutFlow Max=1.82 cfs @ 12.29 hrs HW=844.85' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 1.82 cfs @ 3.33 fps)

Summary for Pond 3P: Underground Infiltration System

Inflow Area = 7,147 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 1.05 cfs @ 12.08 hrs, Volume= 3,729 cf
Outflow = 0.36 cfs @ 12.35 hrs, Volume= 3,730 cf, Atten= 66%, Lag= 16.0 min
Discarded = 0.09 cfs @ 12.35 hrs, Volume= 3,338 cf
Primary = 0.27 cfs @ 12.35 hrs, Volume= 391 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 844.16' @ 12.35 hrs Surf.Area= 696 sf Storage= 1,248 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 106.3 min (850.3 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.09 cfs @ 12.35 hrs HW=844.16' (Free Discharge)
↑**1=Exfiltration** (Controls 0.09 cfs)

Primary OutFlow Max=0.27 cfs @ 12.35 hrs HW=844.16' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.27 cfs @ 1.55 fps)

Summary for Pond 4P: Underground Infiltration System

Inflow Area = 7,000 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 1.02 cfs @ 12.08 hrs, Volume= 3,652 cf
Outflow = 0.33 cfs @ 12.37 hrs, Volume= 3,653 cf, Atten= 68%, Lag= 17.2 min
Discarded = 0.09 cfs @ 12.37 hrs, Volume= 3,305 cf
Primary = 0.24 cfs @ 12.37 hrs, Volume= 348 cf
Routed to Link 2S : Waite Pond

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 844.14' @ 12.37 hrs Surf.Area= 696 sf Storage= 1,240 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 107.0 min (851.0 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	841.50'	622 cf	**19.32'W x 36.00'L x 3.50'H Stone Surround** 2,434 cf Overall - 879 cf Embedded = 1,555 cf x 40.0% Voids
#2	842.00'	879 cf	**Cultec R-330XLHD** x 16 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 4 rows
		1,501 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	841.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 839.50'
#2	Primary	843.83'	**8.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 843.83' / 833.00' S= 0.2708 '/' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.09 cfs @ 12.37 hrs HW=844.14' (Free Discharge)
1=Exfiltration (Controls 0.09 cfs)

Primary OutFlow Max=0.24 cfs @ 12.37 hrs HW=844.14' TW=0.00' (Dynamic Tailwater)
2=Culvert (Inlet Controls 0.24 cfs @ 1.50 fps)

Summary for Pond 5P: Underground Infiltration System

Inflow Area = 6,487 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 0.95 cfs @ 12.08 hrs, Volume= 3,385 cf
Outflow = 0.47 cfs @ 12.23 hrs, Volume= 3,385 cf, Atten= 50%, Lag= 8.6 min
Discarded = 0.05 cfs @ 12.23 hrs, Volume= 2,693 cf
Primary = 0.42 cfs @ 12.23 hrs, Volume= 692 cf
Routed to Link 1S : Main Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 842.26' @ 12.23 hrs Surf.Area= 413 sf Storage= 1,137 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 158.6 min (902.6 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	839.50'	941 cf	**15.00'W x 27.50'L x 3.50'H Stone Surround** 1,444 cf Overall - 503 cf Embedded = 941 cf
#2	840.00'	503 cf	**Cultec R-330XLHD** x 9 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
		1,444 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	839.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 837.50'
#2	Primary	841.83'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 841.83' / 839.00' S= 0.1415 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.05 cfs @ 12.23 hrs HW=842.26' (Free Discharge)
↑**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.42 cfs @ 12.23 hrs HW=842.26' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Inlet Controls 0.42 cfs @ 1.76 fps)

Summary for Link 1S: Main Street

Inflow Area = 15,077 sf, 46.16% Impervious, Inflow Depth = 1.99" for 100-Year event
Inflow = 0.77 cfs @ 12.18 hrs, Volume= 2,505 cf
Primary = 0.77 cfs @ 12.18 hrs, Volume= 2,505 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2S: Waite Pond

Inflow Area = 144,990 sf, 31.59% Impervious, Inflow Depth = 1.52" for 100-Year event
Inflow = 4.96 cfs @ 12.28 hrs, Volume= 18,390 cf
Primary = 4.96 cfs @ 12.28 hrs, Volume= 18,390 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Appendix F

Additional Stormwater Design Drainage Calculations

TABLE NO. 4
STORMWATER MANAGEMENT CALCULATIONS
PROPOSED MULTIFAMILY RESIDENCES
#778 MAIN ST
LEICESTER, MA

STANDARD 3 - RECHARGE
REQUIRED RECHARGE VOLUME
RECHARGE VOLUME (Rv)

Existing Impervious Area =	10,019	s.f.
Proposed Impervious Area =	**52,763**	**s.f.**

Impervious Area (s.f.)	**Rv (cf)**	**Soil Type - Type B = 0.35 inches**
Impervious Area s.f. x (0.35") x (1'/12"	**1,539**	c.f.

Proposed Underground Infiltration Chambers (Pond 1P)
Storage Volume = 2,363 c.f. (Elev. 844.33 = 8" Diam. Outlet Pipe)

Proposed Underground Infiltration Chambers (Pond 2P)
Storage Volume = 2,749 c.f. (Elev. 843.67 = 8" Diam. Outlet Pipe)

Proposed Underground Infiltration Chambers (Pond 3P)
Storage Volume = 1,091 c.f. (Elev. 843.83 = 8" Diam. Outlet Pipe)

Proposed Underground Infitration Chambers (Pond 4P)
Storage Volume = 1,091 c.f. (Elev. 843.83 = 8" Diam. Outlet Pipe)

Proposed Underground Infitration Chambers (Pond 5P)
Storage Volume = 949 c.f. (Elev. 841.83 = 8" Diam. Outlet Pipe)

STANDARD 4 - WATER QUALITY

Impervious Area (s.f.)	**WQv (cf)**	**Rapid Infiltration Rate & IWPA = 1" Runoff**
Impervious Area s.f. x (1") x (1'/12")	**4,397**	**c.f.**
Proposed Storage in Chambers =	**8,243**	**c.f.**

SUBCATCHMENT 2A - Access Driveway & Parking (IWPA)

TSS Removal Calculation		**TSS Removal**	**TSS Remaining**	
1. Deep Sump Hooded Catch Basin	25%	0.25	**0.75**	
2. Cultec Separator Row	25%	0.25	**0.56**	
3. Underground Infiltration Chambers	80%	0.80	**0.11**	
		TSS Removal Efficiency =		**0.89 > 80%**

SUBCATCHMENT 2B - Parking Lot

TSS Removal Calculation		**TSS Removal**	**TSS Remaining**	
1. Deep Sump Hooded Catch Basin	25%	0.25	**0.75**	
2. Cultec Separator Row	25%	0.25	**0.56**	
3. Underground Infiltration Chambers	80%	0.80	**0.11**	
		TSS Removal Efficiency =		**0.89 > 80%**

SUBCATCHMENT 2C - Eastern Site Runoff

TSS Removal Calculation		**TSS Removal**	**TSS Remaining**	
1. Deep Sump Hooded Catch Basin	25%	0.25	**0.75**	
2. Cultec Separator Row	25%	0.25	**0.56**	
3. Underground Infiltration Chambers	80%	0.80	**0.11**	
		TSS Removal Efficiency =		**0.89 > 80%**

TABLE NO. 4
STORMWATER MANAGEMENT CALCULATIONS
PROPOSED MULTIFAMILY RESIDENCES
#778 MAIN ST
LEICESTER, MA

Proposed Underground Infiltration Chambers (Pond 1P)			
Drawdown (Td) = Rv / k A	**7.93**	**hours**	< 72 Hours OK
Recharge Volume (Rv) =	2,363	c.f.	
Permeability (k) =	2.41	in/hr	
Bottom Area (A) =	1,484	s.f.	
Proposed Underground Infiltration Chambers (Pond 2P)			
Drawdown (Td) = Rv / k A	**7.37**	**hours**	< 72 Hours OK
Recharge Volume (Rv) =	2,749	c.f.	
Permeability (k) =	2.41	in/hr	
Bottom Area (A) =	1,857	s.f.	
Proposed Underground Infiltration Chambers (Pond 3P)			
Drawdown (Td) = Rv / k A	**7.81**	**hours**	< 72 Hours OK
Recharge Volume (Rv) =	1,091	c.f.	
Permeability (k) =	2.41	in/hr	
Bottom Area (A) =	696	s.f.	
Proposed Underground Infiltration Chambers (Pond 4P)			
Drawdown (Td) = Rv / k A	**7.81**	**hours**	< 72 Hours OK
Recharge Volume (Rv) =	1,091	c.f.	
Permeability (k) =	2.41	in/hr	
Bottom Area (A) =	696	s.f.	
Proposed Underground Infiltration Chambers (Pond 3P)			
Drawdown (Td) = Rv / k A	**11.46**	**hours**	< 72 Hours OK
Recharge Volume (Rv) =	949	c.f.	
Permeability (k) =	2.41	in/hr	
Bottom Area (A) =	413	s.f.	

Stage-Area-Storage for Pond 1P: Underground Infiltration Chamber

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
842.00	**1,484**	0
842.05	1,484	30
842.10	1,484	59
842.15	1,484	89
842.20	1,484	119
842.25	1,484	148
842.30	1,484	178
842.35	1,484	208
842.40	1,484	237
842.45	1,484	267
842.50	1,484	297
842.55	1,484	358
842.60	1,484	418
842.65	1,484	479
842.70	1,484	539
842.75	1,484	599
842.80	1,484	659
842.85	1,484	719
842.90	1,484	780
842.95	1,484	839
843.00	1,484	899
843.05	1,484	959
843.10	1,484	1,019
843.15	1,484	1,078
843.20	1,484	1,137
843.25	1,484	1,195
843.30	1,484	1,253
843.35	1,484	1,311
843.40	1,484	1,370
843.45	1,484	1,428
843.50	1,484	1,486
843.55	1,484	1,543
843.60	1,484	1,601
843.65	1,484	1,659
843.70	1,484	1,716
843.75	1,484	1,773
843.80	1,484	1,829
843.85	1,484	1,885
843.90	1,484	1,940
843.95	1,484	1,995
844.00	1,484	2,049
844.05	1,484	2,103
844.10	1,484	2,156
844.15	1,484	2,209
844.20	1,484	2,261
844.25	1,484	2,312
844.30	1,484	2,363
844.35	1,484	2,413
844.40	1,484	2,462
844.45	1,484	2,510
844.50	1,484	2,557
844.55	1,484	2,603
844.60	1,484	2,648
844.65	1,484	2,692
844.70	1,484	2,734
844.75	1,484	2,775
844.80	1,484	2,813
844.85	1,484	2,850
844.90	1,484	2,884
844.95	1,484	2,917
845.00	1,484	2,948
845.05	1,484	2,977
845.10	1,484	3,007
845.15	1,484	3,037
845.20	1,484	3,066
845.25	1,484	3,096
845.30	1,484	3,126
845.35	1,484	3,155
845.40	1,484	3,185
845.45	1,484	3,215
845.50	1,484	**3,244**

8" Outlet Pipe - Inv.=844.33

Stage-Area-Storage for Pond 2P: Underground Infiltration Chamber

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
841.50	**1,857**	0
841.55	1,857	37
841.60	1,857	74
841.65	1,857	111
841.70	1,857	149
841.75	1,857	186
841.80	1,857	223
841.85	1,857	260
841.90	1,857	297
841.95	1,857	334
842.00	1,857	371
842.05	1,857	447
842.10	1,857	522
842.15	1,857	597
842.20	1,857	672
842.25	1,857	747
842.30	1,857	822
842.35	1,857	897
842.40	1,857	971
842.45	1,857	1,046
842.50	1,857	1,120
842.55	1,857	1,195
842.60	1,857	1,269
842.65	1,857	1,342
842.70	1,857	1,415
842.75	1,857	1,488
842.80	1,857	1,560
842.85	1,857	1,633
842.90	1,857	1,705
842.95	1,857	1,777
843.00	1,857	1,849
843.05	1,857	1,921
843.10	1,857	1,993
843.15	1,857	2,064
843.20	1,857	2,136
843.25	1,857	2,207
843.30	1,857	2,277
843.35	1,857	2,346
843.40	1,857	2,415
843.45	1,857	2,483
843.50	1,857	2,551
843.55	1,857	2,617
843.60	1,857	2,684
843.65	1,857	2,749
843.70	1,857	2,814
843.75	1,857	2,878
843.80	1,857	2,941
843.85	1,857	3,003
843.90	1,857	3,064
843.95	1,857	3,124
844.00	1,857	3,183
844.05	1,857	3,240
844.10	1,857	3,296
844.15	1,857	3,351
844.20	1,857	3,403
844.25	1,857	3,454
844.30	1,857	3,502
844.35	1,857	3,547
844.40	1,857	3,590
844.45	1,857	3,631
844.50	1,857	3,670
844.55	1,857	3,707
844.60	1,857	3,744
844.65	1,857	3,781
844.70	1,857	3,818
844.75	1,857	3,855
844.80	1,857	3,892
844.85	1,857	3,930
844.90	1,857	3,967
844.95	1,857	4,004
845.00	1,857	**4,041**

8" Outlet Pipe - Inv.=843.67

Stage-Area-Storage for Pond 3P: Underground Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
841.50	**696**	0
841.55	696	14
841.60	696	28
841.65	696	42
841.70	696	56
841.75	696	70
841.80	696	83
841.85	696	97
841.90	696	111
841.95	696	125
842.00	696	139
842.05	696	167
842.10	696	195
842.15	696	223
842.20	696	251
842.25	696	278
842.30	696	306
842.35	696	334
842.40	696	361
842.45	696	389
842.50	696	416
842.55	696	444
842.60	696	471
842.65	696	499
842.70	696	526
842.75	696	553
842.80	696	579
842.85	696	606
842.90	696	633
842.95	696	660
843.00	696	686
843.05	696	713
843.10	696	740
843.15	696	766
843.20	696	792
843.25	696	819
843.30	696	845
843.35	696	870
843.40	696	896
843.45	696	921
843.50	696	946
843.55	696	971
843.60	696	996
843.65	696	1,020
843.70	696	1,044
843.75	696	1,067
843.80	696	1,091
843.85	696	1,114
843.90	696	1,137
843.95	696	1,159
844.00	696	1,181
844.05	696	1,202
844.10	696	1,223
844.15	696	1,243
844.20	696	1,263
844.25	696	1,282
844.30	696	1,299
844.35	696	1,316
844.40	696	1,332
844.45	696	1,348
844.50	696	1,362
844.55	696	1,376
844.60	696	1,390
844.65	696	1,404
844.70	696	1,418
844.75	696	1,432
844.80	696	1,446
844.85	696	1,460
844.90	696	1,473
844.95	696	1,487
845.00	696	**1,501**

8" Outlet Pipe - Inv.=843.83

Stage-Area-Storage for Pond 4P: Underground Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
841.50	**696**	0
841.55	696	14
841.60	696	28
841.65	696	42
841.70	696	56
841.75	696	70
841.80	696	83
841.85	696	97
841.90	696	111
841.95	696	125
842.00	696	139
842.05	696	167
842.10	696	195
842.15	696	223
842.20	696	251
842.25	696	278
842.30	696	306
842.35	696	334
842.40	696	361
842.45	696	389
842.50	696	416
842.55	696	444
842.60	696	471
842.65	696	499
842.70	696	526
842.75	696	553
842.80	696	579
842.85	696	606
842.90	696	633
842.95	696	660
843.00	696	686
843.05	696	713
843.10	696	740
843.15	696	766
843.20	696	792
843.25	696	819
843.30	696	845
843.35	696	870
843.40	696	896
843.45	696	921
843.50	696	946
843.55	696	971
843.60	696	996
843.65	696	1,020
843.70	696	1,044
843.75	696	1,067
843.80	696	1,091
843.85	696	1,114
843.90	696	1,137
843.95	696	1,159
844.00	696	1,181
844.05	696	1,202
844.10	696	1,223
844.15	696	1,243
844.20	696	1,263
844.25	696	1,282
844.30	696	1,299
844.35	696	1,316
844.40	696	1,332
844.45	696	1,348
844.50	696	1,362
844.55	696	1,376
844.60	696	1,390
844.65	696	1,404
844.70	696	1,418
844.75	696	1,432
844.80	696	1,446
844.85	696	1,460
844.90	696	1,473
844.95	696	1,487
845.00	696	**1,501**

8" Outlet Pipe - Inv.=843.83

Stage-Area-Storage for Pond 5P: Underground Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
839.50	**413**	0
839.55	413	21
839.60	413	41
839.65	413	62
839.70	413	83
839.75	413	103
839.80	413	124
839.85	413	144
839.90	413	165
839.95	413	186
840.00	413	206
840.05	413	227
840.10	413	248
840.15	413	268
840.20	413	289
840.25	413	309
840.30	413	330
840.35	413	351
840.40	413	371
840.45	413	392
840.50	413	413
840.55	413	433
840.60	413	454
840.65	413	474
840.70	413	495
840.75	413	516
840.80	413	536
840.85	413	557
840.90	413	577
840.95	413	598
841.00	413	619
841.05	413	639
841.10	413	660
841.15	413	681
841.20	413	701
841.25	413	722
841.30	413	742
841.35	413	763
841.40	413	784
841.45	413	804
841.50	413	825
841.55	413	846
841.60	413	866
841.65	413	887
841.70	413	908
841.75	413	928
841.80	413	949
841.85	413	969
841.90	413	990
841.95	413	1,011
842.00	413	1,031
842.05	413	1,052
842.10	413	1,073
842.15	413	1,093
842.20	413	1,114
842.25	413	1,134
842.30	413	1,155
842.35	413	1,176
842.40	413	1,196
842.45	413	1,217
842.50	413	1,238
842.55	413	1,258
842.60	413	1,279
842.65	413	1,299
842.70	413	1,320
842.75	413	1,341
842.80	413	1,361
842.85	413	1,382
842.90	413	1,402
842.95	413	1,423
843.00	413	**1,444**

8" Outlet Pipe - Elev.=841.83

10/27/2022

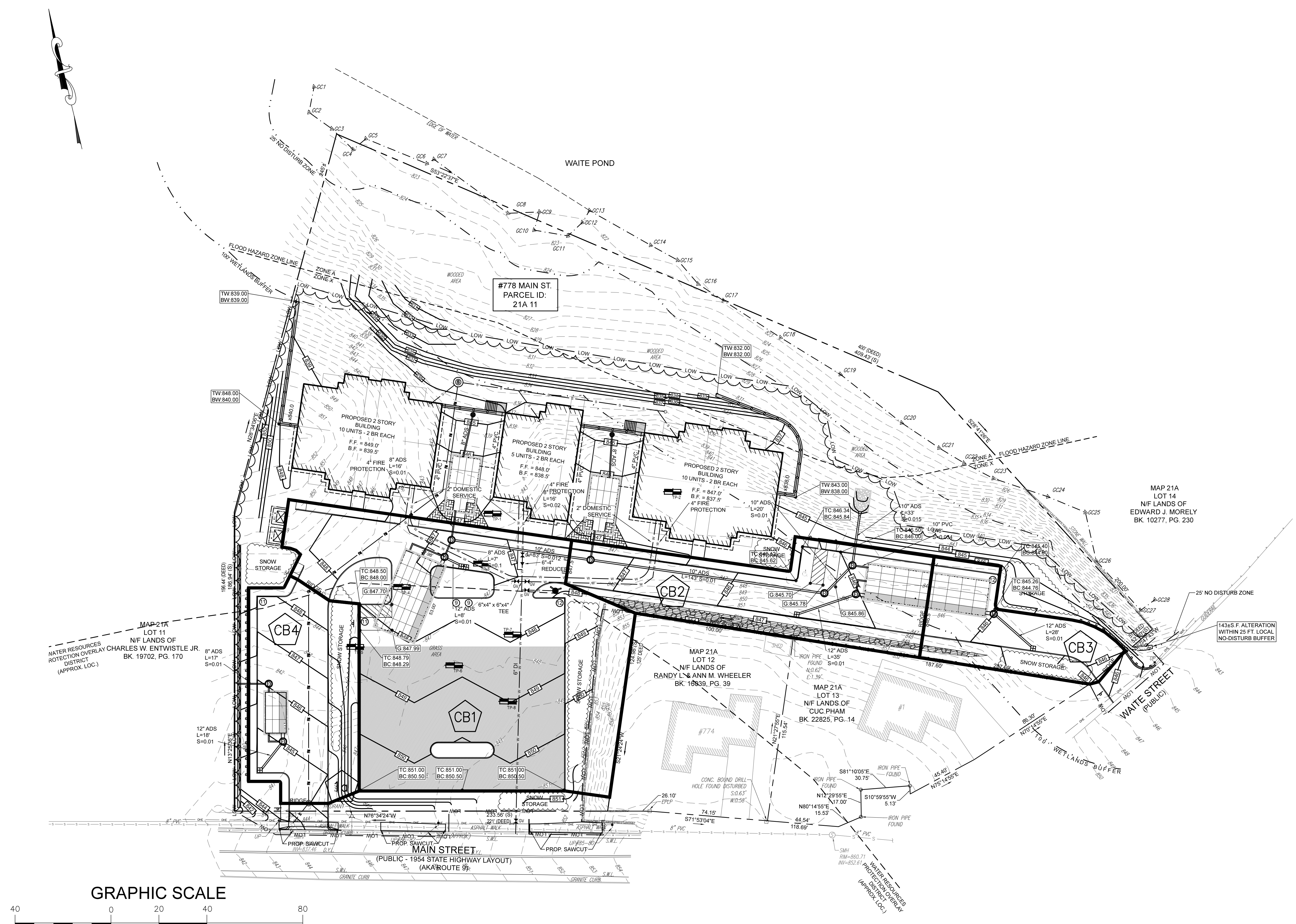
RATIONAL METHOD PIPE DESIGN WORKSHEET
PROPOSED MULTIFAMILY RESIDENCES
LEICESTER, MA

LOCATION	PIPE SEGMENT From	To	INCREMENTAL AREA DESIGNATION	A (Acres)	Total A	C	C*A	Sum (C*A)	FLOW TIME (min.) To Inlet	In Chan.	Tot.	25-Yr I (in/hr)	25-Yr Q (cfs)	DESIGN CONDITIONS Pipe Diam (in.)	Length (ft)	Slope (%)	Q-full (cfs)	V-Full (fps)	Design (25-Yr) Depth Peak (in.)	V-Peak (fps)	Inverts Up	Down	Remarks
CB-1 to CHAMBERS (POND 1P)																							
	CB-1	DMH-1		0.65		0.76	**0.50**		5		5	6.3	**3.14**	12	8	0.010	**3.87**	4.93	9.7	4.00	843.00	842.92	CB-1 Rim =846.50
	DMH-1	CHAMBERS						**0.50**	5		5	6.3	**3.14**	12	5	0.164	**15.66**	19.96	2.4	4.00	842.82	842.00	DMH-1 Rim =846.75
CB-2 to CHAMBERS (POND 2P)																							
	CB-2	CHAMBERS		0.25		0.74	**0.18**		5		5	6.3	**1.15**	10	42	0.010	**2.38**	4.36	4.8	2.11	842.42	842.00	CB-2 Rim =845.50
CB-3 TO CHAMBERS (POND 2P)																							
	CB-3	CHAMBERS		0.248		0.71	**0.18**		5		5	6.3	**1.10**	10	35	0.010	**2.38**	4.36	4.6	2.02	842.35	842.00	CB-3 Rim = 845.50
CB-4 TO CHAMBERS (POND 5P)																							
	CB-4	CHAMBERS		0.127		0.71	**0.09**		5		5	6.3	**0.57**	10	22	0.045	**5.07**	9.30	1.1	1.04	841.00	840.00	CB-4 Rim=844.50
ROOF 1 TO CHAMBERS (POND 3P)																							
	ROOF	CHAMBERS		0.161		0.90	**0.14**		5		5	6.3	**0.91**	6	9	0.020	**0.86**	4.39	6.3	4.64			
ROOF 2 TO CHAMBERS (POND 4P)																							
	ROOF	CHAMBERS		0.164		0.90	**0.15**		5		5	6.3	**0.93**	6	9	0.010	**0.61**	3.10	9.2	4.74			
CHAMBERS TO FES OUTLET																							
	DMH-1	DMH-2			0.65		**0.50**		5		5	6.3	**1.12**	10	7	0.029	**4.02**	7.38	2.8	2.05	844.20	844.00	DMH-1 Rim=846.75
	DMH-2	DMH-3			0.81			**0.64**	5		5	6.3	**1.36**	10	83	0.013	**2.71**	4.98	5.0	2.49	843.50	842.42	DMH-2 Rim=847.10
	DMH-3	DMH-4			0.98			**0.79**	5		5	6.3	**1.63**	10	143	0.010	**2.38**	4.36	6.9	2.99	842.42	840.99	DMH-3 Rim=847.30
	DMH-4	DMH-5			0.98			**0.79**	5		5	6.3	**1.90**	10	20	0.264	**12.23**	22.44	1.6	3.49	840.89	835.60	DMH-4 Rim=845.80
	DMH-5	FES			1.47			**0.86**	5		5	6.3	**3.72**	10	10	0.050	**5.32**	9.76	7.0	6.82	835.50	835.00	DMH-5 Rim=845.90

Notes:

1) Runoff Coefficient C-Values used; Impervious(Pavement) C=0.90 Grass/OpenSpace C=0.20, Residential Suburban C=.25~.40, Mannings "n" HDPE n=0.012, RCP n=0.013
2) Rainfall Intensity I (in/hr) values taken from Figure 10-4 Intensity-Duration-Frequency Curve for Boston, Massachusetts, Mass Highway Design Manual.
3) Five (5) minute minimum flow time used for minimum time of concentration (Tc) to CB inlet to system
4) Massachusetts Cascade Grate Inlet Capacity = 1.26 cfs @ 100% efficiency, Standard Grate = 0.95 cfs est.
5) Blue Highlight denotes calculated peak flow (cfs) to CB Inlet

Drainage Structure	Contributing Area Impervious	Grass/Lawn	Total s.f.	Ac.	Runoff Coefficient C
CB-1	22,855	5,599	28,454	0.653	0.76
CB-2	8,256	2,535	10,791	0.248	0.74
CB-3	4,020	1,533	5,553	0.127	0.71
CB-4	6,485	2,329	8,814	0.202	0.72
ROOF 1	7,000		7,000	0.161	0.90
ROOF 2	7,147		7,147	0.164	0.90



WAITE POND
EDGE OF WATER
25' NO DISTURB ZONE
FLOOD HAZARD ZONE LINE
100' WETLANDS BUFFER
ZONE A
ZONE X
#778 MAIN ST.
PARCEL ID:
21A 11
WOODED AREA
TW:839.00
BW:839.00
TW:848.00
BW:840.00
TW:832.00
BW:832.00
TW:843.00
BW:838.00
PROPOSED 2 STORY BUILDING
10 UNITS - 2 BR EACH
F.F. = 849.0'
B.F. = 839.5'
PROPOSED 2 STORY BUILDING
5 UNITS - 2 BR EACH
F.F. = 848.0'
B.F. = 838.5'
PROPOSED 2 STORY BUILDING
10 UNITS - 2 BR EACH
F.F. = 847.0'
B.F. = 837.5'
4" FIRE PROTECTION
2" DOMESTIC SERVICE
SNOW STORAGE
CB1
CB2
CB3
CB4
GRASS AREA
MAP 21A
LOT 14
N/F LANDS OF
EDWARD J. MORELY
BK. 10277, PG. 230
MAP 21A
LOT 11
N/F LANDS OF
CHARLES W. ENTWISTLE JR.
BK. 19702, PG. 170
WATER RESOURCES PROTECTION OVERLAY DISTRICT (APPROX. LOC.)
MAP 21A
LOT 12
N/F LANDS OF
RANDY L. & ANN M. WHEELER
BK. 16039, PG. 39
MAP 21A
LOT 13
N/F LANDS OF
CUC PHAM
BK. 22825, PG. 14
143±S.F. ALTERATION
WITHIN 25 FT. LOCAL
NO-DISTURB BUFFER
WAITE STREET
(PUBLIC)
MAIN STREET
(PUBLIC - 1954 STATE HIGHWAY LAYOUT)
(AKA ROUTE 9)
PROP. SAWCUT
GRANITE CURB
100' WETLANDS BUFFER

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 ft.

REVISIONS

NO.	DATE	DESCRIPTION	BY	CK'D
1.	12/6/2022	ZONING BOARD OF APPEALS SUBMISSION	RL	JAB

PROFESSIONAL SEAL

PROJECT:
PROPOSED MULTIFAMILY RESIDENCE
#778 MAIN STREET
LEICESTER, MA 01524

PREPARED FOR:
CHARLTON ROAD REALTY, LLC.
25 WATERVILLE LANE
SHREWSBURY, MA 01545

ENGINEERING SERVICES
ENVIRONMENTAL SERVICES
67 Hall Road
Sturbridge, MA 01566
Phone: 774-241-0901
fax: 774-241-0906
CMG EST. 2002

ISSUE DATE:	10/24/2022
DRAWN BY: RL	CHECKED BY: JAB
SCALE:	1" = 40'
PROJECT NO.:	2021-225

SHEET NAME:
RATIONAL METHOD DRAINAGE MAP

SHEET NO.:
D - 3.0

Groundwater Mounding Analysis - Hantush Method

Project: Proposed Multifamily Residence **Project #:** 2021-226

Performed By: RL **Description:** Pond 1P

Checked By: JAB **Calculated Mound Height:** 0.4 **feet**

Input Parameters (input only shaded areas)**:**

Recharge Period	t =	0.33	days	Time to equilibrium (Dewater in 8.0 hrs)
Width of Field	W =	28	feet	
Length of Field	L =	53	feet	
Hydraulic Conductivity	K =	4.82	ft/day	**2.41 in / hr - Rawls Rate Loamy Sand**
Specific Yield	V =	0.25	ft^3/ft^3	Loamy Sand = 0.25 See Specific Yield Tab
Saturated Thickness	D =	18.41	feet	**ESHGW @ 79", Assumed bed rock depth 25'**
Daily Flow	Q =	4,737	gpd	**633 c.f. = Required Recharge Volume**

Calculated Parameters:

1/2 width	a =	14	feet
1/2 length	b =	26.5	feet
Recharge Rate	j =	0.43	ft/day

$$\gamma = \frac{KD}{V} =$$ 354.9 ft^2/day

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} =$$ 0.6468

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} =$$ 1.2243

Solution:

From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.8005

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 18.9 feet

Mound Height =	**h_m - D =**	**0.4**	**feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation."
Water Resources Research, 3, pp. 227-234.

Groundwater Mounding Analysis - Hantush Method

Project: Proposed Multifamily Residence **Project #:** 2021-226

Performed By: RL **Description:** Pond 2P

Checked By: JAB **Calculated Mound Height:** 0.3 **feet**

Input Parameters (input only shaded areas)**:**

Recharge Period	t =	0.3	days	Time to equilibrium (Dewater in 7.2 hrs)
Width of Field	W =	23.65	feet	
Length of Field	L =	78.5	feet	
Hydraulic Conductivity	K =	4.82	ft/day	**2.41 in / hr - Rawls Rate Loamy Sand**
Specific Yield	V =	0.25	ft^3/ft^3	Loamy Sand = 0.25 See Specific Yield Tab
Saturated Thickness	D =	18.91	feet	**ESHGW @ 73", Assumed bed rock depth 25'**
Daily Flow	Q =	3,898	gpd	**521 c.f. = Required Recharge Volume**

Calculated Parameters:

1/2 width	a =	11.825	feet
1/2 length	b =	39.25	feet
Recharge Rate	j =	0.28	ft/day

$$\gamma = \frac{KD}{V} =$$ 364.6 ft^2/day

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} =$$ 0.5653

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} =$$ 1.8765

Solution:

From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.7672

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 19.2 feet

Mound Height =	**h_m - D =**	**0.3**	**feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation."
Water Resources Research, 3, pp. 227-234.

Groundwater Mounding Analysis - Hantush Method

Project: Proposed Multifamily Residence **Project #:** 2021-226

Performed By: RL **Description:** Pond 3P

Checked By: JAB **Calculated Mound Height:** 0.2 **feet**

Input Parameters (input only shaded areas)**:**

Recharge Period	t =	0.32	days	Time to equilibrium (Dewater in 7.8 hrs)
Width of Field	W =	19.32	feet	
Length of Field	L =	36	feet	
Hydraulic Conductivity	K =	4.82	ft/day	**2.41 in / hr - Rawls Rate Loamy Sand**
Specific Yield	V =	0.25	ft^3/ft^3	Loamy Sand = 0.25 See Specific Yield Tab
Saturated Thickness	D =	18.91	feet	**ESHGW @ 73", Assumed bed rock depth 25'**
Daily Flow	Q =	1,559	gpd	**208 c.f. = Required Recharge Volume**

Calculated Parameters:

1/2 width	a =	9.66	feet
1/2 length	b =	18	feet
Recharge Rate	j =	0.30	ft/day

$$\gamma = \frac{KD}{V} = \quad 364.6 \quad ft^2/day$$

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} = \quad 0.4472$$

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} = \quad 0.8332$$

Solution:

From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.6192

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 19.1 feet

Mound Height =	**h_m - D =**	**0.2**	**feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation."

Water Resources Research, 3, pp. 227-234.

Groundwater Mounding Analysis - Hantush Method

Project: Proposed Multifamily Residence **Project #:** 2021-226

Performed By: RL **Description:** Pond 3P

Checked By: JAB **Calculated Mound Height:** 0.2 **feet**

Input Parameters (input only shaded areas)**:**

Recharge Period	t =	0.32	days	Time to equilibrium (Dewater in 7.8 hrs)
Width of Field	W =	19.32	feet	
Length of Field	L =	36	feet	
Hydraulic Conductivity	K =	4.82	ft/day	**2.41 in / hr - Rawls Rate Loamy Sand**
Specific Yield	V =	0.25	ft^3/ft^3	Loamy Sand = 0.25 See Specific Yield Tab
Saturated Thickness	D =	18.91	feet	**ESHGW @ 73", Assumed bed rock depth 25'**
Daily Flow	Q =	1,527	gpd	**204 c.f. = Required Recharge Volume**

Calculated Parameters:

1/2 width	a =	9.66	feet
1/2 length	b =	18	feet
Recharge Rate	j =	0.29	ft/day

$$\gamma = \frac{KD}{V} = \quad 364.6 \quad ft^2/day$$

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} = \quad 0.4472$$

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} = \quad 0.8332$$

Solution:

From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.6192

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 19.1 feet

Mound Height =	**h_m - D =**	**0.2**	**feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation."

Water Resources Research, 3, pp. 227-234.

Groundwater Mounding Analysis - Hantush Method

Project: Proposed Multifamily Residence **Project #:** 2021-226

Performed By: RL **Description:** Pond 3P

Checked By: JAB **Calculated Mound Height:** 0.3 **feet**

Input Parameters (input only shaded areas)**:**

Recharge Period	t =	0.47	days	Time to equilibrium (Dewater in 11.46 hrs)
Width of Field	W =	15	feet	
Length of Field	L =	27.5	feet	
Hydraulic Conductivity	K =	4.82	ft/day	**2.41 in / hr - Rawls Rate Loamy Sand**
Specific Yield	V =	0.25	ft^3/ft^3	Loamy Sand = 0.25 See Specific Yield Tab
Saturated Thickness	D =	18.91	feet	**ESHGW @ 73", Assumed bed rock depth 25'**
Daily Flow	Q =	1,415	gpd	**189 c.f. = Required Recharge Volume**

Calculated Parameters:

1/2 width	a =	7.5	feet
1/2 length	b =	13.75	feet
Recharge Rate	j =	0.46	ft/day

$$\gamma = \frac{KD}{V} =$$ 364.6 ft^2/day

Dimensionless width $$\alpha = \frac{a}{\sqrt{4\gamma t}} =$$ 0.2865

Dimensionless length $$\beta = \frac{b}{\sqrt{4\gamma t}} =$$ 0.5252

Solution:

From Table 1of Hantush (1967), attached:

Function S*(a , b) = 0.3950

Water Table + Mound $$h_m = \sqrt{h_i^2 + \left[\frac{2j}{K}\lambda t \cdot S^*(\alpha,\beta)\right]}$$

h_m = 19.2 feet

Mound Height =	**h_m - D =**	**0.3**	**feet**

Reference: Hantush, M.S. 1967. "Growth and Decay of Groundwater Mounds in Response to Uniform Percolation."
Water Resources Research, 3, pp. 227-234.

RIP RAP SIZING CALCULATIONS
PROPOSED MULTIFAMILY RESIDENCES
#778 MAIN STREET
LEICESTER, MA

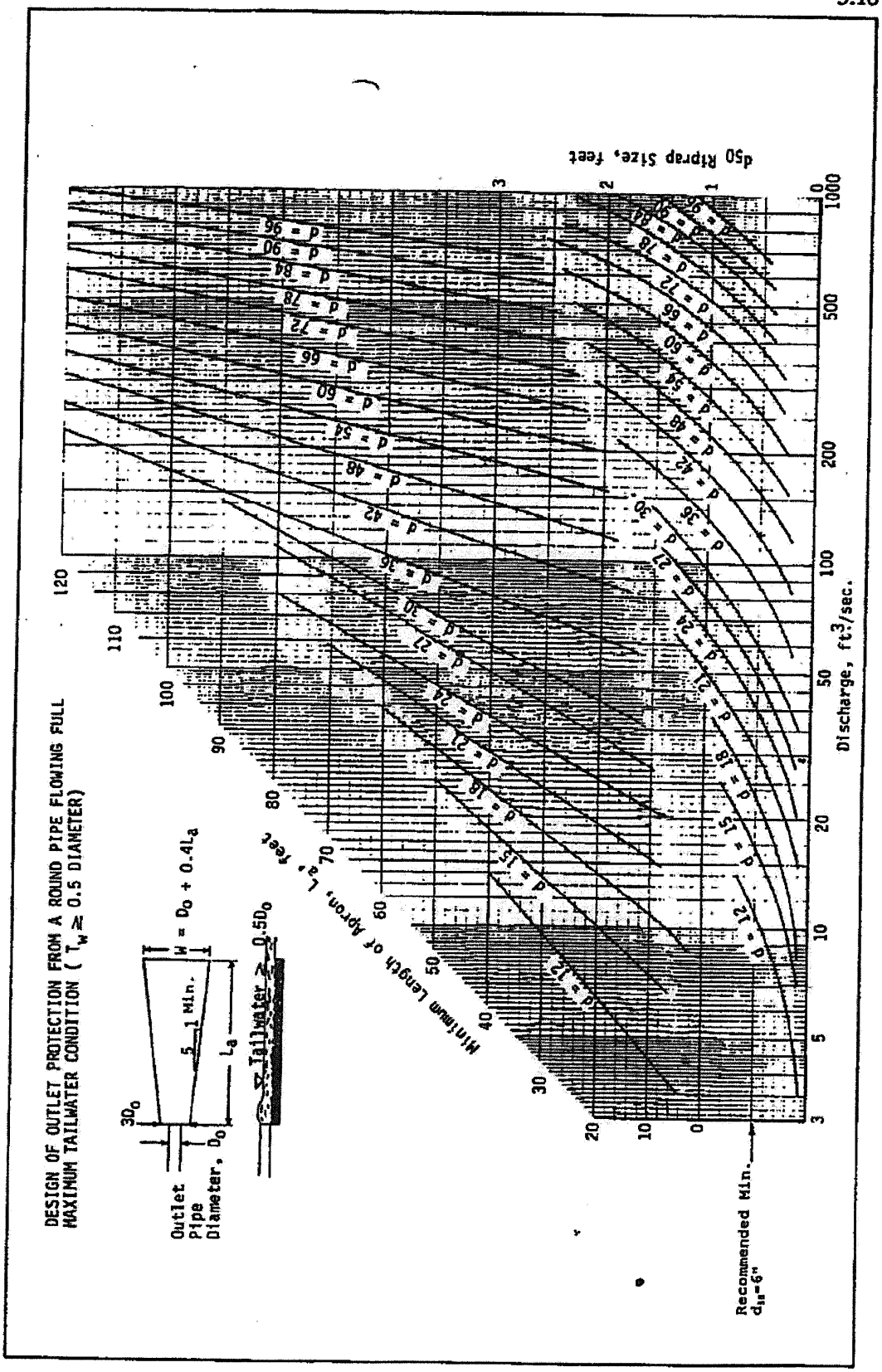
STANDARD 1 - DRAINAGE OUTFALL RIPRAP APRON SIZING

INFILTRATION CHAMBERS OUTLET PIPE	Flow Rate (cfs)	Min. Stone Diam. (in)*	Apron Length (ft)*	Apron Width (Upstream)*	Apron Width (Downstream)*
INFILTRATION CHAMBERS OUTLET PIPE***	5.21	6	8	3	9

*Minimum Stone Diameter, Riprap Apron Length, and Riprap Apron Width were determined by USDA-NRCS Outlet Protection Spec 3.18, dated 1992. See attached nomographs from applicable sections.

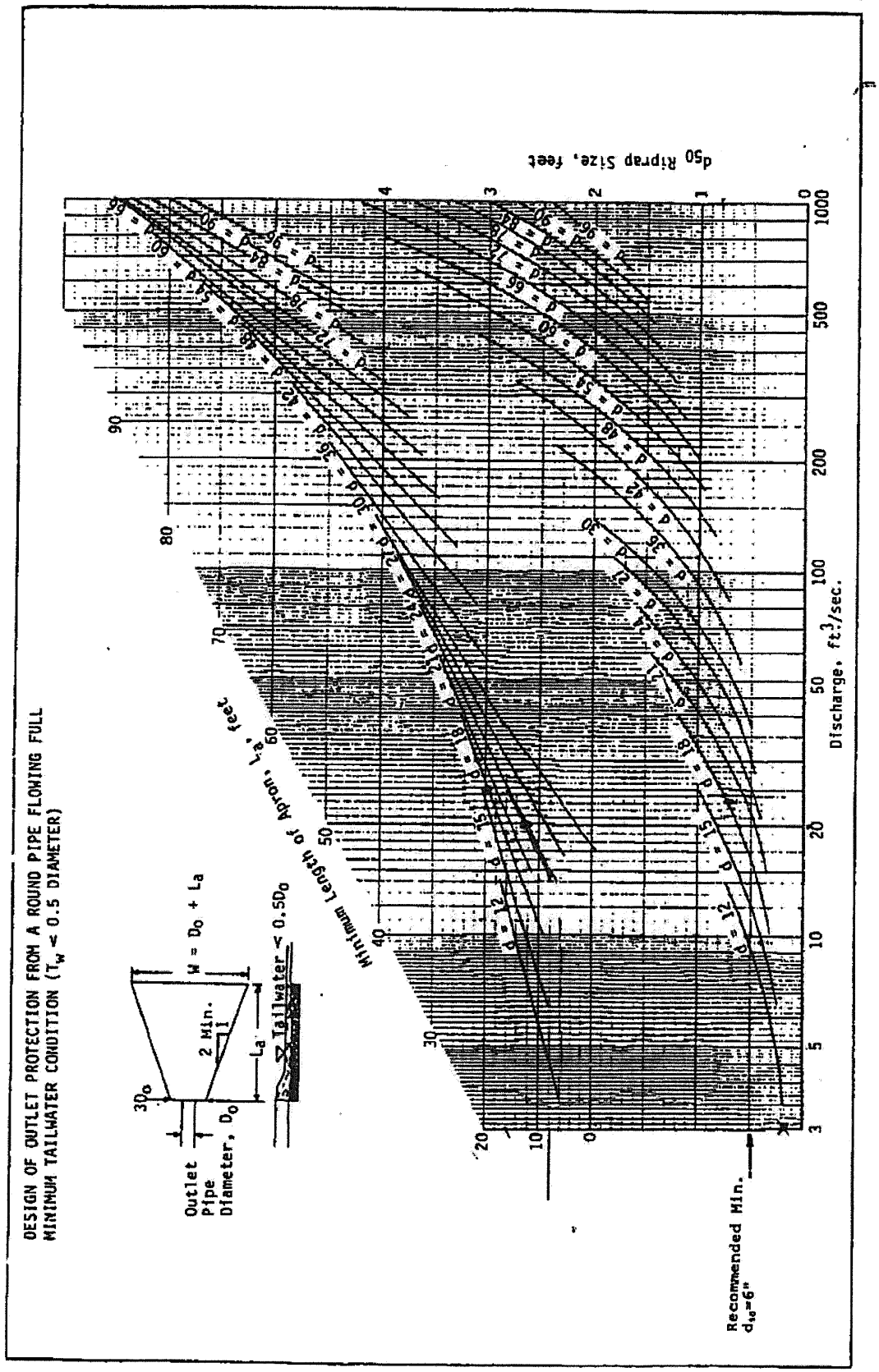
**All outlets designed for 100-year storm flow conditions. Outlets assumed to be below water during design storm flows, therefore, maximum tailwater design calculations were used.

***Outlets assumed to be discharging to grassy slope with no tailwater during design storm flows, therefore, minimum tailwater design calculations were used.



Source: USDA-SCS

Plate 3.18-4



Source: USDA-SCS

Plate 3.18-3

Appendix G

Cultec Separator Row
Performance Verification Statement

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Cultec Separator Row™ Filtration System

Developed by Cultec, Inc.
Brookfield, Connecticut, USA

In accordance with

ISO 14034:2016

Environmental management —
Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 15, 2018
Vancouver, BC, Canada

GLOBE PERFORMANCE SOLUTIONS

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

Cultec Recharger and Contactor chambers are used for infiltration, detention and/or retention of stormwater underground. The system is comprised of thermoplastic arch-shaped chambers surrounded by clear crushed stone. Water enters the system through a Separator row and then flows through the stone and into a Chamber row prior to exiting. The Cultec stormwater system is sized based on the volume of stormwater which is stored in the voids created by the chamber and the voids in the clear stone surround, with a void ratio of 40%. The entire system is wrapped in a non-woven geotextile and/or impermeable geomembrane. In order to minimize fine particles and silts from blinding the voids in the clear stone surround, a single chamber row is wrapped in non-woven geotextile and placed on a woven geotextile. This row is connected to the inlet pipe of the Cultec system providing a filtration function as the surface stormwater run-off passes through the geotextile wrapped inlet row. Sediment is trapped within the Cultec Separator Row™ and may be removed through back flushing of this row. A typical system installation is illustrated in Figure 1 and Figure 2 below.

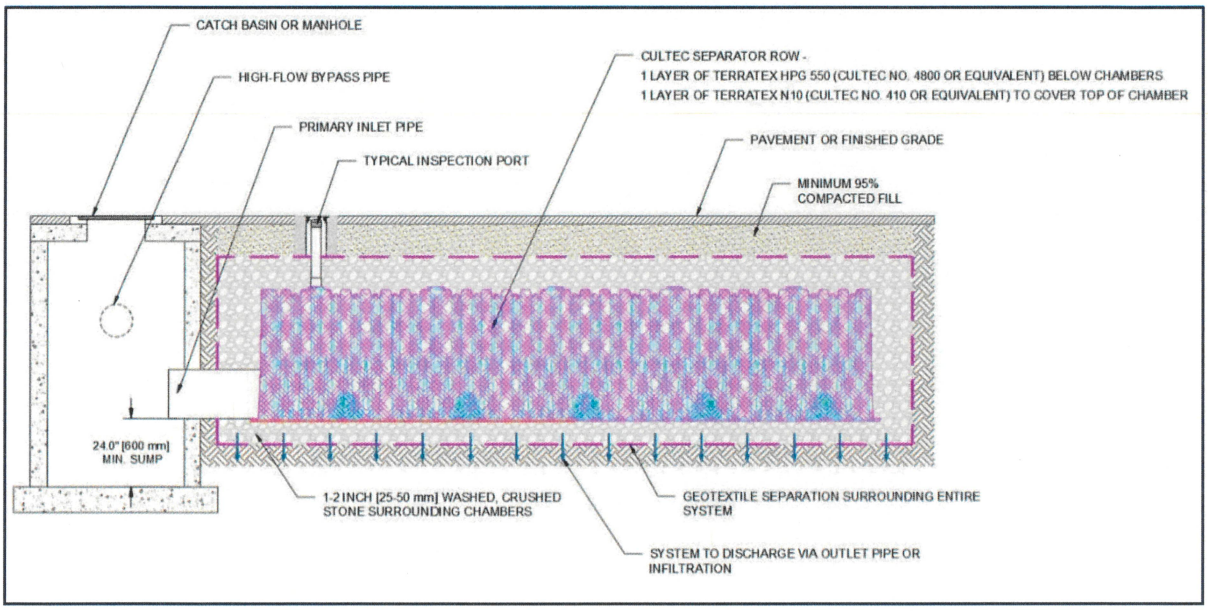


Figure 1: Cultec Separator Row™ Filtration System – Cross-Sectional View

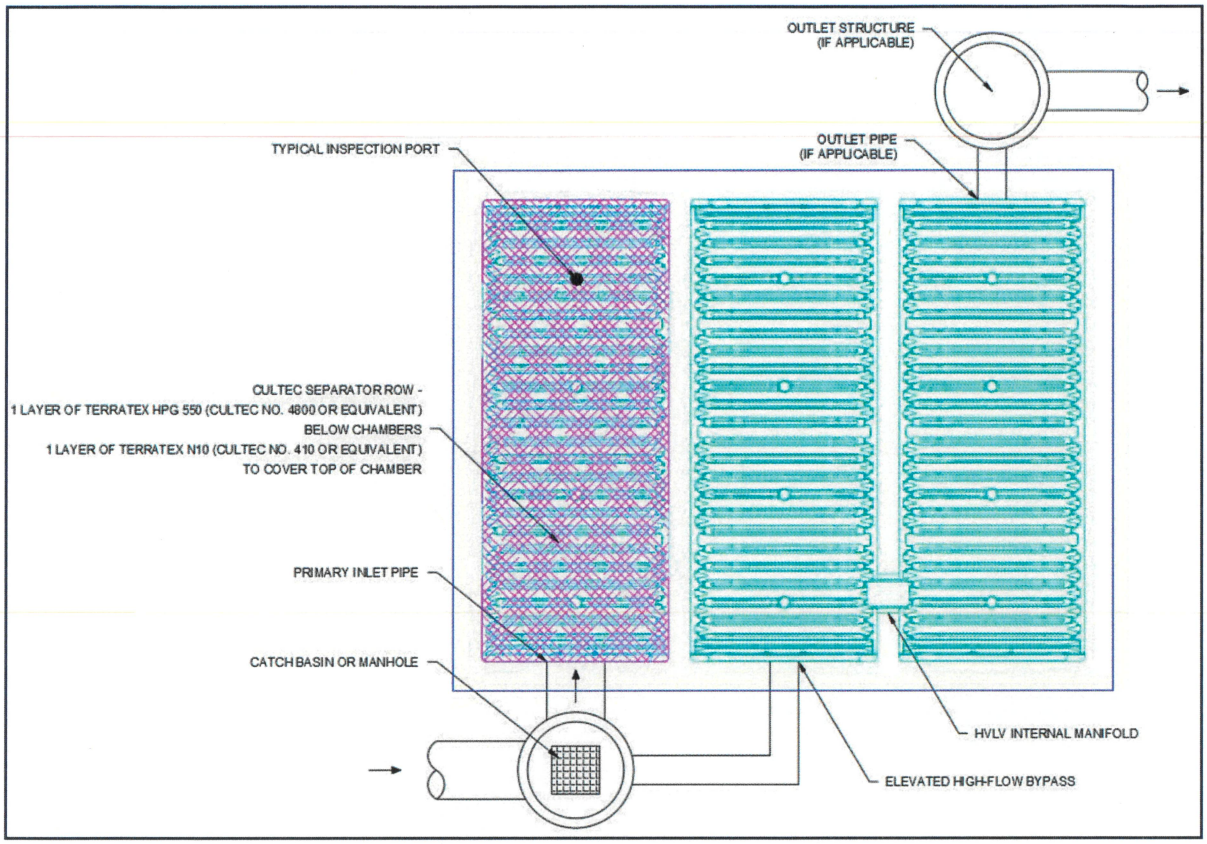


Figure 2: Cultec Separator Row™ Filtration System – Plan View

Performance conditions

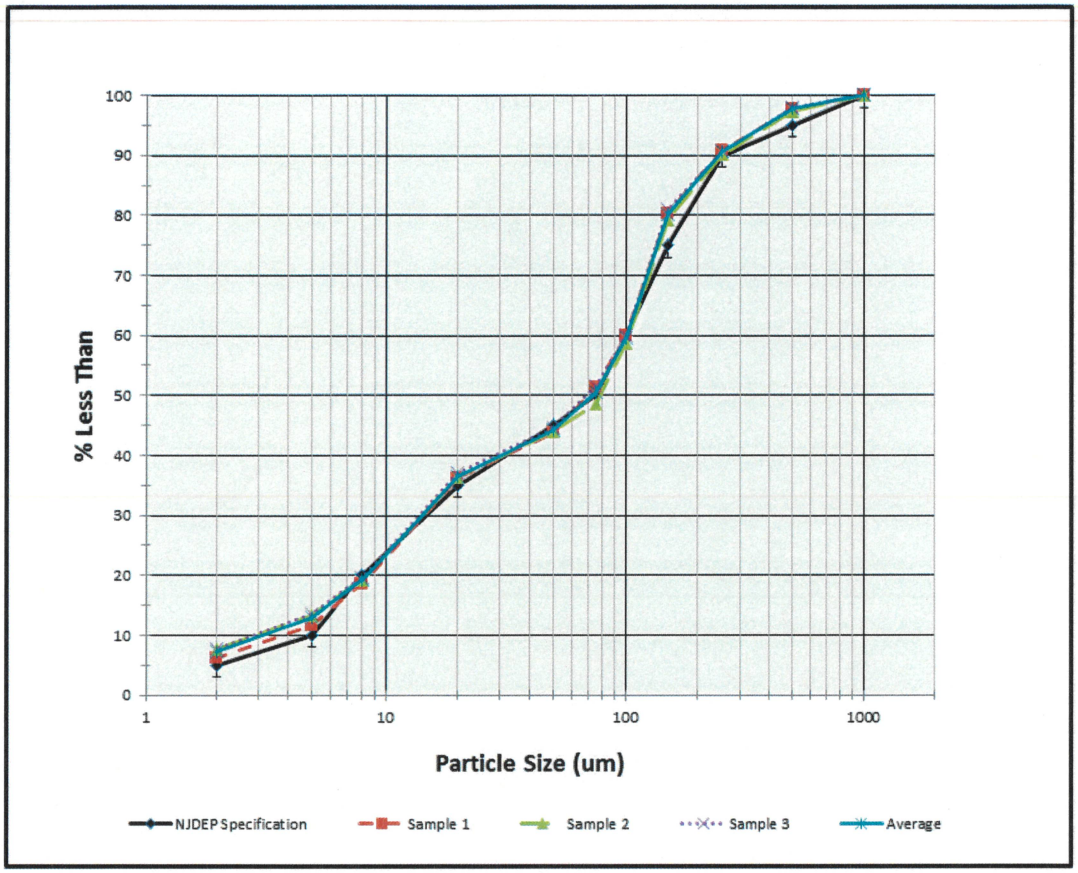
The data and results published in this Verification Statement were obtained from the testing program conducted on the Cultec Separator Row™ in accordance with a technology specific test plan (TSTP) developed and approved by the client and test lab (Good Harbour Laboratories, Mississauga, Ontario), and reviewed by Verification Expert and Verifying Organization, in compliance with ISO/IEC 14034. A copy of the testing procedures contained in the TSTP may be accessed at the following website: https://www.goodharbourlabs.com.

Performance claims

When installed with Terratex HPG 550 and Terratex N10 geotextiles, and tested with silica sediment having a particle size distribution conforming to the *Canadian Environmental Technology Verification Program Procedure for Laboratory Testing of Oil-Grit Separators*, the Cultec Recharger® 150XLHD Separator Row™ will remove at least the following fractions of suspended sediment at the corresponding flow rates: 80% at 24 gpm, 77% at 49 gpm, 73% at 73 gpm, 70% at 97 gpm, and 65% at 121 gpm. These performance claims are verified statistically at a 95% level of confidence.

Performance results

TEST SEDIMENT PARTICLE SIZE DISTRIBUTION IN RELATION TO SPECIFIED PSD



SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 24 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	39.6	38.7	39.2	39.8	39.1	39.5	41.7	41.9	41.1	42.4	43.2	41.6	40.8	41.1	41.6
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	37.6	36.7	37.2	37.8	37.1	37.5	39.7	39.9	39.1	40.4	41.2	39.6	38.8	39.1	39.6
Average Adjusted Effluent Concentration					38.8 mg/L			Removal Efficiency					80.2%		

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 48 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	47.1	47.0	47.1	46.8	47.3	47.3	49.0	50.1	49.5	50.4	49.1	50.2	52.2	49.7	51.8
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	45.1	45.0	45.1	44.8	45.3	45.3	47.0	48.1	47.5	48.4	47.1	48.2	50.2	47.7	49.8
Average Adjusted Effluent Concentration					47.0 mg/L			Removal Efficiency					76.9%		

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 73 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	54.3	55.2	53.3	53.8	55.8	55.8	55.3	54.5	53.5	56.2	56.4	56.5	58.4	56.8	57.7
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	52.3	53.2	51.3	51.8	53.8	53.8	53.3	52.5	51.5	54.2	54.4	54.5	56.4	54.8	55.7
Average Adjusted Effluent Concentration					53.6 mg/L			Removal Efficiency					73.3%		

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 97 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	58.4	59.4	59.0	61.2	61.6	61.1	58.9	60.4	59.9	63.9	63.3	62.5	61.9	61.0	61.0
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	56.4	57.4	57.0	59.2	59.6	59.1	56.9	58.4	57.9	61.9	61.3	60.5	59.9	59.0	59.0
Average Adjusted Effluent Concentration					58.9 mg/L			Removal Efficiency					70.0 %		

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 121 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	72.0	72.8	71.7	72.1	70.1	72.1	69.3	72.3	77.2	71.0	70.7	72.7	71.1	70.4	73.0
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	70.0	70.8	69.7	70.1	68.1	70.1	67.3	70.3	75.2*	69.0	68.7	70.7	69.1	68.4	71.0
Average Adjusted Effluent Concentration					69.9 mg/L			Removal Efficiency					65.3%		

*Note: This data point was considered to be a significant outlier and was therefore omitted as part of the overall statistical calculations to verify performance at a 95% level of confidence.

Verification

This verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Cultec, Inc. to support the performance claim included the final test report prepared by Good Harbour Laboratories of Mississauga, Ontario and dated November 9, 2017. The test report is based on testing completed in compliance with the requirements of ISO/IEC 17025.

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Cultec Separator Row™ Filtration System please contact:

Cultec, Inc.
878 Federal Road
Brookfield, CT
06804 USA
Tel: 203.775.4416 / Toll Free: 1.800.4.CULTEC
custservice@cultec.com
www.cultec.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

Appendix H

Stormwater Management System
Long-Term Operation & Maintenance (O&M) Plan

STORM WATER MANAGEMENT SYSTEM
LONG-TERM OPERATION & MAINTENANCE PLAN

December 6, 2022

Proposed Multifamily Residences
#778 Main Street
Leicester, MA

Prepared For:
Charlton Road Realty, LLC.
25 Waterville Lane
Shrewsbury, MA 01545

Prepared By:
CMG Environmental, Inc.
67 Hall Road
Sturbridge, MA 01566
Phone: (774) 241-0901

CMG ID 2021-226

TABLE OF CONTENTS

TABLES

ATTACHMENTS

Long Term Operation & Maintenance Plan
Site Stormwater Management System
#778 Main Street
Proposed Multifamily Residences
LEICESTER, MA

Operation and Maintenance (O&M) Plan

The purpose of this Storm Water Management System Operation and Maintenance Plan is to prevent erosion, sedimentation, pollution or other deterioration of the storm water management system and resource areas located on and adjacent to the site property located at **#778 Main Street in Leicester, MA** (the "Site"). The storm water management system shall be maintained properly to assure its continued performance.

Responsible Party:
Charlton Road Realty, LLC.
25 Waterville Lane
Shrewsbury, MA 01545
p. (413) 593-1900

Storm water Management System Owner: **(same as above)**

Site subject to Wetlands Protection Act: **YES**

The "Responsible Party" Shall:

- Prepare and submit an **"Operation and Maintenance (O & M) Compliance Statement" (see Attachment #1)** upon completion of site construction activities.
- Implement the routine and non-routine operation, maintenance, and inspection tasks in accordance with the procedures specified in this document to ensure that all storm water management systems function as designed;
- Maintain a log of all operation and maintenance (O & M) activities for the last five (5) years, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and disposal location);
- Make this log available to **Town of Leicester** official representatives upon request;
- Agree to notify in writing all "future property owners" of the presence of the storm water management system and the requirement for proper operation and maintenance.

"Charlton Road Realty, LLC." maintains a contract with the following companies:

Landscaping & Pavement Maintenance: _____

Snow Removal & Plowing: _____

Storm Water System Maintenance: _____

Table No. 1
#778 Main Street, Leicester, MA
Proposed Multifamily Residence

STORMWATER SYSTEM INSPECTION AND MAINTENANCE SCHEDULE		
Best Management Practice (BMP)	**Inspection Frequency**	**Maintenance Frequency**
STRUCTURAL BMPs		
DEEP-SUMP HOODED CATCH BASIN	Four (4) Times/ Year At end of foliage & snow removal seasons	Remove Sediment if Sediment Depth Reaches 50% of Sump as Min 2 Times per Year (End of Foliage & Snow Removal Season)
CULTEC SEPARATOR ROW	Bi – Annual (Early Spring & Late Fall)	Refer to Manufacturer's Recommendations
UNDERGROUND INFILTRATION CHAMBERS	Bi-Annual (Early Spring & Late Fall)	Refer to Manufacturer's Recommendations
POROUS PAVEMENT	Regularly Monitor to Verify Proper Drainage	Vacuum surface of porous pavement at least once a year. Maintain abutting landscape areas to deter siltation of the porous pavement area.
8" OUTLET PIPES Rip-Rap Apron	Four (4) Times / Year	Remove Sediment Four (4) Times / Year (Including End of Foliage & Snow Removal Seasons)
NON-STRUCTURAL STORMWATER CONTROLS		
Landscaping	Four (4) Times / Year	Seasonally As Needed
Roadway / Driveway Sweeping	One (1) Time /Year	Seasonally As Needed
Snow Removal	Seasonally As Needed	In Accordance with M.G.L. Title XIV. Public Ways and Works; Chapter 85

STRUCTURAL STORMWATER BMP MAINTENANCE:

Deep Sump Catch Basin(s):

- Inspect catch basin(s) at least four (4) times per year, including the end of the foliage and snow removal seasons.
- Inspection shall occur by probing the structure with a rod to determine the depth of accumulated sediment.
- Sediments must be removed whenever the depth of sediment is greater than or equal to one half of the depth from the bottom of the invert of the lowest pipe in the basin. At a minimum, cleaning shall occur twice a year during the spring and fall.
- The structure will be cleaned of water and sand/debris with the use of a vacuum truck. Material removed from the structure will be disposed of legally off-site by the vendor.
- Unless there is evidence that they have been contaminated by a spill or other means, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste.

Cultec Separator Row

- Inspect Separator Rows bi-annually using the installed inspection ports.
- Utilizing the JetVac process, remove accumulated sediment or pollutants in the separator row. See the attached Cultec Operation and Maintenance Plan for more details regarding the JetVac process and monitoring procedure.

Underground Infiltration Chambers

- Inspect inlet at least twice a year and remove any debris that may clog the system.

Porous Pavement

- Minimize salt use during winter months. Sanding shall not be used during winter months.
- Keep landscape areas well maintained to prevent soil from being transported onto the pavement.
- Clean the surface using vacuum sweeping machines.
- Regularly monitor the paving surface to make sure it drains properly after storms. Inspect the surface annually for deterioration or spalling.
- Porous pavement shall not be sealed or repaved with any impervious material.

Rip-rap Apron Outlets

- Inspect regularly, especially after large rainfall events;
- Note and repair any erosion & sediment buildup at the Rip-Rap outlet protection.

NON- STRUCTURAL STORM WATER MANAGEMENT CONTROLS:

<u>Non-Structural Control Measures & Stormwater Treatment</u>

Landscape & Pavement Maintenance:

- **No debris, refuse or other materials,** including but not limited to landscaping debris, leaves, shrubs and tree trimmings, logs, bricks, stone or trash shall be deposited within the vegetated wetland.

- The use of pesticides, herbicides, and fertilizers on the site shall be minimized to the extent practicable and shall be applied in accordance with manufacture recommendations by experienced and if applicable, licensed personnel.

- Pavement areas will be swept seasonally as necessary to remove accumulated winter sand and salt and fall leaves, and shall be swept as required to remove litter. Collected material will be properly disposed of off-site.

Trash Removal

- Inspect on-site area for litter and trash as needed. Any accumulated trash, litter, and discarded materials in this area will be removed and will be disposed of at a suitable location on a weekly basis.

HAZARDOUS WASTE / OIL SPILL RESPONSE PROCEDURE

Initial Notification. In the event of a spill of hazardous waste or oil the facility manager or supervisor will be notified immediately by telephone.

Assessment – Initial Containment. The supervisor or manager will assess the incident and initiate control measures. The supervisor will first contact the **Town of Leicester Fire Department** and then notify the **Town of Leicester Police Department**. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Fire Department Telephone: 911 (Emergency); (508) 892-7022 (Non-Emergency)

Police Department Telephone: 911 (Emergency); 508-892-7010 (Non-Emergency)

Further Notification. Based on the assessment by the Fire Chief, additional notification to a clean up contractor may be made. The Massachusetts Department of Environmental Protection and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of clean up and notification required.

SNOW MANAGEMENT PLAN:

- No snow storage shall be located within or "deposited" within wetland resource areas on or off-site.

- No salt shall be used to treat unpaved areas during snow and ice conditions. The storage of all "de-icing" chemicals and treatment products is to be inside the building.

- If Site snow storage interferes with driveway maneuvers or sight distances (i.e. blocking of travel aisles, sight distance, or parking) the snow pile will be either removed or reduced legally in a legal manner by the snow plow vendor within 24-hours.
- Pavement areas will be swept seasonally as necessary to remove accumulated winter sand and salt and fall leaves, and shall be swept as required to remove litter. Collected material will be properly disposed of off-site.

INSPECTIONS / RECORDKEEPING:

Routine Inspections:
Routine inspections and maintenance to be conducted with the frequency described in this Operation and Maintenance Plan. All repairs and maintenance activities regarding the stormwater management system should be recorded and provided to the Leicester Planning Board upon request. An example inspection form is provided in **Attachment #3**.

Recordkeeping
Records of all drainage system inspections and maintenance shall be kept on file for a period of at least **three (3) years.**

PUBLIC SAFETY FEATURES:

- All cast iron storm water structure grates and covers shall be kept in good condition and kept closed at all times. Any damaged or broken structures will be replaced immediately upon discovery;

Attachment #1

Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement
Site Storm Water Management System
#778 Main Street
Proposed Multifamily Residences
LEICESTER, MA

Responsible Party:
Charlton Road Realty, LLC.
25 Waterville Lane
Shrewsbury, MA 01524
p. (774) 696-3288

Storm Water Management System Owner: (same as above)

Site subject to Wetlands Protection Act: YES

The above listed "responsible party" is responsible for implementation of this "Long-Term Operation and Maintenance Plan" and certifies that:

- The site has been inspected for erosion and appropriate steps have been taken to permanently stabilize any eroded areas;
- All aspects of storm water BMPs have been inspected for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the storm water at the site may be managed in accordance with:
    - MA-DEP Stormwater Management Standards, revise date January 2, 2008;
- There is no record or knowledge of illicit discharges to the on-site stormwater management system;
- All "future property owners" must be notified of their continuing legal responsibility to operate and maintain the Site Stormwater Management System.
- The "Long-Term Operation and Maintenance Plan" for the storm water BMPs is being implemented.

Signature of Responsible Party:

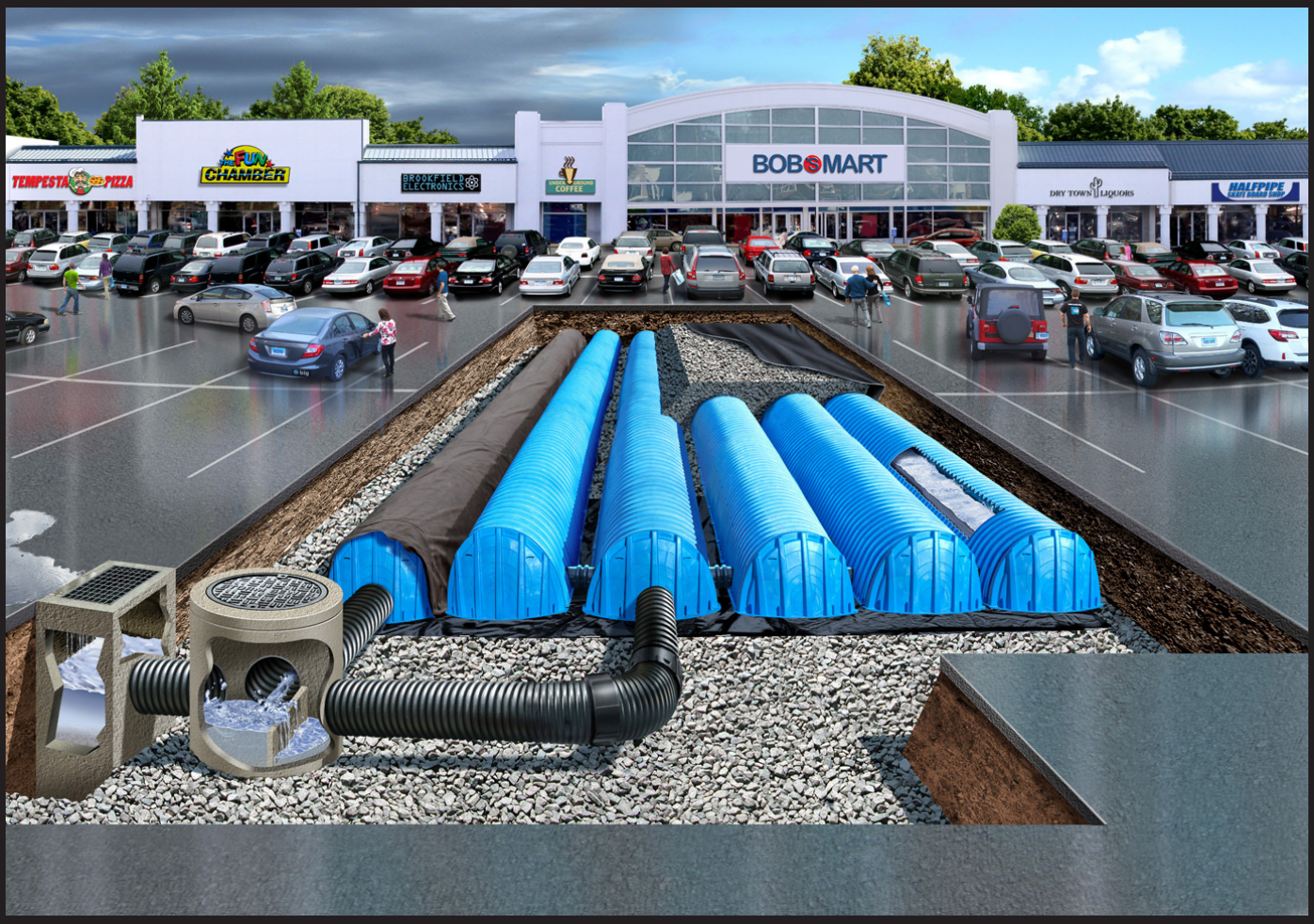
_____ _____
Charlton Road Realty, LLC. Date

Attachment #2

Cultec Separator Row
Operations & Maintenance Manual

CULTEC SEPARATOR™ ROW

WATER QUALITY SYSTEM



OPERATION & MAINTENANCE GUIDE

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

GLOBE VERIFIED VÉRIFIÉ

STORMWATER MANAGEMENT SOLUTIONS

CULTEC®

Inspection and Maintenance

CULTEC recommends inspection of the Separator Row to be performed every six months for the first year of service. Future inspection frequency can be adjusted based upon previous inspection observations. However annual inspections are recommended. Inspection of the Separator Row can be achieved via an inspection port riser installed during construction. This inspection port riser will connect the top of the Separator Row chambers to finished grade with a removable lid. Alternatively the Separator Row may be inspected via the manhole(s) located at the end(s) of the Separator Row. However this method of inspection requires confined space entry. If entry into the manhole is required, all local and OSHA rules for confined space entries must be strictly followed.

To inspect:

- Remove the inspection port lid from the floor box frame.
- Remove the riser pipe cap.
- With a flashlight and stadia rod, measure the depth of sediment.
- Record results in a maintenance log.
- When depth of sediment exceeds 3” (76 mm), use the JetVac procedure described below.

The JetVac process utilizes a high pressure water nozzle controlled from the surface. The high pressure nozzle is introduced down the Separator Row via the access manhole(s). The high pressure water cleans all sediment and debris from the Separator Row as the nozzle is retrieved. Captured pollutants are flushed into the sumped access manhole for vacuuming. This process is repeated until the Separator Row is completely free of sediment and debris. A small diameter culvert cleaning nozzle is recommended for this procedure.

High pressure water nozzle

Cleaning Separator Row and pipes with high pressure water nozzle

SEPARATOR ROW: Separator Row prior to cleaning

ADJACENT ROW: When the Separator Row is working properly, the adjacent rows will not show signs of sediment.

Inspection and Maintenance Record

Date	Mode of Access	Frequency	Depth of Sediment	Actions	Expenses	Inspector	Notes
Ex.	Inspection Port	Semi-annually	2”	Measure sediment depth with stadia rod. Visually inspect	$100	DPG	Depth of Sediment was measured via Northeast Inspection Port Adjacent to MH-1. Sediment depth was found to be 2”. No further action required at this time.
Ex.	Access Manhole	Annually					

Attachment #3

Stormwater Management System
Quarterly Inspection Form

Inspection Form - Storm Water Management System
Proposed Multifamily Residences
#778 Main Street, Leicester, Massachusetts

QUARTERLY INSPECTION AND MAINTENANCE REPORT

Jan.-Mar. Apr.-Jun. July-Sep. Oct. – Dec.

Note: This Log should be copied prior to use. Note Additional Comments on back of Form.

Inspector's Name: _____ Date: _____ Time: _____ am/pm

Inspector's Qualifications: _____

Days Since Last Rainfall: _____ Amount of Last Rainfall: _____ inches

Item/Condition to be Checked	Maintenance Required		Corrective Action & Date
	No	Yes	
Catch Basins			Clean Unit Twice /Year or After Spill Event
Cultec Separator Row			
Underground Infiltration Chambers			
Porous Pavement			
Rip-Rap Aprons			
SPILL KIT			
Parking Lot / Driveway Sweeping			*Sweep Seasonally – As Needed
Landscaping / Trash Removal			
Snow Removal (seasonal)			*All De-icing chemical storage to be inside building

Additional Comments: _____