

March 24, 2026

Reading Conservation Commission
16 Lowell Street
Reading, MA 01867

Re: Notice of Intent
281 Main St, Reading, MA 01867
Parcel ID: Map: 12, Parcel: 42

Dear Reading Conservation Commission,

Goddard Consulting LLC is pleased to submit this Notice of Intent (NOI) on behalf of the Applicant, 281Reading LLC, for the property known as 281 Main St (Map 12, Parcel 42), located in Reading, MA. The Applicant is filing a Notice of Intent for the proposed re-development of the existing two-story building and parking area on-site within a previously disturbed 200-foot Riverfront Area. The project will consist of retail/commercial use with ground level parking and residential units above. The project has been designed to locate the proposed structures to the maximum distance practicable from the on-site perennial stream, and to reuse existing degraded areas. The project has been additionally designed to maintain the existing limits of paved and developed areas within the Riverfront Area.

The project has been designed to fully comply with the local 25-Foot Zone of Natural Vegetation (No-Disturb Zone) and 35-Foot No-Structure Zone established under the local wetland bylaw, as well as Riverfront Redevelopment Standards under 310 CMR 10.58(5). This application is being filed under the Massachusetts Wetlands Protection Act (the WPA), Regulations 310 CMR 10.00 et. al, and Chapter 650, The Town of Reading Wetlands Protection Regulations (the Bylaw).

A list of enclosed documents is as follows:

- NOI Application (WPA Form 3)
- Restoration & Mitigation Exhibits, Goddard Consulting LLC., 3/12/2026
- MassDEP NOI Wetland Fee Transmittal Form
- Local Filing Fee Calculation Form
- Notice of Intent Submittal Checklist, Reading Conservation Commission
- Affidavit of Service, Abutter Notification, Certified Abutters List
- *Wetland Border Report, 281 Main St, Reading, MA*, Goddard Consulting, LLC., 10/23/2025
 - DEP Bordering Vegetated Wetland Determination Form
 - Orthophoto of Locus Site, Goddard Consulting LLC, 10/22/2025
 - NRCS Soils Survey of Locus Site, Goddard Consulting LLC, 10/22/2025
 - FEMA Flood Map of Locus Site, Goddard Consulting LLC, 10/22/2025
 - USGS Map of Locus Site, Goddard Consulting LLC, 10/22/2025
- *Civil Site Plans for Mixed-Use Building: Retail and Residential 281 Main Street (Map 42 Lot 12), Reading, MA*, prepared by Allen & Major Assoc. Inc. Dated March 11, 2026
- *Drainage Report*, Allen & Major Assoc. Inc. Dated February 27, 2026

1.0 Existing Conditions

The site of the proposed project consists of an approximately 0.77-acre lot, known as 281 Main Street in Reading, MA. The site is bordered by Main Street to the west, an unnamed perennial stream and residential uses to the east, and additional commercial properties to the north and south. The site is currently developed with a two-story building, a 28-space parking lot, and landscaped/hardscaped areas surrounding the development. The rear portion of the site is generally wooded and undeveloped, and is bound by a perennial stream to the east. The perennial stream located in the eastern section of the site has no wetlands or jurisdictional FEMA flood zone associated. An elevated walking trail exists along the edges of the stream channel, notably bisecting the hydrology and creating a well-defined channel downgradient. As a result, the only wetland resources on the site are the Mean Annual High Water and Bank of the stream, and the 100-Foot and 200-Foot Riverfront Areas, which extends over much of the site (refer to attached Wetland Border Report by Goddard Consulting for detailed delineation information). Additionally, the Town of Reading regulates a 25-Foot Zone of Natural Vegetation (No-Disturb Zone) and 35-Foot No-Structure Zone from the Bank of the stream.

According to the MassGIS data layers for the Natural Heritage & Endangered Species Program (NHESP), the locus site is not located within Estimated Habitat of Rare Species or Priority Habitat of Rare Wildlife. The site does not fall within an Area of Critical Environmental Concern (ACEC), FEMA Flood Zone, or Outstanding Resource Waters (ORW) area. No mapped certified or potential vernal pools exist on site.

The MA Wetlands Protection Act and the Town of Reading take jurisdiction over the 200-ft Riverfront Area. The Town of Reading, through their Wetlands Protection Bylaw, as noted, additionally regulates a 25-Foot No-Disturb Zone and a 35-Foot No Structure Zone.



Figure 1: Oblique aerial image of the site (2022) displaying the limits of developed areas.

2.0 Project Summary

As outlined above, the project proposes the re-development of the existing two-story building and parking area on-site within a previously disturbed 200-foot Riverfront Area. Because the site contains existing developed and degraded riverfront areas, the project has been designed as a riverfront area redevelopment project pursuant to 310 CMR 10.58(5). The proposed project is the replacement of the two-story building with a four-story mixed-use building. The new building will consist of ground floor commercial development with residential units above. The existing parking and landscaped areas will be reconfigured to work with the new building design. As a result, the proposed development will be located entirely within the footprint of existing degraded and otherwise disturbed riverfront area. Work proposed includes the conversion of maintained areas to landscaped mitigation areas, and improvements to the site's stormwater management system. The proposed development will not be closer to the perennial stream than the existing development. No work is proposed within the 25-ft no disturb zone so that all existing natural vegetation located in this area will remain and no new structures are proposed within the 35-ft no structure zone.

	Existing Degraded	Proposed Degraded	Net Change
Inner Riparian Zone (0-100' RFA)	2,775 SF	2,950 SF	+ 175 SF
Outer Riparian Zone (100-200' RFA)	11,710 SF	13,710 SF	+ 2,000 SF
Entire 0-200' Riverfront Area	14,485 SF	16,660 SF	+ 2,175 SF

Table 1. Approximate existing and proposed degraded riverfront area

Increase in Degraded	+ 2,175 SF
Proposed Restoration (1:1)	- 540 SF
Remaining Increase in Degraded	+ 1,635 SF
Required Mitigation (2:1)	1,635 SF x 2 = 3,270 SF
Proposed Mitigation	3,275 SF

Table 2. Approximate proposed and Required Restoration and Mitigation

2.1 Tree Removal and Replacement

As noted on the attached existing condition plan, the project will require the removal of two landscape trees, one of which is 12" DBH, and the other of which is a triple-stem tree of approximately 15". Only the one 12" DBH landscaped tree is located within the 200-Foot Riverfront area, while the 15" multi-stem tree is located outside of all jurisdictional buffer zones. To mitigate for this tree removal, the applicant proposes the installation of 25 new trees (15 deciduous at 3-inch dbh and 10 evergreens at 7-8-feet) which far exceeds the local tree replacement policy of 1:1. Furthermore, 24 of the 25 trees are proposed within the limits of the jurisdictional buffers.

2.2 Proposed Erosion Control Measures

The applicant proposes erosion control barriers in the form of 12-inch diameter mesh tubes with natural filter media made by Filtrexx (or approved equal) located at the limit of work, along with a silt fence for additional control.

These erosion controls will ensure the resource area is protected against sedimentation during construction. The erosion control barrier will remain throughout the project to protect downgradient resource areas and will not be removed until the project is completed, and the site is

stabilized. Erosion controls will also be installed around stockpile areas. A stabilized construction entrance is also proposed in order to limit the potential for vehicles to track sediment into the roadway.

2.3 Stormwater Management

A robust stormwater management system is proposed to ensure compliance with the MA Stormwater Management Standards. Proposed stormwater management measures consist of deep sump catch basins, water quality units, drain manholes, roof drains, area drains, and underground piping and infiltration chambers. The proposed underground infiltration system comprised of 38 Stormtech chambers with an isolator row will collect the vast majority of stormwater runoff from the proposed development. Additional runoff will be infiltrated by a 1000-gallon drywell at the rear of the parking area. Across all design storms, proposed flows and volumes are reduced from the existing condition, by no less than 87%, and in some cases as much as 100%. A full stormwater report has been provided, prepared by the project's civil engineers, Allen & Major Associates.

3.0 Regulatory Compliance

This project will comply with the regulations set forth in the Massachusetts Wetlands Protection Act, Regulations 310 CMR 10.00 et. al, and Chapter 650, The Town of Reading's Wetlands Protection Regulations.

The project has been laid out to minimize Riverfront Area impacts to the greatest extent feasible. The project has been designed to fully comply with the 25-Foot No Disturb Zone and 35-Foot No Build Zone, as set forth by the Town of Reading's Wetlands Protection Regulations. Erosion controls are proposed upgradient of the 25-foot ZNV and 35-Foot No Build Zone to demarcate the limit of work and provide protection the downgradient resource areas during construction. All proposed structures are located greater than 35 feet from the Mean Annual High-Water line of the perennial stream, which is the start of the 200-ft Riverfront Area cast onto the property.

3.1 25-foot Zone of Natural Vegetation (Bylaw)

The project has been designed to maintain the 25-Foot Zone of Natural Vegetation (ZNV) as established under the local wetland ordinance. The Town of Reading Wetlands Protection Bylaw States:

*“Bordering any wetland, the Commission shall require a Zone of Natural Vegetation (ZNV) or No-Disturb Zone of sufficient width and vegetative community type to assure that silt, soil, fertilizer in solution, organic chemicals, herbicides, organic manures, oils or petroleum products which may be carried by surface run-off shall not reach that wetland, but instead will be trapped by the natural mulch, soil and roots; and that light levels and temperature shall be moderated; and that dispersal of seeds of exotic or otherwise disruptive plant species, such as phragmites reed and purple loosestrife (*Lythrum salicaria*) shall be avoided; and that other alterations shall be avoided or mitigated within the wetland. 2 Under most conditions, a zone width of a minimum of twenty-five feet would be considered sufficient to accomplish this purpose. A wider ZNV may be required, depending on specific site conditions, such as grades, soil permeability or other impact potential, including but not limited to potential vernal pools, as defined in Section 3J2 of these regulations”*

At present, the 25-foot ZNV on the subject property is undeveloped, where a natural wooded buffer exists upgradient of the bank of the perennial stream. The erosion control barrier is proposed

upgradient of the 25-foot ZNV to provide a permanent limit of work, protecting the downgradient resource areas during construction. Absolutely no work is proposed within the 25-foot ZNV across any portion of the project.

3.3 35-foot No Structure Zone (Bylaw)

The project has been designed to maintain the 35-Foot No Structure Zone as established under the local wetland regulations. The Town of Reading Wetlands Protection Bylaw States:

“No new structures or fixtures that may not require a building permit, including, but not limited to, foundations, footings, frost walls, retaining walls, pools and pool equipment, fences, patios, sports courts, driveways, sheds, or other in-ground fixtures, shall be permitted within ten feet of the ZNV. Depending on special site conditions, a greater distance may be required. The ZNV as otherwise defined in this Section 3D, plus this “ten feet” or “greater distance,” may be referred to as the “No Structure Zone.” Associated structures, including but not limited to the following: cantilevered structures, bay windows, eaves, and garrisons, or other overhangs, may protrude to no closer than seven feet from the ZNV.”

As outlined above, at present, the 35-Foot No Structure Zone on the subject property is undeveloped, with no impervious surface cover within. Proposed work will not impact the 35-foot No Structure Zone.

3.4 Riverfront Area (WPA)

Because the site is comprised of existing degraded riverfront area, the project has been designed as a redevelopment project compliant with 310 CMR 10.58(5). Work proposed within the riverfront area is situated no closer to the stream than the closest point of existing development. Restoration and mitigation are proposed within the riverfront area, creating naturally vegetated areas within the existing development where none currently exist.

Riverfront Area:		
§ 10.58	The area of land between a river’s mean annual high-water line and a parallel line measured horizontally	
Performance Standard	Compliance	
10.58 (5)	<p><i>Notwithstanding the provisions of 310 CMR 10.58(4)(c) and (d), the issuing authority may allow work to redevelop a previously developed riverfront area, provided the proposed work improves existing conditions. Redevelopment means replacement, rehabilitation or expansion of existing structures, improvement of existing roads, or reuse of degraded or previously developed areas. A previously developed riverfront area contains areas degraded prior to August 7, 1996 by impervious surfaces from existing structures or pavement, absence of topsoil, junkyards, or abandoned dumping grounds. Work to redevelop previously developed riverfront areas shall conform to the following criteria:</i></p>	<p>The building at 281 Main St was constructed in the 1960’s. The proposed 4-story building has been designed as a redevelopment project intended to improve upon existing conditions. The project will reuse existing degraded and developed area to the greatest extent possible. The work to redevelop these areas will conform with 310 CMR 10.58(5) redevelopment criteria as follows.</p>
10.58 (5)(a)	<p><i>At a minimum, proposed work shall result in an improvement over existing conditions of the capacity</i></p>	<p>The site is presently degraded with an existing building, paved driveway and parking areas.</p>

	<i>of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. When a lot is previously developed but no portion of the riverfront area is degraded, the requirements of 310 CMR 10.58(4) shall be met.</i>	<p>Proposed work will result in an improvement over existing conditions of the riverfront area for the following reasons:</p> <ul style="list-style-type: none"> • Installation of a drainage system sized for the 100-year storm • The restoration of 540 sf of existing degraded riverfront area • The conversion of 3,275 sf of existing lawn and maintained areas to naturally vegetated mitigation planting areas. <p>For these reasons, Goddard believes the proposed conditions represent an improvement over existing conditions and the proposed project therefore complies with 10.58 (5)(a).</p>
10.58 (5)(b)	<i>Stormwater management is provided according to standards established by the Department.</i>	<p>The stormwater system has been designed meet or exceed all DEP stormwater standards. (refer to enclosed Stormwater Management Documents by Allen and Major Assoc.)</p> <p>The proposed project therefore complies with 10.58 (5)(b).</p>
10.58 (5)(c)	<i>Within 200 foot riverfront areas, proposed work shall not be located closer to the river than existing conditions or 100 feet, whichever is less, or not closer than existing conditions within 25 foot riverfront areas, except in accordance with 310 CMR 10.58(5)(f) or (g).</i>	A portion of the building will be constructed within the 100-ft riverfront area. However, it will not be constructed any closer to the river than existing conditions. Therefore, the project complies with 10.58 (5)(c).
10.58 (5)(d)	<i>Proposed work, including expansion of existing structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58(5)(f) or (g).</i>	Proposed work is located within the 200-ft riverfront area but has been sited toward the riverfront area boundary to the greatest extent practicable. It will not be closer to the river than existing conditions and as a result the project complies with 10.58 (5)(d).
10.58 (5)(e)	<i>The area of proposed work shall not exceed the amount of degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58(5)(f) or (g).</i>	Most of the 200-ft riverfront area located on site has been disturbed or degraded in some way from impervious surfaces. The total riverfront area on site is 30,170 sf, 10% of which is 3017 sf. Proposed degraded riverfront area exceeds this threshold, therefore the project must comply with 10.58(f) and (g) as outlined below.
10.58 (5)(f)	<i>When an applicant proposes restoration on-site of degraded riverfront area, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration</i>	Restoration of existing degraded riverfront area is proposed in the amount of 540 sf. Restoration consists of the conversion of existing degraded riverfront area to naturally vegetated areas via the removal of existing pavement and planting with native vegetation.

	<p><i>not conforming to the criteria shall begin at the riverfront area boundary. Restoration shall include:</i></p> <ol style="list-style-type: none"> 1. <i>removal of all debris, but retaining any trees or other mature vegetation;</i> 2. <i>grading to a topography which reduces runoff and increases infiltration;</i> 3. <i>coverage by topsoil at a depth consistent with natural conditions at the site; and</i> 4. <i>seeding and planting with an erosion control seed mixture, followed by plantings of herbaceous and woody species appropriate to the site;</i> 	<p>The proposed 540 sf of restoration allows the new alteration of 540 sf of riverfront area (i.e. a 1:1 ratio). This leaves 1,635 sf of proposed new alteration in excess of the criteria, for which compliance is achieved through 10.58(5)(g) as described below.</p>
<p>10.58 (5)(g)</p>	<p><i>When an applicant proposes mitigation either on-site or in the riverfront area within the same general area of the river basin, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), or (e) at a ratio in square feet of at least 2:1 of mitigation area to area of alteration not conforming to the criteria or an equivalent level of environmental protection where square footage is not a relevant measure. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Mitigation may include off-site restoration of riverfront areas, conservation restrictions under M.G.L. c. 184, §§ 31 through 33 to preserve undisturbed riverfront areas that could be otherwise altered under 310 CMR 10.00, the purchase of development rights within the riverfront area, the restoration of bordering vegetated wetland, projects to remedy an existing adverse impact on the interests identified in M.G.L. c. 131, § 40 for which the applicant is not legally responsible, or similar activities undertaken voluntarily by the applicant which will support a determination by the issuing authority of no significant adverse impact. Preference shall be given to potential mitigation projects, if any, identified in a River Basin Plan approved by the Secretary of the Executive Office of Energy and Environmental Affairs.</i></p>	<p>Proposed new alteration beyond the criteria totals 2,175 sf of new degraded surfaces. Of this new alteration, 540 sf is allowable because of the 540 sf of proposed restoration as described in 10.58(5)(f) above. Remaining alteration not conforming to the criteria (i.e. not already offset by proposed restoration) amounts to 1,635 sf. Mitigation is proposed at a 2:1 ratio, totaling 3,270 sf, to offset the remaining alteration. This mitigation is in the form of the conversion of existing maintained areas to naturally vegetated areas. These mitigation planting areas will be converted from an ecologically barren turfgrass to a native plant palette that will provide greatly improved soil stability, pollinator/wildlife habitat, runoff filtration and nutrient attenuation. Therefore, the project provides the required 2:1 mitigation and complies with 310 CMR 10.58(5)(g), in addition to 310 CMR 10.58(5)(f).</p>
<p>10.58 (5)(h)</p>	<p><i>The issuing authority shall include a continuing condition in the Certificate of Compliance for projects under 310 CMR 10.58(5)(f) or (g) prohibiting further alteration within the restoration or mitigation area, except as may be required to maintain the area in its restored or mitigated condition. Prior to requesting the issuance of the Certificate of Compliance, the applicant shall demonstrate the restoration or mitigation has been successfully completed for at least two growing seasons.</i></p>	<p>The applicant will accept a condition requiring the prohibition of further alteration within restoration/mitigation areas as part of an Order of Conditions.</p>

4.0 Alternatives Analysis

Although not required under 10.58(5), an alternatives analysis is voluntarily provided below, illustrating that the proposed project is the best course of action for this site.

Alternative A: No Change to Existing Conditions

Under a no-build scenario, no new building would be proposed, and the site's current state would remain. Much-needed residential development would not be proposed. The presently developed portion of the site would remain comprised of solely impervious surfaces or lawn/landscaping, and no native vegetation would be installed. Current stormwater runoff would continue to discharge into the stream with minimal treatment and no onsite infiltration. Further, the applicant would be unable to develop the property as needed. As a result, this is not a viable or economically feasible alternative.

Alternative B: Purchase of Additional Land

Due to the shape of the lot and extent of RFA onsite, the current project proposes to build multiple stories upon the existing building/parking lot footprints, i.e. a two-story building being developed into a four-story building and the usage of parking beneath the proposed residential units. If work was not proposed upward, additional land would be needed and would cause additional impacts at the ground level, resulting in greater levels of disturbance. No such land is available for purchase contiguous with the site. Additionally, this alternative is not substantially economically equivalent.

Alternative C: Current Proposed Design

The current proposed design has been sited to maximize the use of existing degraded area on site. All proposed construction is located as far from wetland resources as possible, and does not encroach closer than existing conditions. The stormwater system proposed will capture and treat the 100-year storm and proposed restoration/mitigation will provide an additional 3,275 sf of native vegetation to improve existing wildlife habitat, prevention of pollution, control of runoff and uptake of pollutants. As indicated above, the current design is the most beneficial for the project site.

5.0 Conclusion

In summary, Goddard Consulting believes that the proposed project will not have any adverse impacts on the interests identified in the Wetlands Protection Act or Chapter 650, The Town of Readings Wetlands Protection Regulations (the Bylaw). The project has been designed with sensitivity to the resource areas on site and has been designed to minimize and avoid impacts to the fullest extent feasible. Unavoidable impacts have had mitigation provided to limit their impacts. The limit of work for the proposed project has been kept entirely outside of the 35-Foot No Structure Zone and 25-Foot No Disturb Zone. Robust erosion controls will ensure that the resource areas downgradient of the site are protected during construction.

This allows the project to meet the required replacement of the trees requiring removal, while simultaneously providing wetland and buffer zone restoration/mitigation on the property in post-construction conditions. As the project complies with all performance standards under the Wetlands Protection Act and Chapter 650, The Town of Readings Wetlands Protection Regulations, Goddard Consulting respectfully requests that the Reading Conservation Commission issue an Order of Conditions approving the proposed project as designed.

Sincerely,

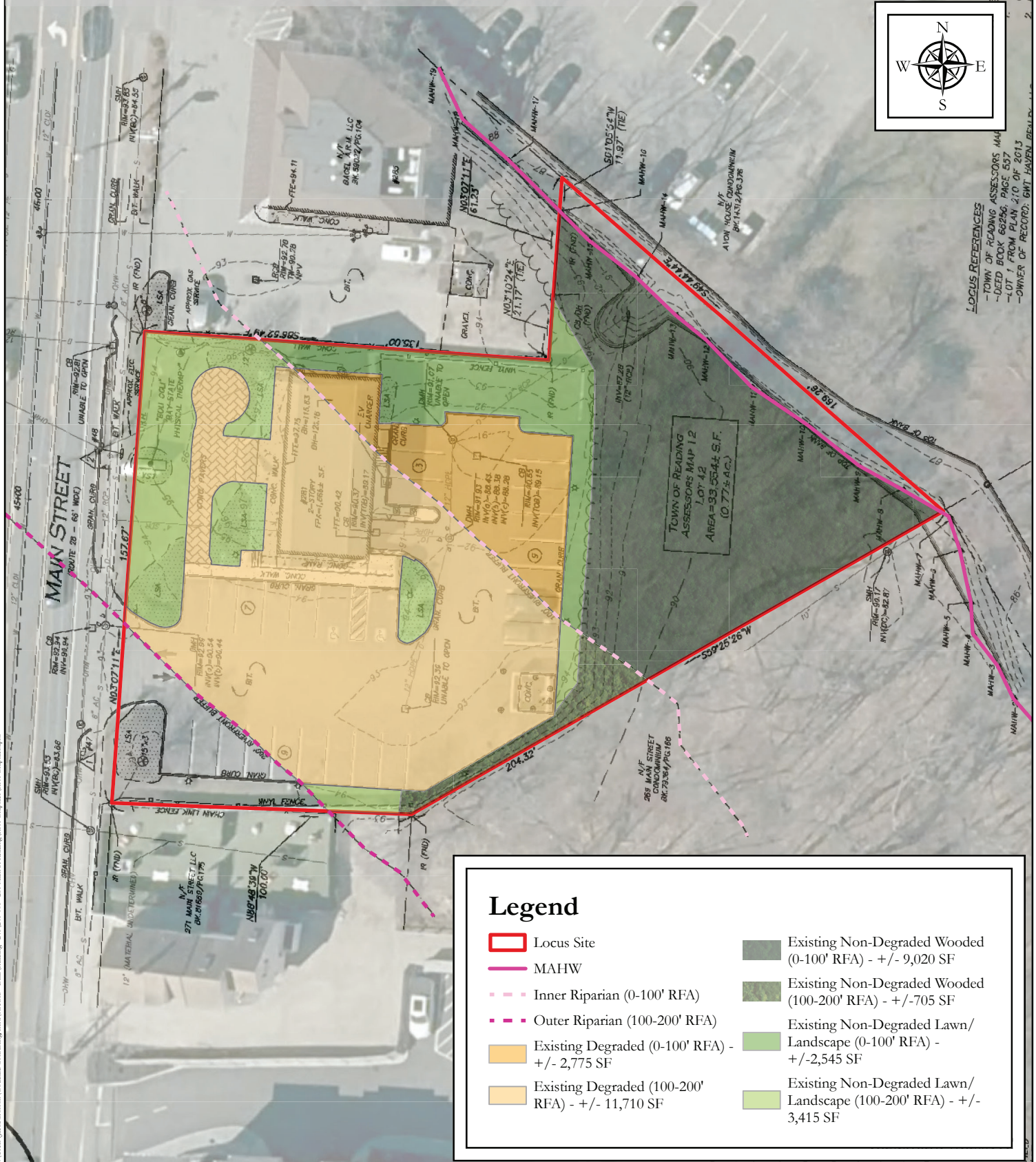
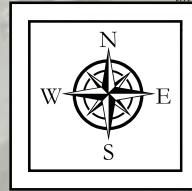
Goddard Consulting, LLC



Andrew Thibault, WPIT, WSA

Environmental Scientist

CC: Mass DEP – NERO – 150 Presidential Way, Woburn, MA 01801



Legend

- Locus Site
- MAHW
- Inner Riparian (0-100' RFA)
- Outer Riparian (100-200' RFA)
- Existing Degraded (0-100' RFA) - +/- 2,775 SF
- Existing Degraded (100-200' RFA) - +/- 11,710 SF
- Existing Non-Degraded Wooded (0-100' RFA) - +/- 9,020 SF
- Existing Non-Degraded Wooded (100-200' RFA) - +/- 705 SF
- Existing Non-Degraded Lawn/Landscape (0-100' RFA) - +/- 2,545 SF
- Existing Non-Degraded Lawn/Landscape (100-200' RFA) - +/- 3,415 SF



Existing Conditions in Riverfront Area

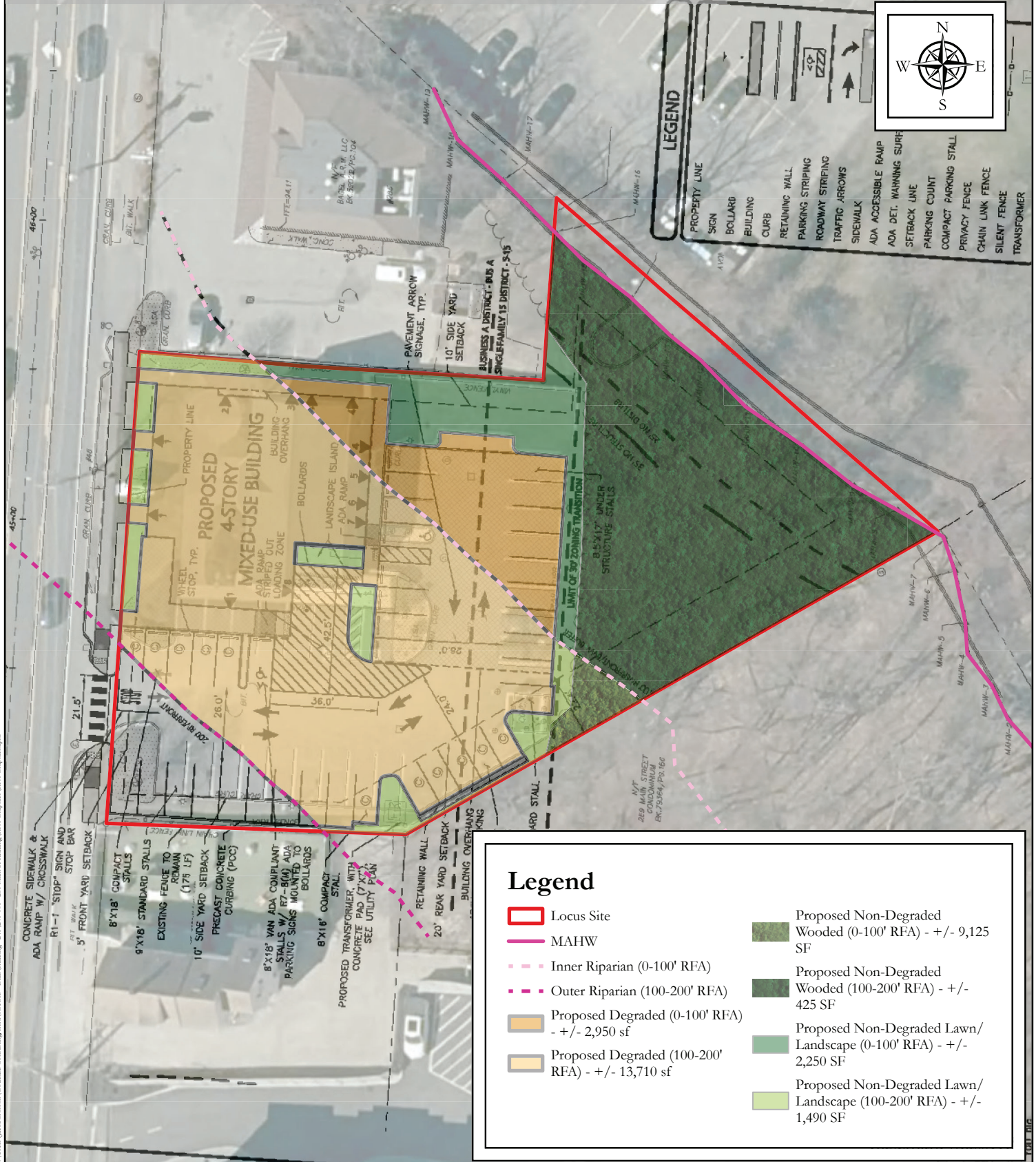
0 30 60 Feet 1" = 60'

71.103078°W, 42.5152779°N

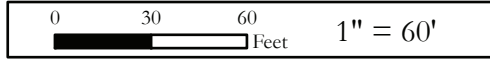
Date: 03/12/2026

281 Main Street
Reading, MA

Parcel ID: 12-42



Proposed Conditions in Riverfront Area



71.1030712°W, 42.5152964°N

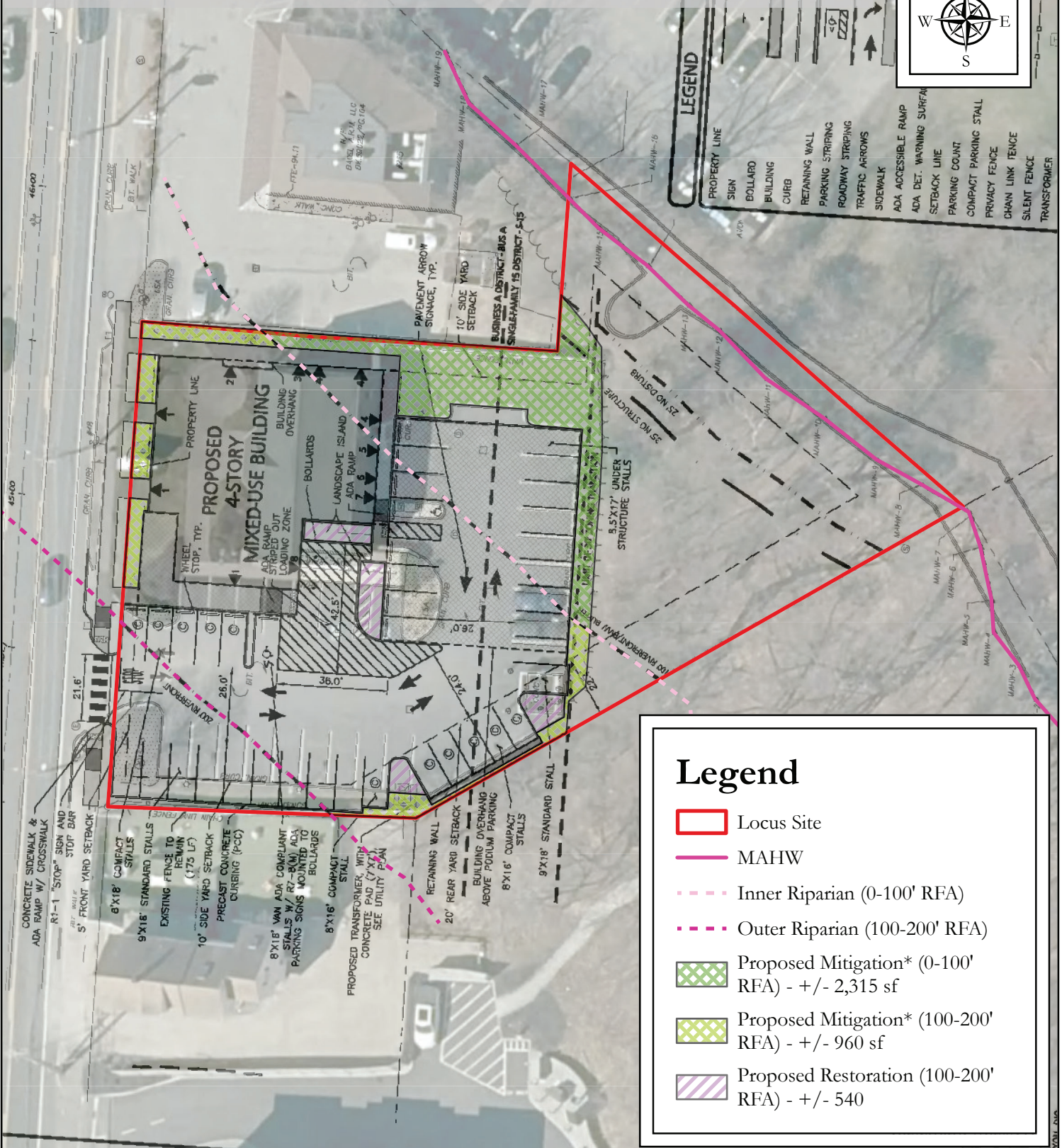
Date: 03/12/2026

281 Main Street
Reading, MA

Parcel ID: 12-42

Site Plan from Allen & Major, Inc., Layout and Materials Plan, Sheet C-102

*See Landscape Plan, Sheet L-101, prepared by Landscape Architect Jacqueline B. Trainer for more details on specific plantings.



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Restoration and Mitigation in Riverfront Area

281 Main Street
Reading, MA

0 25 50 Feet 1" = 60'

71.1030738°W, 42.5153025°N

Parcel ID: 12-42

Date: 03/12/2026



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Reading

City/Town

Important:

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



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

281 Main St

a. Street Address

Reading

b. City/Town

01867

c. Zip Code

42.5153327

d. Latitude

71.1030521

e. Longitude

Latitude and Longitude:

12

f. Assessors Map/Plat Number

42

g. Parcel /Lot Number

2. Applicant:

a. First Name

281 Reading LLC

b. Last Name

c. Organization

281 Main St

d. Street Address

Reading

e. City/Town

MA

f. State

01867

g. Zip Code

781.389.5989

h. Phone Number

i. Fax Number

saverio@weare14.com

j. Email Address

3. Property owner (required if different from applicant): Check if more than one owner

a. First Name

b. Last Name

c. Organization

d. Street Address

e. City/Town

f. State

g. Zip Code

h. Phone Number

i. Fax Number

j. Email address

4. Representative (if any):

Andrew

a. First Name

Thibault

b. Last Name

Goddard Consulting LLC

c. Company

100 Conifer Hill Dr, Suite 516

d. Street Address

Danvers

e. City/Town

MA

f. State

01923

g. Zip Code

508-393-3784

h. Phone Number

i. Fax Number

andrew@goddardconsultingllc.com

j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

1050.00 (only RA, no 1.5 x)

a. Total Fee Paid

512.50

b. State Fee Paid

537.50

c. City/Town Fee Paid



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:	
MassDEP File Number	
Document Transaction Number	
Reading	
City/Town	

A. General Information (continued)

6. General Project Description:

The proposed re-development of a mix-used building and parking lot within a previously disturbed Riverfront Area

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

- 1. Single Family Home
- 2. Residential Subdivision
- 3. Commercial/Industrial
- 4. Dock/Pier
- 5. Utilities
- 6. Coastal engineering Structure
- 7. Agriculture (e.g., cranberries, forestry)
- 8. Transportation
- 9. Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

- 1. Yes No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Middlesex South

a. County

66256

c. Book

b. Certificate # (if registered land)

557

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

- 1. Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
- 2. Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 - Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Reading

City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Table with 3 columns: Resource Area, Size of Proposed Alteration, Proposed Replacement (if any). Rows include Bank, Bordering Vegetated Wetland, and Land Under Waterbodies and Waterways.

Table with 3 columns: Resource Area, Size of Proposed Alteration, Proposed Replacement (if any). Rows include Bordering Land Subject to Flooding and Isolated Land Subject to Flooding.

f. Riverfront Area
1. Name of Waterway (if available) - specify coastal or inland
2. Width of Riverfront Area (check one):
- 25 ft. - Designated Densely Developed Areas only
- 100 ft. - New agricultural projects only
- 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: 30,205 square feet

4. Proposed alteration of the Riverfront Area:
2,175 a. total square feet
175 b. square feet within 100 ft.
2,000 c. square feet between 100 ft. and 200 ft.

- 5. Has an alternatives analysis been done and is it attached to this NOI? [X] Yes [] No
6. Was the lot where the activity is proposed created prior to August 1, 1996? [X] Yes [] No

3. [] Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete Section B.2.f. above.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Reading
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

<u>Resource Area</u>	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
a. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. <input type="checkbox"/> Land Under the Ocean	_____	
	1. square feet	

	2. cubic yards dredged	
c. <input type="checkbox"/> Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. <input type="checkbox"/> Coastal Beaches	_____	_____
	1. square feet	2. cubic yards beach nourishment
e. <input type="checkbox"/> Coastal Dunes	_____	_____
	1. square feet	2. cubic yards dune nourishment
	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
f. <input type="checkbox"/> Coastal Banks	_____	
	1. linear feet	
g. <input type="checkbox"/> Rocky Intertidal Shores	_____	
	1. square feet	
h. <input type="checkbox"/> Salt Marshes	_____	_____
	1. square feet	2. sq ft restoration, rehab., creation
i. <input type="checkbox"/> Land Under Salt Ponds	_____	
	1. square feet	

	2. cubic yards dredged	
j. <input type="checkbox"/> Land Containing Shellfish	_____	
	1. square feet	
k. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	

	1. cubic yards dredged	
l. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	_____	
	1. square feet	
4. <input type="checkbox"/> Restoration/Enhancement	If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.	
	_____	_____
	a. square feet of BVW	b. square feet of Salt Marsh
5. <input type="checkbox"/> Project Involves Stream Crossings		
	_____	_____
	a. number of new stream crossings	b. number of replacement stream crossings



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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MassDEP File Number
Document Transaction Number
Reading
City/Town

C. Other Applicable Standards and Requirements

- This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

- Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. Yes No **If yes, include proof of mailing or hand delivery of NOI to:**

**Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581**

2021
b. Date of map

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

- Percentage/acreage of property to be altered:
 - (a) within wetland Resource Area _____ percentage/acreage
 - (b) outside Resource Area _____ percentage/acreage

2. Assessor's Map or right-of-way plan of site

- Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **
 - (a) Project description (including description of impacts outside of wetland resource area & buffer zone)
 - (b) Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see <https://www.mass.gov/endangered-species-act-mesa-regulatory-review>).

Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Reading

City/Town

Online Users:
Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

C. Other Applicable Standards and Requirements (cont'd)

- 4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?
 a. Yes No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.
 b. ACEC
- 5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
 a. Yes No
- 6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?
 a. Yes No
- 7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
 a. Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
 - 1. Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
 - 2. A portion of the site constitutes redevelopment
 - 3. Proprietary BMPs are included in the Stormwater Management System.
 b. No. Check why the project is exempt:
 - 1. Single-family house
 - 2. Emergency road repair
 - 3. Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

- This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

- 1. USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
- 2. Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Reading

City/Town

D. Additional Information (cont'd)

3. Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. List the titles and dates for all plans and other materials submitted with this NOI.

Civil Site Plan Mixed Use Building Retail and Residential 281 Main St, Reading, MA

a. Plan Title

Allen & Major Assoc. Inc

Carlton Quinn

b. Prepared By

3/11/2026

c. Signed and Stamped by

Varies - 1" = 10 & 20'

d. Final Revision Date

e. Scale

f. Additional Plan or Document Title

g. Date

5. If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. Attach NOI Wetland Fee Transmittal Form

9. Attach Stormwater Report, if needed.

E. Fees

1. Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

171, 172 (bylaw)

3/11/2026, 3/11/2026

2. Municipal Check Number

3. Check date

170

3/11/2026

4. State Check Number

5. Check date

GSC Management, LLC

6. Payor name on check: First Name

7. Payor name on check: Last Name



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

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City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

Saverio P. Fulciniti

1. Signature of Applicant

March 11, 2026

2. Date

3. Signature of Property Owner (if different)

John Thibault

4. Date

3/24/2026

5. Signature of Representative (if any)

6. Date

For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:

If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.



Massachusetts Department of Environmental Protection
 Bureau of Resource Protection - Wetlands
NOI Wetland Fee Transmittal Form
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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



To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

A. Applicant Information

1. Location of Project:

<u>281 Main St</u>	<u>Reading</u>
a. Street Address	b. City/Town
<u>170</u>	<u>\$512.50</u>
c. Check number	d. Fee amount

2. Applicant Mailing Address:

<u>281 Reading LLC</u>	<u>MA</u>		<u>01867</u>
c. Organization	f. State		g. Zip Code
<u>281 Main ST</u>	<u>Reading</u>		
d. Mailing Address	e. City/Town		
<u>781.389.5989</u>	<u>781.389.5989</u>	<u>saverio@weare14.com</u>	
h. Phone Number	i. Fax Number	j. Email Address	

3. Property Owner (if different):

<u></u>	<u></u>		
a. First Name	b. Last Name		
<u></u>	<u></u>		
c. Organization			
<u></u>	<u></u>		
d. Mailing Address			
<u></u>	<u></u>	<u></u>	<u></u>
e. City/Town	f. State	g. Zip Code	
<u></u>	<u></u>	<u></u>	<u></u>
h. Phone Number	i. Fax Number	j. Email Address	

B. Fees

Fee should be calculated using the following process & worksheet. **Please see Instructions before filling out worksheet.**

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract \$12.50. To calculate the city/town share of the fee, divide the total fee in half and add \$12.50.

Notice of Intent **Submittal Checklist**

Reading Conservation Commission

This checklist is intended as an aid only, to assist in the process of submitting a Notice of Intent (NOI) and to help avoid delays. Please consult MGL Chapter 131, Section 40, the Wetlands Protection Act and its accompanying Regulations, 310 CMR 10.00, available through the state website, www.mass.gov/dep. Also, please consult Reading General Bylaws, Section 7.1, and the Reading Wetlands Protection Regulations, available through the Town Clerk's office and on the town website, www.readingma.gov. It is only necessary to file one submittal under both State and Town law.

Prior to the submittal of a Notice of Intent (NOI):

1. It is strongly recommended that the applicant or representative meet with the Conservation Administrator to review the proposed work, research existing site information, and become familiar with the wetlands regulations. Contact the Administrator at Town Hall, (781) 942-6616.
2. Submit a completed Request for Abutters List form to the Conservation Administrator or Public Service Department Staff, who will submit the request to the Assessor's Office. It may take up to 21 days for the Assessor to return the Certified List of Abutters.

Notice of Intent submittal:

1. 1 completed **electronic copy** and 2 physical completed copies with 2 full-size original plans. The electronic file can be e-mailed to ctirone@ci.reading.ma.us and the 2 physical copies with can be dropped off at the Public Services Department. Both must include the following items:
 - a. A completed Notice of Intent form (Form 3)
 - b. A copy of the Locus Map showing the site location clearly marked (e.g., circled and located by a large arrow).
 - c. A description of the site, the proposed activity, and supporting data and calculations such as soils test data, drainage calculations, wetlands boundaries, proposed earth moving, impervious cover area, etc. (Please refer to the wetlands regulations for requirements)
 - d. Resource area Information
 - Identifying what standard was used to define the wetland
 - A summary of methods used to delineate the wetland
 - Provide copies of wetland determination data forms, for each resource area, buffer zone, and upland, either from the USACE New England District wetland delineation manual or equivalent, that documents observations and conditions of hydrology, soil, and vegetation made during the wetland delineation.
 - How a project meets or does meet performance standards for affected resource areas
 - e. A site plan or plans no more than 2' by 3' in size, prepared by an engineer, surveyor, or other licensed professional, having a title block with location, date, legend, scale (1"=20' or 1"=40'), and north arrow, that clearly shows at least the following (please refer to the wetlands regulations for complete requirements):
 - Property boundaries, easements, rights-of-way, etc.;
 - Boundaries of waterways, water bodies, banks, floodplains, and wetlands within and within 100 feet of the site, including locations of field flags;

- Boundaries of the 100-foot Buffer Zone 35- foot No Structure zone and 25-foot Zone of Natural Vegetation;
 - Existing topography (in one- or two-foot intervals), structures, and other physical features (walls, paths, trees, wells, drainage and utility lines, etc.);
 - Proposed topography, structures, and physical features, including temporary and permanent stormwater and erosion control features.
- f. Completed **NOI Fee Transmittal Form** with a check payable to “**Town of Reading**” for Town fee: Use the link to state forms on the Conservation home page, or download the form from the State website, www.mass.gov/dep
 - g. Completed **Reading Bylaw Fee Calculation Form** with a check payable to “**Town of Reading**” for the calculated amount. (One check may be written to the Town to cover both State and Town fees). <https://ma-reading.civicplus.com/468/Applications-for-Conservation-wetland-pe>
 - h. Affidavit of Service
 - i. Notification to Abutters
 - j. Certified List of Abutters
2. The same day the Notice of Intent is submitted to the Commission, mail one completed copy to:
 - a. **DEP Northeast Regional Office**
ATTN: Wetlands Program
150 Presidential Way, Woburn MA 01801
 - b. One copy of the completed Notice of Intent Fee Transmittal Form and check payable to “Commonwealth of Massachusetts” for the State share of the state fee to the DEP Box in Boston shown on the fee form.

Legal Notice & Mailing Information

1. The legal notice mailing and fee for the publication is the responsibility of the applicant/consultant.
2. Conservation Department will:
 - a. Draft and publish the legal notice with the [Daily Times Chronicle](#)
 - b. Send a copy of the legal notice Application/Consultant for the mailing, along with the contact information to directly pay for the **\$325 fee** (fee is subject to change at any time) for the publication:
 - Tricia Lawson
Accounting Department
[Daily Times Chronicle](#)
1 Arrow Drive, Woburn, MA 01801
P 781-933-3700 ext. 353
tricia.lawson@dailytimesinc.com
www.homenewshere.com
3. Mailing Requirements
 - a. One copy of the Affidavit of Service and one copy of the Legal Notice must be sent to all certified abutters.
 - They can be mailed in the same envelope
 - If the certified list of abutters includes duplicates, one mailing is sufficient.

- If the list includes the Planning Boards of abutting towns, do not send notifications to those addresses.
- b. The Legal Notices can be mailed in the following ways:
 - Certified Mail
 - Certificate of Mailing
 - Hand deliver with homeowner's signature.
 - The legal notice must be mailed out 7 days before the scheduled Conservation meeting.
- c. A digital copy of the mailing receipts needs to be scanned and emailed to ctirone@ci.reading.ma.us

Prior to the Public Hearing

1. The Conservation Commission will submit the legal notice of the public hearing to the Daily Times Chronicle for publication.
2. The applicant will pay the legal notice fee, mail the legal notice using the certified abutters list and provide proof of mailing.
3. The Conservation Administrator and the Conservation Commission may inspect the site. The Administrator usually inspects during normal business hours Monday through Thursday. The Commission usually inspects prior to the hearing. The boundaries of all resource areas should be marked on site with labeled flags. The corners of proposed structures and other important features (drainage systems, paved areas, limits of work, etc.) should be marked with stakes or flags, preferably using different colors and labels for different features.

Public Hearing

1. A public hearing will normally be scheduled within 21 days of receipt of a complete submittal. (If not possible, the Commission may ask the applicant to sign a waiver of the 21-day requirement. It is rare that the Commission cannot open the hearing within 21 days.) Commission meetings are generally held every other Wednesday evening.
2. At the hearing, the applicant and his or her representatives will be given the opportunity to present and discuss the proposed work. The Commission, the Administrator, and the general public may comment upon the proposal and ask questions.
3. If additional information is needed for the Commission to understand the proposed work, the Commission and applicant may continue the public hearing to a future date, giving the applicant adequate time to provide the information. When the information is complete, the hearing will be closed and the Commission will draft a decision.

Order of Conditions

1. The Commission will vote on the conditions of the Order during a public meeting and will issue the Order of Conditions within 21 days of the close of the hearing. The Order may be appealed as provided by law.

Note

The Commission adopted a Tree Policy on 9/28/2016. This can be found on the Conservation Commission Home Page. Please read the policy carefully as you are required to replace all trees removed in the Buffer Zone, one to one.

Reading Wetlands Protection Bylaw Fee Calculation Form

Type of Activity	NOI Filing Fee	Calculated Fee
A. Each addition to or accessory use activity Associated with an existing single-family or Multi-family residential dwelling, including but not limited to driveways, sheds, swimming pools, athletic courts, additions to existing houses, grading, and landscaping	\$125.00 plus all applicable fees listed in lines F through K	
B. Each new single-family dwelling, including associated driveway, utilities, grading, landscaping, and drainage structures	\$600.00 plus all applicable fees listed in lines F through K	
C. Each new multi-family dwelling	\$600.00 plus \$125.00 per unit located in any Resource Area or Buffer Zone, plus all applicable fees listed in lines F through K	
D. Each subdivision roadway, or other roadway, or driveway (other than for a single-family dwelling), and all associated drainage structures, utilities, grading, curbing, landscaping, and other associated work exclusive of dwellings	\$1,000.00 plus \$600.00 per house, plus all applicable fees listed in lines F through K	
E. Each commercial, industrial, institutional or other non-residential project	\$1,000.00 , plus all applicable fees listed in lines F through K	\$1000
F. Boundary delineation for any Resource Area	\$1.25 per linear foot of Resource Area boundary, up to a maximum of \$125 for a single-family lot and \$1,250 for any other lot.	\$200
G. Temporary and /or permanent alteration of land within the Buffer Zone	\$1.25 per square foot of Buffer Zone altered for any temporary or permanent alteration within 25 feet of a Resource Area or any permanent structure within 35 feet of a Resource Area	
H. Work in Floodplain	\$1.25 per square foot of Floodplain temporarily or permanently altered outside of any other Resource Area and Buffer Zone	
I. Work in Vernal Pool habitat	\$11.00 per square foot of Vernal Pool habitat temporarily or permanently altered.	
J. Work in Freshwater Wetland, Wet Meadow, Bog, Swamp, Marsh, Creek, River, Stream, Pond, Lake, Land Under Waterbody	\$11.00 per square foot of Resource Area temporarily or permanently altered	
K. Work in Bank	\$11.00 per linear foot of Bank temporarily or permanently altered	
	Total Fee Calculated	\$ _____ \$1200

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act, M.G.L., c.131, s.40 and Reading General Bylaws, Section 7.1

(To be submitted to the Conservation Commission when filing a Notice of Intent or Abbreviated Notice of Resource Area Delineation or Request for Determination of Applicability)

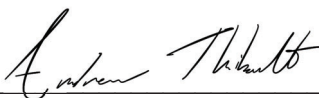
I, Andrew Thibault (Name), hereby certify under the pains and penalties of perjury that on 3/26/2026 (Date), I gave notification to abutters in compliance with the second paragraph of Massachusetts General Laws, c.131, s.40, and the **DEP Guide to Abutter Notification** dated April 8, 1994, and Reading General Bylaws, Section 7.1 in connection with the following matter:

(Check the applicable form.)

- Notice of Intent
- Abbreviated Notice of Resource Area Delineation
- Request for Determination of Applicability

filed under M.G.L., c.131, s.40 and R.G.B., s.7.1 by 281 Reading LLC (Applicant) with the Town of Reading Conservation Commission on 3/25/2026 (Date) for property located at 281 Main St, Reading, MA (Location).

The form of the notification and list of abutters to whom it was given and their addresses are attached to this Affidavit of Service.


Name

3/25/2026
Date

Notification to Abutters

By Hand Delivery, Certified Mail (return receipt requested), or Certificates of Mailing

This is a notification required by law. You are receiving this notification because you have been identified as the owner of land abutting another parcel of land for which certain activities are proposed. Those activities require a permit under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40).

In accordance with the second paragraph of the Massachusetts Wetlands Protection Act, and 310 CMR 10.05(4)(a) of the Wetlands Regulations, you are hereby notified that:

- A. A Notice of Intent was filed with the Reading Conservation Commission on March 25, 2026, seeking permission to remove, fill, dredge, or alter an area subject to protection under M.G.L. c. 131 §40. The following is a description of the proposed activity/activities:

The Applicant is filing a Notice of Intent for the proposed re-development of the existing two-story building and parking area on-site within a previously disturbed 200-foot Riverfront Area. The project will consist of retail/commercial use with ground level parking and residential units above.

- B. The name of the applicant is: 281Reading LLC
- C. The address of the land where the activity is proposed is: 281 Main Street, Reading, MA 01867 (Parcel ID: Map: 12, Parcel: 42)
- D. Copies of the Notice of Intent may be examined or obtained at the office of the Reading Conservation Commission, located at 16 Lowell Street, Reading, MA 01867. The regular business hours of the Commission are Monday, Wednesday, and Thursday, from 8am to 5:30pm, and Tuesday from 8am to 7pm. The Commission may be reached at [781-942-9016](tel:781-942-9016).
- E. Copies of the Notice of Intent may be obtained from the applicant or their representative, Goddard Consulting, by contacting Goddard's Main Office at 508 393 3784 or by emailing andrew@goddardconsultingllc.com An administrative fee may be applied for providing copies of the NOI and plans.
- F. Information regarding the date, time, and location of the public hearing regarding the Notice of Intent may be obtained from the Reading Conservation Commission. Notice of the public hearing will be published at least five business days in advance, in the Daily Times Chronicle.

Notification provided pursuant to the above requirement does not automatically confer standing to the recipient to request Departmental Action for the underlying matter. See 310 CMR 10.05(7)(a)4.



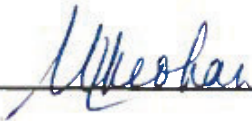
TOWN OF READING
16 LOWELL STREET
READING, MA 01867-2693

BOARD OF ASSESSORS
781-942-9027
FAX: 781-942-9037

ABUTTERS LIST
CERTIFICATION
FOR BOARD OF ASSESSORS

VICTOR P. SANTANIELLO, CHIEF APPRAISER

DATE



3/4/20

MICHELE L. KEOHAN, ASSISTANT ASSESSOR

DATE



**TOWN OF READING
16 LOWELL STREET
READING, MA 01867-2693**

**BOARD OF ASSESSORS
TEL.: 781-942-9027
FAX: 781-942-9037**

January 2025

To whom it may concern:

In an effort to streamline our business practices and desire to decrease turnaround time for taxpayers and other municipal departments, please be advised that effective this date, we the Board of Assessors for the Town of Reading hereby delegate to the Town Chief Assessor of the Assessing Department signatory authority of all Certified Abutters Lists as compiled by the department.

Sincerely,

Reading Board of Assessors

Michael E. Golden

Brendan Zarechian

Jean Paul Plouffe

TOWN OF READING

REQUEST FOR CERTIFIED ABUTTERS LIST

Parcel ID
012-0000-0042

SUBJECT PROPERTY:

ADDRESS: 281 Main Street, Reading, MA

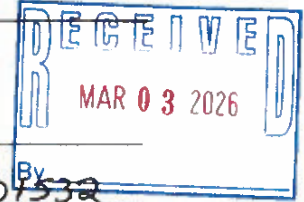
Assessors' Map Number: 12 Lot Number: 42

APPLICANT/AGENT: Representative

Name: Nicole Hayes - Goddard Consulting

Address: 291 Main St, Northboro, MA 01532

Telephone: 774-277-0302 Email: nicole@goddardconsultingllc.com



Board or Commission for which this request is made (check all that are applicable):

Community Planning and Development Commission:

- Site Plan Review (300 feet)
- Special Permit (300 feet)
- Subdivision (300 feet)

Conservation Commission:

- Request for Determination (300 feet)
- Abbreviated Notice of Resource Area Delineation (300 feet)
- Notice of Intent (300 feet)

Zoning Board of Appeals:

- Appeal (300 feet)
- Special Permit (300 feet)
- Variance (300 feet)

- Building Department: Immediate Abutters
- Health Department: Immediate Abutters
- Historic District Commission (300 feet)
- Historical Commission (300 feet)
- Other: _____

Brief description of request: Redevelopment of a previously disturbed Runway Area

Applicant/Agent Signature: Nicole Hayes Date: 3/3/26
The Assessors' Office may require up to three weeks in order to process and approve this request.

Authorized Signature: [Signature] Date: 3/4/2026
Must be signed by the Public Services Department

Subject Parcel ID: 281 Main St Report

Subject Property Location:

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
011.0-0000-0193.0	258 MAIN ST	BLVD READING LLC		258 MAIN ST	READING	MA	01867
011.0-0000-0194.0	262 MAIN ST	BLVD READING LLC		258 MAIN STREET	READING	MA	01867
011.0-0000-0195.0	2 PINEVALE AVE	FARRELL MICHAEL C ETAL TRSTE	FARRELL LYNNE M ETAL TR	1 CHARLES ST UNIT G	READING	MA	01867-1759
011.0-0000-0196.0	10 PINEVALE AVE	HARKINS DANIEL J		10 PINEVALE AVE	READING	MA	01867
011.0-0000-0197.0	12 PINEVALE AVE	KILLEEN JENNIFER J		12 PINEVALE AVE	READING	MA	01867
011.0-0000-0215.0	16 PERCY AVE	NAKANO TAKAYUKI	FUMIKO NAKANO	16 PERCY AVE	READING	MA	01867
011.0-0000-0219.0	11 PINEVALE AVE	WILLIS DANIEL A	ELISHA W WILLIS	11 PINEVALE AVE	READING	MA	01867
011.0-0000-0220.0	7 PINEVALE AVE	MCKENZIE LINDA J		7 PINEVALE AVE	READING	MA	01867
011.0-0000-0221.0	270 MAIN ST	READING DENTAL, P.C.		270 MAIN STREET	READING	MA	01867
011.0-0000-0222.0	274 MAIN ST	274 MAIN OFFICE LLC		274 MAIN ST	READING	MA	01867
011.0-0000-0223.0	288 MAIN ST	READING 288 MAIN STREET LLC		24 SUSAN DR	READING	MA	01867
011.0-0000-0224.0	294 MAIN ST	BANK OF AMERICA	CORPORATE REAL ESTATE	PO BOX 32547	CHARLOTTE	NC	28232
011.0-0000-0225.0	296 MAIN ST	BANK OF AMERICA	REAL PROPERTY TAX	PO BOX 32547	CHARLOTTE	NC	28232
011.0-0000-0231.0	5 PERCY AVE	ZERFAS JASON	JENNIFER BRICKLEY	5 PERCY AVE	READING	MA	01867
011.0-0000-0233.0	9 PERCY AVE	MACDOUGALL GEORGE E	AMY E ROSENBLATT MACDI	9 PERCY AVENUE	READING	MA	01867
012.0-0000-0041.0	271 MAIN ST	271 MAIN STREET LLC		120 WOODCHESTER DR	CHESTNUT HILL	MA	02467
012.0-0000-0042.0	281 MAIN ST	281 READING LLC		281 MAIN ST	READING	MA	01867
012.0-0000-0043.0	285 MAIN ST	BAGEL A R M LLC		79 NORTH MAIN ST	ANDOVER	MA	01810
012.0-0000-0045.0	34 AVON ST	FRANCOIS JEAN G	JEAN VERNET ROSE BETTY	34 AVON STREET	READING	MA	01867
012.0-0000-0046.0	30 AVON ST	LE LONG PHI TRUSTEE	30 AVON STREET TRUST	30 AVON ST	READING	MA	01867
012.0-0000-0047.0	26 AVON ST	JONES GREGORY S	SARA AMIRO JONES	26 AVON ST	READING	MA	01867
012.0-0000-0058.0	21 SHACKFORD RD	BLOM ADAM R KARCHEM TALIA J	BLOM KARCHEM NOMINEE	21 SHACKFORD RD	READING	MA	01867
012.0-0000-0071.0	29 SHACKFORD RD	CERASUOLO CAROL ANN		29 SHACKFORD RD	READING	MA	01867
012.0-0000-0072.0	33 SHACKFORD RD	CERASUOLO MARC	CERASUOLO GIUSEPPINA C	33 SHACKFORD RD	READING	MA	01867
012.0-0000-0073.0	37 SHACKFORD RD	CAMERANO DANIEL ALLAN TRUST	JOHN DENISE CAMERANO II	37 SHACKFORD RD	READING	MA	01867
012.0-0000-0098.0	301 MAIN ST	TIERNEY MARK		301-303 MAIN ST	READING	MA	01867
012.0-0000-0100.0	AVON ST	GALLO MATTEO GIUSEPPE		PO BOX 340	MALDEN	MA	02148
012.0-0703-0044.0	295 MAIN ST 1	DIORIO MATTHEW		295 MAIN ST UNIT 1	READING	MA	01867
012.0-0704-0044.0	295 MAIN ST 2	AMERO STEPHEN M	AMERO SHERRI LYNNE TE	8 HEMENWAY AVE	MELROSE	MA	02176
012.0-0705-0044.0	295 MAIN ST 3	HERNANDEZ CESAR DAVID		295 MAIN STREET UNIT 3	READING	MA	01867
012.0-0706-0044.0	295 MAIN ST 4	NGUYEN NANCY	NGUYEN WASHINGTON TE	295 MAIN STREET UNIT 4	READING	MA	01867
012.0-0707-0044.0	295 MAIN ST 5	BHATIA BHARAT	BHATIA ANITA	295 MAIN ST UNIT 5	READING	MA	01867
012.0-0708-0044.0	295 MAIN ST 6	LEACH JASON 1/2	LYSIAK LINDA ETAL 1/2	16 SHERWOOD ROAD	MELROSE	MA	02176
012.0-0709-0044.0	295 MAIN ST 7	CASSESSO ROBERT JR TRUSTEE	RMC READING REALTY TRU	528 NORTH AVE	WAKEFIELD	MA	01880
012.0-0710-0044.0	295 MAIN ST 8	DALENCAR MARK MARTINIANO		295 MAIN ST UNIT 8	READING	MA	01867
012.0-0712-0044.0	295 MAIN ST 9	MUI KENRICK		175 DERBY RD	MELROSE	MA	02176
012.0-0713-0044.0	295 MAIN ST 10	CHRISTIAN ROBERT B		PO BOX 415	MEDFORD	MA	02155
012.0-0714-0044.0	295 MAIN ST 11	HARTE PAULINE M		295 MAIN ST UNIT 11	READING	MA	01867
012.0-0715-0044.0	295 MAIN ST 12	GREAT FORT PROPERTIES LLC		295 MAIN ST UNIT 12	READING	MA	01867

**Reading
Abutters List**

Subject Parcel ID: 281 Main St Report

Subject Property Location:

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
012.0-0716-0044.0	295 MAIN ST 12A	ZHANG JIANHONG		186 PETER SPRING RD	CONCORD	MA	01742
012.0-0717-0044.0	295 MAIN ST 14	DOREN ERIC W TRUSTEE	DOREN FAMILY IRREVOCAE	295 MAIN ST UNIT 14	READING	MA	01867
012.0-0718-0044.0	295 MAIN ST 15	BISHOP ELIZABETH		295 MAIN STREET UNIT 15	READING	MA	01867
012.0-0719-0044.0	295 MAIN ST 16	YABOUJIAN RAFFI		295 MAIN ST UNIT 16	READING	MA	01867
012.0-0720-0044.0	295 MAIN ST 17	EAST MIDDLESEX ASSOC FOR	RETARDED CITIZENS, INC.	20 GOULD ST	READING	MA	01867
012.0-0721-0044.0	295 MAIN ST 18	MCDERMOTT RYAN		295 MAIN ST #18	READING	MA	01867
012.0-0722-0044.0	295 MAIN ST 19	LAU YUEN CHI		295 MAIN ST UNIT 19	READING	MA	01867
012.0-0723-0044.0	295 MAIN ST 20	MUKHERJEE BARUN	MON MUKHERJEE	295 MAIN ST #20	READING	MA	01867
012.0-0724-0044.0	295 MAIN ST 21	APOSTOLOU ANDREAS	SAKORAFI ARTEMIS TE	295 MAIN ST UNIT 21	READING	MA	01867
012.0-0725-0044.0	295 MAIN ST 22	SARRIS EFSTRATIOS		295 MAIN ST UNIT 22	READING	MA	01867
012.0-0726-0044.0	295 MAIN ST 23	TAGGART VIRGINIA M		295 MAIN ST #23	READING	MA	01867
012.0-0727-0044.0	295 MAIN ST 24	ANTOUNIAN ALEXANDER	ANTOUNIAN HAGOP	48 WEBSTER RD	LEXINGTON	MA	02420
012.0-0728-0044.0	295 MAIN ST 25	CUTONE MARY		295 MAIN ST UNIT 25	READING	MA	01867
012.0-0729-0044.0	295 MAIN ST 26	XU STEVEN		295 MAIN ST UNIT #26	READING	MA	01867
012.0-0730-0044.0	295 MAIN ST 27	WALSH WILLIAM J		295 MAIN ST UNIT 27	READING	MA	01867
012.0-0731-0044.0	295 MAIN ST 28	FULA JOSEPH FERNANDO		7 DIRLAM CIRCLE	TEWKSBURY	MA	01876
012.0-0732-0044.0	295 MAIN ST 29	LOMBARDI PAUL L		295 MAIN ST APT #29	READING	MA	01867
012.0-0733-0044.0	295 MAIN ST 30	JACKSON WALTER T JR		295 MAIN ST UNIT 30	READING	MA	01867
012.0-1001-0040.0	269 MAIN ST 1001	FLEMING PAMELA E		269 MAIN STREET UNIT 1001	READING	MA	01867
012.0-1002-0040.0	269 MAIN ST 1002	BROWN CALVIN A III	NEMCOVICH ALI R TE	269 MAIN ST UNIT 1002	READING	MA	01864
012.0-1003-0040.0	269 MAIN ST 1003	GOWDAGIRI SANDEEP	THIAGARAJAN NANDITHA T	269 MAIN STREET UNIT 1003	READING	MA	01867
012.0-1004-0040.0	269 MAIN ST 1004	DOYLE BRUCE M TRUSTEE	DOYLE FAMILY TRUST	269 MAIN STREET UNIT 1004	READING	MA	01867
012.0-1005-0040.0	269 MAIN ST 1005	MOLL DAVID TRUSTEE	THE DAVID MOLL FAMILY TF	269 MAIN ST UN 1005	READING	MA	06477
012.0-1006-0040.0	269 MAIN ST 1006	JOHNSON LINDA M	HIGDON PHILIP TE	269 MAIN ST UNIT 1006	READING	MA	01867
012.0-2001-0040.0	269 MAIN ST 2001	KNOWLES JAMES E V TRUSTEES	175 NORTHAVEUNIT311 IRR	269 MAIN ST UNIT 2001	READING	MA	01867
012.0-2002-0040.0	269 MAIN ST 2002	BRENNER JEFFREY N SARA W TR	BRENNER FAMILY REVOCAL	269 MAIN STREET UNIT 2002	READING	MA	01867
012.0-2003-0040.0	269 MAIN ST 2003	TRAVAGLINI MICHAEL		225 C FALLON ROAD APT 28	STONEHAM	MA	02180
012.0-2004-0040.0	269 MAIN ST 2004	CHEN SHAOJIA	JING RAN TC	89 E DEDHAM STREET APT : BOSTON	BOSTON	MA	02118
012.0-2005-0040.0	269 MAIN ST 2005	ROSENTHAL ERIC		28 WINSHIP DRIVE	STONEHAM	MA	02180
012.0-2006-0040.0	269 MAIN ST 2006	MANUKYAN ZORAYR		269 MAIN STREET UNIT 2006	READING	MA	01867
012.0-3001-0040.0	269 MAIN ST 3001	MOVASSAGHIAN SARA		269 MAIN STREET	READING	MA	01867
012.0-3002-0040.0	269 MAIN ST 3002	TORRES SETH E	TORRES ASHLEY C TE	269 MAIN STREET UNIT 3002	READING	MA	01867
012.0-3003-0040.0	269 MAIN ST 3003	IMBRIANO NANCY		269 MAIN UNIT 3003	READING	MA	01867
012.0-3004-0040.0	269 MAIN ST 3004	HILL CAROL A TRUSTEE ETAL	CAROL & CHARLES HILL FA	269 MAIN STREET UNIT 3004	READING	MA	01867
012.0-3005-0040.0	269 MAIN ST 3005	NANCY A MINICHELLO TR OF 201	MINICHELLO NANCY A TRU	269 MAIN ST #3005	READING	MA	01867
012.0-3006-0040.0	269 MAIN ST 3006	CHAO WEIGONG	GUO YIPING TE	122 GLASGOW TERRACE	MAHWAH	NJ	07430
012.0-4001-0040.0	269 MAIN ST 4001	XU YANJING	LIU SONGJIU TC	190 PLEASANT STREET APT	MALDEN	MA	02148
012.0-4002-0040.0	269 MAIN ST 4002	TAN MEGAN		22 E EMERSON STREET	MELROSE	MA	02176
012.0-4003-0040.0	269 MAIN ST 4003	SHAH VIJAY	SHAH SHIVANI JTTRS	22 ORSINI DR	WAKEFIELD	MA	01880

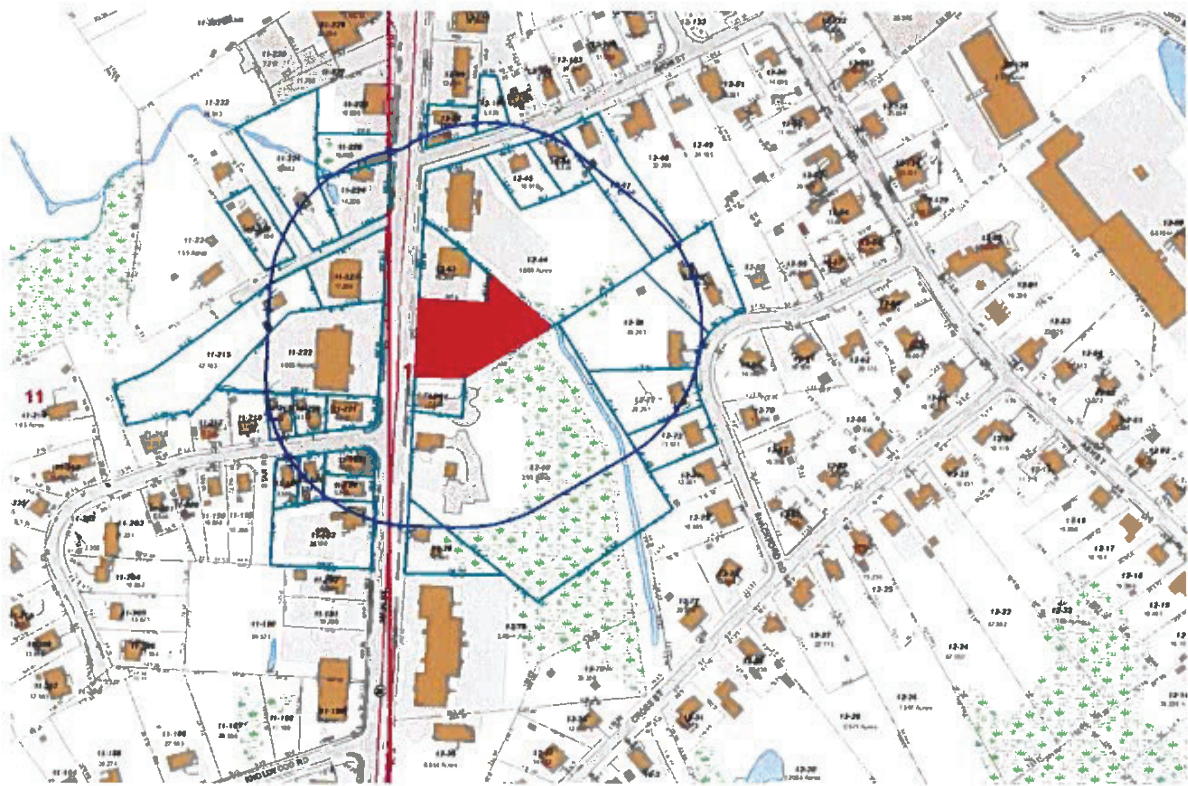
Subject Parcel ID: 281 Main St Report

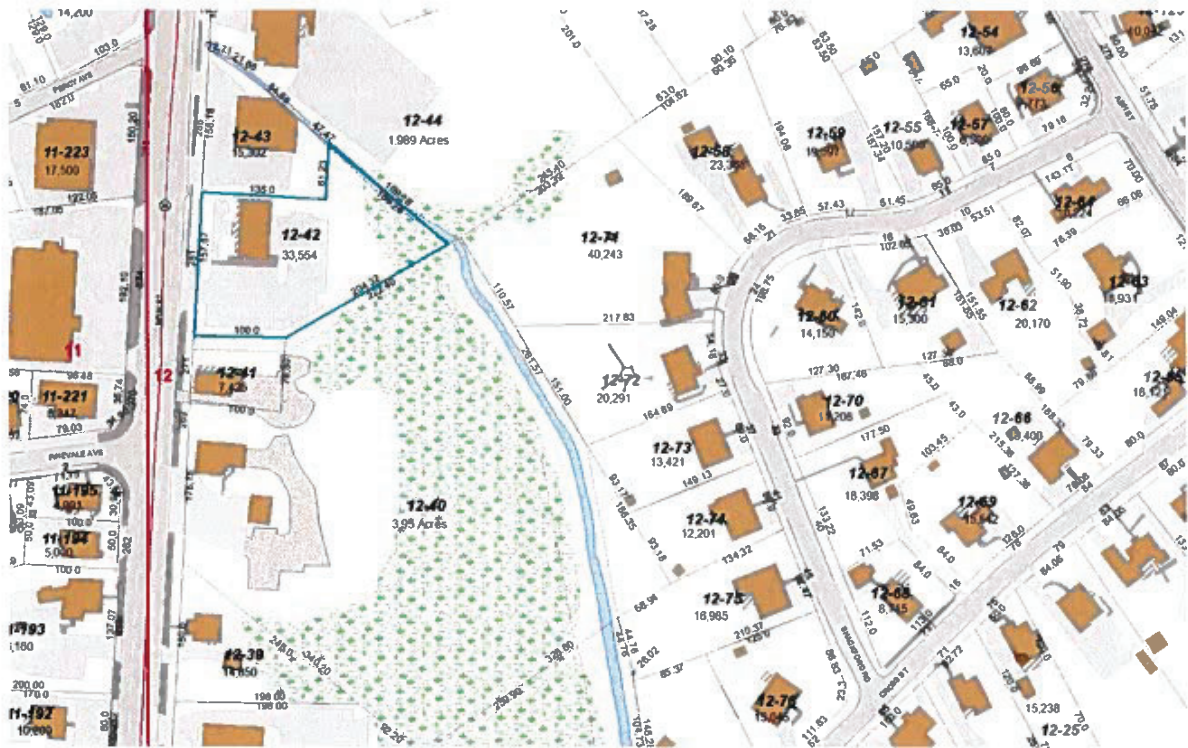
Subject Property Location:

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
012.0-4004-0040.0	269 MAIN ST 4004	BALURDI GIUSEPPE TRUSTEE	BALURDI GELSOMINA MARI	269 MAIN ST UNIT 4004	READING	MA	01867
012.0-4005-0040.0	269 MAIN ST 4005	SOOHOO MARIE		269 MAIN STREET UNIT 4005	READING	MA	01867
012.0-4006-0040.0	269 MAIN ST 4006	EPSTEIN WENDY S		269 MAIN ST UNIT 4006	READING	NH	01867

Parcel Count: 81

End of Report





Wetland Border Report

Site Locus: 281 Main Street, Reading, MA

Prepared for: Allen & Major Associates, Inc.

Prepared by: Goddard Consulting LLC, 100 Conifer Hill Drive, Suite 516, Danvers, MA 01923

Date: 10/23/2025

INTRODUCTION

On September 24th, 2025, the wetland resources were delineated for Allen & Major Associates, Inc. on land on and surrounding the property known as 281 Main Street, Reading, MA (refer to enclosed locus maps). The wetland border was flagged using the criteria in the most recent edition of the MA Wetland Protection Act (WPA) and Regulations 310 CMR 10.00 et al, as well as the Reading Wetlands Protection Bylaw. Hydric soil indicators, vegetation changes, hydrological indicators, and topography were all considered for delineation purposes.

The titles of the attached documents are as follows:

- Orthophoto of Locus Site, Goddard Consulting LLC, 10/22/2025
- NRCS Soils Survey of Locus Site, Goddard Consulting LLC, 10/22/2025
- FEMA Flood Map of Locus Site, Goddard Consulting LLC, 10/22/2025
- USGS Map of Locus Site, Goddard Consulting LLC, 10/22/2025

SUMMARY OF FINDINGS

The subject property, known as 281 Main Street, is an approximately 0.77-acre lot. The property is highlighted by an existing commercial development and associated, driveway, parking features, and landscaping off the property's frontage along Main Street. The site is bordered by existing commercial developments to the north, south, and across Main Street to the west. To the east, single family homes can be found. The bank of a mapped perennial stream was found along the northeastern property boundary. The stream was found to have no associated bordering vegetated wetlands (BVW) due to defined topography for the duration of the stream which occurred on site.

The mapped perennial stream system was located and delineated in the field as part of the site inspection. The stream was delineated with a continuous flag series GC-MAHW-1 – GC-MAHW-19. Much of the length of the stream was found to have steep, defined, banks resulting in the stream having no associated upgradient BVW to occur for the duration of the stream on site. Additionally, soil samples taken directly upgradient of the stream showed no signs of hydric conditions further supporting the finding.

According to the MassGIS data layers for the Natural Heritage & Endangered Species Program (NHESP), the locus site is not located within Estimated and/or Priority Habitat of Rare Wildlife. The site does not fall within an Area of Critical Environmental Concern (ACEC). The Site does not fall within a mapped Outstanding Resource Water (ORW) area. No jurisdictional FEMA flood zones exist on site. Lastly, no certified or potential mapped vernal pools exist on site.

The MA Wetlands Protection Act and the Town of Reading take jurisdiction over perennial streams as resource areas. As regulated by the Wetlands Protection Act, from the edge of the delineated perennial stream bank, a 100-foot Riverfront Area and 200-foot Riverfront Area is cast onto the locus. In addition to the Riverfront Areas, the Town of Reading additionally regulates a 25-foot Zone of Natural Vegetation. Any work within the jurisdictional resource areas, including the 100 and 200-foot Riverfront Areas or the 25-foot Zone of Natural Vegetation requires a Request for Determination (RDA) or Notice of Intent (NOI) to be filed with the Reading Conservation Commission.

DESCRIPTION OF REGULATED INLAND RESOURCE AREA

The table below provides the regulatory jurisdiction, flag numbers/colors, and wetland types and locations for the resource areas delineated.

Resource Area	Regulatory Jurisdiction	Flag Numbers and Color	Wetland Types and Locations
Perennial Stream	100-foot Riverfront Area (State & Bylaw Jurisdictional) 200-foot Riverfront Area (State & Bylaw Jurisdictional) 25-foot Zone of Natural Vegetation (Bylaw Jurisdictional)	GC-MAHW-1 – GC-MAHW-19 (Pink Flags)	Delineated bank of a perennial stream which is found within the northeastern portion of the property.

SITE PHOTOS



Photo 1: Seen is representative of the intermittent stream found on site.



Photo 2: Seen is representative of the area upgradient of the stream bank.



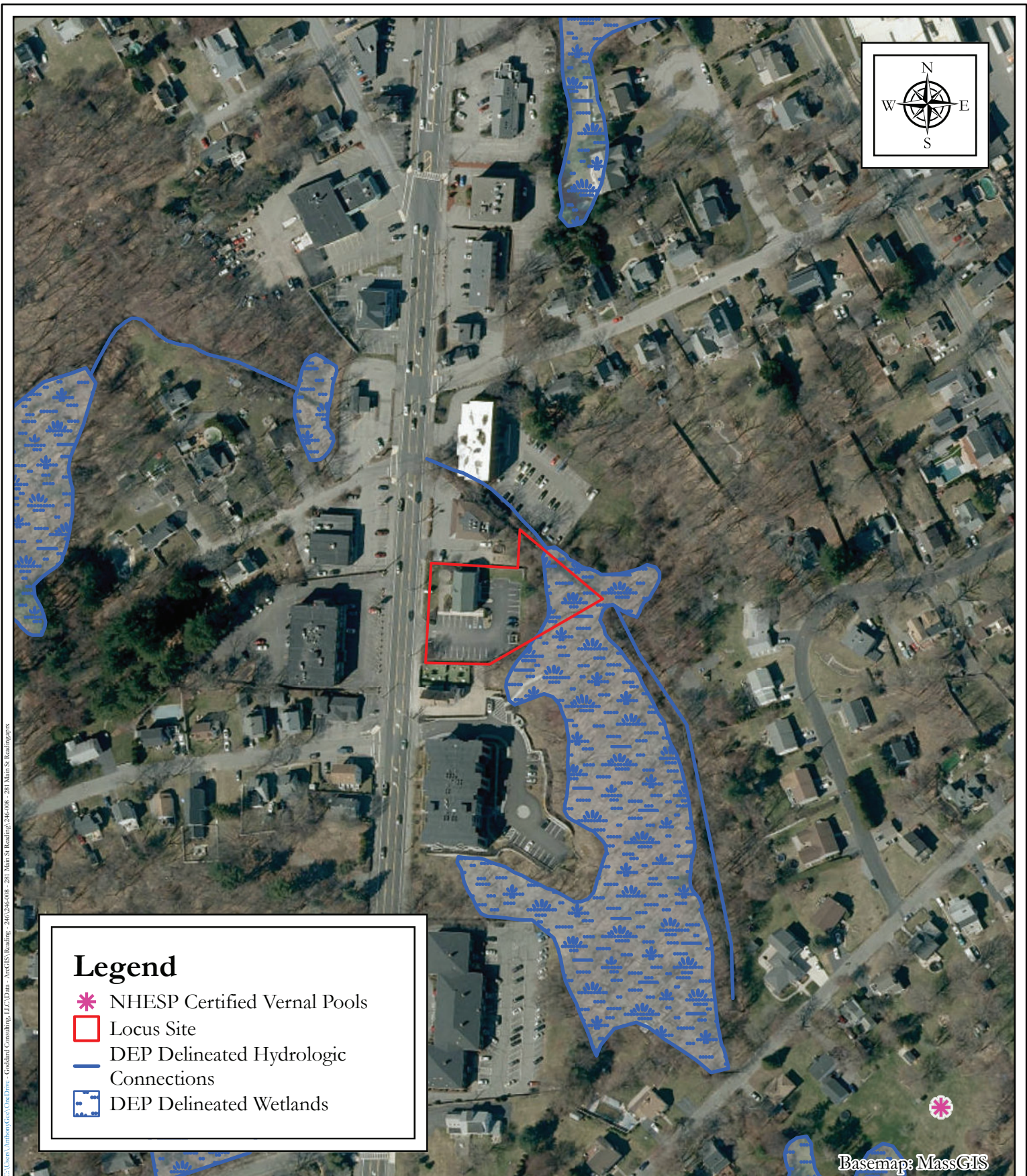
Photo 3: Pictured is representative of the subsoil found within a sample taken upgradient of the stream bank

Goddard Consulting, LLC

Anthony Gee

Anthony Gee, WPIT

Wetland Scientist



C:\Users\anthony\OneDrive - Goddard Consulting\JLC\Draw - ArcGIS\Reading - 246120000000420 - 281 Main St Reading.mxd



Orthophoto of Locus Site

0 100 200 Feet 1" = 200'

71.1030521°W, 42.5153327°N

Date: 10/22/2025

281 Main Street,
Reading, MA, 01867

Parcel ID: 246012000000420

Figure 2



C:\Users\Vanhoose\OneDrive - Goddard Consulting\JLD\Data - ArcGIS\Reading - 246\246r008 - 261\Main St Reading\246r008 - 261\Main St Reading.aprx



NRCS Soil Survey of Locus Site

0 50 100 1" = 100'
 ─────────── Feet

71.1030521°W, 42.5153327°N

Date: 10/22/2025

:

Figure



© USGS, Aerial Imagery, OpenStreetMap, Goddard Consulting, LLC, Data - ArcGIS Reading - 2461246108 - 281 Main St Reading, MA 01867 - 281 Main St Reading, MA

Legend

- Locus Site
- FEMA National Flood Hazard Layer
- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee
- Area Not Included

Basemap: MassGIS, FEMA, MassGIS



FEMA Flood Map
of Locus Site

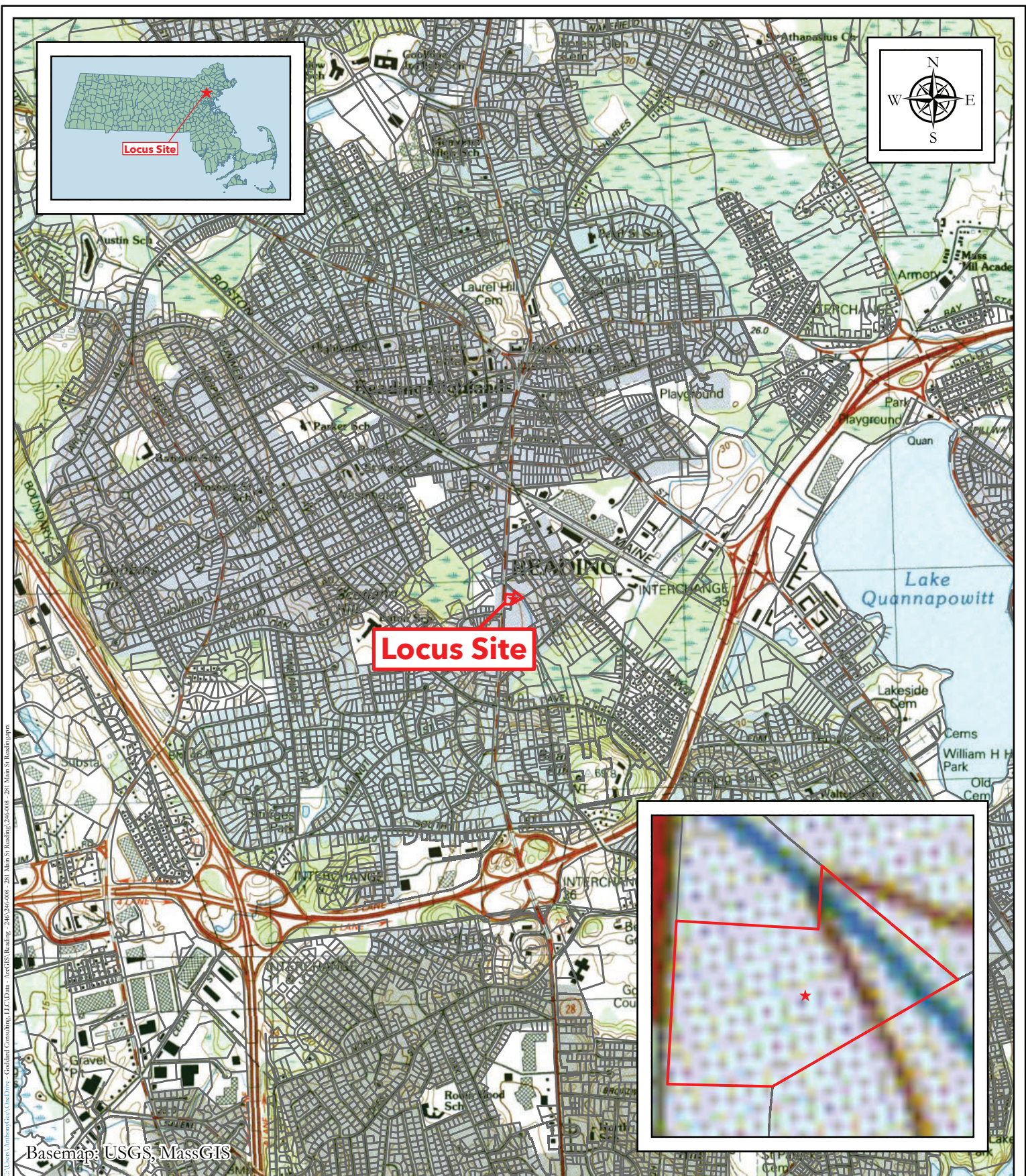
0 100 200 Feet 1" = 200'

71.1030521°W, 42.5153327°N

Date: 10/22/2025

281 Main Street,
Reading, MA, 01867

Parcel ID: 246012000000420



USGS of Locus Site

0 1,000 2,000 Feet 1" = 2,000'

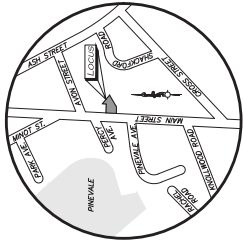
71.1030521°W, 42.5153327°N

Date: 10/22/2025

281 Main Street,
Reading, MA, 01867

Parcel ID: 246012000000420

CIVIL SITE PLANS FOR: MIXED-USE BUILDING: RETAIL AND RESIDENTIAL 281 MAIN STREET (MAP 42 LOT 12) READING, MA



LOCUS MAP
(NOT TO SCALE)

OWNER / APPLICANT:
281 READING, LLC
281 MAIN STREET
READING, MA 01867

CIVIL ENGINEER, LANDSCAPE ARCHITECT & LAND SURVEYOR:
ALLEN & MAJOR ASSOCIATES
100 COMMERCE WAY, SUITE 5
WOBBURN, MA 01801
781.935.6889

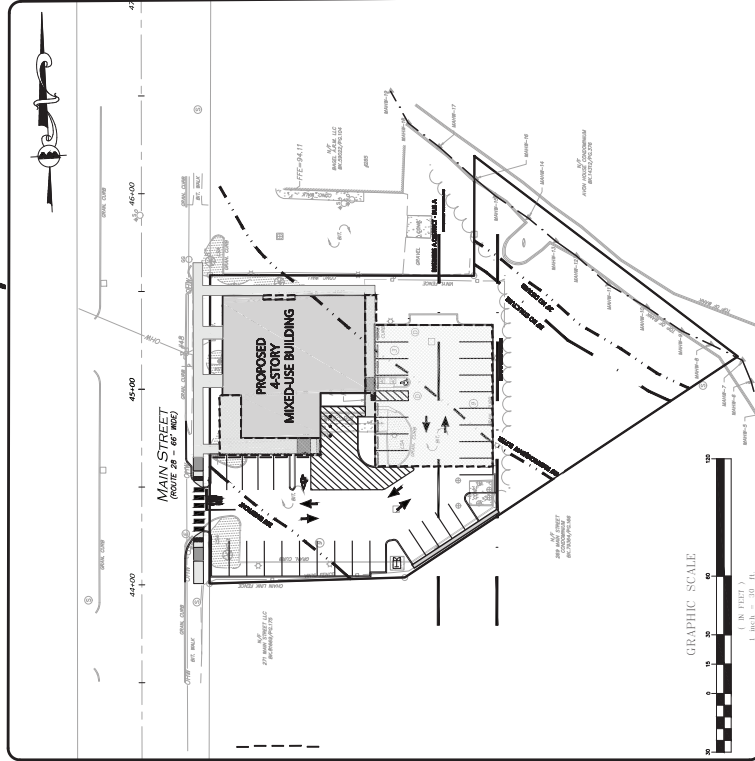
ARCHITECT:
SV DESIGN, LLC
126 DODGE STREET
BEVERLY, MA 01915
978.529.2303

WETLAND SCIENTIST:
GODDARD CONSULTING, LLC
291 MAIN STREET, SUITE 8
NORTHBOROUGH, MA 01532
508.393.3784



PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

ASSESSOR'S INFORMATION		
MAP	LOT	BLOCK AREA (ACRES)
12	42	000 0.77



LIST OF CIVIL, SURVEY AND LANDSCAPE DRAWINGS			
DRAWING TITLE	SHEET NO.	ISSUED	LAST REVISED
SITE PLAN COVER SHEET	—	11-24-2025	03-11-2026
EXISTING CONDITIONS SURVEY	V-101	11-24-2025	03-11-2026
ABBREVIATIONS & NOTES	C-001	11-24-2025	03-11-2026
EROSION CONTROL & SITE PREP PLAN	C-101	11-24-2025	03-11-2026
LAYOUT & MATERIALS PLAN	C-102	11-24-2025	03-11-2026
GRADING & DRAINAGE PLAN	C-103	11-24-2025	03-11-2026
UTILITIES PLAN	C-104	11-24-2025	03-11-2026
LIGHTING PLAN	C-105	11-24-2025	03-11-2026
SNOW STORAGE PLAN	C-106	11-24-2025	03-11-2026
VEHICLE MOVEMENT PLAN	C-107	11-24-2025	03-11-2026
VEHICLE MOVEMENT PLAN	C-108	11-24-2026	03-11-2026
FIRE TRUCK TURNING PLAN	C-109	11-24-2025	03-11-2026
DETAILS	C-501	11-24-2025	03-11-2026
DETAILS	C-502	11-24-2025	03-11-2026
DETAILS	C-503	11-24-2025	03-11-2026
DETAILS	C-504	11-24-2025	03-11-2026
DETAILS	C-505	11-24-2025	03-11-2026
LANDSCAPE PLAN	L-101	11-24-2025	03-11-2026
LANDSCAPE NOTES & DETAILS	L-501	11-24-2025	03-11-2026
LANDSCAPE NOTES & DETAILS	L-502	11-24-2025	03-11-2026



ALLEN & MAJOR ASSOCIATES, INC.

100 COMMERCE WAY, SUITE 5
WOBBURN, MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896

WOBBURN, MA • LANSHUTE, MA • WASHINGTON, DC

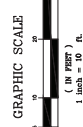
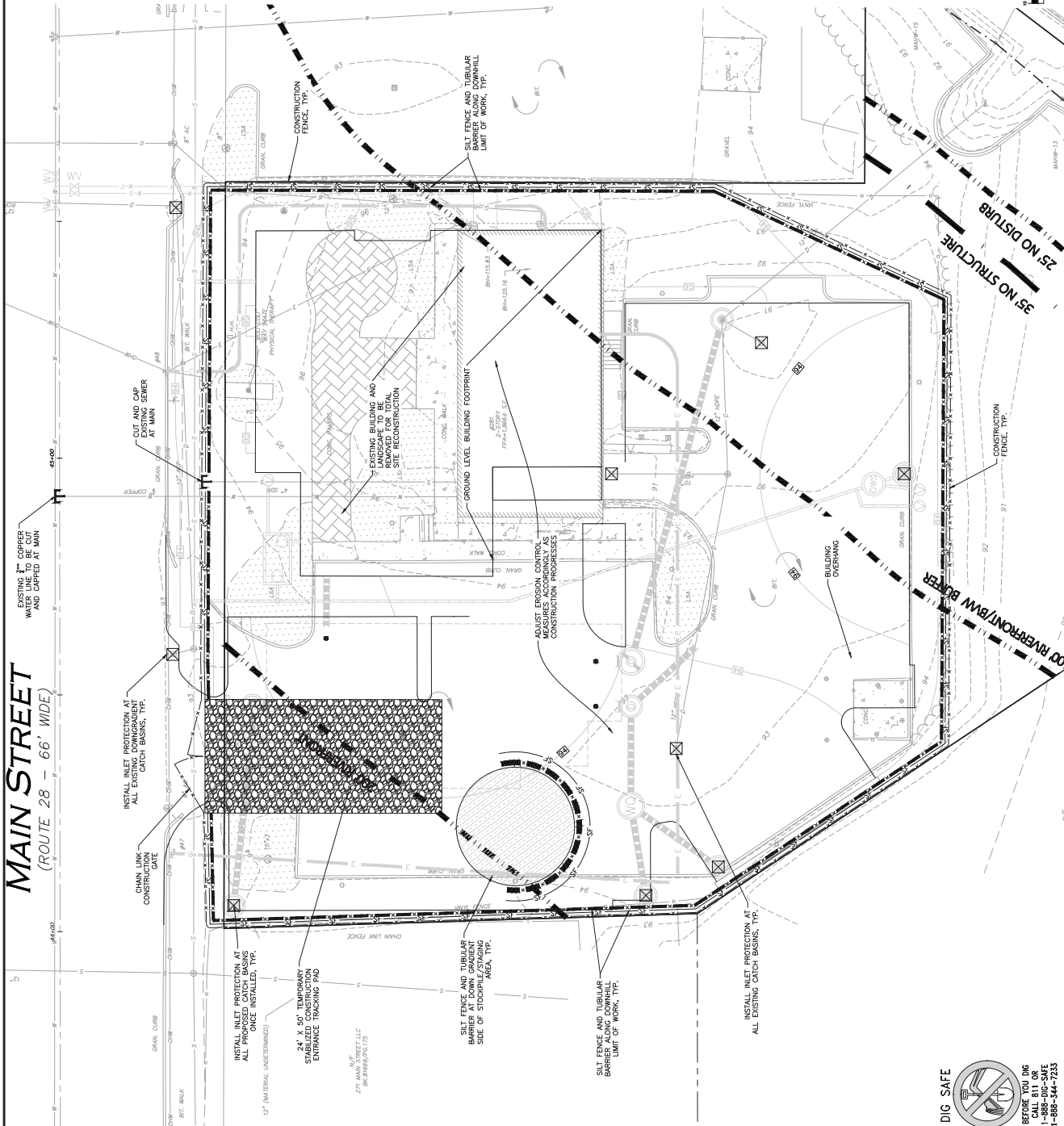
ISSUED FOR APPROVAL: NOVEMBER 24, 2025
ISSUED FOR NOTICE OF INTENT: MARCH 11, 2026

MAIN STREET (ROUTE 28 - 66' WIDE)

LEGEND

	SILT FENCE
	TUBULAR BARRIER
	EROSION CONTROL FABRIC
	CATCH BASIN FILTER
	STONE CHECK DAM
	STABILIZED ENTRANCE
	TURBIDITY CURTAIN
	STOCKPILE/STAGING AREA

- NOTES:**
1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND THE CONTRACTOR SHALL VERIFY THE LOCATION, DEPTH, OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGE TO EXISTING UTILITIES. THE CONTRACTOR SHALL PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
 2. ALL ELEVATIONS REFER TO NAVD 88.
 3. THE INFORMATION SHOWN ON THIS PLAN IS THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. ANY ALTERATION, MISUSE, OR RECALCULATION OF INFORMATION OR DATA WITHOUT THE EXPRESSED WRITTEN PERMISSION OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.
 4. THE CONTRACTOR SHALL CONTACT "DIGSAFE" AND THE TOWN OF READING DEPARTMENT OF PUBLIC WORKS TO REQUEST THE LOCATION OF THE EXISTING UTILITIES.
 5. SEE THE ABBREVIATIONS AND NOTES PLAN, C-001 FOR ABBREVIATIONS, NOTES, AND EROSION CONTROL NOTES.
 6. EXISTING CONDITIONS BASE PLAN WAS PREPARED BY ALLEN & MAJOR ASSOCIATES.



PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

ISSUED FOR NOTICE OF ABT	DATE	2025-11-24
REV. DATE	DESCRIPTION	
PROJECT:		
MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT		
281 MAIN STREET		
READING, MA 01867		
PROJECT NO. 2398-08		
DATE	2025-11-24	
SCALE	1" = 10'	DWG. NAME: C2398-08
DESIGNED BY:	MM	CHECKED BY:
DATE		



ALLEN & MAJOR ASSOCIATES, INC.
civil engineering • land surveying
100 COMMERCE WAY, SUITE 2
READING, MASSACHUSETTS 01867
TEL: 978-944-7233
FAX: 978-944-7239

EROSION CONTROL & SITE PREP PLAN
SHEET NO. C-101

PROJECT NO. 2398-08 DATE: 2025-11-24
SCALE: 1" = 10' DWG. NAME: C2398-08
DESIGNED BY: MM CHECKED BY: CMO
DATE: / /

MASSACHUSETTS REGISTERED PROFESSIONAL ENGINEER
NO. 10000
ALLEN & MAJOR ASSOCIATES, INC.
100 COMMERCE WAY, SUITE 2
READING, MASSACHUSETTS 01867
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OFF-STREET PARKING SUMMARY

USE: PER TOWN OF READING ZONING BYLAW SECTION 5.6.7.4A, MIXED-USE DEVELOPMENTS, RESIDENTIAL USES:
 A MINIMUM OF 1.25 SPACES FOR EACH DWELLING UNIT SHALL BE PROVIDED.
 RETAIL STORES/OFFICES/CONSUMER SERVICE ESTABLISHMENTS
 ONE SPACE PER 300 SQUARE FEET (S.F.) OF GROSS FLOOR AREA
 ONE LOADING SPACE MINIMUM FOR EVERY 20 UNITS.

PARKING SUMMARY:
 24 UNIT APARTMENT BUILDING: 24 UNITS x 1.25 SPACES/UNIT = 30 SPACES
 RETAIL SPACES REQUIRED: 2,400 S.F. / 300 S.F. = 8 SPACES
 TOTAL OFF-STREET PARKING REQUIREMENT = 38 SPACES

ADA REQUIRED: THESE ARE SEVEN (7) ADA PARKING SPACES. REQUIRE 2 TOTAL PARKING SPACES TO BE ACCESSIBLE AND 1 BEING VAN ACCESSIBLE.
 ADA PROVIDED: 2 TOTAL ACCESSIBLE PARKING, WITH 1 BEING VAN ACCESSIBLE.

LOADING SPACES REQUIRED = 1 REQUIRED. 1 PROVIDED. (1 LOADING SPACE PER 20 UNITS WITH 24 TOTAL UNITS PROPOSED)(1)

STANDARD (9' x 18')	COVERED (8.5' x 17')	COMPACT (8' x 15')	ACCESSIBLE (8' WIDE)	TOTAL REQUIRED	TOTAL PROVIDED
10	16	5	6	2	38
TOTAL REQUIRED					39

(UPPER 8.1.1.2 OF THE TOWN OF READING ZONING BYLAW, OFF-STREET PARKING AREAS, OR LOADING AND UNLOADING AREAS, INCLUDING OFF-STREET PARKING AND LOADING AND UNLOADING REQUIREMENTS) WHERE THE COMPARISON OF THE RESULTS OF THE CALCULATION OF A FLOOR SPACE TO THE FLOOR SPACE OF THE PROPERTY IS LESS THAN ONE (1), THE PROPERTY IS TO BE CONSIDERED TO BE IN COMPLIANCE WITH THE FLOOR SPACE REQUIREMENT OF THE FLOOR SPACE. THE BOARD OF APPEALS SHALL DETERMINE THE PROPER INTERPRETATION.

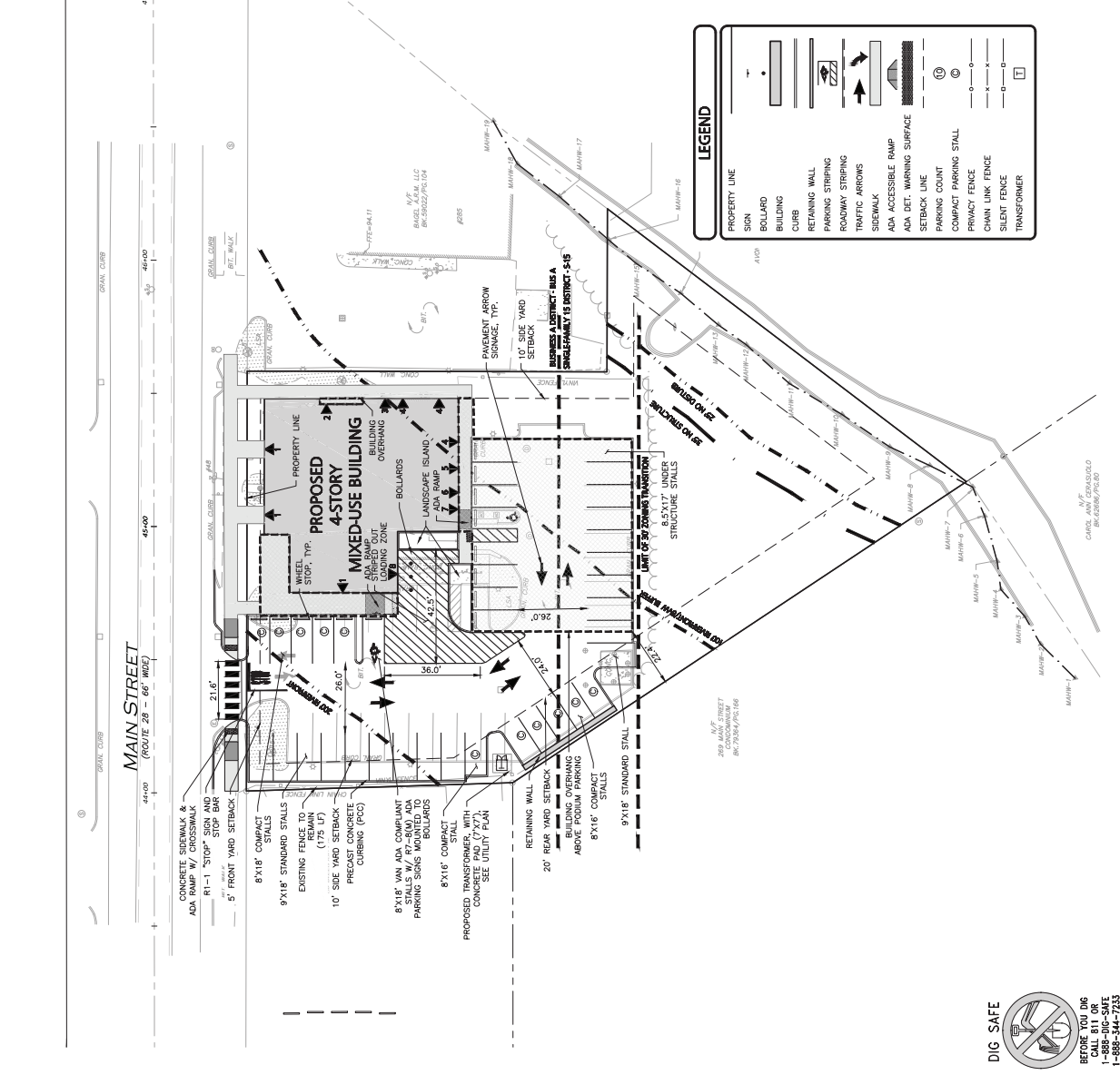
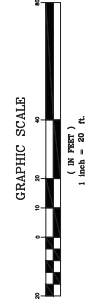
DIMENSIONAL REQUIREMENTS: BUSINESS-A DISTRICT (BUS. A) AND MIXED-USE DEVELOPMENT PER SECTION 5.6.7 OF THE ZONING BYLAW

ITEM	REQUIRED/ALLOWED	EXISTING	PROPOSED
LOT AREA (MIN.)	N/A	33,584.4 S.F. 0.772 ACRES	33,584.4 S.F. 0.772 ACRES
LOT FRONTAGE (MIN.)	N/A	157.7'	157.7'
FRONT YARD BUILDING SETBACK	5' (MIN.)	42.0'	5'
SIDE YARD BUILDING SETBACK	10' (MIN.)	16.0'	10'
REAR YARD BUILDING SETBACK	20' (MIN.)	79.0'	22'
BUILDING LOT COVERAGE (MAX.)	60%	54.4%	50%
BUILDING HEIGHT (MAX.)	45'	535'	<45'
OPEN SPACE (%)	N/A	53.7%	55.5%

ENTRANCE TABLE

BUILDING ENTRANCES	CORRESPONDING NUMBER
COMMERCIAL ENTRANCE	1
RESIDENTIAL SIDE ENTRANCE	2
BIKE STORAGE ENTRANCE	3
MECHANICAL ROOM ENTRANCE	4
PACKAGE ENTRANCE	5
RESIDENTIAL LOBBY ENTRANCE	6
RESIDENTIAL REAR ENTRANCE	7
TRASHROOM ENTRANCE	8

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LEGEND

- PROPERTY LINE
- SIGN
- BOLLARD
- BUILDING
- CURB
- RETAINING WALL
- PARKING STRIPING
- ROADWAY STRIPING
- TRAFFIC ARROWS
- SIDEWALK
- ADA ACCESSIBLE RAMP
- ADA DET. WARNING SURFACE
- SETBACK LINE
- PARKING COUNT
- COMPACT PARKING STALL
- PROPERTY FENCE
- CHAIN LINK FENCE
- SILENT FENCE
- TRANSFORMER

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PROFESSIONAL ENGINEER FOR
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MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT
 281 MAIN STREET
 READING, MA 01867

PROJECT NO. 2398-08 DATE: 2023-11-30
 SCALE: 1" = 20' DWG. NAME: C-102-08
 DESIGNED BY: MJP CHECKED BY: CMO
 PREPARED BY: CMO

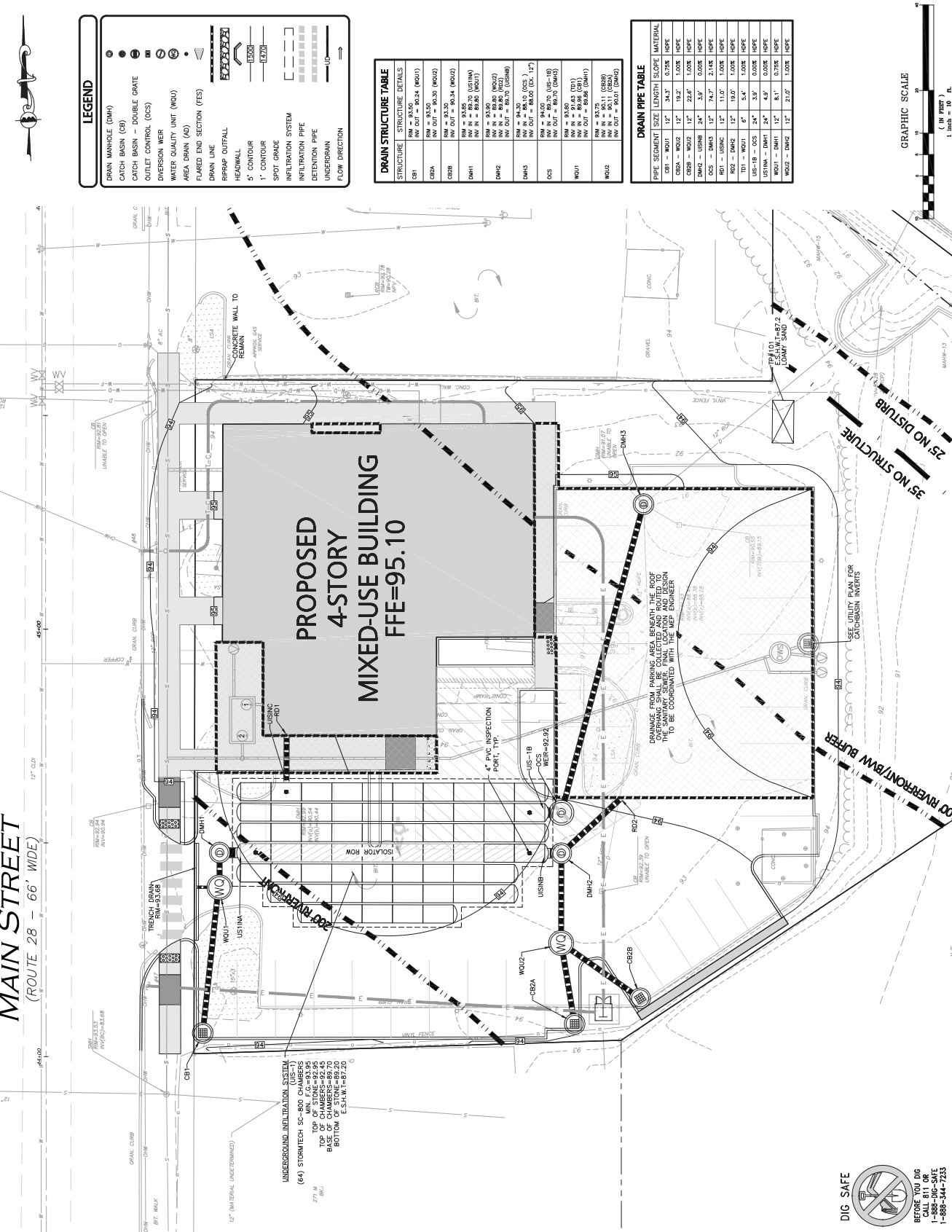
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 civil engineering • land surveying
 100 COMMERCE WAY, SUITE 200
 READING, MASSACHUSETTS 01867
 TEL: (978) 952-9889 FAX: (978) 952-9899

REGISTERED PROFESSIONAL ENGINEER
 LICENSE NO. 0000000000
 STATE OF MASSACHUSETTS
 CIVIL ENGINEERING
 EXPIRES 12/31/2024

LAYOUT & MATERIALS PLAN

SHEET NO. **C-102**

MAIN STREET (ROUTE 28 - 66' WIDE)



LEGEND

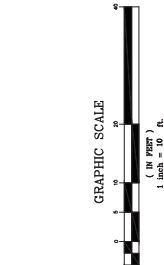
- DRAIN MANHOLE (DMH)
- CATCH BASIN (CB)
- OUTLET CONTROL (OCS)
- DIVERSION WEIR
- WATER QUALITY UNIT (WQU)
- AREA DRAIN (AD)
- FLARED END SECTION (FES)
- DRAIN LINE
- RIPRAP OUTFALL
- HEADWALL
- 5" CONTOUR
- 1" CONTOUR
- SPOT GRADE
- INFILTRATION SYSTEM
- INFILTRATION PIPE
- DETENTION PIPE
- UNDERDRAIN
- FLOW DIRECTION

DRAIN STRUCTURE TABLE

STRUCTURE	STRUCTURE DETAILS
CB1	RM = 83.70 RM IN = 83.70 (CB1) RM OUT = 83.70 (CB1)
CB2A	RM = 83.50 RM IN = 83.50 (CB2A) RM OUT = 83.50 (CB2A)
CB2B	RM = 83.50 RM IN = 83.50 (CB2B) RM OUT = 83.50 (CB2B)
DMH1	RM = 83.55 RM IN = 83.55 (DMH1) RM OUT = 83.55 (DMH1)
DMH2	RM = 83.80 RM IN = 83.80 (DMH2) RM OUT = 83.80 (DMH2)
DMH3	RM = 84.30 RM IN = 84.30 (DMH3) RM OUT = 84.30 (DMH3)
OCS	RM = 84.00 RM IN = 84.00 (OCS) RM OUT = 84.00 (OCS)
WOU1	RM = 83.50 RM IN = 83.50 (WOU1) RM OUT = 83.50 (WOU1)
WOU2	RM = 83.25 RM IN = 83.25 (WOU2) RM OUT = 83.25 (WOU2)

DRAIN PIPE TABLE

PIPE SEGMENT	SIZE	LENGTH	SLOPE	MATERIAL
CB1 - WOU1	12"	54.3'	0.75%	HDPE
CB2A - WOU2	12"	19.2'	1.00%	HDPE
DMH2 - WOU2	12"	22.6'	1.00%	HDPE
DMH2 - USNB	24"	3.9'	0.00%	HDPE
OCS - DMH3	12"	74.7'	2.14%	HDPE
DMH3 - DMH1	12"	19.9'	1.00%	HDPE
DMH1 - WOU1	12"	5.4'	1.00%	HDPE
US1B - OCS	24"	3.9'	0.00%	HDPE
US1A - DMH1	24"	4.9'	0.00%	HDPE
WOU1 - DMH1	12"	8.1'	0.25%	HDPE
WOU2 - DMH2	12"	21.0'	1.00%	HDPE



PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

SEAL: [Professional Seal]

PROJECT:
**MIXED-USE RETAIL AND
RESIDENTIAL DEVELOPMENT**
281 MAIN STREET
READING, MA 01867

PROJECT NO. 238408 DATE: 2025-11-24
SCALE: 1" = 10' DWG. NAME: C1389-08
DESIGNED BY: MTH CHECKED BY: CMG
PREPARED BY: [Name]

**ALLEN & MAJOR
ASSOCIATES, INC.**
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READING, MASSACHUSETTS 01867
TEL: (978) 932-8889
FAX: (978) 932-8899

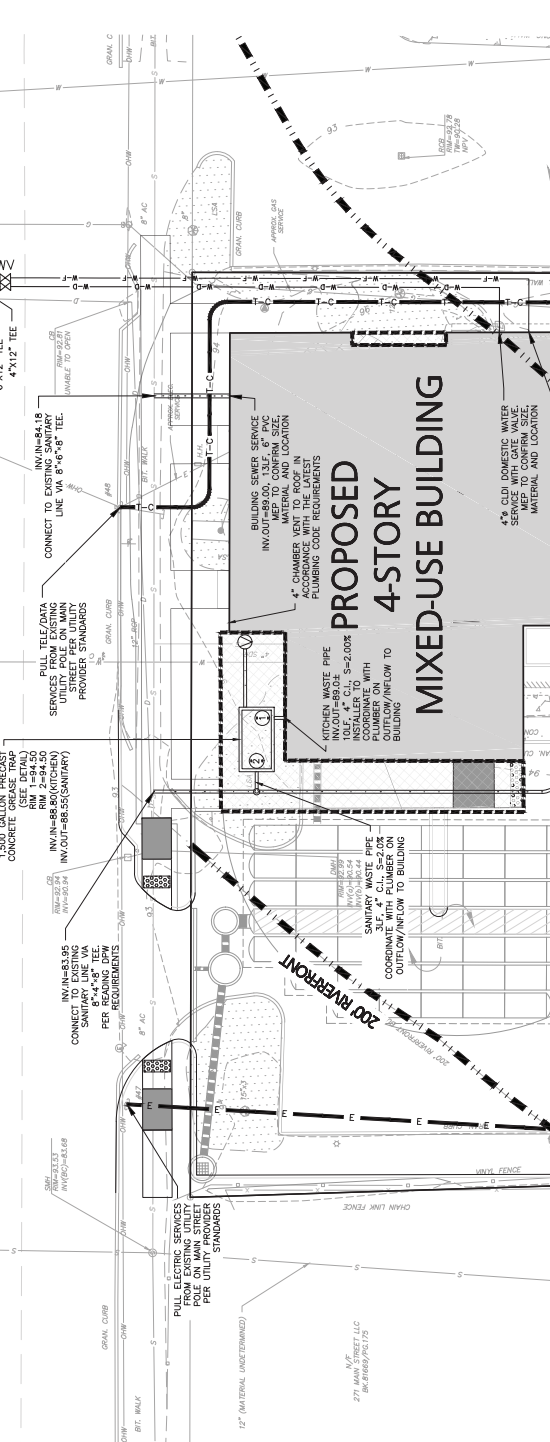
REGISTERED PROFESSIONAL ENGINEER
LICENSED SURVEYOR IN MASSACHUSETTS
MEMBER OF THE MASSACHUSETTS SOCIETY OF PROFESSIONAL ENGINEERS
MEMBER OF THE MASSACHUSETTS SOCIETY OF PROFESSIONAL SURVEYORS
MEMBER OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS
MEMBER OF THE AMERICAN SOCIETY OF SURVEYORS

SHEET NO. **C-103**

MAIN STREET (ROUTE 28 - 66' WIDE)

LEGEND

○	SEWER MANHOLE
○	SEWER CLEANOUT
○	SEWER VENT
○	SEWER LINE
○	SEWER FORCEMAIN
○	CONCRETE PIPE ENCASMENT
○	WATER LINE
○	WATER (FIRE SERVICE)
○	WATER (DOMESTIC SERVICE)
○	WATER VALVE
○	HYDRANT
○	WATER LINE REDUCER
○	GAS LINE
○	GAS VALVE
○	SEPTIC/HOLDING TANK
○	GREASE TRAP
○	LIGHT FIXTURE
○	OVER HEAD WIRE
○	UTILITY POLE
○	ELECTRIC MANHOLE/SPICE BOX
○	SWITCHING STATION
○	HAND HOLE
○	ELECTRICAL CONDUIT
○	LIGHTING CONDUIT
○	IRRIGATION SLEEVE
○	ELEC/TELE/CABLE CONDUIT
○	TELE/FIRE CONDUIT



PROJECT: MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA 01867

PROJ. NO.: 2398-08 **DATE:** 2023-11-30
SCALE: 1" = 10' **DWG. NAME:** C139B-08

DESIGNED BY: MJP **CHECKED BY:** CMG

PREPARED BY: MJP

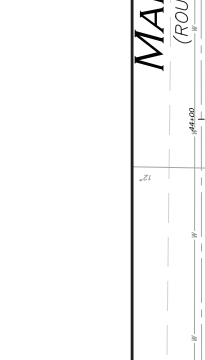
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FAX: (978) 932-0999

REGISTERED PROFESSIONAL ENGINEER
STATE OF MASSACHUSETTS
LICENSE NO. 11000
EXPIRES 12/31/2025

PROJ. NO.: 2398-08 **SHEET No.:** C-104


NOTES:

- CONNECT PROPOSED WATER TO EXISTING WATER MAIN PER READING DWM REQUIREMENTS TYP.
- CONNECT TO EXISTING WATER MAIN VIA 8" x 4" TEE. (INV. = 84.18)
- PULL TELE/DATA SERVICES FROM EXISTING UTILITY POLE ON MAIN STREET PER UTILITY PROVIDER STANDARDS.
- 1,500 GALLON PRECAST CONCRETE GREASE TRAP (SEE DETAIL) RM 2-84.50 (INV. = 84.50)
- CONNECT TO EXISTING SANITARY MAIN VIA 4" x 4" TEE PER READING DWM REQUIREMENTS.
- PULL ELECTRIC SERVICES FROM EXISTING UTILITY POLE ON MAIN STREET PER UTILITY PROVIDER STANDARDS.
- 12" (MINIMUM UNDEFERRED) BIT WALK.
- 12" (MINIMUM UNDEFERRED) CHAIN LINK FENCE.
- TRANSFORMER SIZE & COMPANY REQUIREMENTS.
- COVERED PARKING AREA WILL NEED DRAINAGE DISCHARGES DESIGNED BY MEP ENGINEER TO BE DESIGNED BY MEP ENGINEER.
- 60 WATER SEPARATORS SHOWN FOR PERMITTING PURPOSES ONLY. AWS LOCATION AND OUTLET TO BE DESIGNED BY MEP ENGINEER.
- CATCHBASIN (INV. = 80.03)
- 25' NO DISTURB
- 35' NO STRUCTURE
- 100' RIVERFRONT/BM BUFFER



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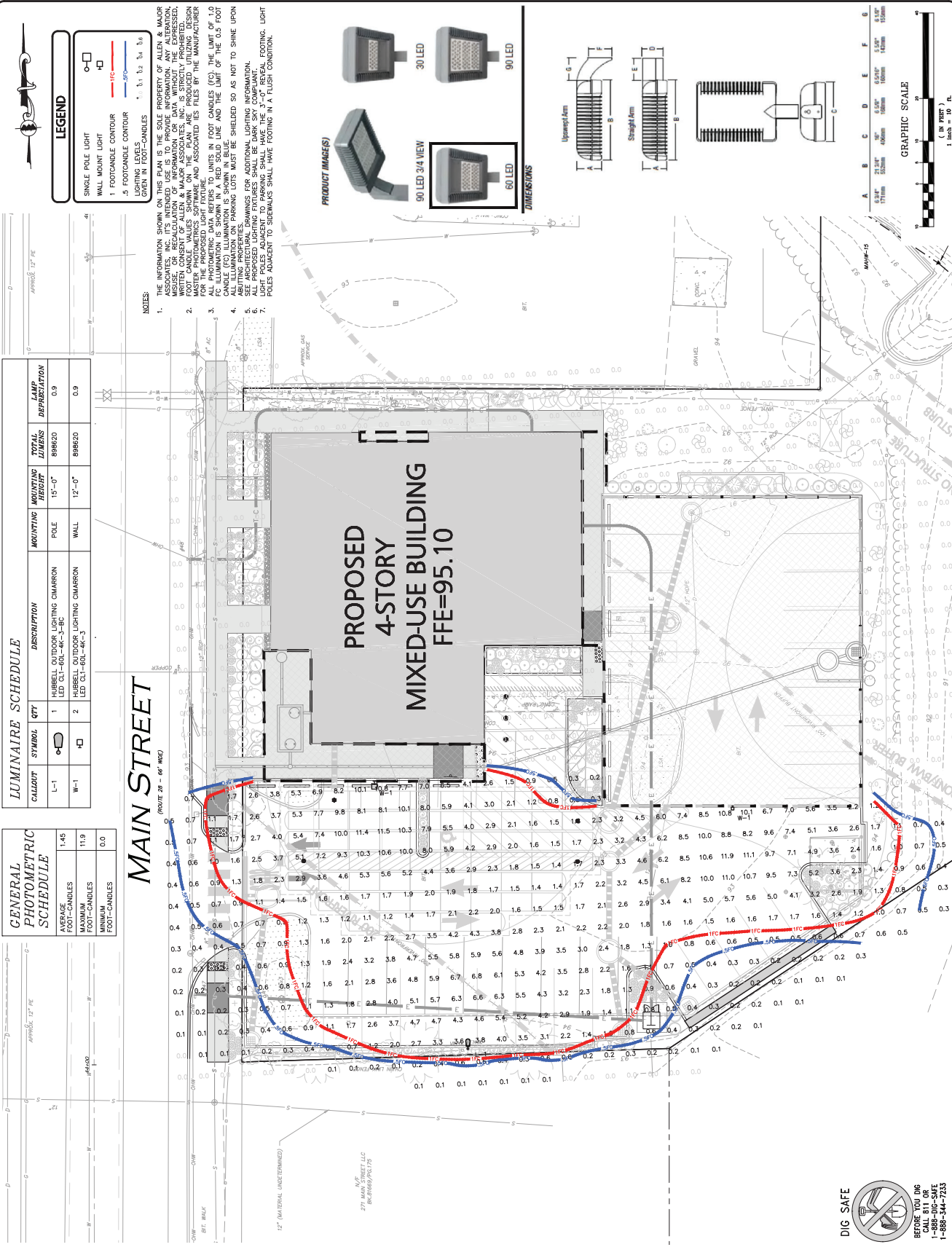
PROJECT:
MIXED-USE RETAIL AND
RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA 01867

PROJECT NO. 2398-134 DATE 2023-11-24
SCALE: 1" = 10' DWG NAME: C-2398-08
DESIGNED BY: BJT CHECKED BY: CMO
DATE: 11/23/23



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civil engineering • landscape architecture
180 COMMERCIAL WAY, SUITE 205
READING, MASSACHUSETTS 01867
TEL: (978) 932-0889 FAX: (978) 932-0899

DRAWING TITLE: **LIGHTING PLAN**
SHEET NO.: **C-105**



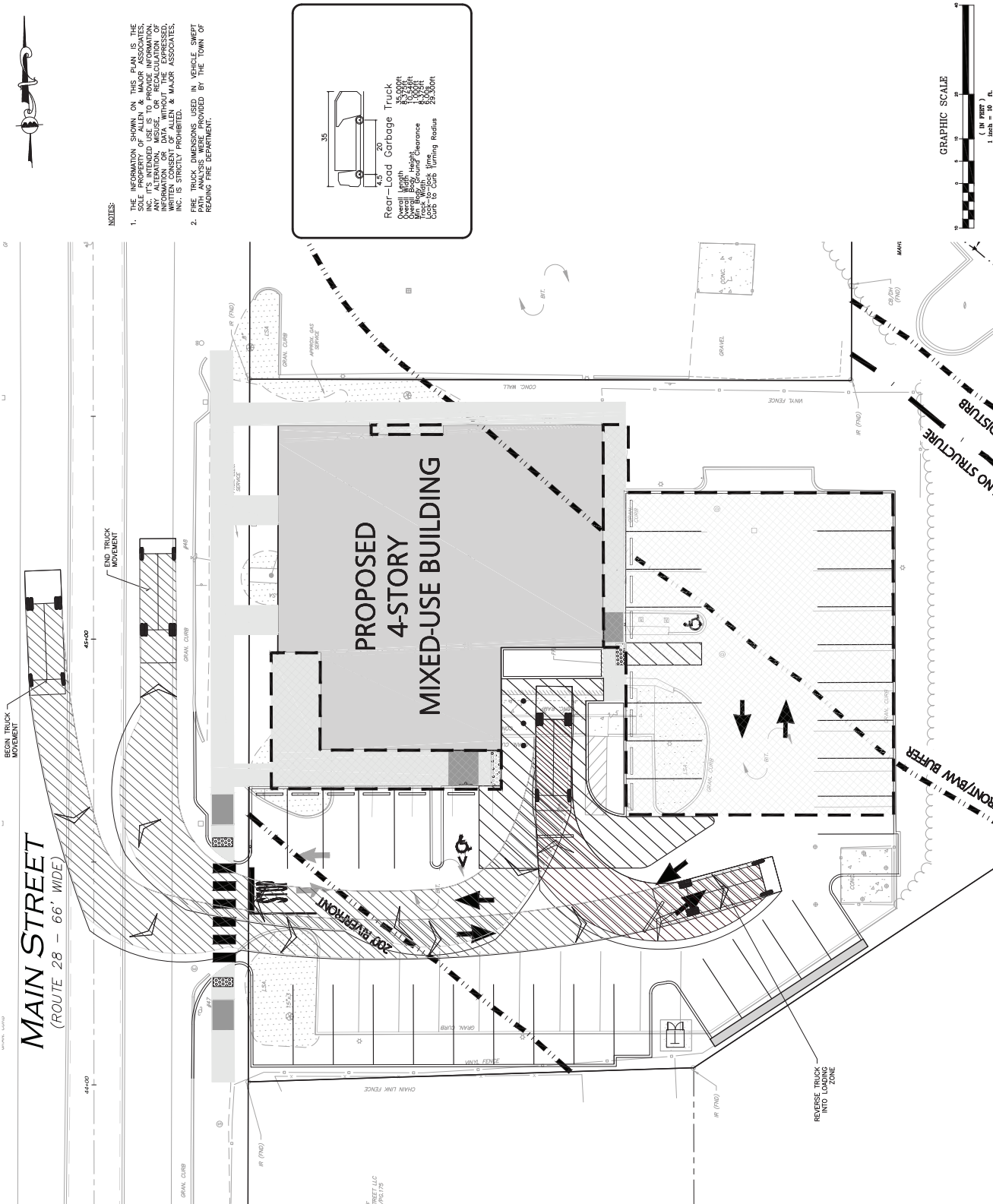
LUMINAIRE SCHEDULE

CALLOUT	SYMBOL	QTY	DESCRIPTION	MOUNTING HEIGHT	TOTAL LUMENS	LAMP DEPRECIATION
L-1	[Symbol]	1	HUBBELL OUTDOOR LIGHTING CHARRON LED CL1-60L-4K-3-BC	15'-0"	898620	0.9
W-1	[Symbol]	2	HUBBELL OUTDOOR LIGHTING CHARRON LED CL1-60L-4K-3	12'-0"	898620	0.9

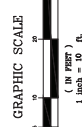
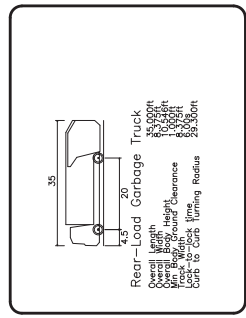
GENERAL PHOTOMETRIC SCHEDULE

AVERAGE FOOT-CANDLES	1.45
MINIMUM FOOT-CANDLES	11.9
MAXIMUM FOOT-CANDLES	0.0

MAIN STREET
(ROUTE 28 - 66' WIDE)



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1	ISSUED FOR NOTICE OF VIOLATION	
REV.	DATE	DESCRIPTION

PROJECT:
MIXED-USE RETAIL AND
RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA 01867

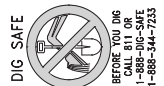
PROJECT NO.: 2398-08 | **DATE:** 2025-11-24
SCALE: 1" = 10' | **DWG. NAME:** C-107-08

DESIGNED BY: MJA | **CHECKED BY:** CMG
PREPARED BY: CMG

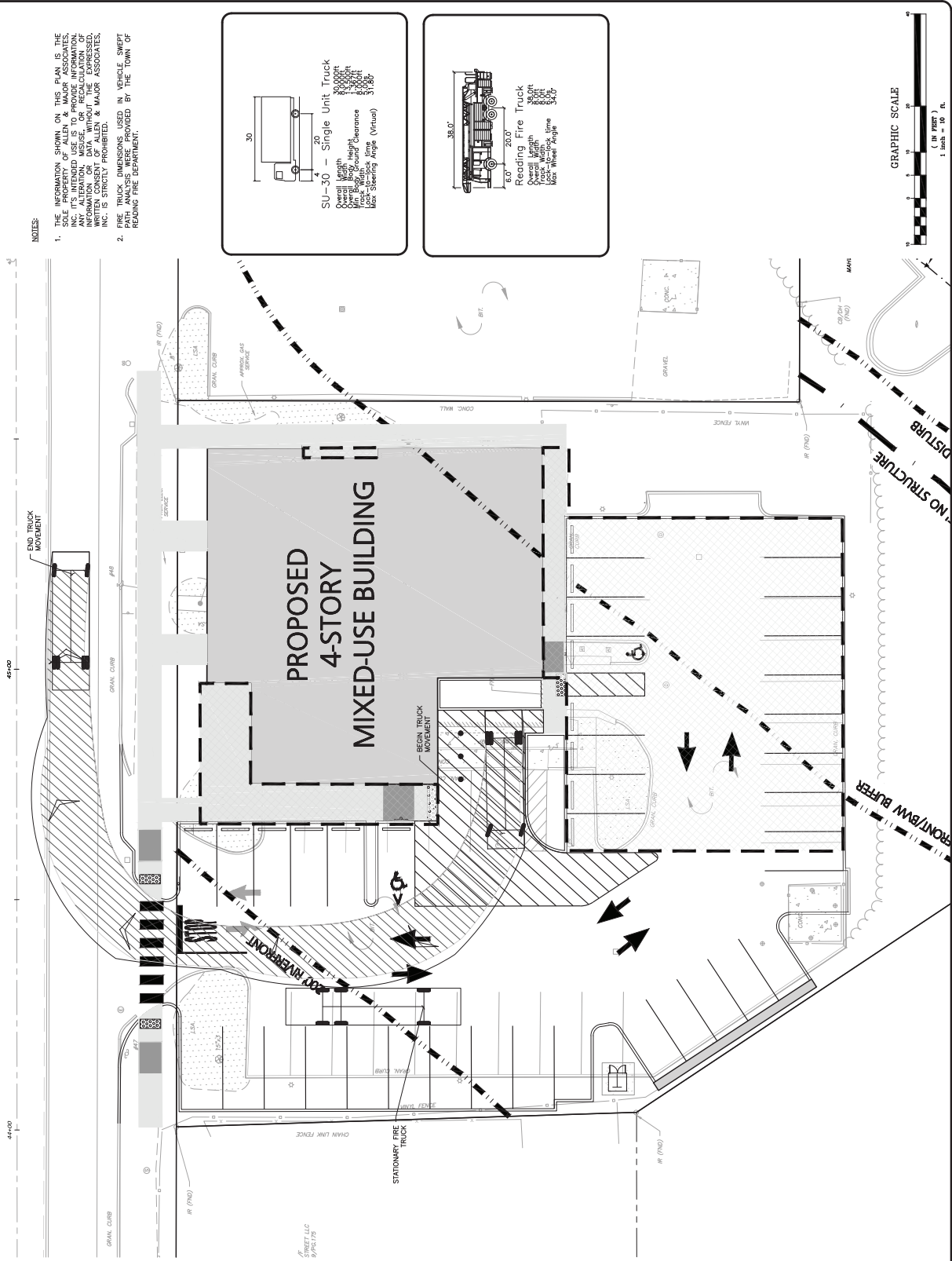


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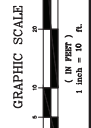
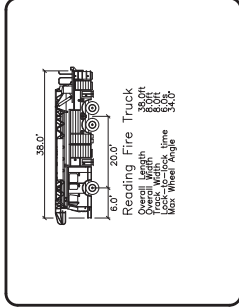
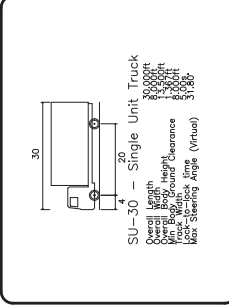
DRAWING TITLE:
VEHICLE MOVEMENT PLAN
SHEET NO.: C-107



MAIN STREET (ROUTE 28 - 66' WIDE)



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1	ISSUE	ISSUED FOR NOTICE OF ABSENT
REV	DATE	DESCRIPTION

PROJECT: **MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT**
 281 MAIN STREET
 READING, MA 01867

PROJECT NO. 2398-08 DATE 2025-11-24
 SCALE: 1" = 10' DWG NAME: C108-08
 DESIGNED BY: MJA CHECKED BY: CMC



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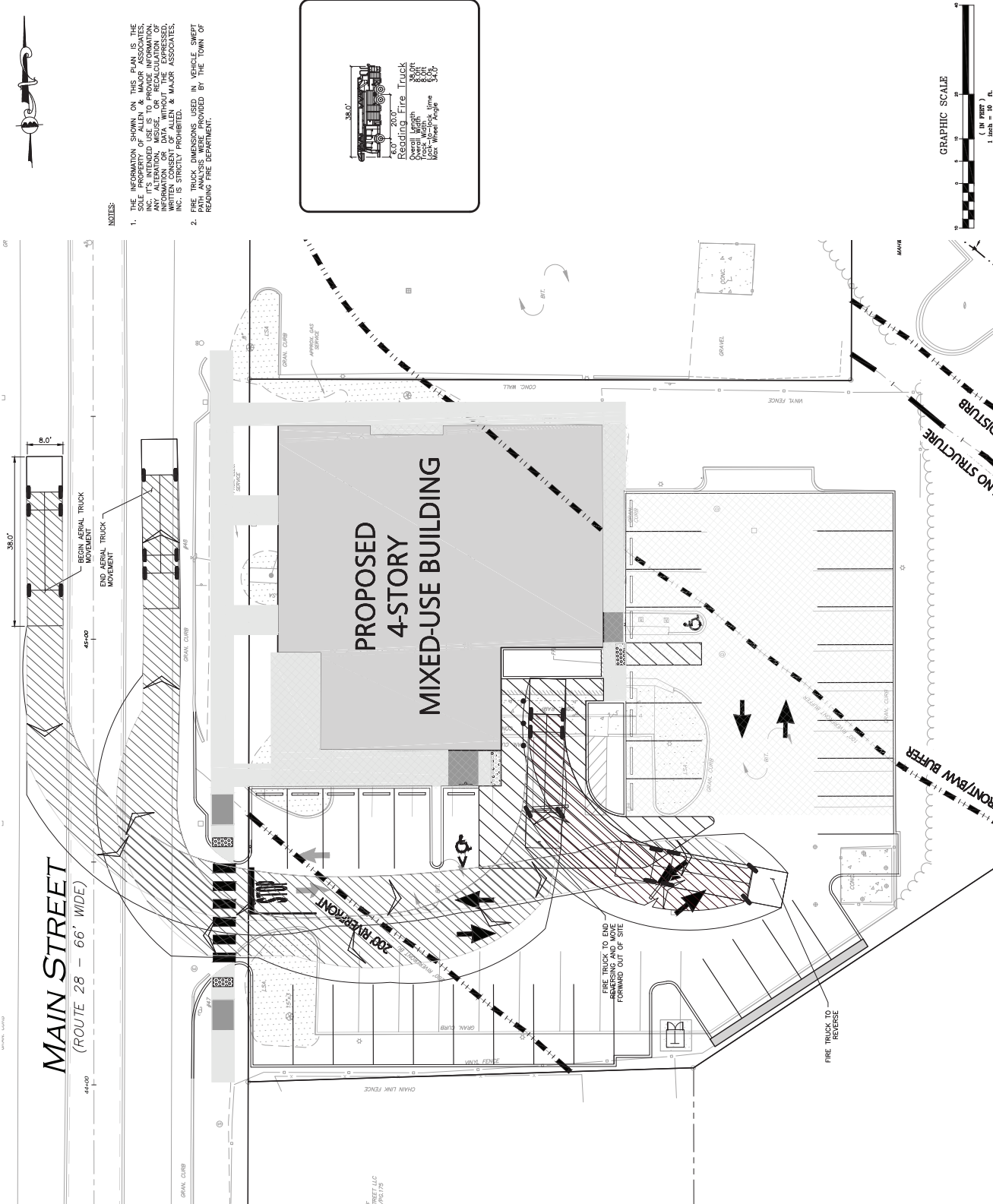
STATE OF MASSACHUSETTS
 REGISTERED PROFESSIONAL ENGINEER
 LICENSE NO. 91227
 EXPIRES 12/31/2028

DRAWING TITLE
 VEHICLE MOVEMENT PLAN

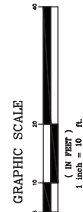
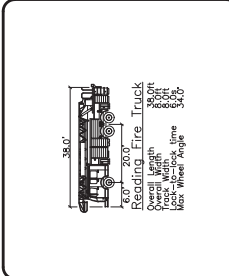
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PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

1	ISSUED FOR NOTICE OF INTENT
REV	DATE DESCRIPTION
APPROVALS:	
281 READING, LLC	
281 MAIN STREET	
READING, MA 01867	

PROJECT:
**MIXED-USE RETAIL AND
RESIDENTIAL DEVELOPMENT**
281 MAIN STREET
READING, MA

PROJECT NO. 239808 DATE 2025-11-24
SCALE: 1" = 10' DWG NAME: C-239808
DESIGNED BY: MJD CHECKED BY: CMG

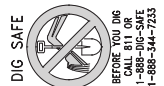


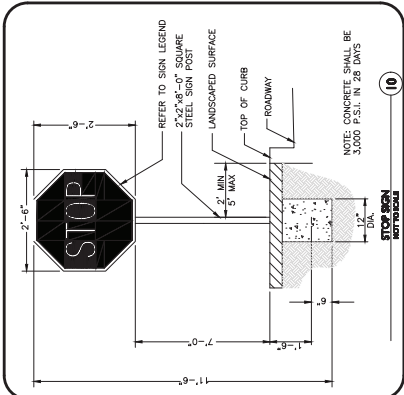
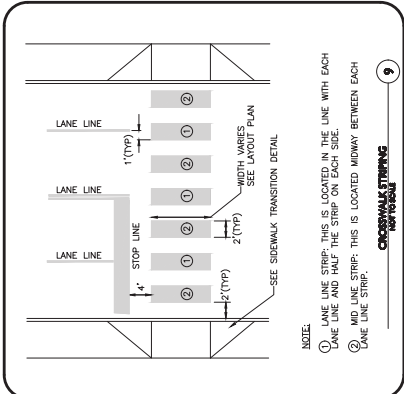
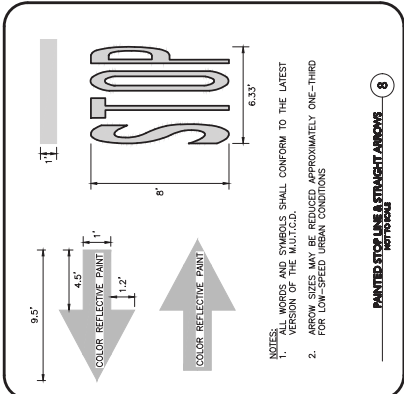
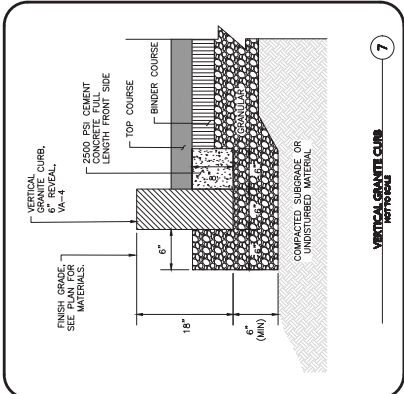
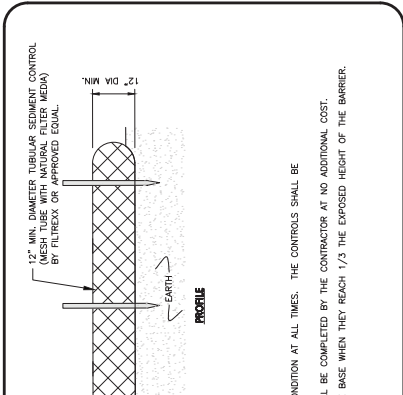
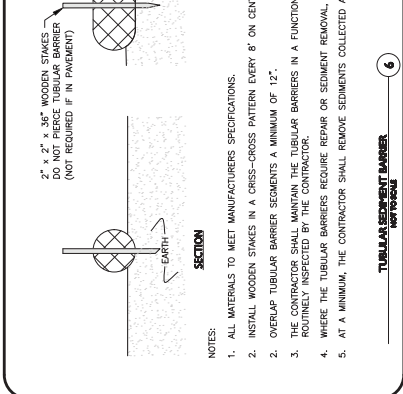
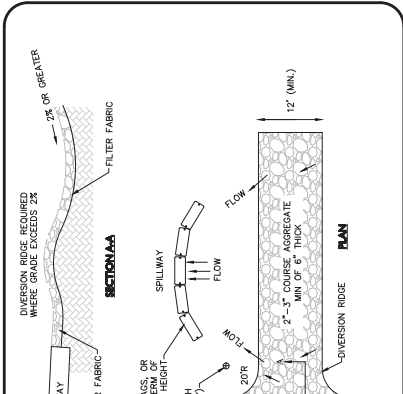
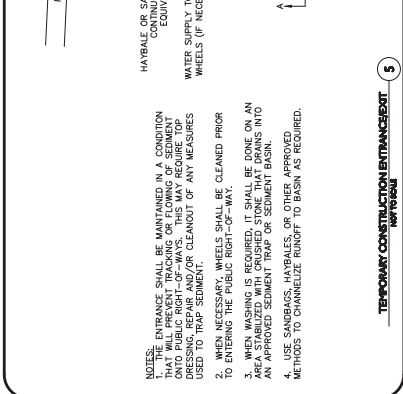
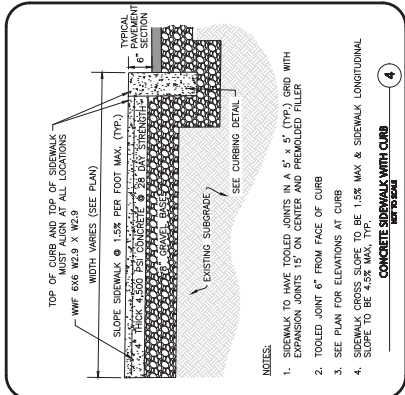
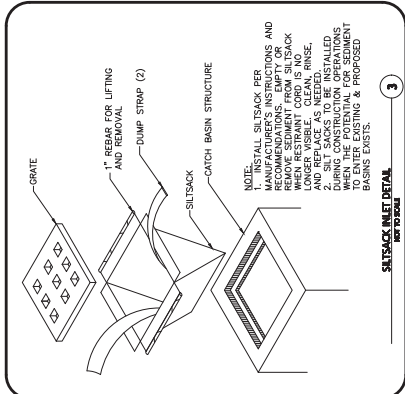
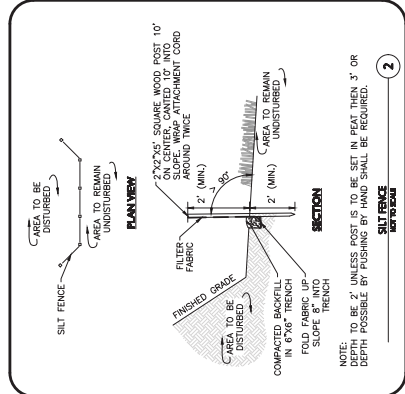
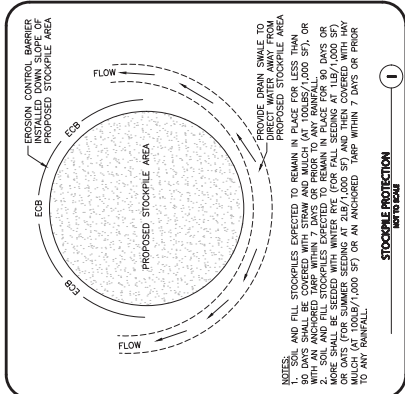
**ALLEN & MAJOR
ASSOCIATES, INC.**

civil engineering • land surveying
environmental planning • site planning
100 COMMERCIAL WAY, SUITE 200
TELE: (910) 852-0889
FAX: (910) 852-0899

STATE OF MASSACHUSETTS
REGISTERED PROFESSIONAL ENGINEER
LICENSE NO. 10000
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SHEET NO. **C-109**
DRAWING TITLE
FIRE TRUCK TURNING PLAN





PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

NO.	ISSUE	ISSUED FOR NOTICE OF
1	ISSUE	ISSUED FOR NOTICE OF
REV.	DATE	DESCRIPTION

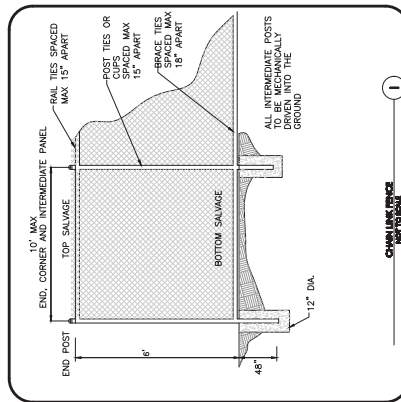
PROJECT:
MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA 01867

PROJECT NO. 2398-08 DATE 2025-11-24
SCALE AS SHOWN DWG NAME C-2398-08
DESIGNED BY: MTH CHECKED BY: CMG

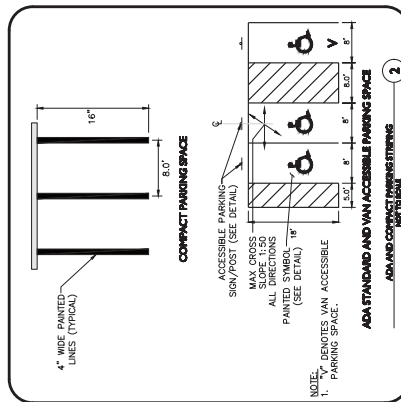
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering • land use planning • architecture
100 COMMERCIAL WAY, SUITE 200
READING, MASSACHUSETTS 01867
TEL: (978) 943-6889 FAX: (978) 943-6999

REGISTERED PROFESSIONAL ENGINEER
LICENSE NO. 10000
STATE OF MASSACHUSETTS
REGISTERED ARCHITECT
LICENSE NO. 10000
STATE OF MASSACHUSETTS
REGISTERED LAND USE PLANNING
LICENSE NO. 10000
STATE OF MASSACHUSETTS

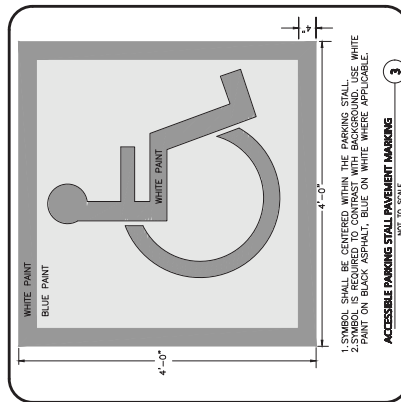
DRAWING TITLE: **DETAILS**
SHEET NO.: **C-501**



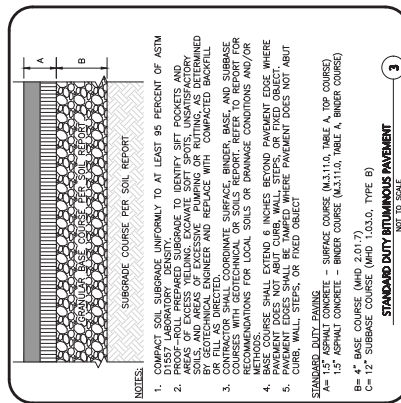
CHAIN LINK FENCE
NOT TO SCALE



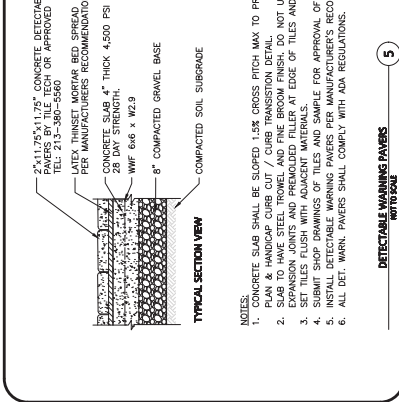
ADA STANDARD AND VAN ACCESSIBLE PARKING SPACE
NOT TO SCALE



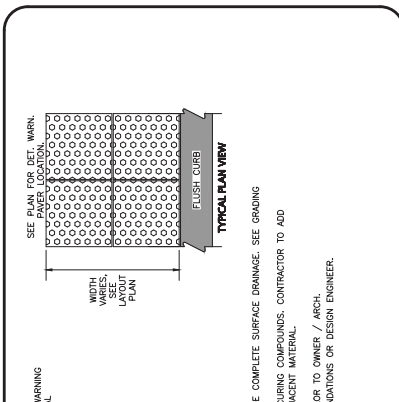
ACCESSIBLE PARKING STALL PAVEMENT MARKINGS
NOT TO SCALE



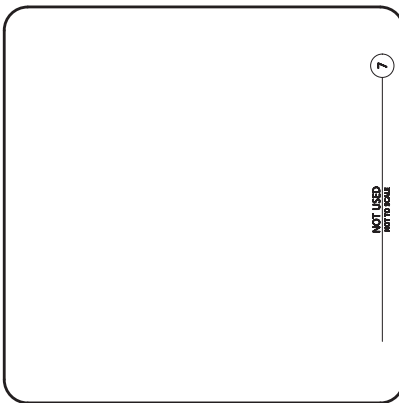
STANDARD DUTY BITUMINOUS PAVEMENT
NOT TO SCALE



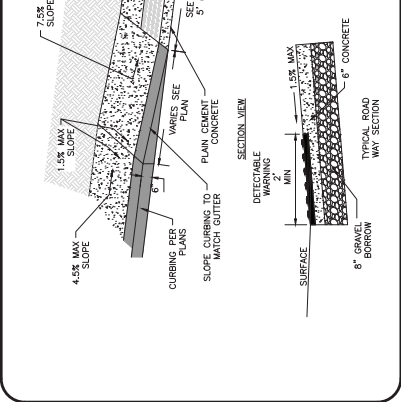
DETECTABLE WARNING PAVERS
NOT TO SCALE



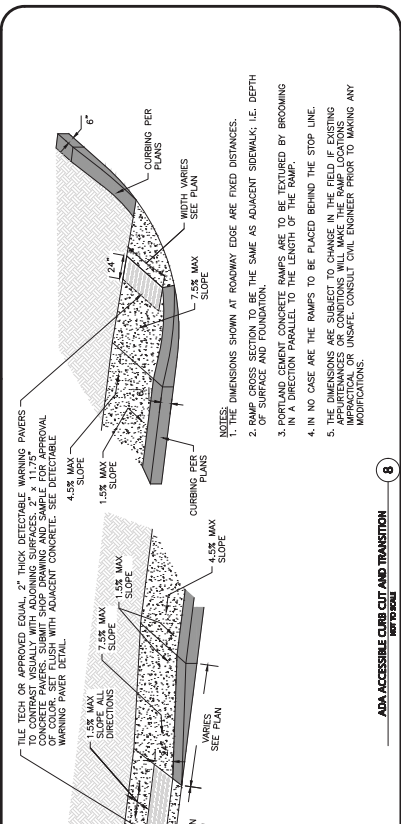
PAVEMENT KEY CUT
NOT TO SCALE



NOT USED
NOT TO SCALE



ADA ACCESSIBLE CURB, CUT AND TRANSITION
NOT TO SCALE



NOT USED
NOT TO SCALE



PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

NO.	ISSUE	ISSUED FOR NOTICE OF
1	ISSUE	ISSUED FOR NOTICE OF
REV.	DATE	DESCRIPTION

PROJECT: **MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT**
281 MAIN STREET
READING, MA 01867

PROJECT NO: 230808 DATE: 2023-11-30
SCALE: AS SHOWN DWG NAME: C230808
DESIGNED BY: MJP CHECKED BY: CMO



ALLEN & MAJOR ASSOCIATES, INC.
civil engineering • land surveying
100 COMMERCE WAY, SUITE 203
READING, MASSACHUSETTS 01867
TEL: (978) 942-0889
FAX: (978) 942-0899

REGISTERED PROFESSIONAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL LAND SURVEYOR
LICENSE NO. 10000
REGISTERED PROFESSIONAL ARCHITECT
LICENSE NO. 10000
REGISTERED PROFESSIONAL CIVIL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL ELECTRICAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL MECHANICAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL CHEMICAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL INDUSTRIAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL METALLURGICAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL NUCLEAR ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL AERONAUTICAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL AGRICULTURAL ENGINEER
LICENSE NO. 10000
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LICENSE NO. 10000
REGISTERED PROFESSIONAL AGRICULTURAL ENGINEER
LICENSE NO. 10000
REGISTERED PROFESSIONAL BIOLOGICAL ENGINEER
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REGISTERED PROFESSIONAL CHEMICAL ENGINEER
LICENSE NO. 10000

DRAWING TITLE: **DETAILS**
SHEET NO.: **C-502**

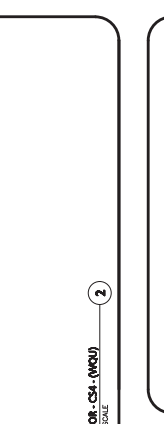
NO.	REVISION	DATE	DESCRIPTION
1	ISSUED FOR NOTICE OF ABILITY		
2	REVISED		
3	REVISED		

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

281 READING, LLC
281 MAIN STREET
READING, MA 01867

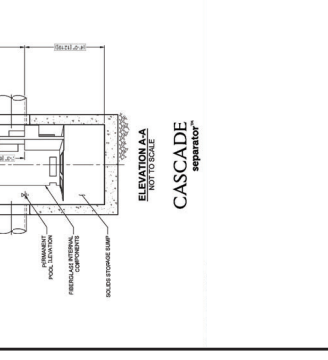
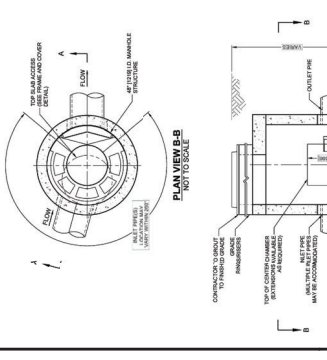
PROJECT: MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA

PROJECT NO. 238608 DATE 2023-11-30
SCALE: AS SHOWN DWG. NAME: C-5904-00
DESIGNED BY: MTH CHECKED BY: CMC



REGISTERED PROFESSIONAL ENGINEER
STATE OF MASSACHUSETTS
LICENSE NO. 10012
ALLEN & MAJOR ASSOCIATES, INC.
100 COMMERS WAY, SUITE 200
READING, MA 01867
TEL: (978) 932-9889
FAX: (978) 932-9899

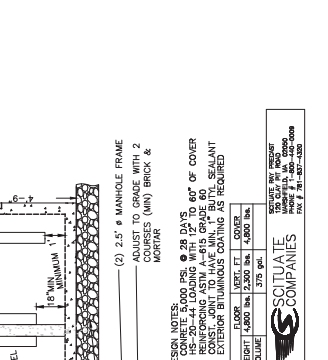
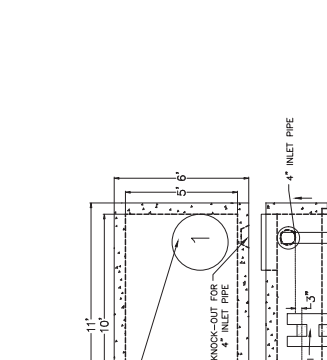
DRAWING TITLE: DETAILS
SHEET NO.: C-504



CASCADE separator
NOT TO SCALE

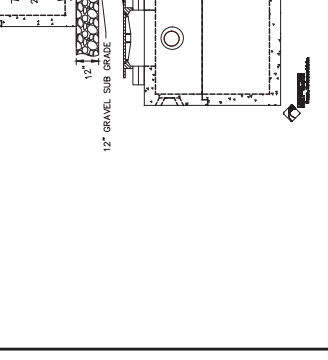
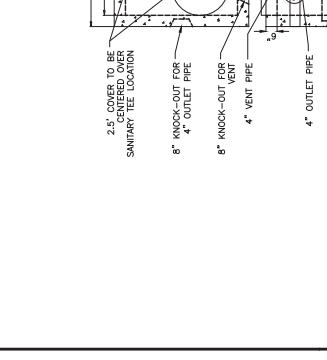
CONTECH
CONCRETE PRODUCTS, INC.
1000 WEST 10TH AVENUE
DENVER, CO 80202

CS-4 CASCADE separator
STANDARD DETAIL



CASCADE TRAP (1,500 GALLON)
NOT TO SCALE

DESIGN NOTES:
1. MANHOLE SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL DESIGN AND CONSTRUCTION REQUIREMENTS.
2. H-20 LOADING WITH 12" TO 60" OF COVER.
3. CONFORMING ASTM A-615 GRADE 60 SEAMANT.
4. EXTERIOR BITUMINOUS COATING AS REQUIRED.
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.



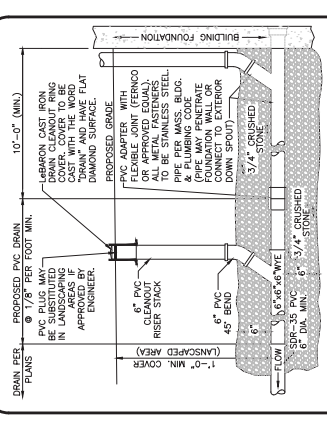
PRECAST CONCRETE SEWER MANHOLE
NOT TO SCALE

DESIGN NOTES:
1. MANHOLE SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL DESIGN AND CONSTRUCTION REQUIREMENTS.
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4. EXTERIOR BITUMINOUS COATING AS REQUIRED.
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.



ROOF DRAIN
NOT TO SCALE

DESIGN NOTES:
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3. CONFORMING ASTM A-615 GRADE 60 SEAMANT.
4. EXTERIOR BITUMINOUS COATING AS REQUIRED.
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.



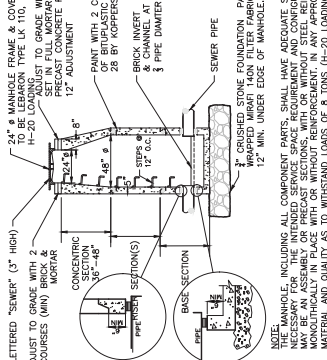
CASCADE TRAP (1,500 GALLON)
NOT TO SCALE

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1. MANHOLE SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL DESIGN AND CONSTRUCTION REQUIREMENTS.
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4. EXTERIOR BITUMINOUS COATING AS REQUIRED.
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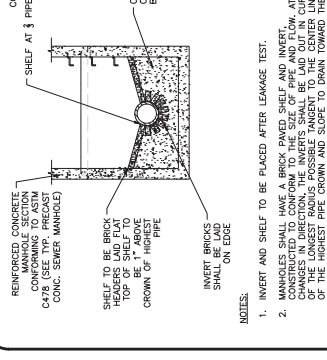
PRECAST CONCRETE SEWER MANHOLE
NOT TO SCALE

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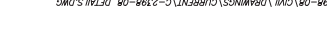
ROOF DRAIN
NOT TO SCALE

DESIGN NOTES:
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4. EXTERIOR BITUMINOUS COATING AS REQUIRED.
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.



ROOF DRAIN
NOT TO SCALE

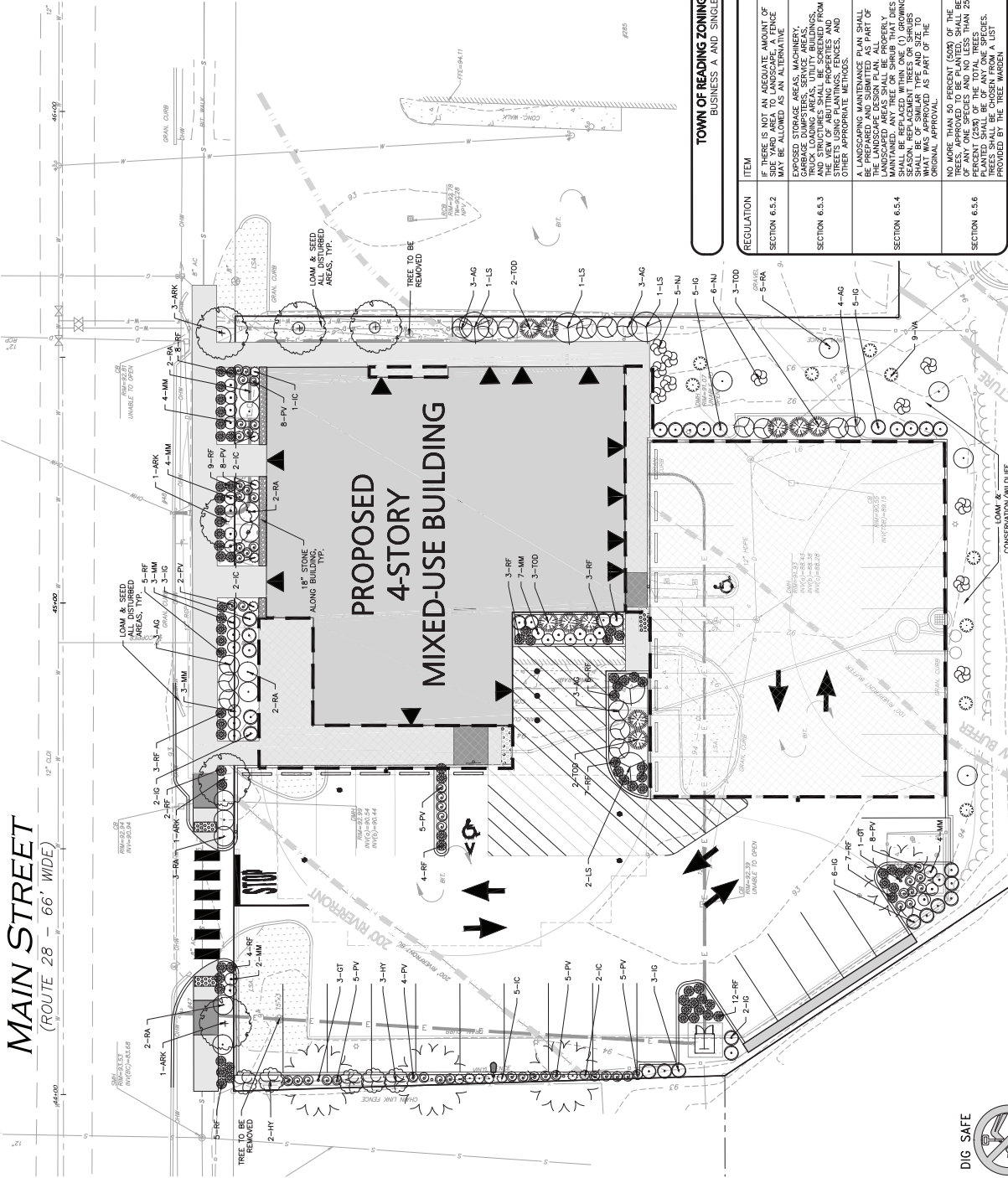
DESIGN NOTES:
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2. H-20 LOADING WITH 12" TO 60" OF COVER.
3. CONFORMING ASTM A-615 GRADE 60 SEAMANT.
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5. EXTERIOR BITUMINOUS COATING AS REQUIRED.



ROOF DRAIN
NOT TO SCALE

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3. CONFORMING ASTM A-615 GRADE 60 SEAMANT.
4. EXTERIOR BITUMINOUS COATING AS REQUIRED.
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.

MAIN STREET
(ROUTE 28 - 66' WIDE)



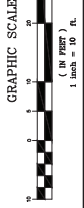
LEGEND

DECIDUOUS TREE	
EVERGREEN TREE	
SHRUBS	
MULCH BED	
PERENNIALS/ROUNDERCOVER	

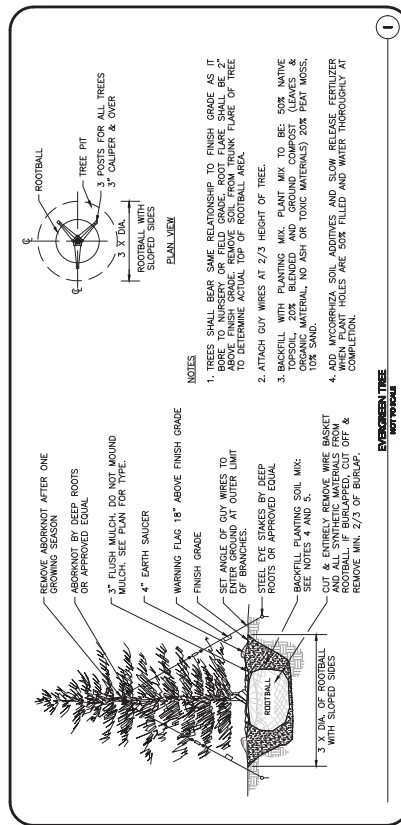
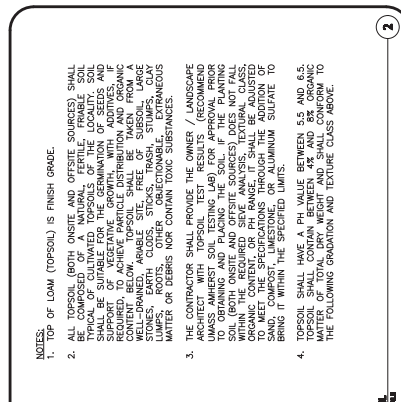
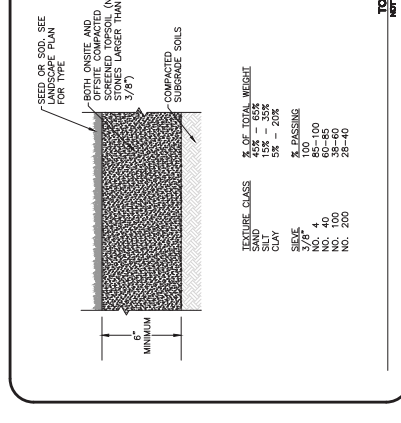
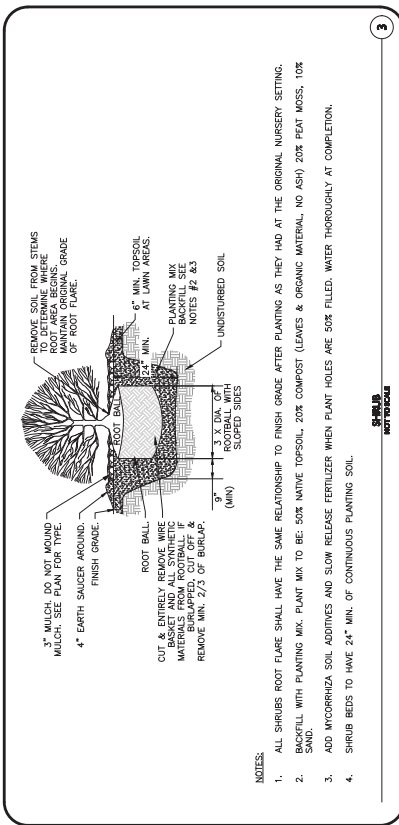
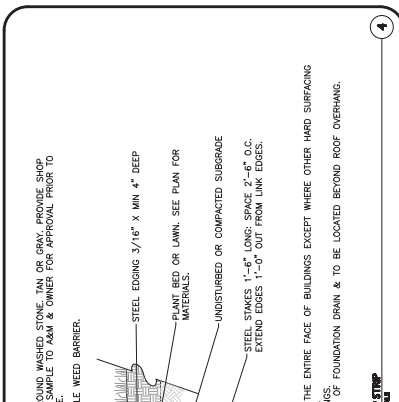
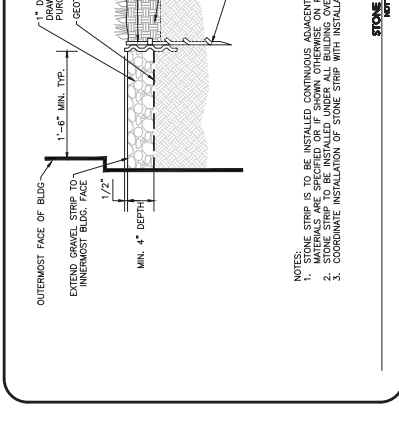
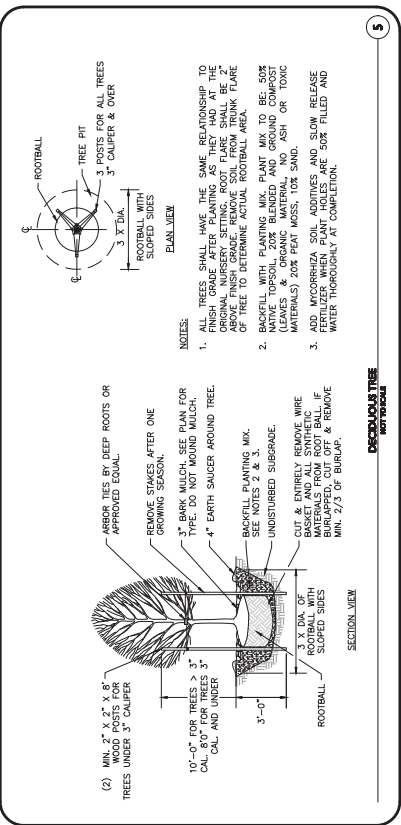
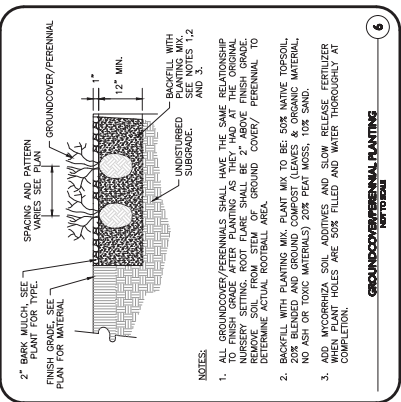
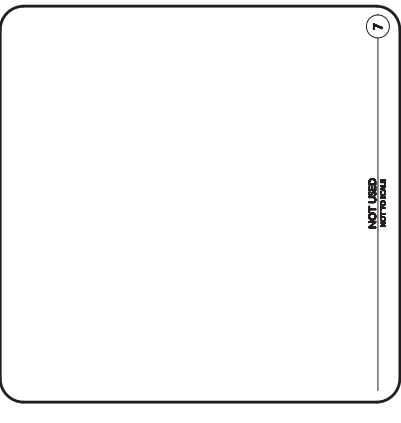
- NOTES:**
- THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE LOCATION OF ALL EXISTING UTILITIES IS THE RESPONSIBILITY FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S AND ALL UNDERGROUND UTILITIES. PRESERVE ANY AND ALL INFORMATION, INCLUDING INFORMATION, RECALCULATION OF INFORMATION OR DATA WITHOUT THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. ANY ALTERATION IN INFORMATION OR DATA WITHOUT THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.

TOWN OF READING ZONING SUMMARY - LANDSCAPE
BUSINESS A AND SINGLE FAMILY 15 DISTRICTS

REGULATION	ITEM	REQUIRED / ALLOWED	PROPOSED
SECTION 6.5.2	IF THERE IS NOT AN ADEQUATE AMOUNT OF EXISTING TREES, THE FOLLOWING SCREENING MAY BE ALLOWED AS AN ALTERNATIVE: EXPOSED STORAGE AREAS, MACHINERY, GARbage DUMPSTERS, SERVICE AREAS, AND STRUCTURES SHALL BE SCREENED FROM THE VIEW OF ADJUTING PROPERTIES AND OTHER APPROPRIATE METHODS.	SIDE YARD SCREENING	UTILITY SCREENING
SECTION 6.5.3	A LANDSCAPING MAINTENANCE PLAN SHALL BE SUBMITTED AS PART OF THE LANDSCAPE DESIGN AND ALL LANDSCAPED AREAS SHALL BE PROPERLY MAINTAINED THROUGHOUT THE GROWING SEASON. REPLACEMENT TREES OR SHRUBS SHALL BE REPLACED WITHIN ONE (1) GROWING SEASON AND SHALL BE APPROVED AS PART OF THE ORIGINAL APPROVAL.	LANDSCAPE MAINTENANCE PLAN	SEE DETAIL SHEET
SECTION 6.5.4	NO MORE THAN 50 PERCENT (50%) OF THE PLANTING SPECIES AND NO LESS THAN 25 PERCENT (25%) OF THE TOTAL PLANTING TREES SHALL BE CHOSEN FROM A LIST PROVIDED BY THE TREE WARDEN.	TREE SPECIES	SEE PLANT SCHEDULE



DIG SAFE
BEFORE YOU DIG
CALL 811 OR
1-888-500-SAFE
1-888-344-7253



PROFESSIONAL LANDSCAPE ARCHITECT FOR ALLEN & MAJOR ASSOCIATES, INC.

09.11.2008

281 READING, LLC
281 MAIN STREET
READING, MA 01867

PROJECT:
MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA

PROJECT NO. 2398-08 DATE 2023-11-30
SCALE AS SHOWN DWG NAME L2398-08
DESIGNED BY JMT CHECKED BY: CMC
PREPARED BY: ALLEN & MAJOR ASSOCIATES, INC.
180 COMMERCE WAY, SUITE 2
READING, MA 01867
TEL: (978) 942-9889
FAX: (978) 942-9899

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering • landscape architecture
180 COMMERCE WAY, SUITE 2
READING, MA 01867
TEL: (978) 942-9889
FAX: (978) 942-9899

REVISIONS:

NO.	DATE	ISSUED FOR NOTICE OF ABIT	DESCRIPTION
1	09.11.2008		
2			
3			
4			
5			
6			
7			
8			
9			
10			

DRAWING TITLE
LANDSCAPE NOTES & DETAILS L-501

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01/2008 (REVISED 11/2023)

CONSERVATION/WILDLIFE SEED MIX:

NEW ENGLAND CONSERVATION/WILDLIFE MIX
MIX PERCENTAGE: 10% (1.750 SQ FT/LB)
APPLICATION RATE: 35 LBS/ACRE (1.750 SQ FT/LB)

ITEM/BOTANICAL NAME	COMMON NAME	INDICATOR
1. ELIUS VIRGINICUS	VIRGINIA WILD RYE	FACH-
2. ANDROPOGON GERARDI	ANDROPOGON	FACU
3. FESTUCA RUBRA	RED FESCUE	FACU
4. PANICUM VIRGATUM	SWITCH GRASS	FACU
5. PANDANUS FLORIDENSIS	PANICUM	FACU
6. PASPALUM FLORIDENSIS	PANICUM	FACU
7. BUTYLARIUM CURPANII	BUTTERFLY BURDECK	FACU
8. ASPERGILLUS	ASPERGILLUS	FACU
9. EUPATORIUM PURPUREUM	PURPLE JOE PEE WEED	FACU
10. RUBROCOCA FLORIDA	BLACK EYED SUSAN	FACU
11. RUBROCOCA FLORIDA	BLACK EYED SUSAN	FACU
12. RUBROCOCA FLORIDA	BLACK EYED SUSAN	FACU
13. RUBROCOCA FLORIDA	BLACK EYED SUSAN	FACU
14. RUBROCOCA FLORIDA	BLACK EYED SUSAN	FACU

THE NEW ENGLAND CONSERVATION/WILDLIFE MIX PROVIDES A PERMANENT COVER OF SEEDS THAT WILL GROW IN A WIDE RANGE OF SOIL TYPES AND CLIMATES AND IS APPROPRIATE FOR CUT AND FILL SLOPES, DETENTION BASIN SIDE SLOPES, AND BOUNDED AREAS ADJACENT TO COMMERCIAL AND RESIDENTIAL PROJECTS.

SEED MIX

NOT FOR SALE

LANDSCAPE NOTES

- ALL WORK SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE TOWN OF READING, MA.
- PLANTING PLAN IS DIAGRAMMATIC IN NATURE. FINAL PLACEMENT OF PLANTS TO BE DETERMINED BY THE LANDSCAPE ARCHITECT IN THE FIELD.
- CONTRACTOR SHALL SHOW THE LANDSCAPE ARCHITECT AND OWNER'S REPRESENTATIVE AND LANDSCAPE ARCHITECT THE EXISTING UTILITIES AND "NO-SHIFT" AREAS (1-888-344-7233) AT LEAST 72 HOURS IN ADVANCE OF ANY WORK COMMENCING. CONTRACTOR SHALL NOTIFY THE OWNERS REPRESENTATIVE OF ANY CONFLICTS IN WRITING. FINAL APPROVAL OF ANY CONFLICTS SHALL BE INSTALLED UNTIL ALL GRADING AND DETAIL CONSTRUCTION HAS BEEN COMPLETED IN THE IMMEDIATE AREA.
- ANY TREES NOTED AS "SEAL OR SELECTED SPECIES" SHALL BE TAGGED AND PROTECTED BY THE LANDSCAPE ARCHITECT (L.A.) UNLESS OTHERWISE NOTED OR APPROVED BY THE OWNER'S REPRESENTATIVE AND LANDSCAPE ARCHITECT.
- CONTRACTOR SHALL VERIFY QUANTITIES SHOWN ON PLANT LIST. QUANTITIES SHALL BE BALANCED AND BILLED (O.B.) UNLESS OTHERWISE NOTED OR APPROVED BY THE OWNER'S REPRESENTATIVE AND LANDSCAPE ARCHITECT.
- ALL PLANT MATERIALS INSTALLED SHALL MEET THE GUIDELINES PUBLISHED BY AMERICAN NURSERY AND LANDSCAPE ARCHITECTS ASSOCIATION (ANLA) FOR NURSERY STOCK.
- ALL PLANT MATERIALS SHALL BE GUARANTEED FOR ONE YEAR FOLLOWING DATE OF ACCEPTANCE. ANY PLANT MATERIALS WHICH DIE WITHIN THE ONE YEAR PERIOD SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE. CONTRACTOR OWNERS TO COORDINATE DIRECTLY WITH THE LANDSCAPE ARCHITECT FOR REPLACEMENT PLANTINGS.
- ALL DISTURBED AREAS NOT OTHERWISE NOTED SHALL RECEIVE 6" OF MULCH WITH 3:1 OR GREATER SLOPES SHALL BE PROTECTED WITH AN EROSION CONTROL BLANKET.
- ANY FALL TRANSPANTING HAZARD PLANTS SHALL BE DUG IN THE SPRING AND STORED FOR FALL PLANTING.
- ALL PLANTS SHALL BE WATERED AS NOTATED ON THE PLANTING SCHEDULE TAKEN ONE FOOT ABOVE THE ROOT CROWN.
- ALL PLANT BEDS AND TREE SAUGERS TO RECEIVE 3" OF PINE BARK MULCH. GROUNDCOVER AREAS SHALL RECEIVE 1" OF PINE BARK MULCH. SCHEDULE TAKEN ONE FOOT ABOVE THE ROOT CROWN.
- ALL TREE STEMS SHALL BE STAINED DARK BROWN.
- CONTRACTOR RESPONSIBLE FOR WATERING AND RESEEDING OF BARE SPOTS UNTIL A UNIFORM STAND OF VEGETATION IS ESTABLISHED AND MAINTAINED THROUGHOUT THE GROWING SEASON.
- ALL PARKING GRASSES PLANTED WITH SHRUBS SHALL HAVE 24" OF TOP SOIL. FINISH GRADE SHALL BE SLOPED TO SIX INCHES (6") ABOVE THE TOP OF CURB.
- ALL TREES, SHRUBS, AND ROAD PLANTINGS SHALL BE PROTECTED TO THE LANDSCAPE ARCHITECT OR THE OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
- MULCH SHALL NOT BE NEWLY APPLIED WITHIN 18" OF ANY COMBUSTIBLE MATERIALS OR STRUCTURES. THE LATEST BOARD OF FIRE PREVENTION REGULATIONS (927 CMR 12.03).
- SLOPES AT 2:1 SHOULD HAVE 6" LOAM & SEED. SEEDING OF 2:1 SLOPES SHALL OCCUR IN THE DRY & AFTER SLOPES ARE COMPACTED.

LANDSCAPE NOTES

NOT FOR SALE

LANDSCAPE MANAGEMENT NOTES:

LANDSCAPE MANAGEMENT GUIDELINES:
• MULCH NOT MORE THAN 3" DEPTH WITH SHREDED PINE OR FIR BARK.
• MAINTAIN MULCH DEPTH AT 2" TO 3" THROUGHOUT THE GROWING SEASON.
• AVOID-GROUND BRASS (OLIVER STEMS) STEM REMOVALS TO OCCUR WITHIN 6" OF THE MULCH.
• MULCH SHOULD BE OPEN UP SHRUB AND MAINTAIN TWO-YEAR WOOD (PINE BARK) MULCH.
• FERTILIZE WITH 1/2 LB. SLOW-RELEASE FERTILIZER (SEE ABOVE SECTION ON FERTILIZATION).
• HAND PRUNE EVERGREEN SHRUBS ONLY AS NEEDED TO REMOVE DEAD AND DISEASED BRANCHES.
• NEVER MECHANICALLY SHEAR EVERGREEN SHRUBS.
• PRUNE TREES ON A FOUR-YEAR CYCLE.
• PROVIDE AFTER-CARE FOR NEW TREE PLANTINGS FOR THE FIRST THREE YEARS.
• WATER TREES, PERENNIALS, & GRASSES AS NEEDED TO MAINTAIN HEALTH.
• WATER TREES ON A FOUR-YEAR CYCLE.
• PRUNE TREES ON A FOUR-YEAR CYCLE.
• SPRING PRUNING OF TREES SHOULD BE DONE IN EARLY SPRING.
• GRASSES/PERENNIALS DO NOT NEED TO BE CUT DOWN BEFORE WINTER. IN FACT, GRASSES/PERENNIALS SHOULD BE LEFT TO WINTER OVER TO PROVIDE WILDLIFE HABITAT VALUE.
• INSULATE THE CROWN OF THE PLANT. STANDING AND THE FOLIAGE HELPS TO PROTECT THE PLANT FROM WINTER DAMAGE.
• DISEASE AND PEST DAMAGE TO PLANTS SHOULD BE TREATED IMMEDIATELY.
• SOIL pH SHOULD BE TESTED AND ADJUSTED AS NEEDED.
• SOIL pH SHOULD BE TESTED AND ADJUSTED AS NEEDED.
• SOIL pH SHOULD BE TESTED AND ADJUSTED AS NEEDED.
• SOIL pH SHOULD BE TESTED AND ADJUSTED AS NEEDED.

LANDSCAPE MAINTENANCE NOTES

NOT FOR SALE

LANDSCAPE MAINTENANCE PROGRAM PRACTICES:
• MULCH NOT MORE THAN 3" DEPTH WITH SHREDED PINE OR FIR BARK.
• MAINTAIN MULCH DEPTH AT 2" TO 3" THROUGHOUT THE GROWING SEASON.
• AVOID-GROUND BRASS (OLIVER STEMS) STEM REMOVALS TO OCCUR WITHIN 6" OF THE MULCH.
• MULCH SHOULD BE OPEN UP SHRUB AND MAINTAIN TWO-YEAR WOOD (PINE BARK) MULCH.
• FERTILIZE WITH 1/2 LB. SLOW-RELEASE FERTILIZER (SEE ABOVE SECTION ON FERTILIZATION).
• HAND PRUNE EVERGREEN SHRUBS ONLY AS NEEDED TO REMOVE DEAD AND DISEASED BRANCHES.
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• INSULATE THE CROWN OF THE PLANT. STANDING AND THE FOLIAGE HELPS TO PROTECT THE PLANT FROM WINTER DAMAGE.
• DISEASE AND PEST DAMAGE TO PLANTS SHOULD BE TREATED IMMEDIATELY.
• SOIL pH SHOULD BE TESTED AND ADJUSTED AS NEEDED.
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• SOIL pH SHOULD BE TESTED AND ADJUSTED AS NEEDED.

3

PLANTING SCHEDULE - TREES, SHRUBS, PERENNIALS, & GRASSES

KEY QTY	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	COMMENTS
4	ARK	AKER RIBBUN 'KARPOK'	3" CAL.	AS SHOWN	B&B
4	GT	OLENDRA TRICANTHOS F. INERMIS	3" CAL.	AS SHOWN	B&B
5	LS	LIQUIDAMBAR STRYACIFLUA	3" CAL.	AS SHOWN	B&B
5	LS	'SLENDER SILHOUETTE'	3" CAL.	AS SHOWN	B&B
10	T00	SHRUB	7-8" HT.	4' O.C.	B&B
11	NJ	CEANOTHUS AMERICANUS	#3	36" O.C.	POT
12	HY	HYDRANGEA PANICULATA	#3	5' O.C.	POT
12	ILX	ILEX CREMATA 'SMT PENCIL'	#3	24" O.C.	POT
16	RU	RUBUS SP. 'WINEBERRY'	#3	8' O.C.	POT
16	RU	RUBUS SP. 'WINEBERRY'	#3	8' O.C.	POT
9	VA	VACUNINIUM ANGIUSTIFOLIUM	#1	28" O.C.	POT
16	AG	ANDROPOGON GERARDI	#2	48" O.C.	STAGGERED
27	MM	MOUNTAIN MINT	#2	30" O.C.	STAGGERED
78	RF	RUBROCOCA FLORIDA	#1	30" O.C.	STAGGERED
PERENNIALS/GRASSES					
ASSUMING A SPRING PLANTING, UTILIZE "PROVEN WINNERS" ANNUALS - "CALIFORNIA MIX" OR EQUAL #1 POT, PERENNIALS - SUPERBUNNIA ROYAL MARGERA & SUPERBUNNIA VISTA WHITE, & VERBENA - SUPERBUNNIA					
* DENOTES PLANTED SPECIES OR NATIVE CULTIVAR					
TOTAL TREES REMOVED - 2					
TOTAL TREES REMOVED - 2					

1



PROFESSIONAL LANDSCAPE ARCHITECT FOR
ALLEN & MAJOR ASSOCIATES, INC.

MIXED-USE RETAIL AND
RESIDENTIAL DEVELOPMENT
281 MAIN STREET
READING, MA

PROJECT NO.	230408	DATE	2023-11-30
SCALE	AS SHOWN	DWG. NAME	L230408
DESIGNED BY	ART	CHECKED BY	CMG



ALLEN & MAJOR
ASSOCIATES, INC.
civil engineering • landscape architecture
100 COMMERCE WAY, SUITE 200
READING, MASSACHUSETTS 01867
TEL: (978) 943-6889
FAX: (978) 943-6899

DRAWING TITLE
LANDSCAPE NOTES & DETAILS
SHEET NO.
L-502



DRAINAGE REPORT

**ALLEN & MAJOR
ASSOCIATES, INC.**

Mixed Used Building
281 Main Street
Reading, Massachusetts



APPLICANT:
281 Reading, LLC
281 Main Street
Reading, MA 01867

PREPARED BY:
Allen & Major Associates, Inc.
100 Commerce Way, Suite 5
Woburn, Massachusetts 01801
E.O.R. Carlton Quinn PE



DRAINAGE REPORT

Mixed Used Building
281 Main Street
Reading, MA

APPLICANT:

281 Reading, LLC
281 Main Street
Reading, MA 01867

PREPARED BY:

Allen & Major Associates, Inc.
100 Commerce Way, Suite 5
Woburn, Massachusetts 01801



ISSUED:

November 24, 2025

REVISED:

February 27, 2026

A&M PROJECT NO.:

2398-08



TABLE OF CONTENTS

SECTION 1.0 - DRAINAGE REPORT	5
Introduction	5
Site Categorization for Stormwater Regulations	5
Site Location and Access.....	5
Existing Site Conditions	5
Existing Soil Conditions	6
FEMA Floodplain/Environmental Due Diligence.....	6
Environmentally Sensitive Zones	6
Drainage Analysis Methodology.....	6
Proposed Conditions – Peak Rate of Runoff.....	7
MASSDEP Stormwater Performance Standards	9
MASSDEP Stormwater Checklist	14
SECTION 2.0 - OPERATION & MAINTENANCE PLAN	22
Introduction	23
Notification Procedures for Change of Responsibility for O&M.....	23
Contact Information.....	24
Demolition & Construction Maintenance Plan.....	24
Long-Term Pollution Prevention Plan.....	25
Long-Term Maintenance Plan – Facilities Description.....	30
Inspection and Maintenance Frequency and Corrective Measures.....	31
Supplemental Information	32
SECTION 3.0 - EXHIBITS.....	65
USGS Site Locus Map	66
Aerial Photo	67
MASSDEP Wetlands Map.....	68
FEMA Flood Insurance Rate Map.....	69
NHESP Map.....	70
SECTION 4.0 - EXISTING DRAINAGE ANALYSIS.....	71
Existing HydroCAD	72
Existing Watershed Plan.....	107



SECTION 5.0 - PROPOSED DRAINAGE ANALYSIS	108
Proposed HydroCAD	109
Proposed Watershed Plan	141
SECTION 6.0 - APPENDIX	142
Rainfall Data.....	143
Manning’s Roughness Coefficients Tables	144
Soils Map.....	145
Stormwater Test Pits.....	170
MADEP Calculation	173
Illicit Discharge Compliance Statement.....	175



**SECTION 1.0 -
DRAINAGE REPORT**



Introduction

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the new development located at 281 Main Street in Reading. The report will show by means of narrative, calculations and exhibits that the proposed stormwater management system will meet or exceed the Massachusetts Department of Environmental Protection (MassDEP) stormwater standards, and the town Stormwater Management Regulations.

The proposed site improvements include the demolishing of an existing building, clearing of existing vegetation and constructing one mixed-use building. Other improvements to the site include construction of surface parking, landscaping and underground utilities servicing the site. The project will be serviced by connecting existing utilities off Main Street.

The proposed SMS incorporates structural and non-structural Best Management Practices (BMPs) to provide stormwater peak flow mitigation, quality treatment, and conveyance.

The SMS includes catch basins, water quality units, drain manholes, roof drains, underground piping, underground infiltration chambers, and an Operation & Maintenance Plan.

Site Categorization for Stormwater Regulations

The proposed site improvements at 281 Main Street are considered a new development under the DEP Stormwater Management Standards due to the net increase in impervious area. A new development project is required to meet all of Stormwater Management Standards listed within the MA DEP Stormwater Handbook.

Site Location and Access

The site consists of one lot with 157 feet of frontage on Main Street entirely within the town of Reading. The site is currently accessed by one curb cut on Main Street.

Existing Site Conditions

The site currently includes one two story building. The east portion of the site is wooded and abuts riverfront.

The surface drainage flows were analyzed at two Study Points. Study Point #1 summarizes off-site flows to the Municipal drainage on Main Street. Study Point #2 summarizes off site flows towards the riverfront at the east portion of the site.

Existing Soil Conditions

The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County. The site is primarily soil type 602 – Urban Land. These soil types are assumed to be A-type soils because of the landform (outwash



terraces/plans) as well as the surrounding soil types. There are a copy of the stormwater test pits and boring logs taken at this site, provided in the appendix of this report.

A copy of the NRCS Custom Soil Resource Report is included in the appendix of this report.

FEMA Floodplain/Environmental Due Diligence

There are no portions of the site located within the FEMA Zone "AE" Special Flood Hazard Area Subject to Inundation by the 1% Annual Chance Flood (100-year floodplain). The official Flood Insurance Rate Map (FIRM) effective date June 4, 2010, community panel 312 of 656. Map number 25017C0313E. See section 3 of this report for a copy of the FEMA FIRM.

Environmentally Sensitive Zones

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including: Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); Priority and Protected Habitat for rare and endangered species, and areas protected under the Wetlands Protection Act. The subject property is not located within any of these regulated areas.

Drainage Analysis Methodology

A peak rate of runoff will be determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD © Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.00-24. The HydroCAD program was used to generate runoff hydrographs for the watershed areas, to determine discharge/ stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).
3. Soil Survey of Middlesex County Massachusetts by United States Department of Agriculture, NRCS. Soil types and boundaries were obtained from this reference.

Proposed Conditions – Peak Rate of Runoff

The stormwater runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Further, the analysis has been prepared in accordance with the MassDEP and the town



requirements and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, 25, and 100-year storm events.

The proposed stormwater management system for the site consists of catch basins, water quality units, drain manholes, roof drains, underground piping, area drains, underground infiltration chambers. These systems have been designed in accordance with the MA DEP Stormwater Management Policy to recharge groundwater and reduce rate of runoff from the parcel.

The proposed Underground Infiltration System #1 (UIS#1) collects the vast majority of flows from the proposed development. The system has an emergency overflow pipe that connects to an existing drainage 12" RCP that outlets to the Riverfront.

The stormwater runoff model indicates that the proposed site development reduces the rate of runoff during all storm events at the identified points of analysis. The following tables provide a summary of the estimated peak rate, in Cubic Feet per Second (CFS) and total runoff volume, in cubic feet (CF) at each of the two Study Points for each of the design storm events. The HydroCAD worksheets are included in Section 4 and 5 of this report.

STUDY POINT #1				
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.30	0.68	0.93	1.33
Proposed Flow (CFS)	0.02	0.07	0.10	0.16
Reduction %	93.3%	89.7%	89.2%	87.9%
Existing Volume (CF)	950	2,094	2,881	4,148
Proposed Volume (CF)	85	227	336	521
Reduction %	91.1%	89.1%	88.3%	87.4%

STUDY POINT #2				
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.61	1.15	1.49	2.04
Proposed Flow (CFS)	0.00	0.00	0.01	0.08
Reduction %	100.0%	100.0%	99.3%	96.1%
Existing Volume (CF)	2,017	3,783	5,061	7,256
Proposed Volume (CF)	0	46	220	700
Reduction %	100.0%	98.8%	95.6%	90.7%



MASSDEP Stormwater Performance Standards

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for stormwater management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include –

- Deep Sump Catch Basins
- Subsurface Structures
- Water Quality Units

Stormwater Best Management Practices (BMP's) have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale and/or silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are enumerated below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

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

The proposed development will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts. All discharges will be treated for water quality and the rate will not be increased over existing conditions.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

The proposed development has been designed so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates. A



summary of the existing and proposed discharge rates is included within this document.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

The existing annual recharge for the site has been approximated in the proposed condition. There are proposed subsurface infiltration systems designed to meet this requirement. Stormwater runoff generated from the impervious areas of the proposed development are routed through these infiltration BMPs. The proposed Recharge Volume is based on the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1.

See the appendix located at section 6 of this report for stormwater recharge calculations.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
 - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
 - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
 - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-term Pollution Prevention Plan. The water quality volume for the site



redevelopment is captured and treated using underground infiltration systems with isolator rows and water quality units.

The implemented BMPs have been designed to treat the contributing water quality volume. These water quality calculations can be seen within the appendix of this report.

The proposed stormwater management system has been designed to remove 80% of the average annual post-construction load for each treatment train. The TSS removal calculations can be seen within the appendix of this report.

The TSS removal efficiencies for the proprietary separator are based on the values assigned under the Technology Acceptance and Reciprocity Partnership (TARP) testing protocol. The TARP is a workgroup of the Environmental Council of States that was originally comprised of California, Illinois, Maryland, Massachusetts, New Jersey, New York, Pennsylvania and Virginia. TARP is recognized in the MA DEP Stormwater Management Handbook as a valid source for assigning TSS removal efficiencies for proprietary separators.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

The site is not considered a land use with higher potential pollutant loads.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account*



site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

The project site does not discharge stormwater within a Zone II or Interim Wellhead Protection Area or near a critical area. Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

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

The proposed project is not considered a re-development project under the Stormwater Management Handbook guidelines as there is an increase in the amount of impervious area.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.



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

A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.

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

See appendix for Illicit Discharge Statement

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 8²
- 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.

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.

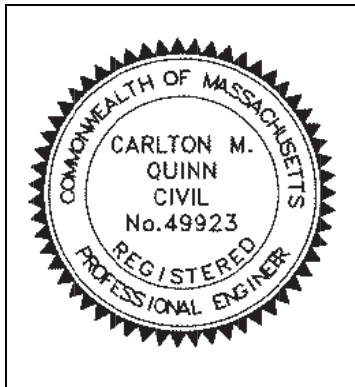
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



2/27/26

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): Underground Infiltration System (Stormtech SC-800)

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 Field¹
- 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.



**SECTION 2.0 -
OPERATION &
MAINTENANCE PLAN**



Introduction

In accordance with the standards set forth by the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection (MassDEP), Allen & Major Associates, Inc. has prepared the following Operations & Maintenance (O&M) Plan for the proposed development at 281 Main Street, Reading, MA.

The plan is broken down into three major sections. The first section describes construction-related erosion and sedimentation controls (Demolition & Construction Maintenance Plan). The second section describes the long-term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long-Term Maintenance Plan – Facilities Description).

Notification Procedures for Change of Responsibility for O&M

The Stormwater Management System (SMS) for this project is owned by 281 Reading, LLC (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance Plan.

The owner shall submit an annual summary report and the completed Operation & Maintenance Schedule & Checklist to the Conservation Commission (via email or print copy), highlighting inspection and maintenance activities including performances of BMPs. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Commission that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring owner until the transferee owner notifies the Commission of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the owner(s) shall establish an association on other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the Commission.



Contact Information

Stormwater Management System Owner: 281 Reading, LLC
281 Main Street
Reading, MA 01867
Phone: (781) 389-5989

Emergency Contact Information:

281 Reading, LLC (Owner/Operator)	Phone: (781) 389-5989
Allen & Major Associates, Inc. (Site Civil Engineer)	Phone: (781) 935-6889
Reading Department of Public Works	Phone: (781) 942-9092
Reading Conservation Commission	Phone: (781) 942-9016
Reading Fire Department (non-emergency line)	Phone: (781) 944-3131
MassDEP Emergency Response	Phone: (888) 304-1133
Clean Harbors Inc (24-Hour Line)	Phone: (800) 645-8265

Demolition & Construction Maintenance Plan

1. Call Digsafe: 1-888-344-7233
2. Contact the town at least three (3) days prior to start of demolition and/or construction activities.
3. Install Erosion Control measures as shown on the Plans prepared by A&M. The town shall review the installation of straw bales and silt fencing prior to the start of any site demolition work. Install Construction fencing if determined to be necessary at the commencement of construction.
4. Install construction entrances, straw bales, and silt fence at the locations shown on the Erosion Control Plan prepared by A&M.
5. Site access shall be achieved only from the designated construction entrances.
6. Cut and clear trees in construction areas only (within the limit of work; see plans).
7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.



9. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on-site for review.
10. All erosion control measures shall be maintained, repaired, or replaced as required or at the direction of the owner's engineer or the town.
11. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
13. Install stone check dams on-site during construction as needed. Refer to the erosion control details. Temporary sediment basins combined with stone check dams shall be installed on-site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.
14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
16. Dust pollution shall be controlled using on-site water trucks and/or an approved soil stabilization product.
17. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.

Long-Term Pollution Prevention Plan

Standard #4 from the MassDEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance Plan of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures of the LTPPP.



- Housekeeping

The existing development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland areas. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.
- Storing of Materials & Water Products

The trash and waste program for the site includes exterior dumpsters. There is a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.
- Vehicle Washing

Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The existing development does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.
- Spill Prevention & Response

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

 1. Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
 2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
 3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
 4. All spills shall be cleaned up immediately after discovery.
 5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at (888) 304-1333.



6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.
- Maintenance of Lawns, Gardens, and Other Landscaped Areas
It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. No trees shall be planted over the drain lines or recharge area, and that only shallow rooted plants and shrubs will be allowed.

- Fertilizer

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

Type:	LESCO® 28-0-12 (Lawn Fertilizer)
	MERIT® 0.2 Plus Turf Fertilizer
	MOMENTUM™ Force Weed & Feed

- Suggested Aeration Program

In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The



depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- Landscape Maintenance Program Practices:
 - Lawn
 1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
 2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
 3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
 4. Do not remove grass clippings after mowing.
 5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.
 - Shrubs
 1. Mulch not more than 3" depth with shredded pine or fir bark.



2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals are to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
 3. Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.
- Trees
 1. Provide aftercare of new tree plantings for the first three years.
 2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
 3. Water once a week for the first year; twice a month for the second; once a month for the third year.
 4. Prune trees on a four-year cycle.
 - Invasive Species
 1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.
- Storage and Use of Herbicides and Pesticides

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) should be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor household or structural pests, refer to 333 CMR 13.08.

Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of



signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice so that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company;
2. Date and time of the application;
3. Name and license number of the applicator;
4. Target pests; and
5. Name and EPA Registration Number of pesticide products applied.

- Pet Waste Management

The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the development. The pet waste shall be disposed of in accordance with local and state regulations.

- Operations and Management of Septic Systems

There are no proposed septic systems within the limits of the project.

- Management of Deicing Chemicals and Snow

Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to MassDEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations

The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. If used, the de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. If used, de-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand.

Long-Term Maintenance Plan – Facilities Description

A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location



where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

The following is a description of the Stormwater Management System for the project site.

Stormwater Collection System – On-Site:

The stormwater collection system is a series of inlets located at low points within the limits of the paved area. All of the proposed on-site catch basins incorporate a deep sump and hooded outlet. The catch basins are connected by a closed gravity pipe network that pass through proprietary separators prior to entering the underground detention chamber or porous pavement.

Other Maintenance Activity:

- Mosquito Control - Both above ground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential. See the supplemental information for Mosquito Control in Stormwater Management Practices, and the Operation and Maintenance Plan Schedule for inspection schedule.
- Street Sweeping - Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

Inspection and Maintenance Frequency and Corrective Measures

In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the previously described BMPs will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the footprint of the SMS.

Supplemental Information

- Operation & Maintenance Plan Schedule
- Massachusetts Stormwater Handbook, Chapter 5, Miscellaneous Stormwater Topics, Mosquito Control in Stormwater Management Practices.
- Massachusetts Department of Environmental Protection Bureau of Water Resources Snow Disposal Guidance.
- Stormtech Isolator ROW O&M Manual
-

Chapter 5 Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, <http://www.mass.gov/agr/mosquito/>, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that “accept” them through local subdivision approval are responsible for their maintenance.¹ The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- **Minimize Land Disturbance:** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- **Catch Basin inlets:** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

¹ MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- **Check Dams:** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- **Design construction period sediment traps** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- **Construction period open conveyances:** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- **Revegetating Disturbed Surfaces:** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- **Sediment fences/hay bale barriers:** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
 - **Bioretention Areas/Rain Gardens/Sand Filter:** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
 - **Infiltration Trenches:** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
 - **Constructed Stormwater Wetlands:** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
 - **Wet Basins:** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or “dead” zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- **Basins:** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- **BMPs without a permanent pool of water:** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- **Energy Dissipators and Flow Spreaders:** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- **Outlet control structures:** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- **Rain Barrels and Cisterns:** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- **Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- **Check dams:** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- **Cisterns:** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- **Water quality swales:** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- **Larvicide Treatment:** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs)*, the preferred

larvicide for stormwater BMPs, should be hand-broadcast.² Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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² *Bacillus thuringiensis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the “good housekeeping” requirement of the municipality’s or agency’s MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.³ In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project’s post-construction BMPs will be operated and maintained.⁴

³ The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

⁴ The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.⁵ The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

⁵ Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.



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Massachusetts Department of Environmental Protection Bureau of Water Resources Snow Disposal Guidance

Effective Date: December 23, 2019

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

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waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address:

<https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/>.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
 - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
 - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPA's of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
 - Do not dispose of snow where trucks may cause shoreline damage or erosion.
 - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.
- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. *A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps:*

- Call the emergency contact phone number [(888) 304-1133] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114



Isolator[™] Row O&M Manual
StormTech[®] Chamber System for Stormwater Management

1.0 The Isolator™ Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patent pending technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.



Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR™ ROW

The Isolator Row is a row of StormTech chambers, either SC-740 or SC-310 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated side-walls allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

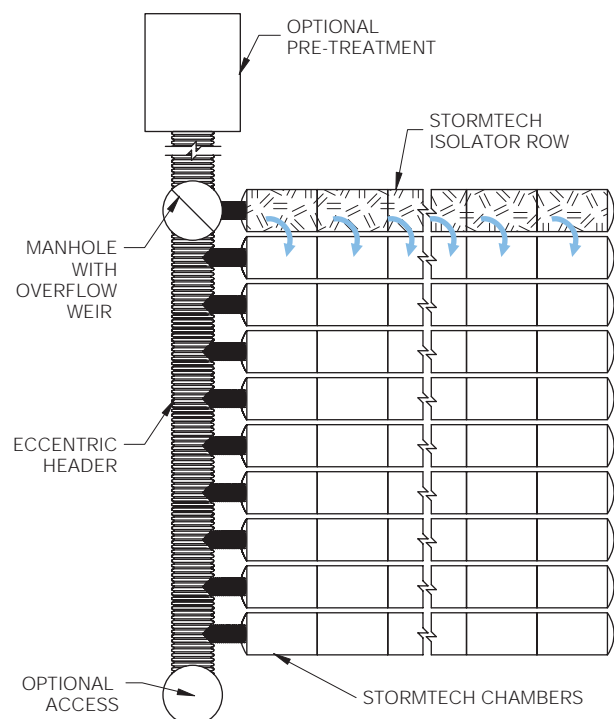
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber.

The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway (not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

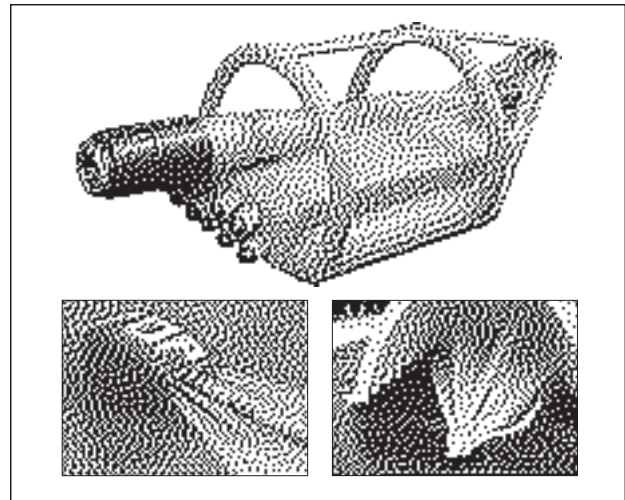
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

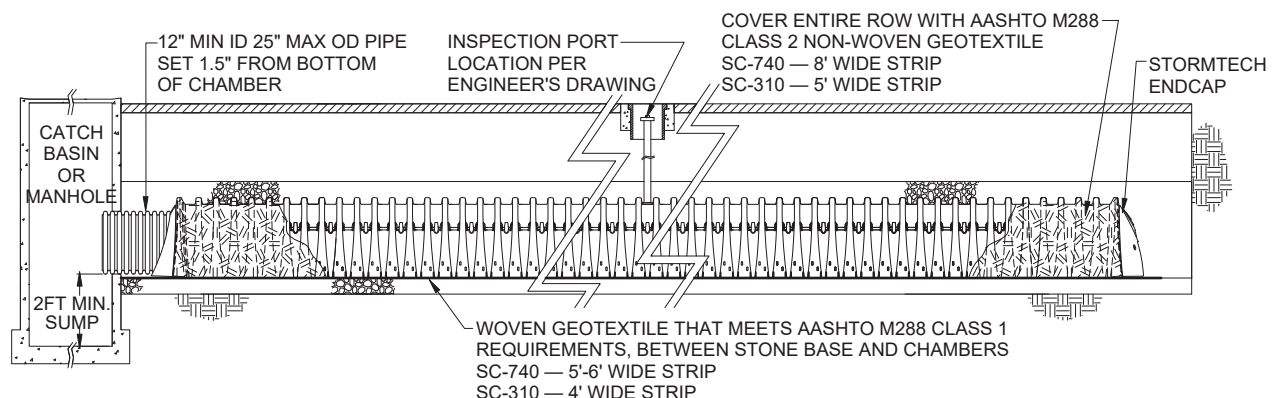
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



3.0 Isolator Row Step By Step Maintenance Procedures

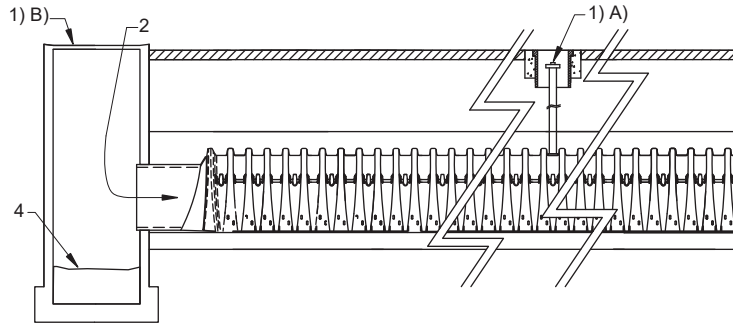
Step 1) Inspect Isolator Row for sediment

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

- i. Remove cover from manhole at upstream end of Isolator Row
- ii. Using a flashlight, inspect down Isolator Row through outlet pipe
 - 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 - 2. Follow OSHA regulations for confined space entry if entering manhole
- iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

- A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

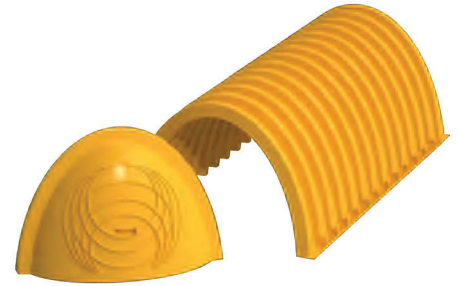


Subsurface Stormwater ManagementSM

20 Beaver Road, Suite 104 | Wethersfield | Connecticut | 06109
 860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

StormTech® SC-800 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications

(not to scale)

Size (L x W x H)
 85.4" x 51" x 33"
 2169 mm x 1295 mm x 838 mm

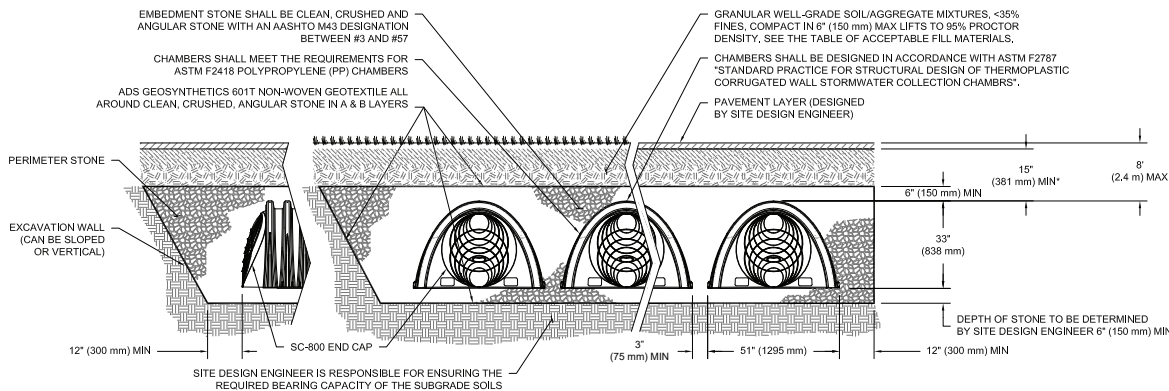
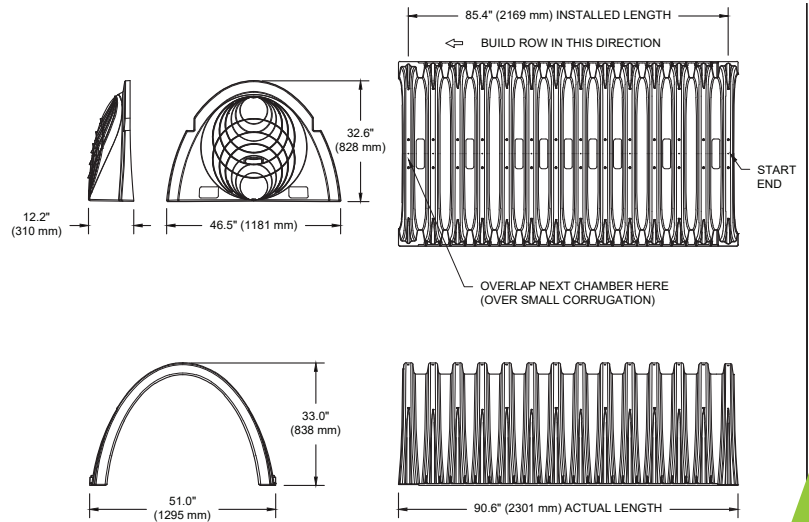
Chamber Storage
 50.6 ft³ (1.43 m³)

Min. Installed Storage*
 78.4 ft³ (2.22 m³)

Weight
 81.8 lbs (37.1 kg)

Shipping
 30 chambers/pallet
 60 end caps/pallet
 12 pallets/truck

*Assumes 6" (150 mm) stone above and below chambers, 3" (75 mm) stone between chambers, and 40% stone porosity.



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT, FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 21" (533 mm).

StormTech SC-800 Specifications

Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft ³ (m ³)	Total System Cumulative Storage ft ³ (m ³)
45 (1143)	↑ 50.62 (1.433)	78.41 (2.22)
44 (1118)	50.62 (1.433)	77.34 (2.19)
43 (1092)	50.62 (1.433)	76.28 (2.16)
42 (1067)	Stone Cover ↑ 50.62 (1.433)	75.21 (2.13)
41 (1041)	50.62 (1.433)	74.14 (2.10)
40 (1016)	↓ 50.62 (1.433)	73.07 (2.07)
39 (991)	50.62 (1.433)	72.01 (2.04)
38 (965)	50.55 (1.431)	70.89 (2.01)
37 (940)	50.35 (1.426)	69.71 (1.97)
36 (914)	50.07 (1.418)	68.47 (1.94)
35 (889)	49.56 (1.403)	67.10 (1.90)
34 (864)	48.82 (1.382)	65.59 (1.86)
33 (838)	47.93 (1.357)	63.98 (1.81)
32 (813)	46.91 (1.328)	62.31 (1.76)
31 (787)	45.79 (1.297)	60.57 (1.72)
30 (762)	44.58 (1.262)	58.77 (1.66)
29 (737)	43.28 (1.226)	56.93 (1.61)
28 (711)	41.91 (1.187)	55.04 (1.56)
27 (686)	40.47 (1.146)	53.10 (1.50)
26 (660)	38.96 (1.103)	51.13 (1.45)
25 (635)	37.40 (1.059)	49.13 (1.39)
24 (610)	35.78 (1.013)	47.09 (1.33)
23 (584)	34.10 (0.966)	45.02 (1.27)
22 (559)	32.38 (0.917)	42.91 (1.22)
21 (533)	30.61 (0.867)	40.79 (1.15)
20 (508)	28.80 (0.816)	38.63 (1.09)
19 (483)	26.95 (0.763)	36.45 (1.03)
18 (457)	25.06 (0.710)	34.25 (0.97)
17 (432)	23.13 (0.655)	32.02 (0.91)
16 (406)	21.17 (0.599)	29.78 (0.84)
15 (381)	19.17 (0.543)	27.51 (0.78)
14 (356)	17.14 (0.485)	25.23 (0.71)
13 (330)	15.09 (0.427)	22.93 (0.65)
12 (305)	13.00 (0.368)	20.61 (0.58)
11 (279)	10.89 (0.308)	18.28 (0.52)
10 (254)	8.76 (0.248)	15.93 (0.45)
9 (229)	6.60 (0.187)	13.57 (0.38)
8 (203)	4.42 (0.125)	11.19 (0.32)
7 (178)	2.22 (0.063)	8.81 (0.25)
6 (152)	↑ 0 (0)	6.41 (0.18)
5 (127)	0 (0)	5.34 (0.15)
4 (102)	Stone Foundation ↑ 0 (0)	4.27 (0.12)
3 (76)	0 (0)	3.20 (0.09)
2 (51)	↓ 0 (0)	2.14 (0.06)
1 (25)	0 (0)	1.07 (0.03)

Note: Add 1.07 ft³ (0.03 m³) of storage for each additional inch (25 mm) of stone foundation.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTM F2922, comply with all requirements in the Build America, Buy America (BABA) Act.

Working on a project?

Visit us at adspipe.com/stormtech and utilize the Design Tool

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber Storage ft ³ (m ³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-800 Chamber	50.6 (1.43)	78.4 (2.22)	84.8 (2.4)	91.2 (2.58)

Note: Assumes 6" (150 mm) stone above chambers, 3" (75 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

English Tons (yds ³)	Stone Foundation Depth		
	6"	12"	18"
SC-800	3.6 (2.6)	4.4 (3.2)	5.3 (3.8)
Metric Kilograms (m ³)	150 mm	300 mm	450 mm
SC-800	3270 (2.0)	3990 (2.4)	4810 (2.9)

Note: Assumes 6" (150 mm) of stone above chambers and 3" (75 mm) stone between chambers.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6" (150 mm)	12" (300 mm)	18" (450 mm)
SC-800	5.3 (4.1)	5.9 (4.5)	6.5 (5.0)

Note: Assumes 3" (75 mm) of row separation and 15" (375 mm) of cover. The volume of excavation will vary as depth of cover increases.



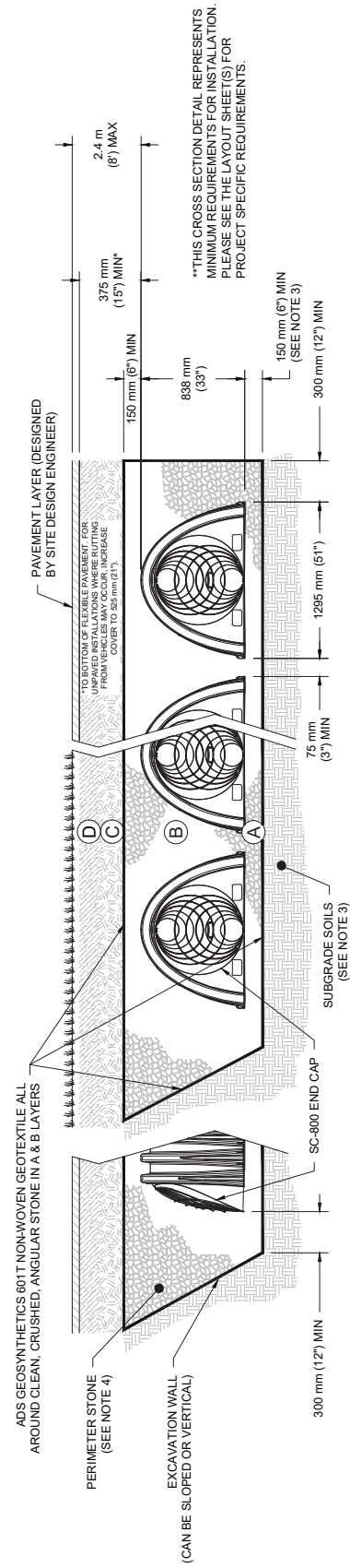
adspipe.com
800-821-6710

ACCEPTABLE FILL MATERIALS: STORMTECH SC-800 CHAMBER SYSTEMS

MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D FINAL FILL: FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C INITIAL FILL: FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 375 mm (15") ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145 ¹ A-1, A-2-1, A-3 OR AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 88, 9, 10	BEGIN COMPACTIONS AFTER 300 mm (12") OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 150 mm (6") MAX LIFTS TO A MIN. 96% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B EMBEDMENT STONE: FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. ^{2,3}

PLEASE NOTE:

- THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
- STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 150 mm (6") (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
- WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
- ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
- WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".

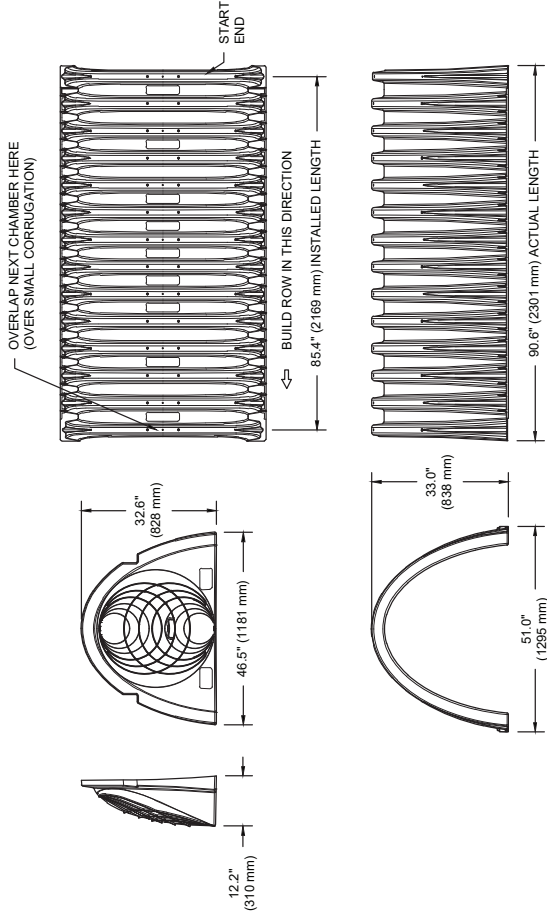


NOTES:

- CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418. "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- SC-800 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
- PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
- REQUIREMENTS FOR HANDLING AND INSTALLATION:
 - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
 - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
 - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 700 LBS/FT²%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-800 TECHNICAL SPECIFICATION

NTS



OVERLAP NEXT CHAMBER HERE
(OVER SMALL CORRUGATION)

TECHNICAL SPECIFICATIONS
SC-800 CHAMBER

DATE: 04/18/2025 DRAWN: SMW
DRAWING #: 721-810 CHECKED: JLM

DATE	DRWN	CHKD	DESCRIPTION

NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH) 51.0" X 33.0" X 85.4"
 CHAMBER STORAGE 50.6 CUBIC FEET (1,295 mm X 838 mm X 2169 mm)
 MINIMUM INSTALLED STORAGE** 78.4 CUBIC FEET (2,22 m³)
 WEIGHT 81.8 lbs. (37.1 kg)

NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH) 46.5" X 32.6" X 10.5"
 END CAP STORAGE 3.4 CUBIC FEET (0.09 m³)
 MINIMUM INSTALLED STORAGE** 14.7 CUBIC FEET (0.42 m³)
 WEIGHT 15.7 lbs. (7.1 kg)

* ASSUMES 6" (150 mm) STONE ABOVE AND BELOW CHAMBER, 3" (75 mm) BETWEEN CHAMBERS
 ** ASSUMES 6" (150 mm) STONE ABOVE AND BELOW END CAPS, 3" (75 mm) BETWEEN ROWS, 12" (300 mm) BEYOND END CAPS

PRE-CORED HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "BPC"
 PRE-CORED HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "TPC"

PART #	STUB	B	C
SC800EPE06TPC	6" (150 mm)	21.4" (544 mm)	---
SC800EPE06BPC	---	---	0.9" (23 mm)
SC800EPE08TPC	8" (200 mm)	19.2" (488 mm)	---
SC800EPE08BPC	---	---	1.0" (25 mm)
SC800EPE10TPC	10" (250 mm)	17.0" (432 mm)	---
SC800EPE10BPC	---	---	1.2" (30 mm)
SC800EPE12TPC	12" (300 mm)	14.4" (366 mm)	---
SC800EPE12BPC	---	---	1.6" (41 mm)
SC800EPE15TPC	15" (375 mm)	11.3" (287 mm)	---
SC800EPE15BPC	---	---	1.7" (43 mm)
SC800EPE18TPC	18" (450 mm)	8.0" (203 mm)	---
SC800EPE18BPC	---	---	2.0" (51 mm)
SC800ECEZ	24" (600 mm)	---	2.3" (58 mm)

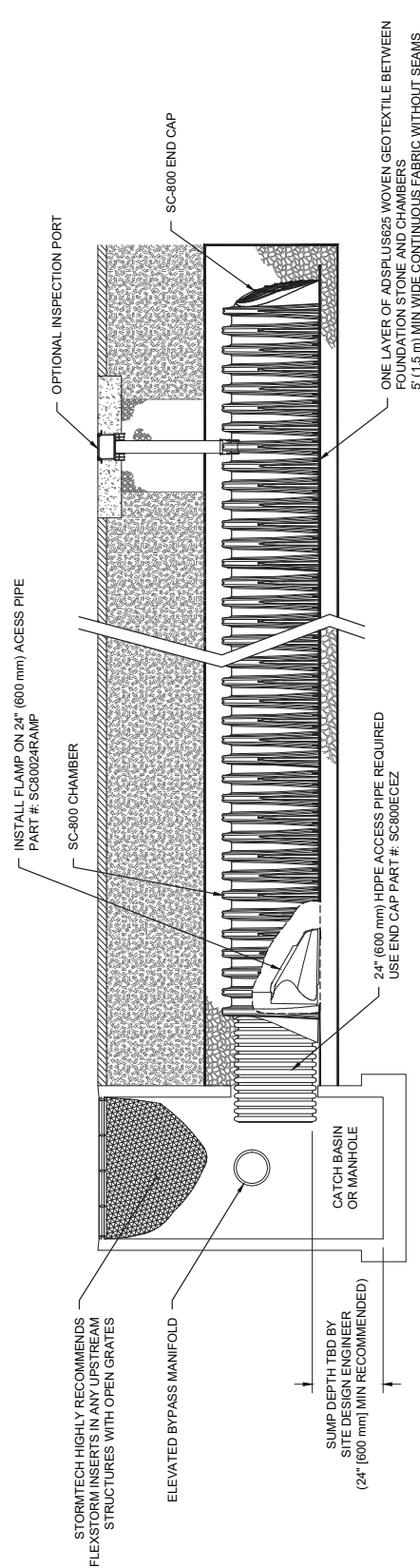
NOTE: ALL DIMENSIONS ARE NOMINAL

StormTech®
Chamber System

4640 TRUMAN BLVD
HILLIARD, OH 43026



THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO AOSTORMTECH UNDER THE DIRECTION OF THE PROJECT'S ENGINEER OF RECORD (EOR) OR OTHER PROJECT REPRESENTATIVE. THESE DRAWINGS ARE NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE EOR'S PRIOR APPROVAL. EOR SHALL REVIEW THIS DRAWING FOR ACCURACY PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCTS (EOR) OR OTHER PROJECT REPRESENTATIVE HAS ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



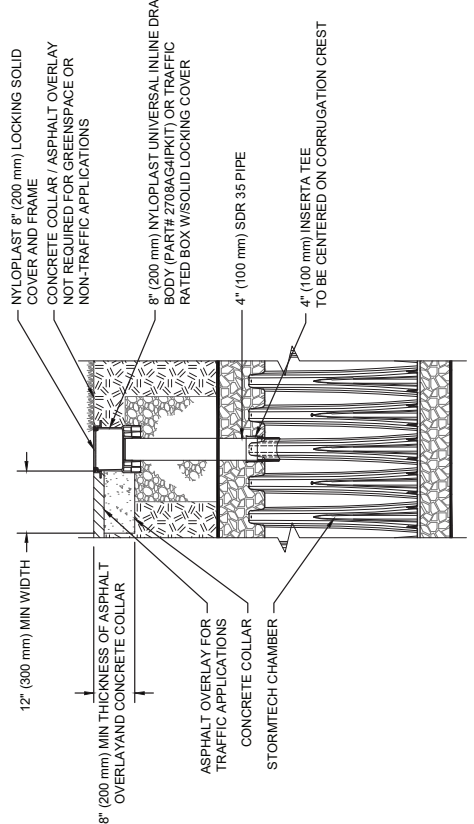
SC-800 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

- STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
 - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
 - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
 - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
 - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
 - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
 - B. ALL ISOLATOR PLUS ROWS
 - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
 - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
 - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
 - B.2. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° (1.1 m) OR MORE IS PREFERRED
 - B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
 - C. VACUUM STRUCTURE SUMP AS REQUIRED
- STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.
- STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION CREST.

4" PVC INSPECTION PORT DETAIL
(SC SERIES CHAMBER)
NTS

Isolator[®] Row Plus

O&M Manual



The Isolator[®] Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS), Total Phosphorus (TP), Total Petroleum Hydrocarbons (TPH) and Total Nitrogen (TN) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, DC-780, SC-800, MC-3500, MC-4500 or MC-7200 models, are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS Isolator Row and Plus fabric are placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting.

The Isolator Row Plus is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

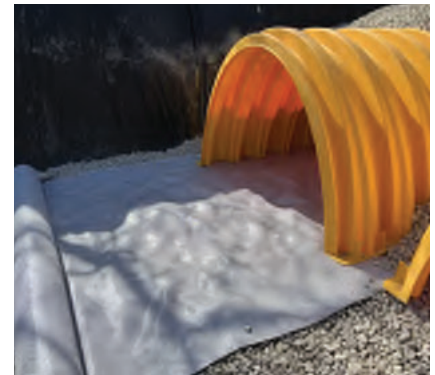
The Isolator Row Plus Flamp™ is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end, or more difficult to remove and require confined space entry into the chamber area. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

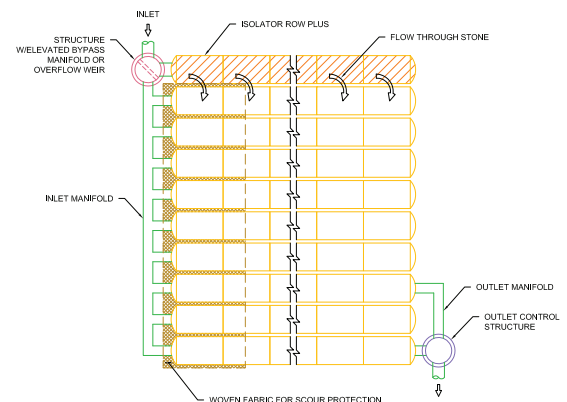
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.



Looking down the Isolator Row Plus from the manhole opening, ADS Plus Fabric is shown between the chamber and stone base.



StormTech Isolator Row Plus with Overflow Structure (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

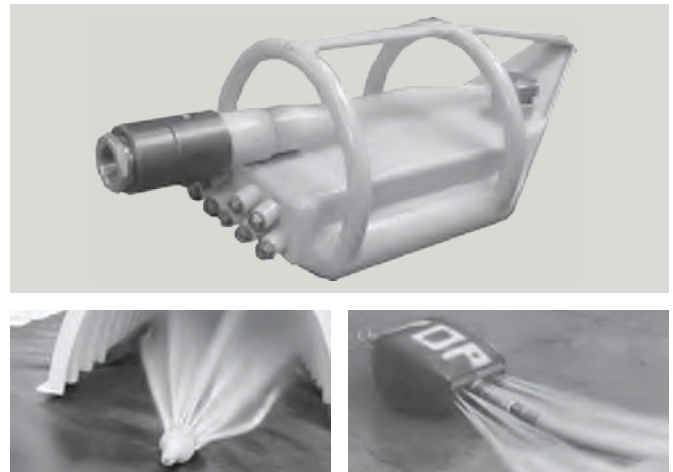
If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3" (75 mm) throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

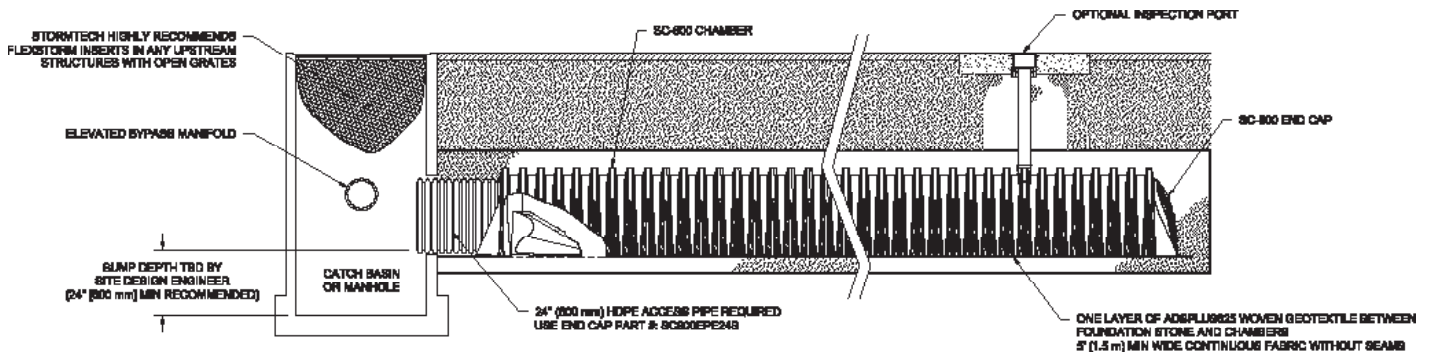
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided

via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entry.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row Plus (not to scale)



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Row Plus
 - i. Remove cover from manhole at upstream end of Isolator Row Plus
 - ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

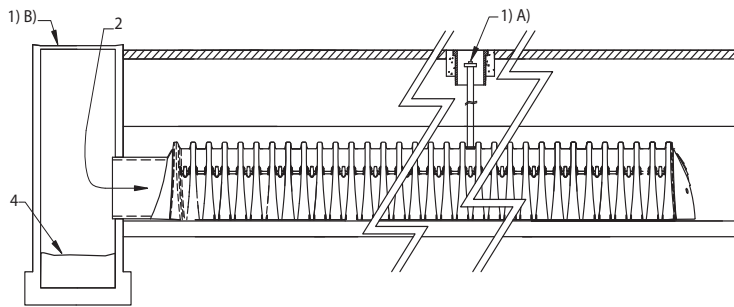
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi-ment Depth (1)-(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row Plus, maintenance due	NV
7/7/13	6.3 ft		0	System jettied and vacuumed	DJM

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StormTech® Installation Guide

SC-310/DC-780/SC-800



StormTech
Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps and pre-cored end caps
- StormTech chambers
- StormTech manifolds and fittings

Important Notes:

- This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.
- Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the “dump and push” method are not covered under the StormTech standard warranty.
- Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation



Excavate bed and prepare subgrade per engineer's plans.

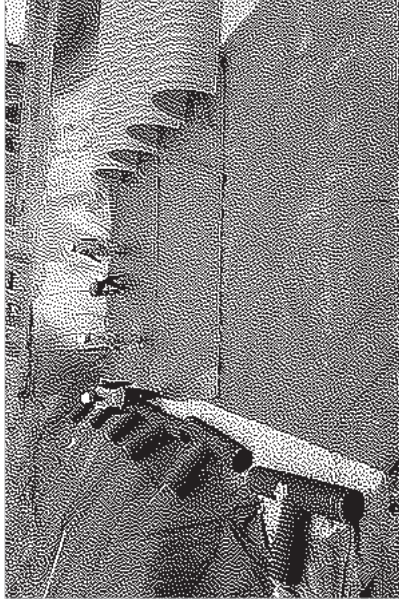


Place non-woven geotextile over prepared soils and up excavation walls. Install underdrains if required.



Place clean, crushed, angular stone foundation 6" (150 mm) min. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly



Install manifolds and lay out ADS Plus Fabric at inlet rows. Place ADS Plus Fabric at each inlet end cap parallel to the row (min. 12.5 ft (3.8 m)). Place a continuous piece entire length of Isolator® Plus Row(s).



Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.



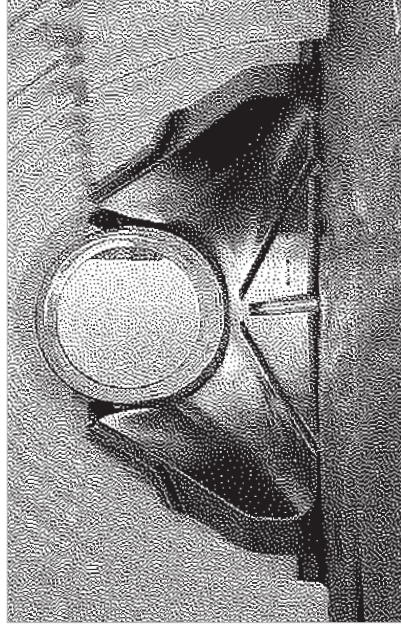
Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled "Lower Joint - Overlap Here" and "Build this direction - Upper Joint". Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 3" (75 mm) spacing between rows for SC-310 and SC-800, and 6" (150 mm) spacing for DC-780.

Attaching the End Caps



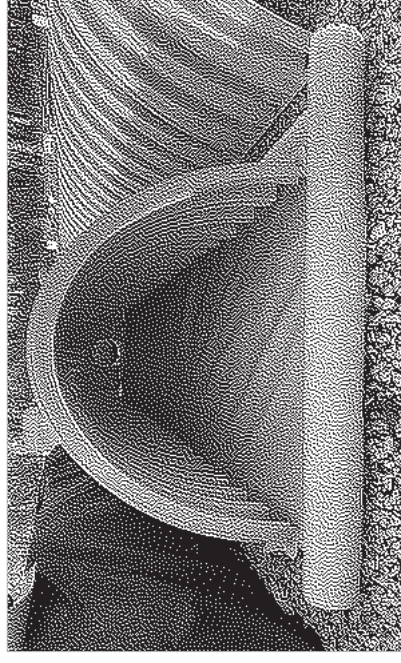
Lift the end of the chamber a few inches off the ground. With the curved face of the end cap facing outward, place the end cap into the chamber's end corrugation.

Prefabricated End Caps



24" (600 mm) inlets are the maximum size that can fit into a DC-780 or SC-800 end cap and must be prefabricated with a 24" (600 mm) pipe stub. SC-310 chambers with a 12" (300 mm) inlet pipe must use a prefabricated end cap with a 12" (300 mm) pipe stub. When used on an Isolator Row Plus, these end caps will contain a welded FLAMP (flared end ramp) that will lay on top of the ADS Plus fabric (shown above)

Isolator Row Plus



Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet.

Initial Anchoring of Chambers – Embedment Stone



Initial embedment shall be spotted along the center line of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

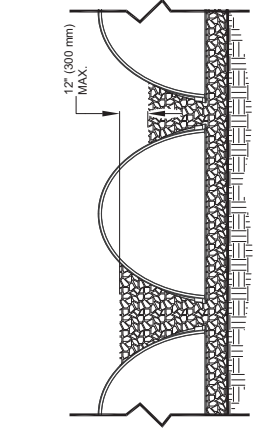
No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

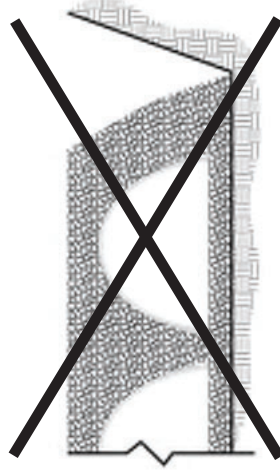


Uneven Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12" (300 mm) between adjacent chamber rows or between chamber rows and perimeter.

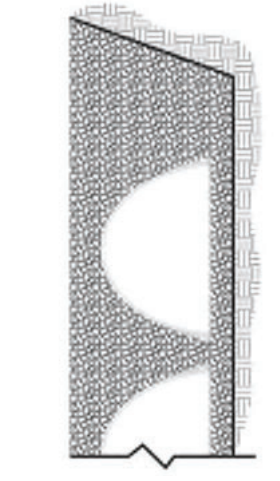


Even Backfill



Perimeter Not Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.



Perimeter Fully Backfilled

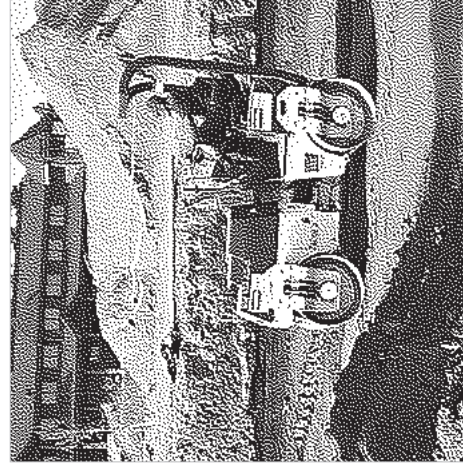
Backfill - Embedment Stone & Cover Stone



Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6" (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone.**

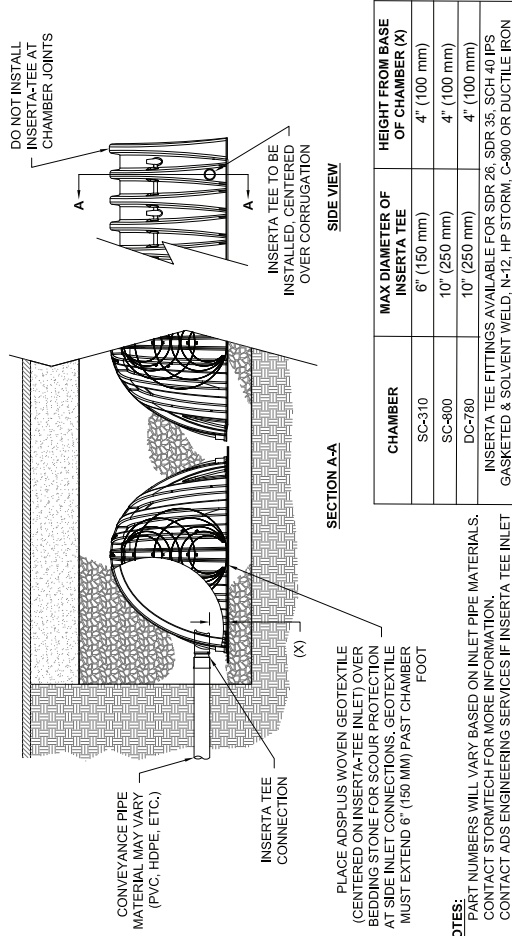
Small dozers and skid loaders may be used to finish grading stone backfill in accordance with ground pressure limits in Table 2. They must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends that the contractor inspect chambers before placing final backfill. Any chambers damaged by construction shall be removed and replaced.

Final Backfill of Chambers – Fill Material



Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) min., where edges meet. Compact each lift of backfill as specified in the site design engineer's drawings. Roller travel parallel with rows.

Inserta Tee Detail



StormTech Isolator Row Plus Detail

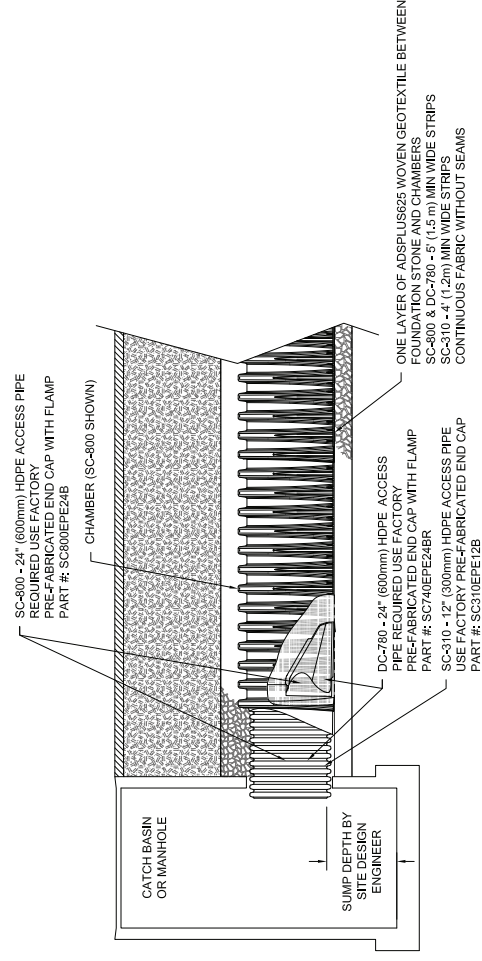


Table 1 - Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation ¹	Compaction/Density Requirement
D Final Fill: Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
C Initial Fill: Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M45 A-1, A-2-4, A-3 or AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
B Embedment Stone: Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone or Recycled Concrete ⁴	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	No compaction required.
A Foundation Stone: Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone or Recycled Concrete ⁴	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (6") lifts using two full coverages with a vibratory compactor. ^{2,3}

Please Note:

- The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
- StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.
- Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.
- Where recycled concrete aggregate is used in layers 'A' or 'B' the material should also meet the acceptable criteria outlined in ADS Technical Note 6.20 "Recycled Concrete Structural Backfill".

Figure 2 - Fill Material Locations

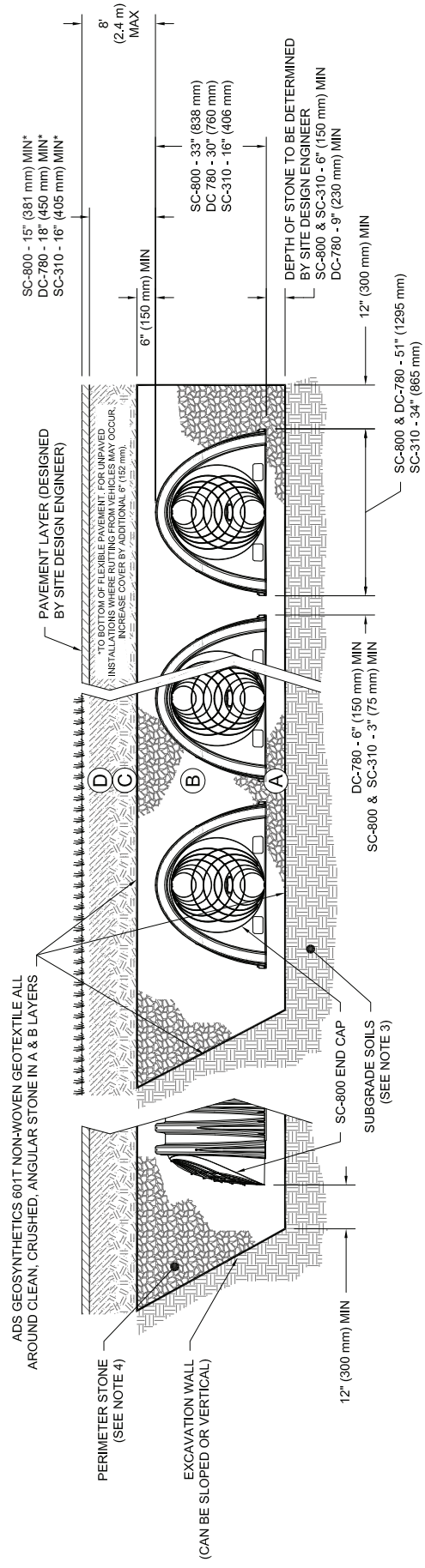


Figure 1 - Inspection Port Detail

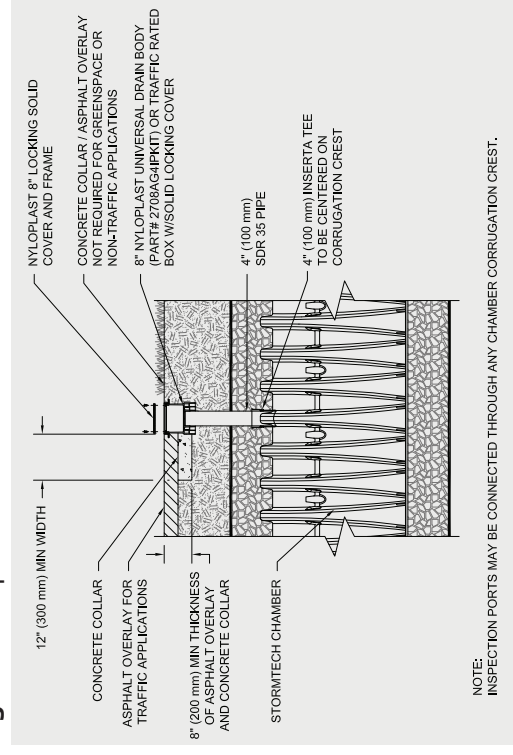


Table 2 - Maximum Allowable Construction Vehicle Loads⁶

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads ⁶		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	
Ⓐ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305)	3880 (186)	38,000 (169)
				18" (457)	2640 (126)	
				24" (610)	2040 (97)	
				30" (762)	1690 (81)	
				36" (914)	1470 (70)	
Ⓑ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305)	2690 (128)	20,000 (89)
				18" (457)	1880 (90)	
				24" (610)	1490 (71)	
				30" (762)	1280 (61)	
				36" (914)	1150 (55)	
Ⓒ Embedment Stone	24" (600) Loose/Dumped	32,000 (142)	16,000 (71)	12" (305)	2390 (114)	Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
				18" (457)	1700 (81)	
				24" (610)	1370 (65)	
				30" (762)	1190 (57)	
				36" (914)	1080 (51)	
Ⓓ Embedment Stone	18" (450)	32,000 (142)	16,000 (71)	12" (305)	2110 (101)	Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
				18" (457)	1510 (72)	
				24" (610)	1250 (59)	
				30" (762)	1100 (52)	
				36" (914)	1020 (48)	
Ⓔ Embedment Stone	12" (300)	16,000 (71)	NOT ALLOWED	12" (305)	1540 (74)	Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
				18" (457)	1190 (57)	
				24" (610)	1010 (48)	
				30" (762)	910 (43)	
				36" (914)	840 (40)	
Ⓕ Embedment Stone	6" (150)	8,000 (35)	NOT ALLOWED	12" (305)	1070 (51)	NOT ALLOWED
				18" (457)	900 (43)	
				24" (610)	800 (38)	
				30" (762)	760 (36)	
				36" (914)	720 (34)	

Notes:

- 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.

- During paving operations, dump truck axle loads on 18" (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.

- Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.

- Mini-excavators (< 8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.

- Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.

- Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/Restrictions	Wheel Load Restrictions	Track Load Restrictions		Roller Load Restrictions
			See Table 2 for Maximum Construction Loads	See Table 2 for Maximum Construction Loads	
Ⓐ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows until 36" (900mm) compacted cover is reached. ⁴	Dozers to push parallel to rows until 36" (900 mm) compacted cover is reached.	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓑ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 18" (450 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 6" (150 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 12" (300 mm) over chambers. Roller travel parallel to chamber rows only.	
Ⓒ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 6" (150 mm) cover stone is in place.	No tracked equipment is allowed on chambers until a min. 6" (150 mm) cover stone is in place.	No rollers allowed.
Ⓓ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.				

StormTech® Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC (“STORMTECH”): PRODUCTS

- (A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the “Purchaser”). The chambers and end plates are collectively referred to as the “Products.”
- (B) The structural integrity of the Products, when installed strictly in accordance with StormTech’s written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech’s corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech’s liability specifically excludes the cost of removal and/or installation of the Products.
- (C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.
- (D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.
- (E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.
- (F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech’s written installation instructions.
- (G) THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLIGENCE; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH’S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH’S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.



Drainage



Filtration



Separation

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

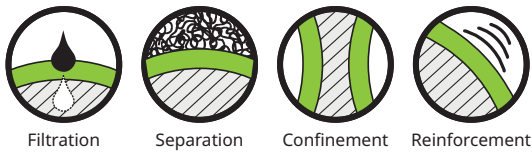
Property	Test Method	Unit	Typical Value ¹ MD	Typical Value ¹ CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec ⁻¹	1.5	1.5
Flow Rate	ASTM D4491	gal/min/ft ² (l/min/m ²)	105 (4278)	105 (4278)
UV Resistance (at 500 hours) ¹	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value ²
Weight	ASTM D5161	oz/yd ² (g/m ²)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd ² (m ²)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

¹ Modified, Minimum Test Value

² ASTM D4439 Standard Terminology for Geosynthetics: typical value, *n-for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.



ADS PLUS WOVEN GEOTEXTILE SPECIFICATION

For use with StormTech® Isolator® Row Plus

Scope

This specification describes ADS Plus woven geotextile.

ADS Plus woven geotextile fabrics are woven polypropylene materials offering optimum performance when used in stabilization applications. Produced from first quality raw materials, they provide the perfect balance of strength and separation in styles capable of functioning exceptionally well in a wide range of performance requirements.

Filter Fabric Properties

Property ¹	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value) ²
Weight	ASTM D5261	oz/yd ² (g/m ²)	8.0 (271.25)
Grab Tensile Strength	ASTM D4632	lbs (kN)	325 (1.45)
Grab Elongation	ASTM D4632	%	15
Trapezoidal Tear Strength	ASTM D4533	lbs (kN)	125 (0.89)
CBR Puncture Resistance	ASTM D6241	lbs (kN)	1,124 (5.0)

1. The property values listed above are subject to change without notice.

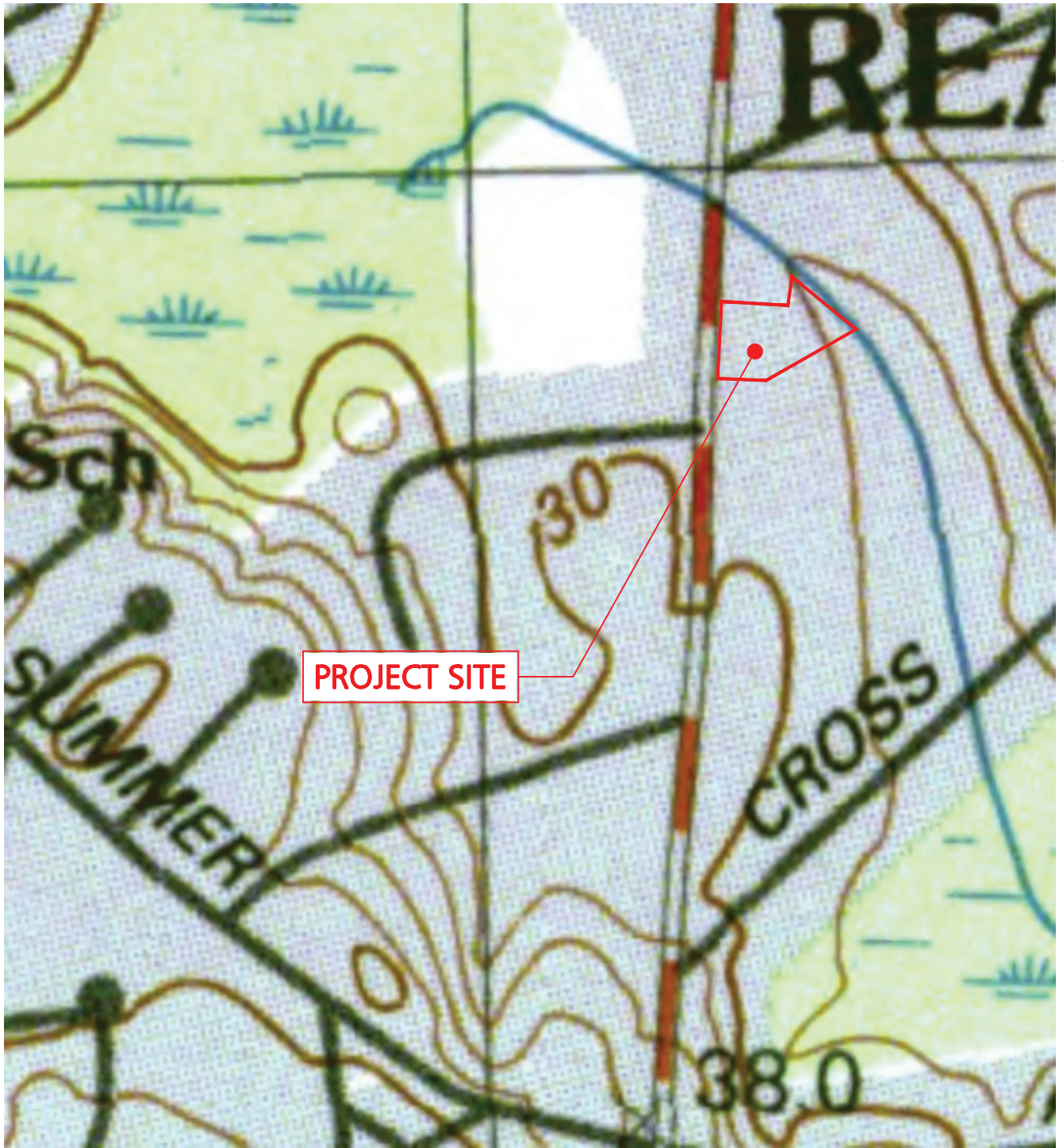
2. Minimum Average Roll Values (MARV) is calculated as the average minus two standard deviations. Statistically, it yields approximately 97.5% degree of confidence that any samples taken from quality assurance testing will meet or exceed the values described above.

Dimensions

ADS Plus shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 12.5' (3.8 m) width x 360' (110 m) length for Plus125 and 6.25' (1.9 m) width x 360' (110 m) length for Plus625.



**SECTION 3.0 -
EXHIBITS**



PROJECT SITE

PREPARED BY:



ALLEN & MAJOR ASSOCIATES, INC.

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WOBURN, MA ♦ LAKEVILLE, MA ♦ MANCHESTER, NH

PROJECT:

**281 MAIN STREET
 READING, MA**

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USGS SITE LOCUS MAP

PROJECT NO. 2398-08 DATE: 11-24-2025

SCALE: 1"=300' DWG. NAME: EXHIBITS

DESIGNED BY: MTB/BDP CHECKED BY: CMQ

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SHEET No.

EX-1



PROJECT SITE

PREPARED BY:



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PROJECT:

**281 MAIN STREET
READING, MA**

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AERIAL PHOTO

PROJECT NO. 2398-08 DATE: 11-24-2025

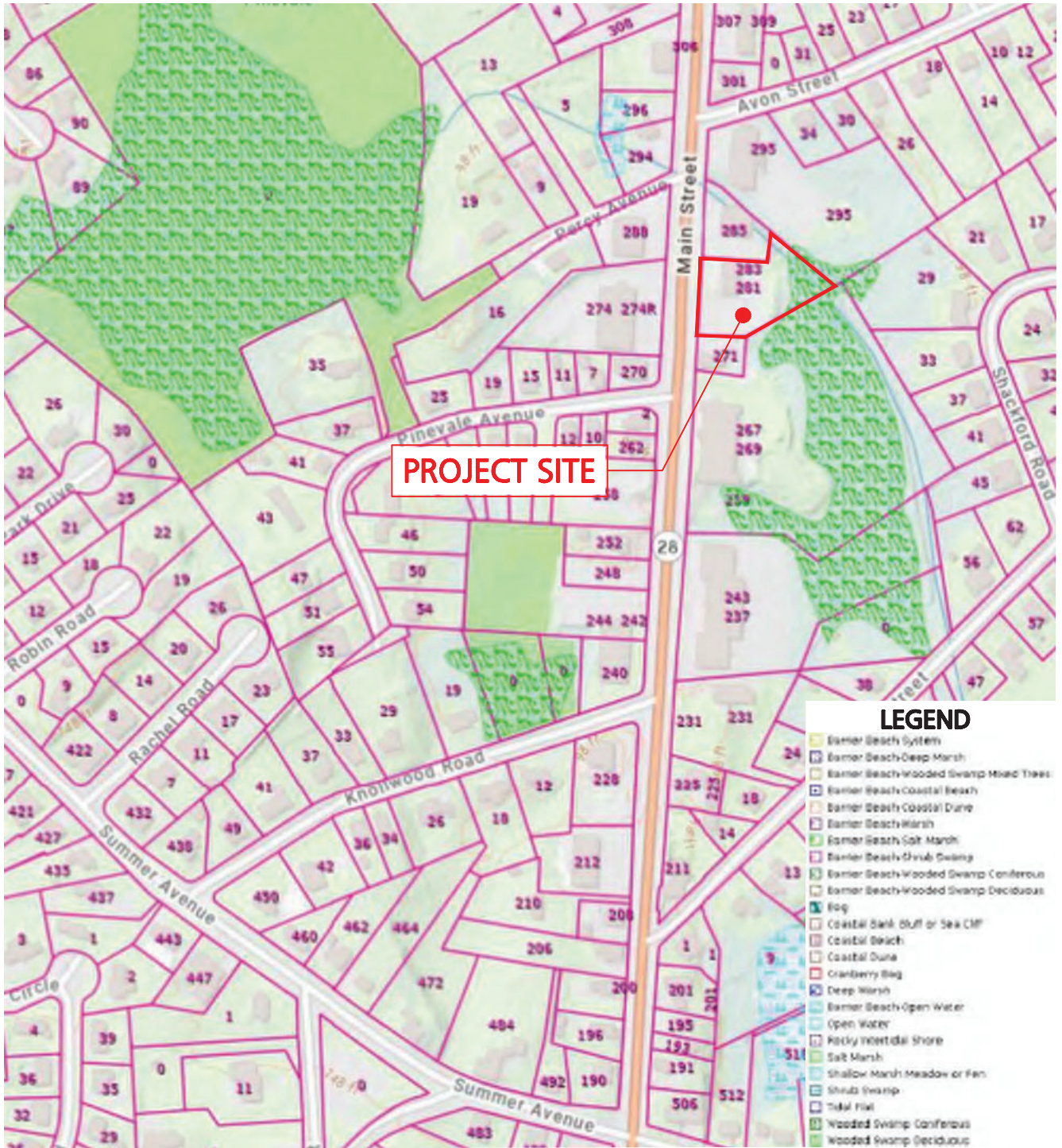
SCALE: 1"=300' DWG. NAME: EXHIBITS

DESIGNED BY: MTB/BDP CHECKED BY: CMQ

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SHEET No.

EX-2



THERE ARE DEP WETLANDS ON THE EASTERN PORTION OF THE SITE

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 www.allenmajor.com

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FAX: (781) 935-2896

WOBURN, MA ♦ LAKEVILLE, MA ♦ MANCHESTER, NH

PROJECT:

**281 MAIN STREET
 READING, MA**

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WETLANDS MAP

PROJECT NO. 2398-08 DATE: 11-24-2025

SCALE: 1"=300' DWG. NAME: EXHIBITS

DESIGNED BY: MTB/BDP CHECKED BY: CMQ

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SHEET No.

EX-3



Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, X, A99
		With BFE or Depth Zone AE, AD, 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		Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



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 11/24/2025 at 3:55 PM 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.

FEMA FLOOD INSURANCE RATE MAP
MIDDLESEX COUNTY, MASSACHUSETTS
MAP NUMBER 25017C0313F
EFFECTIVE DATE: JULY 8, 2025

SITE IS NOT LOCATED IN A FLOOD HAZARD ZONE

PREPARED BY:



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FEMA FIRM MAP

PROJECT NO. 2398-08 DATE: 11-24-2025

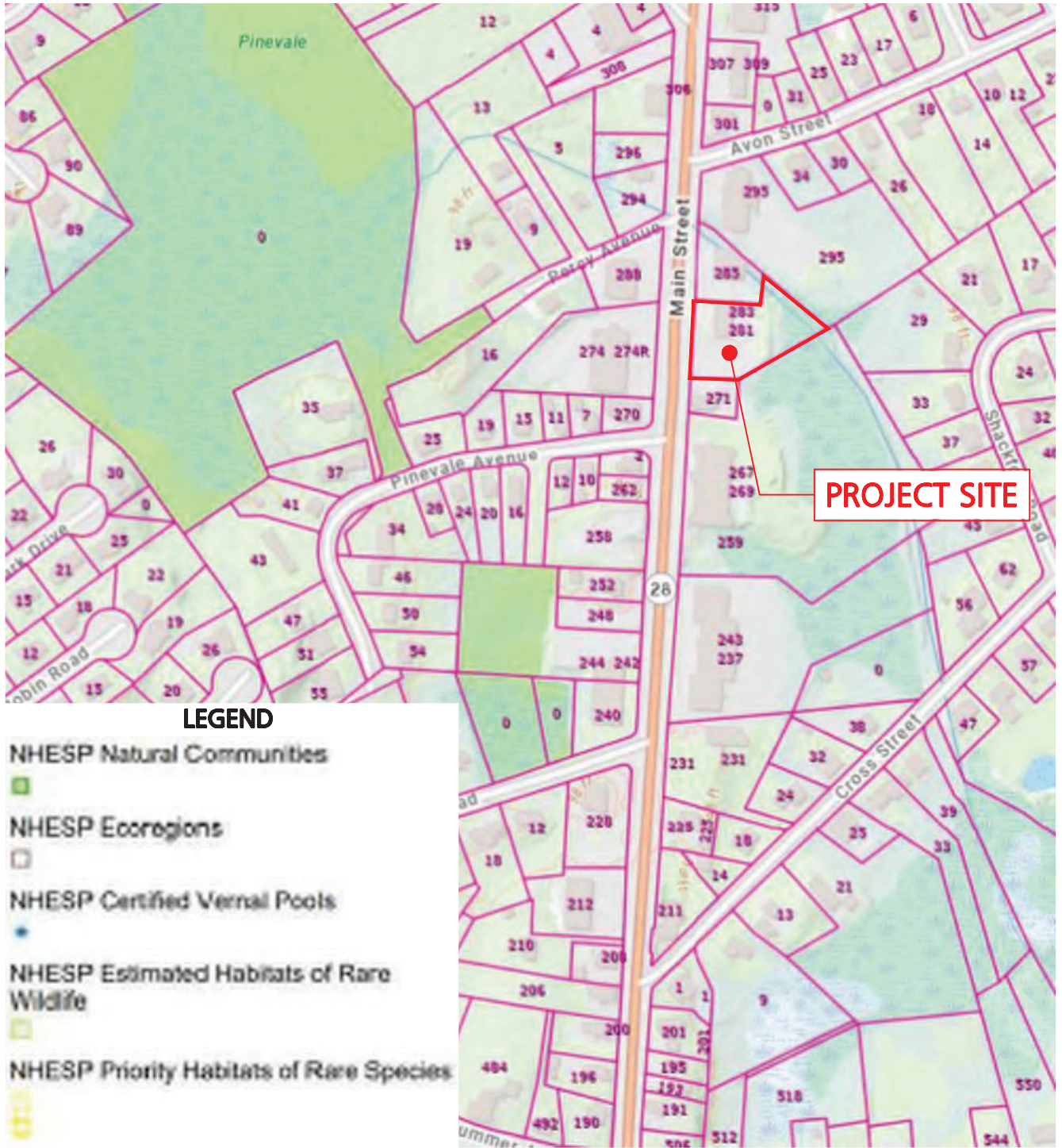
SCALE: NTS DWG. NAME: EXHIBITS

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SHEET No.

EX-4



PROJECT SITE

NO PRIORITY & ESTIMATED HABITATS LOCATED ON SITE

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PROJECT:

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 READING, MA**

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PRIORITY & ESTIMATED HABITATS

PROJECT NO.	2398-08	DATE:	11-24-2025
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	MTB/BDP	CHECKED BY:	CMQ

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SHEET No.

EX-5



**SECTION 4.0 -
EXISTING DRAINAGE
ANALYSIS**

Existing HydroCAD

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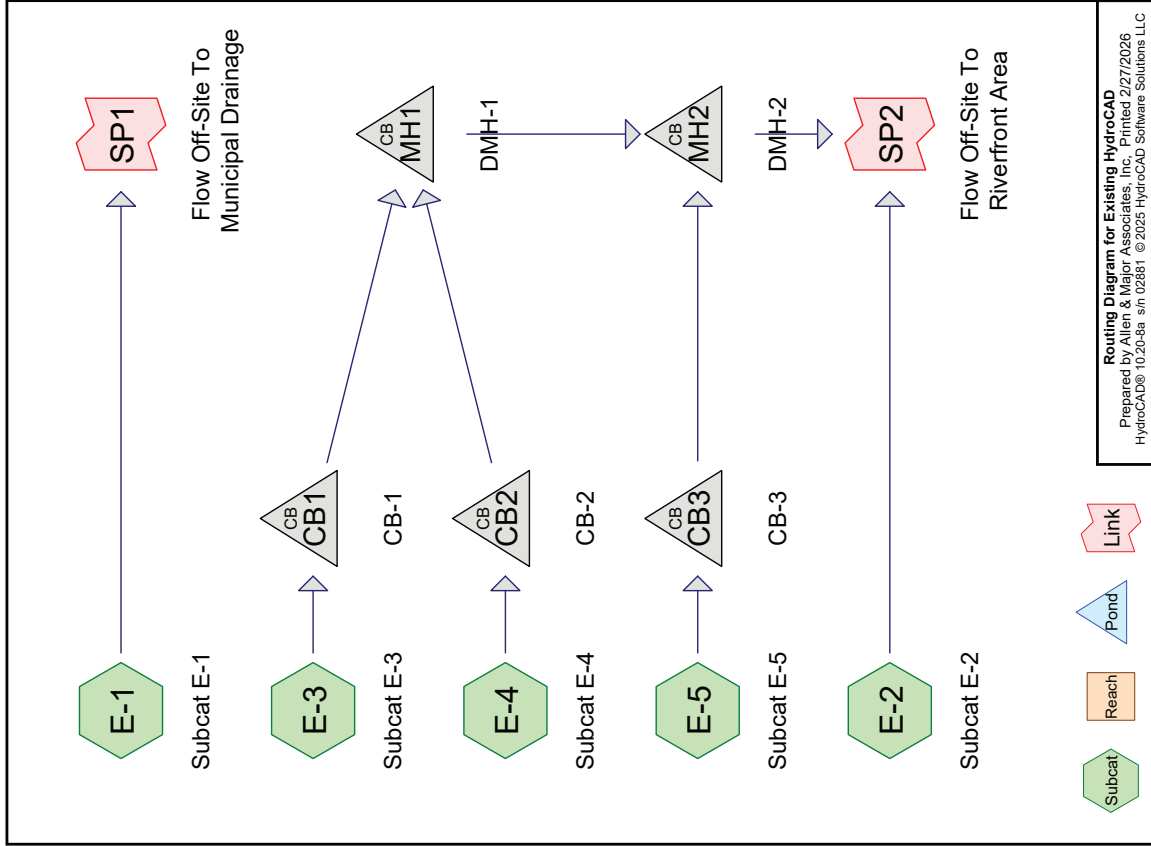
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Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr	Type III 24-hr	Default	24.00	1	3.31	2
2	10-year	Type III 24-hr	Type III 24-hr	Default	24.00	1	5.21	2
3	25-year	Type III 24-hr	Type III 24-hr	Default	24.00	1	6.40	2
4	100-year	Type III 24-hr	Type III 24-hr	Default	24.00	1	8.23	2



Existing HydroCAD

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,453	39	>75% Grass cover, Good, HSG A (E-1, E-2, E-3, E-4, E-5)
13,665	98	Paved parking, HSG A (E-1, E-2, E-3, E-4, E-5)
1,867	98	Roofs, HSG A (E-1, E-4, E-5)
10,569	30	Woods, Good, HSG A (E-2)
33,554	63	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
33,554	HSG A	E-1, E-2, E-3, E-4, E-5
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
33,554		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
7,453	0	0	0	0	7,453	>75% Grass cover, Good	
13,665	0	0	0	0	13,665	Paved parking	
1,867	0	0	0	0	1,867	Roofs	
10,569	0	0	0	0	10,569	Woods, Good	
33,554	0	0	0	0	33,554	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	CB1	89.02	88.43	58.9	0.0100	0.012	0.0	12.0	0.0	
2	CB2	89.17	88.38	24.5	0.0322	0.012	0.0	10.0	0.0	
3	CB3	89.15	89.05	9.6	0.0104	0.012	0.0	12.0	0.0	
4	MH1	88.28	87.95	32.6	0.0101	0.012	0.0	12.0	0.0	
5	MH2	88.00	87.28	72.0	0.0100	0.012	0.0	12.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

- Subcatchment E-1: Subcat E-1** Runoff Area=9,274 sf 62.30% Impervious Runoff Depth=1.23"
 Tc=6.0 min CN=76 Runoff=0.30 cfs 950 cf
- Subcatchment E-2: Subcat E-2** Runoff Area=11,560 sf 0.00% Impervious Runoff Depth=0.00"
 Tc=6.0 min CN=31 Runoff=0.00 cfs 0 cf
- Subcatchment E-3: Subcat E-3** Runoff Area=4,210 sf 98.71% Impervious Runoff Depth=2.97"
 Tc=6.0 min CN=97 Runoff=0.31 cfs 1,040 cf
- Subcatchment E-4: Subcat E-4** Runoff Area=947 sf 92.30% Impervious Runoff Depth=2.55"
 Tc=6.0 min CN=93 Runoff=0.06 cfs 201 cf
- Subcatchment E-5: Subcat E-5** Runoff Area=7,564 sf 62.46% Impervious Runoff Depth=1.23"
 Tc=6.0 min CN=76 Runoff=0.24 cfs 775 cf
- Pond CB1: CB-1** 12.0" Round Culvert n=0.012 L=58.9' S=0.0100 '/' Outflow=0.31 cfs 1,040 cf
 Peak Elev=89.33'
- Pond CB2: CB-2** 10.0" Round Culvert n=0.012 L=24.5' S=0.0322 '/' Outflow=0.06 cfs 201 cf
 Peak Elev=89.31'
- Pond CB3: CB-3** 12.0" Round Culvert n=0.012 L=9.6' S=0.0104 '/' Outflow=0.24 cfs 775 cf
 Peak Elev=89.43'
- Pond MH1: DMH-1** 12.0" Round Culvert n=0.012 L=32.6' S=0.0101 '/' Outflow=0.37 cfs 1,242 cf
 Peak Elev=88.64'
- Pond MH2: DMH-2** 12.0" Round Culvert n=0.012 L=72.0' S=0.0100 '/' Outflow=0.61 cfs 2,017 cf
 Peak Elev=88.38'
- Link SP1: Flow Off-Site To Municipal Drainage** Inflow=0.30 cfs 950 cf
 Primary=0.30 cfs 950 cf
- Link SP2: Flow Off-Site To Riverfront Area** Inflow=0.61 cfs 2,017 cf
 Primary=0.61 cfs 2,017 cf

Total Runoff Area = 33,554 sf Runoff Volume = 2,966 cf Average Runoff Depth = 1.06"
53.71% Pervious = 18,022 sf 46.29% Impervious = 15,531 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 950 cf, Depth= 1.23"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.31"

Area (sf)	CN	Description
3,496	39	>75% Grass cover, Good, HSG A
931	98	Roofs, HSG A
4,847	98	Paved parking, HSG A
9,274	76	Weighted Average
3,496		37.70% Pervious Area
5,778		62.30% Impervious Area

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

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.31"

Area (sf)	CN	Description
10,569	30	Woods, Good, HSG A
990	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
11,560	31	Weighted Average
11,560		100.00% Pervious Area
0		0.00% Impervious Area
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)
6.0		Capacity (cfs)
		Description
		Direct Entry,

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.31 cfs @ 12.08 hrs, Volume= 1,040 cf, Depth= 2.97"
 Routed to Pond CB1 : CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.31"

Area (sf)	CN	Description
54	39	>75% Grass cover, Good, HSG A
4,156	98	Paved parking, HSG A
4,210	97	Weighted Average
54		1.29% Pervious Area
4,156		98.71% Impervious Area
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)
6.0		Capacity (cfs)
		Description
		Direct Entry,

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 201 cf, Depth= 2.55"
 Routed to Pond CB2 : CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.31"

Area (sf)	CN	Description
73	39	>75% Grass cover, Good, HSG A
248	98	Roots, HSG A
626	98	Paved parking, HSG A
947	93	Weighted Average
73		7.70% Pervious Area
874		92.30% Impervious Area

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

Summary for Subcatchment E-5: Subcat E-5

Runoff = 0.24 cfs @ 12.09 hrs, Volume= 775 cf, Depth= 1.23"
 Routed to Pond CB3 : CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-year Rainfall=3.31"

Area (sf)	CN	Description
4,037	98	Paved parking, HSG A
2,840	39	>75% Grass cover, Good, HSG A
688	98	Roots, HSG A
7,564	76	Weighted Average
2,840		37.54% Pervious Area
4,724		62.46% Impervious Area

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

Summary for Pond CB1: CB-1

Inflow Area = 4,210 sf, 98.71% Impervious, Inflow Depth = 2.97" for 2-year event
 Inflow = 0.31 cfs @ 12.08 hrs, Volume= 1,040 cf
 Outflow = 0.31 cfs @ 12.08 hrs, Volume= 1,040 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.31 cfs @ 12.08 hrs, Volume= 1,040 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.33' @ 12.08 hrs
 Flood Elev= 92.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.02'	12.0" Round 12" HDPE (Estimated Invert) L= 58.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.02' / 88.43' S= 0.0100 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.31 cfs @ 12.08 hrs HW=89.33' TW=88.64' (Dynamic Tailwater)
1-1=12" HDPE (Estimated Invert) (Inlet Controls 0.31 cfs @ 1.49 fps)

Summary for Pond CB2: CB-2

Inflow Area = 947 sf, 92.30% Impervious, Inflow Depth = 2.55" for 2-year event
 Inflow = 0.06 cfs @ 12.09 hrs, Volume= 201 cf
 Outflow = 0.06 cfs @ 12.09 hrs, Volume= 201 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.06 cfs @ 12.09 hrs, Volume= 201 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.31' @ 12.09 hrs
 Flood Elev= 90.37'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.17'	10.0" Round 10" HDPE L= 24.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.17' / 88.38' S= 0.0322 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.55 sf

Primary Outflow Max=0.06 cfs @ 12.09 hrs HW=89.31' TW=88.64' (Dynamic Tailwater)
1-1=10" HDPE (Inlet Controls 0.06 cfs @ 1.01 fps)

Summary for Pond CB3: CB-3

Inflow Area = 7,564 sf, 62.46% Impervious, Inflow Depth = 1.23" for 2-year event
 Inflow = 0.24 cfs @ 12.09 hrs, Volume= 775 cf
 Outflow = 0.24 cfs @ 12.09 hrs, Volume= 775 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.24 cfs @ 12.09 hrs, Volume= 775 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.43' @ 12.09 hrs
 Flood Elev= 90.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.15'	12.0" Round 12" HDPE Assumed Size and Slope L= 9.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.15' / 89.05' S= 0.0104' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.24 cfs @ 12.09 hrs HW=89.43' TW=88.37' (Dynamic Tailwater)
1-1=12" HDPE Assumed Size and Slope(Barrel Controls 0.24 cfs @ 2.07 fps)

Summary for Pond MH1: DMH-1

Inflow Area = 5,156 sf, 97.53% Impervious, Inflow Depth = 2.89" for 2-year event
 Inflow = 0.37 cfs @ 12.08 hrs, Volume= 1,242 cf
 Outflow = 0.37 cfs @ 12.08 hrs, Volume= 1,242 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.37 cfs @ 12.08 hrs, Volume= 1,242 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.64' @ 12.09 hrs
 Flood Elev= 91.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.28'	12.0" Round 12" HDPE (Estimated Slope) L= 32.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.28' / 87.95' S= 0.0101' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.37 cfs @ 12.08 hrs HW=88.64' TW=88.37' (Dynamic Tailwater)
1-1=12" HDPE (Estimated Slope) (Outlet Controls 0.37 cfs @ 2.18 fps)

Summary for Pond MH2: DMH-2

Inflow Area = 12,720 sf, 76.68% Impervious, Inflow Depth = 1.90" for 2-year event
 Inflow = 0.61 cfs @ 12.09 hrs, Volume= 2,017 cf
 Outflow = 0.61 cfs @ 12.09 hrs, Volume= 2,017 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.61 cfs @ 12.09 hrs, Volume= 2,017 cf

Routed to Link SP2 : Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.38' @ 12.09 hrs
 Flood Elev= 91.07'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	12.0" Round 12" RCP (Estimated Slope) L= 72.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 88.00' / 87.28' S= 0.0100 /' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=0.61 cfs @ 12.09 hrs HW=88.38' TW=0.00' (Dynamic Tailwater)
 1-1=12" RCP (Estimated Slope)(Barrel Controls 0.61 cfs @ 3.36 fps)

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 9,274 sf, 62.30% Impervious, Inflow Depth = 1.23" for 2-year event
 Inflow = 0.30 cfs @ 12.09 hrs, Volume= 950 cf
 Primary = 0.30 cfs @ 12.09 hrs, Volume= 950 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 24,280 sf, 40.17% Impervious, Inflow Depth = 1.00" for 2-year event
 Inflow = 0.61 cfs @ 12.09 hrs, Volume= 2,017 cf
 Primary = 0.61 cfs @ 12.09 hrs, Volume= 2,017 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentE-1: Subcat E-1	Runoff Area=9,274 sf 62.30% Impervious Runoff Depth=2.71" Tc=6.0 min CN=76 Runoff=0.68 cfs 2,094 cf
SubcatchmentE-2: Subcat E-2	Runoff Area=11,560 sf 0.00% Impervious Runoff Depth=0.02" Tc=6.0 min CN=31 Runoff=0.00 cfs 24 cf
SubcatchmentE-3: Subcat E-3	Runoff Area=4,210 sf 98.71% Impervious Runoff Depth=4.86" Tc=6.0 min CN=97 Runoff=0.49 cfs 1,704 cf
SubcatchmentE-4: Subcat E-4	Runoff Area=947 sf 92.30% Impervious Runoff Depth=4.40" Tc=6.0 min CN=93 Runoff=0.11 cfs 347 cf
SubcatchmentE-5: Subcat E-5	Runoff Area=7,564 sf 62.46% Impervious Runoff Depth=2.71" Tc=6.0 min CN=76 Runoff=0.55 cfs 1,708 cf
Pond CB1: CB-1	12.0" Round Culvert n=0.012 L=58.9' S=0.0100 '/' Outflow=0.49 cfs 1,704 cf Peak Elev=89.42' Inflow=0.49 cfs 1,704 cf
Pond CB2: CB-2	10.0" Round Culvert n=0.012 L=24.5' S=0.0322 '/' Outflow=0.11 cfs 347 cf Peak Elev=89.36' Inflow=0.11 cfs 347 cf
Pond CB3: CB-3	12.0" Round Culvert n=0.012 L=9.6' S=0.0104 '/' Outflow=0.55 cfs 1,708 cf Peak Elev=89.59' Inflow=0.55 cfs 1,708 cf
Pond MH1: DMH-1	12.0" Round Culvert n=0.012 L=32.6' S=0.0101 '/' Outflow=0.59 cfs 2,051 cf Peak Elev=88.77' Inflow=0.59 cfs 2,051 cf
Pond MH2: DMH-2	12.0" Round Culvert n=0.012 L=72.0' S=0.0100 '/' Outflow=1.15 cfs 3,759 cf Peak Elev=88.53' Inflow=1.15 cfs 3,759 cf
Link SP1: Flow Off-Site To Municipal Drainage	Inflow=0.68 cfs 2,094 cf Primary=0.68 cfs 2,094 cf
Link SP2: Flow Off-Site To Riverfront Area	Inflow=1.15 cfs 3,783 cf Primary=1.15 cfs 3,783 cf

**Total Runoff Area = 33,554 sf Runoff Volume = 5,877 cf Average Runoff Depth = 2.10"
 53.71% Pervious = 18,022 sf 46.29% Impervious = 15,531 sf**

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.68 cfs @ 12.09 hrs, Volume= 2,094 cf, Depth= 2.71"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.21"

Area (sf)	CN	Description
3,496	39	>75% Grass cover, Good, HSG A
931	98	Roots, HSG A
4,847	98	Paved parking, HSG A
9,274	76	Weighted Average
3,496		37.70% Pervious Area
5,778		62.30% Impervious Area
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)
6.0		Capacity (cfs)
		Description

Direct Entry,

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.00 cfs @ 21.26 hrs, Volume= 24 cf, Depth= 0.02"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.21"

Area (sf)	CN	Description
10,569	30	Woods, Good, HSG A
990	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
11,560	31	Weighted Average
11,560		100.00% Pervious Area
0		0.00% Impervious Area
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)
6.0		Capacity (cfs)
		Description

Direct Entry,

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.49 cfs @ 12.08 hrs, Volume= 1,704 cf, Depth= 4.86"
 Routed to Pond CB1 : CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.21"

Area (sf)	CN	Description
54	39	>75% Grass cover, Good, HSG A
4,156	98	Paved parking, HSG A
4,210	97	Weighted Average
54		1.29% Pervious Area
4,156		98.71% Impervious Area

Tc Length Slope Velocity Capacity Description
 (min) (feet) (ft/ft) (ft/sec) (cfs)

6.0

Direct Entry,

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 347 cf, Depth= 4.40"
 Routed to Pond CB2 : CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.21"

Area (sf)	CN	Description
73	39	>75% Grass cover, Good, HSG A
248	98	Roofs, HSG A
626	98	Paved parking, HSG A
947	93	Weighted Average
73		7.70% Pervious Area
874		92.30% Impervious Area

Tc Length Slope Velocity Capacity Description
 (min) (feet) (ft/ft) (ft/sec) (cfs)

6.0

Direct Entry,

Summary for Subcatchment E-5: Subcat E-5

Runoff = 0.55 cfs @ 12.09 hrs, Volume= 1,708 cf, Depth= 2.71"
 Routed to Pond CB3 : CB-3
 Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.21"

Area (sf)	CN	Description		
4,037	98	Paved parking, HSG A		
2,840	39	>75% Grass cover, Good, HSG A		
688	98	Roofs, HSG A		
7,564	76	Weighted Average		
2,840		37.54% Pervious Area		
4,724		62.46% Impervious Area		
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0				Direct Entry,

Summary for Pond CB1: CB-1

Inflow Area = 4,210 sf, 98.71% Impervious, Inflow Depth = 4.86" for 10-year event
 Inflow = 0.49 cfs @ 12.08 hrs, Volume= 1,704 cf
 Outflow = 0.49 cfs @ 12.08 hrs, Volume= 1,704 cf
 Primary = 0.49 cfs @ 12.08 hrs, Volume= 1,704 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.42' @ 12.08 hrs
 Flood Elev= 92.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.02'	12.0" Round 12" HDPE (Estimated Invert) L= 58.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.02' / 88.43' S= 0.0100 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.49 cfs @ 12.08 hrs HW=89.42' TW=88.77' (Dynamic Tailwater)
12.0" Round 12" HDPE (Estimated Invert) (Inlet Controls 0.49 cfs @ 1.69 fps)

Summary for Pond CB2: CB-2

Inflow Area = 947 sf, 92.30% Impervious, Inflow Depth = 4.40" for 10-year event
 Inflow = 0.11 cfs @ 12.08 hrs, Volume= 347 cf
 Outflow = 0.11 cfs @ 12.08 hrs, Volume= 347 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.11 cfs @ 12.08 hrs, Volume= 347 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.36' @ 12.08 hrs
 Flood Elev= 90.37'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.17'	10.0" Round 10" HDPE L= 24.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.17' / 88.38' S= 0.0322' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.55 sf

Primary Outflow Max=0.10 cfs @ 12.08 hrs HW=89.36' TW=88.77' (Dynamic Tailwater)
 1-1=10" HDPE (Inlet Controls 0.10 cfs @ 1.16 fps)

Summary for Pond CB3: CB-3

Inflow Area = 7,564 sf, 62.46% Impervious, Inflow Depth = 2.71" for 10-year event
 Inflow = 0.55 cfs @ 12.09 hrs, Volume= 1,708 cf
 Outflow = 0.55 cfs @ 12.09 hrs, Volume= 1,708 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.55 cfs @ 12.09 hrs, Volume= 1,708 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.59' @ 12.09 hrs
 Flood Elev= 90.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.15'	12.0" Round 12" HDPE Assumed Size and Slope L= 9.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.15' / 89.05' S= 0.0104' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.55 cfs @ 12.09 hrs HW=89.59' TW=88.53' (Dynamic Tailwater)
 1-1=12" HDPE Assumed Size and Slope (Barrel Controls 0.55 cfs @ 2.43 fps)

Summary for Pond MH1: DMH-1

Inflow Area = 5,156 sf, 97.53% Impervious, Inflow Depth = 4.77" for 10-year event
 Inflow = 0.59 cfs @ 12.08 hrs, Volume= 2,051 cf
 Outflow = 0.59 cfs @ 12.08 hrs, Volume= 2,051 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.59 cfs @ 12.08 hrs, Volume= 2,051 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.77' @ 12.08 hrs
 Flood Elev= 91.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.28'	12.0" HDPE (Estimated Slope) L= 32.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.28' / 87.95' S= 0.0101 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.59 cfs @ 12.08 hrs HW=88.77' TW=88.53' (Dynamic Tailwater)
1-1=12" HDPE (Estimated Slope)(Outlet Controls 0.59 cfs @ 2.25 fps)

Summary for Pond MH2: DMH-2

Inflow Area = 12,720 sf, 76.68% Impervious, Inflow Depth = 3.55" for 10-year event
 Inflow = 1.15 cfs @ 12.09 hrs, Volume= 3,759 cf
 Outflow = 1.15 cfs @ 12.09 hrs, Volume= 3,759 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.15 cfs @ 12.09 hrs, Volume= 3,759 cf
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.53' @ 12.09 hrs
 Flood Elev= 91.07'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	12.0" Round RCP (Estimated Slope) L= 72.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 88.00' / 87.28' S= 0.0100 /' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary Outflow Max=1.14 cfs @ 12.09 hrs HW=88.53' TW=0.00' (Dynamic Tailwater)
1-1=12" RCP (Estimated Slope)(Barrel Controls 1.14 cfs @ 3.92 fps)

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 9,274 sf, 62.30% Impervious, Inflow Depth = 2.71" for 10-year event
Inflow = 0.68 cfs @ 12.09 hrs, Volume= 2,094 cf
Primary = 0.68 cfs @ 12.09 hrs, Volume= 2,094 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 24,280 sf, 40.17% Impervious, Inflow Depth = 1.87" for 10-year event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 3,783 cf
Primary = 1.15 cfs @ 12.09 hrs, Volume= 3,783 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

- Subcatchment E-1: Subcat E-1**
 Runoff Area=9,274 sf 62.30% Impervious Runoff Depth=3.73"
 Tc=6.0 min CN=76 Runoff=0.93 cfs 2,881 cf
- Subcatchment E-2: Subcat E-2**
 Runoff Area=11,560 sf 0.00% Impervious Runoff Depth=0.16"
 Tc=6.0 min CN=31 Runoff=0.01 cfs 151 cf
- Subcatchment E-3: Subcat E-3**
 Runoff Area=4,210 sf 98.71% Impervious Runoff Depth=6.04"
 Tc=6.0 min CN=97 Runoff=0.60 cfs 2,120 cf
- Subcatchment E-4: Subcat E-4**
 Runoff Area=947 sf 92.30% Impervious Runoff Depth=5.58"
 Tc=6.0 min CN=93 Runoff=0.13 cfs 440 cf
- Subcatchment E-5: Subcat E-5**
 Runoff Area=7,564 sf 62.46% Impervious Runoff Depth=3.73"
 Tc=6.0 min CN=76 Runoff=0.76 cfs 2,350 cf
- Pond CB1: CB-1**
 12.0" Round Culvert n=0.012 L=58.9' S=0.0100 '/' Outflow=0.60 cfs 2,120 cf
 Peak Elev=89.46' Inflow=0.60 cfs 2,120 cf
- Pond CB2: CB-2**
 10.0" Round Culvert n=0.012 L=24.5' S=0.0322 '/' Outflow=0.13 cfs 440 cf
 Peak Elev=89.38' Inflow=0.13 cfs 440 cf
- Pond CB3: CB-3**
 12.0" Round Culvert n=0.012 L=9.6' S=0.0104 '/' Outflow=0.76 cfs 2,350 cf
 Peak Elev=89.68' Inflow=0.76 cfs 2,350 cf
- Pond MH1: DMH-1**
 12.0" Round Culvert n=0.012 L=32.6' S=0.0101 '/' Outflow=0.74 cfs 2,560 cf
 Peak Elev=88.85' Inflow=0.74 cfs 2,560 cf
- Pond MH2: DMH-2**
 12.0" Round Culvert n=0.012 L=72.0' S=0.0100 '/' Outflow=1.49 cfs 4,910 cf
 Peak Elev=88.62' Inflow=1.49 cfs 4,910 cf
- Link SP1: Flow Off-Site To Municipal Drainage**
 Inflow=0.93 cfs 2,881 cf
 Primary=0.93 cfs 2,881 cf
- Link SP2: Flow Off-Site To Riverfront Area**
 Inflow=1.49 cfs 5,061 cf
 Primary=1.49 cfs 5,061 cf

Total Runoff Area = 33,554 sf Runoff Volume = 7,942 cf Average Runoff Depth = 2.84"
53.71% Pervious = 18,022 sf 46.29% Impervious = 15,531 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 2,881 cf, Depth= 3.73"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.40"

Area (sf)	CN	Description
3,496	39	>75% Grass cover, Good, HSG A
931	98	Roofs, HSG A
4,847	98	Paved parking, HSG A
9,274	76	Weighted Average
3,496		37.70% Pervious Area
5,778		62.30% Impervious Area

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

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.01 cfs @ 14.70 hrs, Volume= 151 cf, Depth= 0.16"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.40"

Area (sf)	CN	Description
10,569	30	Woods, Good, HSG A
990	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
11,560	31	Weighted Average
11,560		100.00% Pervious Area
0		0.00% Impervious Area
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)
6.0		Capacity (cfs)
		Description
		Direct Entry,

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.60 cfs @ 12.08 hrs, Volume= 2,120 cf, Depth= 6.04"
 Routed to Pond CB1 : CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.40"

Area (sf)	CN	Description
54	39	>75% Grass cover, Good, HSG A
4,156	98	Paved parking, HSG A
4,210	97	Weighted Average
54		1.29% Pervious Area
4,156		98.71% Impervious Area
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)
6.0		Capacity (cfs)
		Description
		Direct Entry,

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.13 cfs @ 12.08 hrs, Volume= 440 cf, Depth= 5.58"
 Routed to Pond CB2 : CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.40"

Area (sf)	CN	Description
73	39	>75% Grass cover, Good, HSG A
248	98	Roots, HSG A
626	98	Paved parking, HSG A
947	93	Weighted Average
73		7.70% Pervious Area
874		92.30% Impervious Area

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

Summary for Subcatchment E-5: Subcat E-5

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 2,350 cf, Depth= 3.73"
 Routed to Pond CB3 : CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-year Rainfall=6.40"

Area (sf)	CN	Description
4,037	98	Paved parking, HSG A
2,840	39	>75% Grass cover, Good, HSG A
688	98	Roots, HSG A
7,564	76	Weighted Average
2,840		37.54% Pervious Area
4,724		62.46% Impervious Area

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

Summary for Pond CB1: CB-1

Inflow Area = 4,210 sf, 98.71% Impervious, Inflow Depth = 6.04" for 25-year event
 Inflow = 0.60 cfs @ 12.08 hrs, Volume= 2,120 cf
 Outflow = 0.60 cfs @ 12.08 hrs, Volume= 2,120 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.60 cfs @ 12.08 hrs, Volume= 2,120 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.46' @ 12.08 hrs
 Flood Elev= 92.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.02'	12.0" Round 12" HDPE (Estimated Invert) L= 58.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.02' / 88.43' S= 0.0100 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.60 cfs @ 12.08 hrs HW=89.46' TW=88.85' (Dynamic Tailwater)
1-1=12" HDPE (Estimated Invert) (Inlet Controls 0.60 cfs @ 1.79 fps)

Summary for Pond CB2: CB-2

Inflow Area = 947 sf, 92.30% Impervious, Inflow Depth = 5.58" for 25-year event
 Inflow = 0.13 cfs @ 12.08 hrs, Volume= 440 cf
 Outflow = 0.13 cfs @ 12.08 hrs, Volume= 440 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.13 cfs @ 12.08 hrs, Volume= 440 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.38' @ 12.08 hrs
 Flood Elev= 90.37'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.17'	10.0" Round 10" HDPE L= 24.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.17' / 88.38' S= 0.0322 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.55 sf

Primary Outflow Max=0.13 cfs @ 12.08 hrs HW=89.38' TW=88.85' (Dynamic Tailwater)
1-1=10" HDPE (Inlet Controls 0.13 cfs @ 1.23 fps)

Summary for Pond CB3: CB-3

Inflow Area = 7,564 sf, 62.46% Impervious, Inflow Depth = 3.73" for 25-year event
 Inflow = 0.76 cfs @ 12.09 hrs, Volume= 2,350 cf
 Outflow = 0.76 cfs @ 12.09 hrs, Volume= 2,350 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.76 cfs @ 12.09 hrs, Volume= 2,350 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.68' @ 12.09 hrs
 Flood Elev= 90.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.15'	12.0" Round 12" HDPE Assumed Size and Slope L= 9.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.15' / 89.05' S= 0.0104 ' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.76 cfs @ 12.09 hrs HW=89.68' TW=88.62' (Dynamic Tailwater)
1-1=12" HDPE Assumed Size and Slope(Barrel Controls 0.76 cfs @ 2.60 fps)

Summary for Pond MH1: DMH-1

Inflow Area = 5,156 sf, 97.53% Impervious, Inflow Depth = 5.96" for 25-year event
 Inflow = 0.74 cfs @ 12.08 hrs, Volume= 2,560 cf
 Outflow = 0.74 cfs @ 12.08 hrs, Volume= 2,560 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.74 cfs @ 12.08 hrs, Volume= 2,560 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.85' @ 12.08 hrs
 Flood Elev= 91.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.28'	12.0" Round 12" HDPE (Estimated Slope) L= 32.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.28' / 87.95' S= 0.0101 ' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.73 cfs @ 12.08 hrs HW=88.85' TW=88.62' (Dynamic Tailwater)
1-1=12" HDPE (Estimated Slope) (Outlet Controls 0.73 cfs @ 2.27 fps)

Summary for Pond MH2: DMH-2

Inflow Area = 12,720 sf, 76.68% Impervious, Inflow Depth = 4.63" for 25-year event
 Inflow = 1.49 cfs @ 12.09 hrs, Volume= 4,910 cf
 Outflow = 1.49 cfs @ 12.09 hrs, Volume= 4,910 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.49 cfs @ 12.09 hrs, Volume= 4,910 cf
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.62' @ 12.09 hrs
 Flood Elev= 91.07'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	12.0" Round 12" RCP (Estimated Slope) L= 72.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 88.00' / 87.28' S= 0.0100 /' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=1.49 cfs @ 12.09 hrs HW=88.62' TW=0.00' (Dynamic Tailwater)
1-1=12" RCP (Estimated Slope)(Barrel Controls 1.49 cfs @ 4.16 fps)

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 9,274 sf, 62.30% Impervious, Inflow Depth = 3.73" for 25-year event
 Inflow = 0.93 cfs @ 12.09 hrs, Volume= 2,881 cf
 Primary = 0.93 cfs @ 12.09 hrs, Volume= 2,881 cf, Atten= 0%, Lag= 0.0 min
 Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 24,280 sf, 40.17% Impervious, Inflow Depth = 2.50" for 25-year event
 Inflow = 1.49 cfs @ 12.09 hrs, Volume= 5,061 cf
 Primary = 1.49 cfs @ 12.09 hrs, Volume= 5,061 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentE-1: Subcat E-1	Runoff Area=9,274 sf 62.30% Impervious Runoff Depth=5.37" Tc=6.0 min CN=76 Runoff=1.33 cfs 4,148 cf
SubcatchmentE-2: Subcat E-2	Runoff Area=11,560 sf 0.00% Impervious Runoff Depth=0.55" Tc=6.0 min CN=31 Runoff=0.05 cfs 528 cf
SubcatchmentE-3: Subcat E-3	Runoff Area=4,210 sf 98.71% Impervious Runoff Depth=7.87" Tc=6.0 min CN=97 Runoff=0.78 cfs 2,761 cf
SubcatchmentE-4: Subcat E-4	Runoff Area=947 sf 92.30% Impervious Runoff Depth=7.39" Tc=6.0 min CN=93 Runoff=0.17 cfs 583 cf
SubcatchmentE-5: Subcat E-5	Runoff Area=7,564 sf 62.46% Impervious Runoff Depth=5.37" Tc=6.0 min CN=76 Runoff=1.09 cfs 3,383 cf
Pond CB1: CB-1	12.0" Round Culvert n=0.012 L=58.9' S=0.0100 '/' Outflow=0.78 cfs 2,761 cf Peak Elev=89.53' Inflow=0.78 cfs 2,761 cf
Pond CB2: CB-2	10.0" Round Culvert n=0.012 L=24.5' S=0.0322 '/' Outflow=0.17 cfs 583 cf Peak Elev=89.41' Inflow=0.17 cfs 583 cf
Pond CB3: CB-3	12.0" Round Culvert n=0.012 L=9.6' S=0.0104 '/' Outflow=1.09 cfs 3,383 cf Peak Elev=89.81' Inflow=1.09 cfs 3,383 cf
Pond MH1: DMH-1	12.0" Round Culvert n=0.012 L=32.6' S=0.0101 '/' Outflow=0.95 cfs 3,344 cf Peak Elev=88.98' Inflow=0.95 cfs 3,344 cf
Pond MH2: DMH-2	12.0" Round Culvert n=0.012 L=72.0' S=0.0100 '/' Outflow=2.04 cfs 6,727 cf Peak Elev=88.75' Inflow=2.04 cfs 6,727 cf
Link SP1: Flow Off-Site To Municipal Drainage	Inflow=1.33 cfs 4,148 cf Primary=1.33 cfs 4,148 cf
Link SP2: Flow Off-Site To Riverfront Area	Inflow=2.04 cfs 7,256 cf Primary=2.04 cfs 7,256 cf

Total Runoff Area = 33,554 sf Runoff Volume = 11,404 cf Average Runoff Depth = 4.08"
53.71% Pervious = 18,022 sf 46.29% Impervious = 15,531 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 1.33 cfs @ 12.09 hrs, Volume= 4,148 cf, Depth= 5.37"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.23"

Area (sf)	CN	Description
3,496	39	>75% Grass cover, Good, HSG A
931	98	Roots, HSG A
4,847	98	Paved parking, HSG A
9,274	76	Weighted Average
3,496		37.70% Pervious Area
5,778		62.30% Impervious Area

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

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.05 cfs @ 12.37 hrs, Volume= 528 cf, Depth= 0.55"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.23"

Area (sf)	CN	Description
10,569	30	Woods, Good, HSG A
990	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
11,560	31	Weighted Average
11,560		100.00% Pervious Area
0		0.00% Impervious Area

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

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.78 cfs @ 12.08 hrs, Volume= 2,761 cf, Depth= 7.87"
 Routed to Pond CB1 : CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.23"

Area (sf)	CN	Description
54	39	>75% Grass cover, Good, HSG A
4,156	98	Paved parking, HSG A
4,210	97	Weighted Average
54		1.29% Pervious Area
4,156		98.71% Impervious Area

Tc Length Slope Velocity Capacity Description
 (min) (feet) (ft/ft) (ft/sec) (cfs)

6.0

Direct Entry,

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 583 cf, Depth= 7.39"
 Routed to Pond CB2 : CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.23"

Area (sf)	CN	Description
73	39	>75% Grass cover, Good, HSG A
248	98	Roofs, HSG A
626	98	Paved parking, HSG A
947	93	Weighted Average
73		7.70% Pervious Area
874		92.30% Impervious Area

Tc Length Slope Velocity Capacity Description
 (min) (feet) (ft/ft) (ft/sec) (cfs)

6.0

Direct Entry,

Summary for Subcatchment E-5: Subcat E-5

Runoff = 1.09 cfs @ 12.09 hrs, Volume= 3,383 cf, Depth= 5.37"
 Routed to Pond CB3 : CB-3

Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-year Rainfall=8.23"

Area (sf)	CN	Description
4,037	98	Paved parking, HSG A
2,840	39	>75% Grass cover, Good, HSG A
688	98	Roofs, HSG A
7,564	76	Weighted Average
2,840		37.54% Pervious Area
4,724		62.46% Impervious Area

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

Summary for Pond CB1: CB-1

Inflow Area = 4,210 sf, 98.71% Impervious, Inflow Depth = 7.87" for 100-year event
 Inflow = 0.78 cfs @ 12.08 hrs, Volume= 2,761 cf
 Outflow = 0.78 cfs @ 12.08 hrs, Volume= 2,761 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.78 cfs @ 12.08 hrs, Volume= 2,761 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.53' @ 12.08 hrs
 Flood Elev= 92.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.02'	12.0" Round 12" HDPE (Estimated Invert) L= 58.9' CPP, projecting, no headwall, Ke= 0.90 Inlet / Outlet Invert= 89.02' / 88.43' S= 0.0100 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.78 cfs @ 12.08 hrs HW=89.53' TW=88.98' (Dynamic Tailwater)
12.0" Round 12" HDPE (Estimated Invert) (Inlet Controls 0.78 cfs @ 1.92 fps)

Summary for Pond CB2: CB-2

Inflow Area = 947 sf, 92.30% Impervious, Inflow Depth = 7.39" for 100-year event
 Inflow = 0.17 cfs @ 12.08 hrs, Volume= 583 cf
 Outflow = 0.17 cfs @ 12.08 hrs, Volume= 583 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.17 cfs @ 12.08 hrs, Volume= 583 cf
 Routed to Pond MH1 : DMH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.41' @ 12.08 hrs
 Flood Elev= 90.37'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.17'	10.0" Round 10" HDPE L= 24.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.17' / 88.38' S= 0.0322' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.55 sf

Primary Outflow Max=0.17 cfs @ 12.08 hrs HW=89.41' TW=88.98' (Dynamic Tailwater)
 1-1=10" HDPE (Inlet Controls 0.17 cfs @ 1.32 fps)

Summary for Pond CB3: CB-3

Inflow Area = 7,564 sf, 62.46% Impervious, Inflow Depth = 5.37" for 100-year event
 Inflow = 1.09 cfs @ 12.09 hrs, Volume= 3,383 cf
 Outflow = 1.09 cfs @ 12.09 hrs, Volume= 3,383 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.09 cfs @ 12.09 hrs, Volume= 3,383 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 89.81' @ 12.09 hrs
 Flood Elev= 90.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	89.15'	12.0" Round 12" HDPE Assumed Size and Slope L= 9.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.15' / 89.05' S= 0.0104' /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=1.08 cfs @ 12.09 hrs HW=89.81' TW=88.75' (Dynamic Tailwater)
 1-1=12" HDPE Assumed Size and Slope(Barrel Controls 1.08 cfs @ 2.81 fps)

Summary for Pond MH1: DMH-1

Inflow Area = 5,156 sf, 97.53% Impervious, Inflow Depth = 7.78" for 100-year event
 Inflow = 0.95 cfs @ 12.08 hrs, Volume= 3,344 cf
 Outflow = 0.95 cfs @ 12.08 hrs, Volume= 3,344 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.95 cfs @ 12.08 hrs, Volume= 3,344 cf
 Routed to Pond MH2 : DMH-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.98' @ 12.08 hrs
 Flood Elev= 91.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.28'	12.0" HDPE (Estimated Slope) L= 32.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.28' / 87.95' S= 0.0101 /' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary Outflow Max=0.95 cfs @ 12.08 hrs HW=88.98' TW=88.75' (Dynamic Tailwater)
1-1=12" HDPE (Estimated Slope)(Outlet Controls 0.95 cfs @ 2.29 fps)

Summary for Pond MH2: DMH-2

Inflow Area = 12,720 sf, 76.68% Impervious, Inflow Depth = 6.35" for 100-year event
 Inflow = 2.04 cfs @ 12.09 hrs, Volume= 6,727 cf
 Outflow = 2.04 cfs @ 12.09 hrs, Volume= 6,727 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.04 cfs @ 12.09 hrs, Volume= 6,727 cf
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 88.75' @ 12.09 hrs
 Flood Elev= 91.07'

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	12.0" Round RCP (Estimated Slope) L= 72.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 88.00' / 87.28' S= 0.0100 /' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary Outflow Max=2.03 cfs @ 12.09 hrs HW=88.75' TW=0.00' (Dynamic Tailwater)
1-1=12" RCP (Estimated Slope)(Barrel Controls 2.03 cfs @ 4.45 fps)

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 9,274 sf, 62.30% Impervious, Inflow Depth = 5.37" for 100-year event
Inflow = 1.33 cfs @ 12.09 hrs, Volume= 4,148 cf
Primary = 1.33 cfs @ 12.09 hrs, Volume= 4,148 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 24,280 sf, 40.17% Impervious, Inflow Depth = 3.59" for 100-year event
Inflow = 2.04 cfs @ 12.09 hrs, Volume= 7,256 cf
Primary = 2.04 cfs @ 12.09 hrs, Volume= 7,256 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Events for Subcatchment E-1: Subcat E-1

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-year	3.31	0.30	950	1.23
10-year	5.21	0.68	2,094	2.71
25-year	6.40	0.93	2,881	3.73
100-year	8.23	1.33	4,148	5.37

Events for Subcatchment E-2: Subcat E-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-year	3.31	0.00	0	0.00
10-year	5.21	0.00	24	0.02
25-year	6.40	0.01	151	0.16
100-year	8.23	0.05	528	0.55

Events for Subcatchment E-3: Subcat E-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-year	3.31	0.31	1,040	2.97
10-year	5.21	0.49	1,704	4.86
25-year	6.40	0.60	2,120	6.04
100-year	8.23	0.78	2,761	7.87

Events for Subcatchment E-4: Subcat E-4

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-year	3.31	0.06	201	2.55
10-year	5.21	0.11	347	4.40
25-year	6.40	0.13	440	5.58
100-year	8.23	0.17	583	7.39

Events for Subcatchment E-5: Subcat E-5

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-year	3.31	0.24	775	1.23
10-year	5.21	0.55	1,708	2.71
25-year	6.40	0.76	2,350	3.73
100-year	8.23	1.09	3,383	5.37

Events for Pond CB1: CB-1

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	0.31	0.31	89.33	0
10-year	0.49	0.49	89.42	0
25-year	0.60	0.60	89.46	0
100-year	0.78	0.78	89.53	0

Events for Pond CB2: CB-2

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	0.06	0.06	89.31	0
10-year	0.11	0.11	89.36	0
25-year	0.13	0.13	89.38	0
100-year	0.17	0.17	89.41	0

Events for Pond CB3: CB-3

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	0.24	0.24	89.43	0
10-year	0.55	0.55	89.59	0
25-year	0.76	0.76	89.68	0
100-year	1.09	1.09	89.81	0

Events for Pond MH1: DMH-1

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	0.37	0.37	88.64	0
10-year	0.59	0.59	88.77	0
25-year	0.74	0.74	88.85	0
100-year	0.95	0.95	88.98	0

Events for Pond MH2: DMH-2

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	0.61	0.61	88.38	0
10-year	1.15	1.15	88.53	0
25-year	1.49	1.49	88.62	0
100-year	2.04	2.04	88.75	0

Events for Link SP1: Flow Off-Site To Municipal Drainage

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-year	0.30	0.30	0.00
10-year	0.68	0.68	0.00
25-year	0.93	0.93	0.00
100-year	1.33	1.33	0.00

Events for Link SP2: Flow Off-Site To Riverfront Area

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-year	0.61	0.61	0.00
10-year	1.15	1.15	0.00
25-year	1.49	1.49	0.00
100-year	2.04	2.04	0.00



**SECTION 5.0 -
PROPOSED DRAINAGE
ANALYSIS**

Proposed hydroCAD

Prepared by Allen & Major Associates, Inc

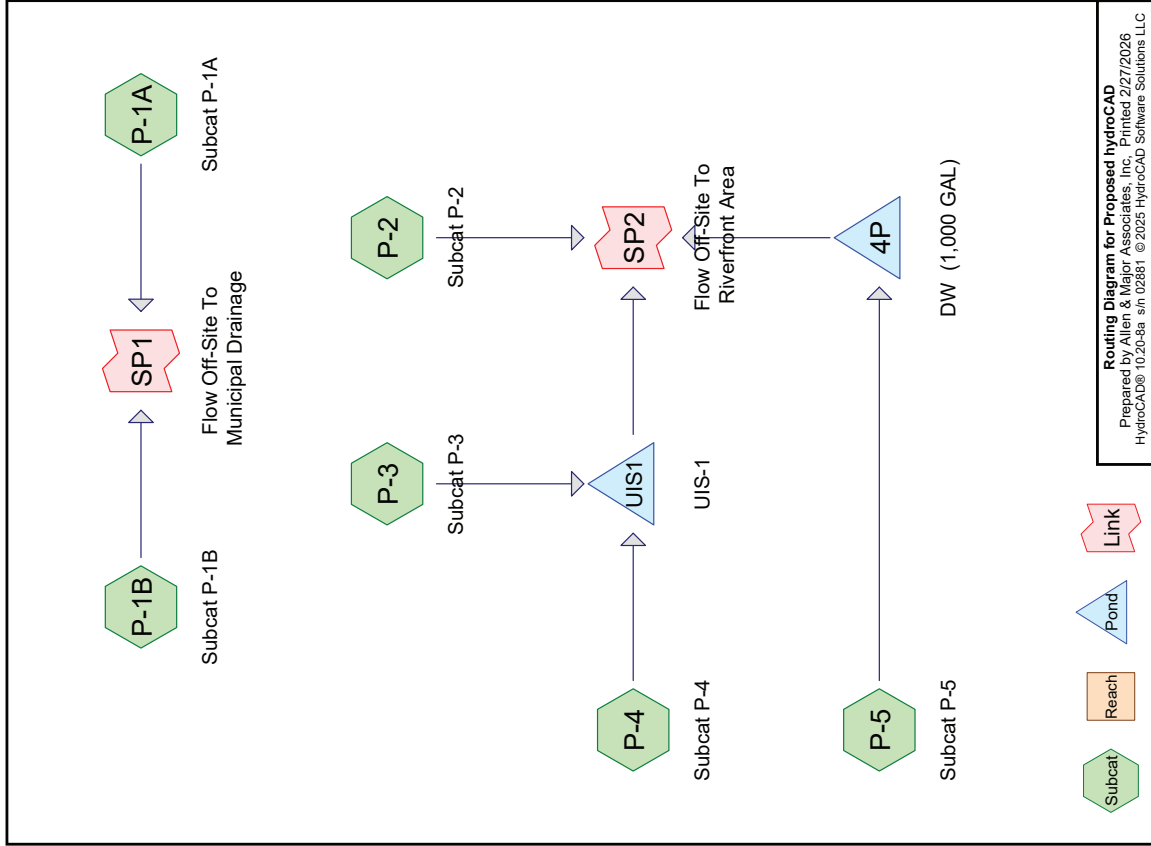
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Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr	Default	Default	24.00	1	3.31	2
2	10-Year	Type III 24-hr	Default	Default	24.00	1	5.21	2
3	25-Year	Type III 24-hr	Default	Default	24.00	1	6.40	2
4	100-Year	Type III 24-hr	Default	Default	24.00	1	8.23	2



Routing Diagram for Proposed hydroCAD
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Page 3

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
3,789	39	>75% Grass cover, Good, HSG A (P-1A, P-1B, P-2)
9,282	98	Paved parking, HSG A (P-1A, P-3, P-5)
9,922	98	Roofs, HSG A (P-1A, P-4)
10,561	30	Woods, Good, HSG A (P-2)
33,553	70	TOTAL AREA

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Page 4

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
33,553	HSG A	P-1A, P-1B, P-2, P-3, P-4, P-5
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
33,553		TOTAL AREA

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Page 5

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
3,789	0	0	0	0	3,789	>75% Grass cover, Good	
9,282	0	0	0	0	9,282	Paved parking	
9,922	0	0	0	0	9,922	Roofs	
10,561	0	0	0	0	10,561	Woods, Good	
33,553	0	0	0	0	33,553	TOTAL AREA	

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Page 6

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	4P	91.86	91.76	10.0	0.0100	0.013	0.0	8.0	0.0	
2	UIS1	89.70	87.93	88.8	0.0199	0.013	0.0	12.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A Runoff Area=1,362 sf 48.21% Impervious Runoff Depth=0.75"
 Tc=6.0 min CN=67 Runoff=0.02 cfs 85 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=297 sf 0.00% Impervious Runoff Depth=0.00"
 Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment P-2: Subcat P-2 Runoff Area=13,348 sf 0.00% Impervious Runoff Depth=0.00"
 Tc=6.0 min CN=32 Runoff=0.00 cfs 0 cf

Subcatchment P-3: Subcat P-3 Runoff Area=8,506 sf 100.00% Impervious Runoff Depth=3.08"
 Tc=6.0 min CN=98 Runoff=0.63 cfs 2,181 cf

Subcatchment P-4: Subcat P-4 Runoff Area=9,922 sf 100.00% Impervious Runoff Depth=3.08"
 Tc=6.0 min CN=98 Runoff=0.73 cfs 2,544 cf

Subcatchment P-5: Subcat P-5 Runoff Area=119 sf 100.00% Impervious Runoff Depth=3.08"
 Tc=6.0 min CN=98 Runoff=0.01 cfs 31 cf

Pond 4P: DW (1,000 GAL) Discarded=0.01 cfs 31 cf Peak Elev=89.21' Storage=0 cf Inflow=0.01 cfs 31 cf
 Primary=0.00 cfs 0 cf Outflow=0.01 cfs 31 cf

Pond UJ1: UJ1-1 Discarded=0.14 cfs 4,727 cf Peak Elev=90.19' Storage=1,520 cf Inflow=1.36 cfs 4,725 cf
 Primary=0.00 cfs 0 cf Outflow=0.14 cfs 4,727 cf

Link SP1: Flow Off-Site To Municipal Drainage
 Inflow=0.02 cfs 85 cf
 Primary=0.02 cfs 85 cf

Link SP2: Flow Off-Site To Riverfront Area
 Inflow=0.00 cfs 0 cf
 Primary=0.00 cfs 0 cf

Total Runoff Area = 33,553 sf Runoff Volume = 4,841 cf Average Runoff Depth = 1.73"
42.77% Pervious = 14,350 sf 57.23% Impervious = 19,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 0.02 cfs @ 12.10 hrs, Volume= 85 cf, Depth= 0.75"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.31"

Area (sf)	CN	Description		
657	98	Paved parking, HSG A		
705	39	>75% Grass cover, Good, HSG A		
0	98	Roofs, HSG A		
1,362	67	Weighted Average		
705		51.79% Pervious Area		
657		48.21% Impervious Area		
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0				Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.31"

Area (sf)	CN	Description
297	39	>75% Grass cover, Good, HSG A
297		100.00% Pervious Area

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.31"

Area (sf)	CN	Description
10,561	30	Woods, Good, HSG A
2,787	39	>75% Grass cover, Good, HSG A
13,348	32	Weighted Average
13,348		100.00% Pervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 2,181 cf, Depth= 3.08"
 Routed to Pond UFS1 : UFS-1

Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.31"

Area (sf)	CN	Description
8,506	98	Paved parking, HSG A
8,506		100.00% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.73 cfs @ 12.08 hrs, Volume= 2,544 cf, Depth= 3.08"
 Routed to Pond UFS1 : UFS-1

Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.31"

Area (sf)	CN	Description
9,922	98	Roofs, HSG A
9,922		100.00% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 0.01 cfs @ 12.08 hrs, Volume= 31 cf, Depth= 3.08"
 Routed to Pond 4P: DW (1,000 GAL)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.31"

Area (sf)	CN	Description
119	98	Paved parking, HSG A
119		100.00% Impervious Area

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

Summary for Pond 4P: DW (1,000 GAL)

Inflow Area = 119 sf, 100.00% Impervious, Inflow Depth = 3.08" for 2-Year event
 Inflow = 0.01 cfs @ 12.08 hrs, Volume= 31 cf
 Outflow = 0.01 cfs @ 12.18 hrs, Volume= 31 cf, Atten= 20%, Lag= 5.9 min
 Discarded = 0.01 cfs @ 12.18 hrs, Volume= 31 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 89.21' @ 12.14 hrs Surf.Area= 126 sf Storage= 0 cf

Plug-Flow detention time= (not calculated): outflow precedes inflow
 Center-of-Mass det. time= 0.2 min (755.9 - 755.7)

Volume	Invert	Avail.Storage	Storage Description
#1	89.20'	83 cf	8.66'W x 14.50'L x 3.00'H Drywell Stone
#2	89.70'	149 cf	377 cf Overall - 170 cf Embedded = 207 cf x 40.0% Voids 5.67'W x 10.50'L x 2.50'H Drywell Structure Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
		232 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	91.86'	8.0" Round Culvert L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.86' / 91.76' S= 0.01000 /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	89.20'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.01 cfs @ 12.18 hrs HW=89.21' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond UIS1: UIS-1

Inflow Area = 18,428 sf, 100.00% Impervious, Inflow Depth = 3.08" for 2-Year event
 Inflow = 1.36 cfs @ 12.08 hrs, Volume= 4,725 cf
 Outflow = 0.14 cfs @ 12.04 hrs, Volume= 4,727 cf, Atten= 89%, Lag= 0.0 min
 Discarded = 0.14 cfs @ 12.04 hrs, Volume= 4,727 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dj= 0.01 hrs / 3
 Peak Elev= 90.19' @ 12.77 hrs Surf.Area= 2,579 sf Storage= 1,520 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 68.4 min (824.1 - 755.7)

Volume #	Invert	Avail. Storage	Storage Description
#1A	89.20'	2,530 cf	11.00'W x 232.17'L x 3.75'H Field A
#2A	89.70'	3,252 cf	9,577 cf Overall - 3,252 cf Embedded = 6,325 cf x 40.0% Voids ADS_StormTech SC-800 +Cap x 64 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 64 Chambers in 2 Rows Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf
#3	89.70'	123 cf	4.00'D x 4.90'H DHM1&DHM2 x 2
		5,905 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device #	Routing	Invert	Outlet/Devices
#1	Primary	89.70'	12.0" Round Culvert L= 88.8' CPP, projecting, no headwall, Ke= 0.900 Inlet/Outlet Invert= 89.70' / 87.93' S= 0.0199 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.92'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	89.20'	2.410 in/hr Exfiltration Loamy Sand over Surface area

Discarded OutFlow Max=0.14 cfs @ 12.04 hrs HW=89.72' (Free Discharge)
 ↳-3=Exfiltration Loamy Sand (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
 ↳-1=Culvert (Controls 0.00 cfs)
 ↳-2=Broad-Crested Rectangular Weir(Controls 0.00 cfs)

Pond UIS1: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-800+Cap (ADS StormTech@SC-800 with cap volume)
 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf
 Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap
 Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

32 Chambers/Row x 7.12' Long +0.88' Cap Length x 2 = 229.50' Row Length +16.0" End Stone x 2 = 232.17' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width
 6.0" Stone Base + 33.0" Chamber Height + 6.0" Stone Cover = 3.75' Field Height

64 Chambers x 50.6 cf + 3.4 cf Cap Volume x 2 x 2 Rows = 3,251.6 cf Chamber Storage

9,576.9 cf Field - 3,251.6 cf Chambers = 6,325.3 cf Stone x 40.0% Voids = 2,530.1 cf Stone Storage

Chamber Storage + Stone Storage = 5,781.7 cf = 0.133 af
 Overall Storage Efficiency = 60.4%
 Overall System Size = 232.17' x 11.00' x 3.75'

64 Chambers
 354.7 cy Field
 234.3 cy Stone



5905

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 1,659 sf, 39.59% Impervious, Inflow Depth = 0.61" for 2-Year event
Inflow = 0.02 cfs @ 12.10 hrs, Volume= 85 cf
Primary = 0.02 cfs @ 12.10 hrs, Volume= 85 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 31,895 sf, 58.15% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 0.07 cfs @ 12.09 hrs, Volume= 221 cf, Depth= 1.95"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
657	98	Paved parking, HSG A
705	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
1,362	67	Weighted Average
705		51.79% Pervious Area
657		48.21% Impervious Area

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

- Subcatchment P-1A: Subcat P-1A**
 Runoff Area=1,362 sf 48.21% Impervious Runoff Depth=1.95"
 Tc=6.0 min CN=67 Runoff=0.07 cfs 221 cf
- Subcatchment P-1B: Subcat P-1B**
 Runoff Area=297 sf 0.00% Impervious Runoff Depth=0.24"
 Tc=6.0 min CN=39 Runoff=0.00 cfs 6 cf
- Subcatchment P-2: Subcat P-2**
 Runoff Area=13,348 sf 0.00% Impervious Runoff Depth=0.04"
 Tc=6.0 min CN=32 Runoff=0.00 cfs 46 cf
- Subcatchment P-3: Subcat P-3**
 Runoff Area=8,506 sf 100.00% Impervious Runoff Depth=4.97"
 Tc=6.0 min CN=98 Runoff=1.00 cfs 3,525 cf
- Subcatchment P-4: Subcat P-4**
 Runoff Area=9,922 sf 100.00% Impervious Runoff Depth=4.97"
 Tc=6.0 min CN=98 Runoff=1.16 cfs 4,112 cf
- Subcatchment P-5: Subcat P-5**
 Runoff Area=119 sf 100.00% Impervious Runoff Depth=4.97"
 Tc=6.0 min CN=98 Runoff=0.01 cfs 49 cf
- Pond 4P: DW (1,000 GAL)**
 Discarded=0.01 cfs 49 cf Peak Elev=89.27' Storage=3 cf Inflow=0.01 cfs 49 cf
 Outflow=0.01 cfs 49 cf
- Pond UJ1: UJ1-1**
 Discarded=0.14 cfs 7,638 cf Peak Elev=90.93' Storage=2,961 cf Inflow=2.16 cfs 7,637 cf
 Outflow=0.14 cfs 7,638 cf Primary=0.00 cfs 0 cf
- Link SP1: Flow Off-Site To Municipal Drainage**
 Inflow=0.07 cfs 227 cf
 Primary=0.07 cfs 227 cf
- Link SP2: Flow Off-Site To Riverfront Area**
 Inflow=0.00 cfs 46 cf
 Primary=0.00 cfs 46 cf

Total Runoff Area = 33,553 sf Runoff Volume = 7,960 cf Average Runoff Depth = 2.85"
42.77% Pervious = 14,350 sf 57.23% Impervious = 19,204 sf

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 0.00 cfs @ 12.44 hrs, Volume= 6 cf, Depth= 0.24"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
297	39	>75% Grass cover, Good, HSG A
297		100.00% Pervious Area

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.00 cfs @ 16.94 hrs, Volume= 46 cf, Depth= 0.04"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
10,561	30	Woods, Good, HSG A
2,787	39	>75% Grass cover, Good, HSG A
13,348	32	Weighted Average
13,348		100.00% Pervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 1.00 cfs @ 12.08 hrs, Volume= 3,525 cf, Depth= 4.97"
 Routed to Pond UIS1 : UIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
8,506	98	Paved parking, HSG A
8,506		100.00% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 1.16 cfs @ 12.08 hrs, Volume= 4,112 cf, Depth= 4.97"
 Routed to Pond UIS1 : UIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
9,922	98	Roofs, HSG A
9,922		100.00% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 0.01 cfs @ 12.08 hrs, Volume= 49 cf, Depth= 4.97"
 Routed to Pond 4P: DW (1,000 GAL)
 Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=5.21"

Area (sf)	CN	Description
119	98	Paved parking, HSG A
119		100.00% Impervious Area

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

Summary for Pond 4P: DW (1,000 GAL)

Inflow Area = 119 sf, 100.00% Impervious, Inflow Depth = 4.97" for 10-Year event
 Inflow = 0.01 cfs @ 12.08 hrs, Volume= 49 cf
 Outflow = 0.01 cfs @ 12.09 hrs, Volume= 49 cf, Atten= 50%, Lag= 0.4 min
 Discarded = 0.01 cfs @ 12.09 hrs, Volume= 49 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 89.27' @ 12.22 hrs Surf.Area= 126 sf Storage= 3 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.5 min (748.9 - 747.3)

Volume	Invert	Avail.Storage	Storage Description
#1	89.20'	83 cf	8.66'W x 14.50'L x 3.00'H Drywell Stone
#2	89.70'	149 cf	377 cf Overall - 170 cf Embedded = 207 cf x 40.0% Voids 5.67'W x 10.50'L x 2.50'H Drywell Structure Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
		232 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	91.86'	8.0" Round Culvert L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.86' / 91.76' S= 0.01000 /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	89.20'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.01 cfs @ 12.09 hrs HW=89.23' (Free Discharge)
 ↳-2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
 ↳-1=Culvert (Controls 0.00 cfs)

Summary for Pond UIS1: UIS-1

Inflow Area = 18,428 sf, 100.00% Impervious, Inflow Depth = 4.97" for 10-Year event
 Inflow = 2.16 cfs @ 12.08 hrs, Volume= 7,637 cf
 Outflow = 0.14 cfs @ 11.87 hrs, Volume= 7,638 cf, Atten= 93%, Lag= 0.0 min
 Discarded = 0.14 cfs @ 11.87 hrs, Volume= 7,638 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 90.93' @ 13.43 hrs Surf.Area= 2,579 sf Storage= 2,961 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 153.8 min (901.1 - 747.3)

Volume #	Invert	Avail. Storage	Storage Description
#1A	89.20'	2,530 cf	11.00'W x 232.17'L x 3.75'H Field A 9,577 cf Overall - 3,252 cf Embedded = 6,325 cf x 40.0% Voids
#2A	89.70'	3,252 cf	ADS_StormTech SC-800 +Cap x 64 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap
#3	89.70'	123 cf	64 Chambers in 2 Rows Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf 4.00'D x 4.90'H DHM1&DHM2 x 2
			5,905 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device #	Routing	Invert	Outlet/Devices
#1	Primary	89.70'	12.0" Round Culvert L= 88.8' CPP, projecting, no headwall, Ke= 0.900 Inlet/Outlet Invert= 89.70' / 87.93' S= 0.0199 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.92'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	89.20'	2.410 in/hr Exfiltration Loamy Sand over Surface area

Discarded OutFlow Max=0.14 cfs @ 11.87 hrs HW=89.71' (Free Discharge)
 ↳-3=Exfiltration Loamy Sand (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
 ↳-1=Culvert (Controls 0.00 cfs)
 ↳-2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond UIS1: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-800+Cap (ADS StormTech@SC-800 with cap volume)
 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf
 Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap
 Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

32 Chambers/Row x 7.12' Long +0.88' Cap Length x 2 = 229.50' Row Length +16.0" End Stone x 2 = 232.17' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width
 6.0" Stone Base + 33.0" Chamber Height + 6.0" Stone Cover = 3.75' Field Height

64 Chambers x 50.6 cf + 3.4 cf Cap Volume x 2 x 2 Rows = 3,251.6 cf Chamber Storage

9,576.9 cf Field - 3,251.6 cf Chambers = 6,325.3 cf Stone x 40.0% Voids = 2,530.1 cf Stone Storage

Chamber Storage + Stone Storage = 5,781.7 cf = 0.133 af
 Overall Storage Efficiency = 60.4%
 Overall System Size = 232.17' x 11.00' x 3.75'

64 Chambers
 354.7 cy Field
 234.3 cy Stone



64 Chambers

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 1,659 sf, 39.59% Impervious, Inflow Depth = 1.65" for 10-Year event
Inflow = 0.07 cfs @ 12.09 hrs, Volume= 227 cf
Primary = 0.07 cfs @ 12.09 hrs, Volume= 227 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 31,895 sf, 58.15% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.00 cfs @ 16.94 hrs, Volume= 46 cf
Primary = 0.00 cfs @ 16.94 hrs, Volume= 46 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A Runoff Area=1,362 sf 48.21% Impervious Runoff Depth=2.84"
 Tc=6.0 min CN=67 Runoff=0.10 cfs 322 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=297 sf 0.00% Impervious Runoff Depth=0.57"
 Tc=6.0 min CN=39 Runoff=0.00 cfs 14 cf

Subcatchment P-2: Subcat P-2 Runoff Area=13,348 sf 0.00% Impervious Runoff Depth=0.20"
 Tc=6.0 min CN=32 Runoff=0.01 cfs 220 cf

Subcatchment P-3: Subcat P-3 Runoff Area=8,506 sf 100.00% Impervious Runoff Depth=6.16"
 Tc=6.0 min CN=98 Runoff=1.23 cfs 4,367 cf

Subcatchment P-4: Subcat P-4 Runoff Area=9,922 sf 100.00% Impervious Runoff Depth=6.16"
 Tc=6.0 min CN=98 Runoff=1.43 cfs 5,094 cf

Subcatchment P-5: Subcat P-5 Runoff Area=119 sf 100.00% Impervious Runoff Depth=6.16"
 Tc=6.0 min CN=98 Runoff=0.02 cfs 61 cf

Pond 4P: DW (1,000 GAL) Discarded=0.01 cfs 61 cf Peak Elev=89.32' Storage=6 cf Inflow=0.02 cfs 61 cf
 Outflow=0.01 cfs 61 cf

Pond UJIS1: UJIS-1 Discarded=0.14 cfs 9,462 cf Peak Elev=91.52' Storage=4,022 cf Inflow=2.65 cfs 9,462 cf
 Outflow=0.14 cfs 9,462 cf Primary=0.00 cfs 0 cf

Link SP1: Flow Off-Site To Municipal Drainage Inflow=0.10 cfs 336 cf
 Primary=0.10 cfs 336 cf

Link SP2: Flow Off-Site To Riverfront Area Inflow=0.01 cfs 220 cf
 Primary=0.01 cfs 220 cf

Total Runoff Area = 33,553 sf Runoff Volume = 10,079 cf Average Runoff Depth = 3.60"
42.77% Pervious = 14,350 sf 57.23% Impervious = 19,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 322 cf, Depth= 2.84"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.40"

Area (sf)	CN	Description			
657	98	Paved parking, HSG A			
705	39	>75% Grass cover, Good, HSG A			
0	98	Roofs, HSG A			
1,362	67	Weighted Average			
705		51.79% Pervious Area			
657		48.21% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 0.00 cfs @ 12.30 hrs, Volume= 14 cf, Depth= 0.57"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.40"

Area (sf)	CN	Description
297	39	>75% Grass cover, Good, HSG A
297		100.00% Pervious Area

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.01 cfs @ 13.74 hrs, Volume= 220 cf, Depth= 0.20"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.40"

Area (sf)	CN	Description
10,561	30	Woods, Good, HSG A
2,787	39	>75% Grass cover, Good, HSG A
13,348	32	Weighted Average
13,348		100.00% Pervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 1.23 cfs @ 12.08 hrs, Volume= 4,367 cf, Depth= 6.16"
 Routed to Pond U/S1 : U/S-1

Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.40"

Area (sf)	CN	Description
8,506	98	Paved parking, HSG A
8,506		100.00% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 1.43 cfs @ 12.08 hrs, Volume= 5,094 cf, Depth= 6.16"
 Routed to Pond U/S1 : U/S-1

Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.40"

Area (sf)	CN	Description
9,922	98	Roofs, HSG A
9,922		100.00% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 0.02 cfs @ 12.08 hrs, Volume= 61 cf, Depth= 6.16"
 Routed to Pond 4P: DW (1,000 GAL)
 Runoff by SCS TR-20 method, UH=S-CS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=6.40"

Area (sf)	CN	Description
119	98	Paved parking, HSG A
119		100.00% Impervious Area

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

Summary for Pond 4P: DW (1,000 GAL)

Inflow Area = 119 sf, 100.00% Impervious, Inflow Depth = 6.16" for 25-Year event
 Inflow = 0.02 cfs @ 12.08 hrs, Volume= 61 cf
 Outflow = 0.01 cfs @ 12.06 hrs, Volume= 61 cf, Atten= 59%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.06 hrs, Volume= 61 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 89.32' @ 12.29 hrs Surf.Area= 126 sf Storage= 6 cf

Plug-Flow detention time= (not calculated): outflow precedes inflow
 Center-of-Mass det. time= 2.9 min (747.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1	89.20'	83 cf	8.66'W x 14.50'L x 3.00'H Drywell Stone
#2	89.70'	149 cf	377 cf Overall - 170 cf Embedded = 207 cf x 40.0% Voids 5.67'W x 10.50'L x 2.50'H Drywell Structure Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
		232 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	91.86'	8.0" Round Culvert L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.86' / 91.76' S= 0.01000 /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	89.20'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.01 cfs @ 12.06 hrs HW=89.24' (Free Discharge)
 ↳-2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
 ↳-1=Culvert (Controls 0.00 cfs)

Summary for Pond UIS1: UIS-1

Inflow Area = 18,428 sf, 100.00% Impervious, Inflow Depth = 6.16" for 25-Year event
 Inflow = 2.65 cfs @ 12.08 hrs, Volume= 9,462 cf
 Outflow = 0.14 cfs @ 11.76 hrs, Volume= 9,462 cf, Atten= 95%, Lag= 0.0 min
 Discarded = 0.14 cfs @ 11.76 hrs, Volume= 9,462 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dj= 0.01 hrs / 3
 Peak Elev= 91.52' @ 13.94 hrs Surf.Area= 2,579 sf Storage= 4,022 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 220.4 min (964.6 - 744.2)

Volume #	Invert	Avail. Storage	Storage Description
#1A	89.20'	2,530 cf	11.00'W x 232.17'L x 3.75'H Field A
#2A	89.70'	3,252 cf	9.577 cf Overall - 3,252 cf Embedded = 6,325 cf x 40.0% Voids ADS_StormTech SC-800 +Cap x 64 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 64 Chambers in 2 Rows Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf
#3	89.70'	123 cf	4.00'D x 4.90'H DHM1&DHM2 x 2
		5,905 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device #	Routing	Invert	Outlet/Devices
#1	Primary	89.70'	12.0" Round Culvert L= 88.8' CPP, projecting, no headwall, Ke= 0.900 Inlet/Outlet Invert= 89.70' / 87.93' S= 0.0199 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.92'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	89.20'	2.410 in/hr Exfiltration Loamy Sand over Surface area

Discarded OutFlow Max=0.14 cfs @ 11.76 hrs HW=89.71' (Free Discharge)
 ↳-3=Exfiltration Loamy Sand (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
 ↳-1=Culvert (Controls 0.00 cfs)
 ↳-2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond UIS1: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-800+Cap (ADS StormTech@SC-800 with cap volume)
 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf
 Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap
 Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

32 Chambers/Row x 7.12' Long +0.88' Cap Length x 2 = 229.50' Row Length +16.0" End Stone x 2 = 232.17' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width
 6.0" Stone Base + 33.0" Chamber Height + 6.0" Stone Cover = 3.75' Field Height

64 Chambers x 50.6 cf + 3.4 cf Cap Volume x 2 x 2 Rows = 3,251.6 cf Chamber Storage

9,576.9 cf Field - 3,251.6 cf Chambers = 6,325.3 cf Stone x 40.0% Voids = 2,530.1 cf Stone Storage

Chamber Storage + Stone Storage = 5,781.7 cf = 0.133 af
 Overall Storage Efficiency = 60.4%
 Overall System Size = 232.17' x 11.00' x 3.75'

64 Chambers
 354.7 cy Field
 234.3 cy Stone



5.905

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 1,659 sf, 39.59% Impervious, Inflow Depth = 2.43" for 25-Year event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 336 cf
Primary = 0.10 cfs @ 12.09 hrs, Volume= 336 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 31,895 sf, 58.15% Impervious, Inflow Depth = 0.08" for 25-Year event
Inflow = 0.01 cfs @ 13.74 hrs, Volume= 220 cf
Primary = 0.01 cfs @ 13.74 hrs, Volume= 220 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1A: Subcat P-1A Runoff Area=1,362 sf 48.21% Impervious Runoff Depth=4.31"
 Tc=6.0 min CN=67 Runoff=0.16 cfs 489 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=297 sf 0.00% Impervious Runoff Depth=1.25"
 Tc=6.0 min CN=39 Runoff=0.01 cfs 31 cf

Subcatchment P-2: Subcat P-2 Runoff Area=13,348 sf 0.00% Impervious Runoff Depth=0.63"
 Tc=6.0 min CN=32 Runoff=0.08 cfs 698 cf

Subcatchment P-3: Subcat P-3 Runoff Area=8,506 sf 100.00% Impervious Runoff Depth=7.99"
 Tc=6.0 min CN=98 Runoff=1.58 cfs 5,664 cf

Subcatchment P-4: Subcat P-4 Runoff Area=9,922 sf 100.00% Impervious Runoff Depth=7.99"
 Tc=6.0 min CN=98 Runoff=1.84 cfs 6,606 cf

Subcatchment P-5: Subcat P-5 Runoff Area=119 sf 100.00% Impervious Runoff Depth=7.99"
 Tc=6.0 min CN=98 Runoff=0.02 cfs 79 cf

Pond 4P: DW (1,000 GAL) Discarded=0.01 cfs 79 cf Primary=0.00 cfs 0 cf Inflow=0.02 cfs 79 cf
 Peak Elev=89.42' Storage=11 cf Outflow=0.01 cfs 79 cf

Pond UJ1: UJ1-1 Discarded=0.14 cfs 12,270 cf Primary=0.00 cfs 2 cf Inflow=3.42 cfs 12,270 cf
 Peak Elev=92.92' Storage=5,835 cf Outflow=0.15 cfs 12,272 cf

Link SP1: Flow Off-Site To Municipal Drainage Inflow=0.16 cfs 521 cf
 Primary=0.16 cfs 521 cf

Link SP2: Flow Off-Site To Riverfront Area Inflow=0.08 cfs 700 cf
 Primary=0.08 cfs 700 cf

Total Runoff Area = 33,553 sf Runoff Volume = 13,568 cf Average Runoff Depth = 4.85"
42.77% Pervious = 14,350 sf 57.23% Impervious = 19,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 489 cf, Depth= 4.31"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description		
657	98	Paved parking, HSG A		
705	39	>75% Grass cover, Good, HSG A		
0	98	Roofs, HSG A		
1,362	67	Weighted Average		
705		51.79% Pervious Area		
657		48.21% Impervious Area		
Tc (min)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0				Direct Entry,

Summary for Subcatchment P-1B: Subcat P-1B

Runoff = 0.01 cfs @ 12.12 hrs, Volume= 31 cf, Depth= 1.25"
 Routed to Link SP1 : Flow Off-Site To Municipal Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
297	39	>75% Grass cover, Good, HSG A
297		100.00% Pervious Area

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.08 cfs @ 12.34 hrs, Volume= 698 cf, Depth= 0.63"
 Routed to Link SP2 : Flow Off-Site To Riverfront Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
10,561	30	Woods, Good, HSG A
2,787	39	>75% Grass cover, Good, HSG A
13,348	32	Weighted Average
13,348		100.00% Pervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 1.58 cfs @ 12.08 hrs, Volume= 5,664 cf, Depth= 7.99"
 Routed to Pond U/S1 : U/S-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
8,506	98	Paved parking, HSG A
8,506		100.00% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 1.84 cfs @ 12.08 hrs, Volume= 6,606 cf, Depth= 7.99"
 Routed to Pond U/S1 : U/S-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
9,922	98	Roofs, HSG A
9,922		100.00% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 0.02 cfs @ 12.08 hrs, Volume= 79 cf, Depth= 7.99"
 Routed to Pond 4P: DW (1,000 GAL)
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
119	98	Paved parking, HSG A
119		100.00% Impervious Area

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

Summary for Pond 4P: DW (1,000 GAL)

Inflow Area = 119 sf, 100.00% Impervious, Inflow Depth = 7.99" for 100-Year event
 Inflow = 0.02 cfs @ 12.08 hrs, Volume= 79 cf
 Outflow = 0.01 cfs @ 12.01 hrs, Volume= 79 cf, Atten= 68%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.01 hrs, Volume= 79 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 89.42' @ 12.38 hrs Surf.Area= 126 sf Storage= 11 cf

Plug-Flow detention time= (not calculated): outflow precedes inflow)
 Center-of-Mass det. time= 6.1 min (746.9 - 740.9)

Volume	Invert	Avail.Storage	Storage Description
#1	89.20'	83 cf	8.66'W x 14.50'L x 3.00'H Drywell Stone
#2	89.70'	149 cf	377 cf Overall - 170 cf Embedded = 207 cf x 40.0% Voids 5.67'W x 10.50'L x 2.50'H Drywell Structure Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
		232 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	91.86'	8.0" Round Culvert L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.86' / 91.76' S= 0.01000 /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	89.20'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.01 cfs @ 12.01 hrs HW=89.24' (Free Discharge)
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.20' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Controls 0.00 cfs)

Summary for Pond UIS1: UIS-1

Inflow Area = 18,428 sf, 100.00% Impervious, Inflow Depth = 7.99" for 100-Year event
 Inflow = 3.42 cfs @ 12.08 hrs, Volume= 12,270 cf
 Outflow = 0.15 cfs @ 14.74 hrs, Volume= 12,272 cf, Atten= 96%, Lag= 159.7 min
 Discarded = 0.14 cfs @ 11.47 hrs, Volume= 12,270 cf
 Primary = 0.00 cfs @ 14.74 hrs, Volume= 2 cf
 Routed to Link SP2: Flow Off-Site To Riverfront Area

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 92.92' @ 14.74 hrs Surf.Area= 2,579 sf Storage= 5,835 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 332.0 min (1,072.9 - 740.9)

Volume #	Invert	Avail. Storage	Storage Description
#1A	89.20'	2,530 cf	11.00'W x 232.17'L x 3.75'H Field A 9,577 cf Overall - 3,252 cf Embedded = 6,325 cf x 40.0% Voids ADS_StormTech SC-800 +Cap x 64 Inside #1
#2A	89.70'	3,252 cf	Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 64 Chambers in 2 Rows Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf
#3	89.70'	123 cf	4.00'D x 4.90'H DHM1&DHM2 x 2
			5,905 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device #	Routing	Invert	Outlet/Devices
#1	Primary	89.70'	12.0" Round Culvert L= 88.8' CPP, projecting, no headwall, Ke= 0.900 Inlet/Outlet Invert= 89.70' / 87.93' S= 0.0199 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.92'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	89.20'	2.410 in/hr Exfiltration Loamy Sand over Surface area

Discarded OutFlow Max=0.14 cfs @ 11.47 hrs HW=89.70' (Free Discharge)
 ↳-3=Exfiltration Loamy Sand (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 14.74 hrs HW=92.92' TW=0.00' (Dynamic Tailwater)
 ↳-1=Culvert (Passes 0.00 cfs of 4.93 cfs potential flow)
 ↳-2=Broad-Crested Rectangular Weir (Weir Controls 0.00 cfs @ 0.15 fps)

Pond UIS1: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-800+Cap (ADS StormTech@SC-800 with cap volume)
 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12L = 50.6 cf
 Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap
 Cap Storage= 3.4 cf x 2 x 2 rows = 13.7 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

32 Chambers/Row x 7.12' Long +0.88' Cap Length x 2 = 229.50' Row Length +16.0" End Stone x 2 = 232.17' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width
 6.0" Stone Base + 33.0" Chamber Height + 6.0" Stone Cover = 3.75' Field Height

64 Chambers x 50.6 cf + 3.4 cf Cap Volume x 2 x 2 Rows = 3,251.6 cf Chamber Storage

9,576.9 cf Field - 3,251.6 cf Chambers = 6,325.3 cf Stone x 40.0% Voids = 2,530.1 cf Stone Storage

Chamber Storage + Stone Storage = 5,781.7 cf = 0.133 af

Overall Storage Efficiency = 60.4%

Overall System Size = 232.17' x 11.00' x 3.75'

64 Chambers
 354.7 cy Field
 234.3 cy Stone



64 Chambers

Summary for Link SP1: Flow Off-Site To Municipal Drainage

Inflow Area = 1,659 sf, 39.59% Impervious, Inflow Depth = 3.77" for 100-Year event
Inflow = 0.16 cfs @ 12.09 hrs, Volume= 521 cf
Primary = 0.16 cfs @ 12.09 hrs, Volume= 521 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link SP2: Flow Off-Site To Riverfront Area

Inflow Area = 31,895 sf, 58.15% Impervious, Inflow Depth = 0.26" for 100-Year event
Inflow = 0.08 cfs @ 12.34 hrs, Volume= 700 cf
Primary = 0.08 cfs @ 12.34 hrs, Volume= 700 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Events for Subcatchment P-1A: Subcat P-1A

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.31	0.02	85	0.75
10-Year	5.21	0.07	221	1.95
25-Year	6.40	0.10	322	2.84
100-Year	8.23	0.16	489	4.31

Events for Subcatchment P-1B: Subcat P-1B

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.31	0.00	0	0.00
10-Year	5.21	0.00	6	0.24
25-Year	6.40	0.00	14	0.57
100-Year	8.23	0.01	31	1.25

Events for Subcatchment P-2: Subcat P-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.31	0.00	0	0.00
10-Year	5.21	0.00	46	0.04
25-Year	6.40	0.01	220	0.20
100-Year	8.23	0.08	698	0.63

Events for Subcatchment P-3: Subcat P-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.31	0.63	2,181	3.08
10-Year	5.21	1.00	3,525	4.97
25-Year	6.40	1.23	4,367	6.16
100-Year	8.23	1.58	5,664	7.99

Events for Subcatchment P-4: Subcat P-4

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.31	0.73	2,544	3.08
10-Year	5.21	1.16	4,112	4.97
25-Year	6.40	1.43	5,094	6.16
100-Year	8.23	1.84	6,606	7.99

Events for Subcatchment P-5: Subcat P-5

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.31	0.01	31	3.08
10-Year	5.21	0.01	49	4.97
25-Year	6.40	0.02	61	6.16
100-Year	8.23	0.02	79	7.99

Proposed hydroCAD

Events for Pond 4P: DW (1,000 GAL)

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.01	0.01	0.01	0.00	89.21	0
10-Year	0.01	0.01	0.01	0.00	89.27	3
25-Year	0.02	0.01	0.01	0.00	89.32	6
100-Year	0.02	0.01	0.01	0.00	89.42	11

Proposed hydroCAD

Events for Pond UIS1: UIS-1

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	1.36	0.14	0.14	0.00	90.19	1,520
10-Year	2.16	0.14	0.14	0.00	90.93	2,961
25-Year	2.65	0.14	0.14	0.00	91.52	4,022
100-Year	3.42	0.15	0.14	0.00	92.92	5,835

Events for Link SP1: Flow Off-Site To Municipal Drainage

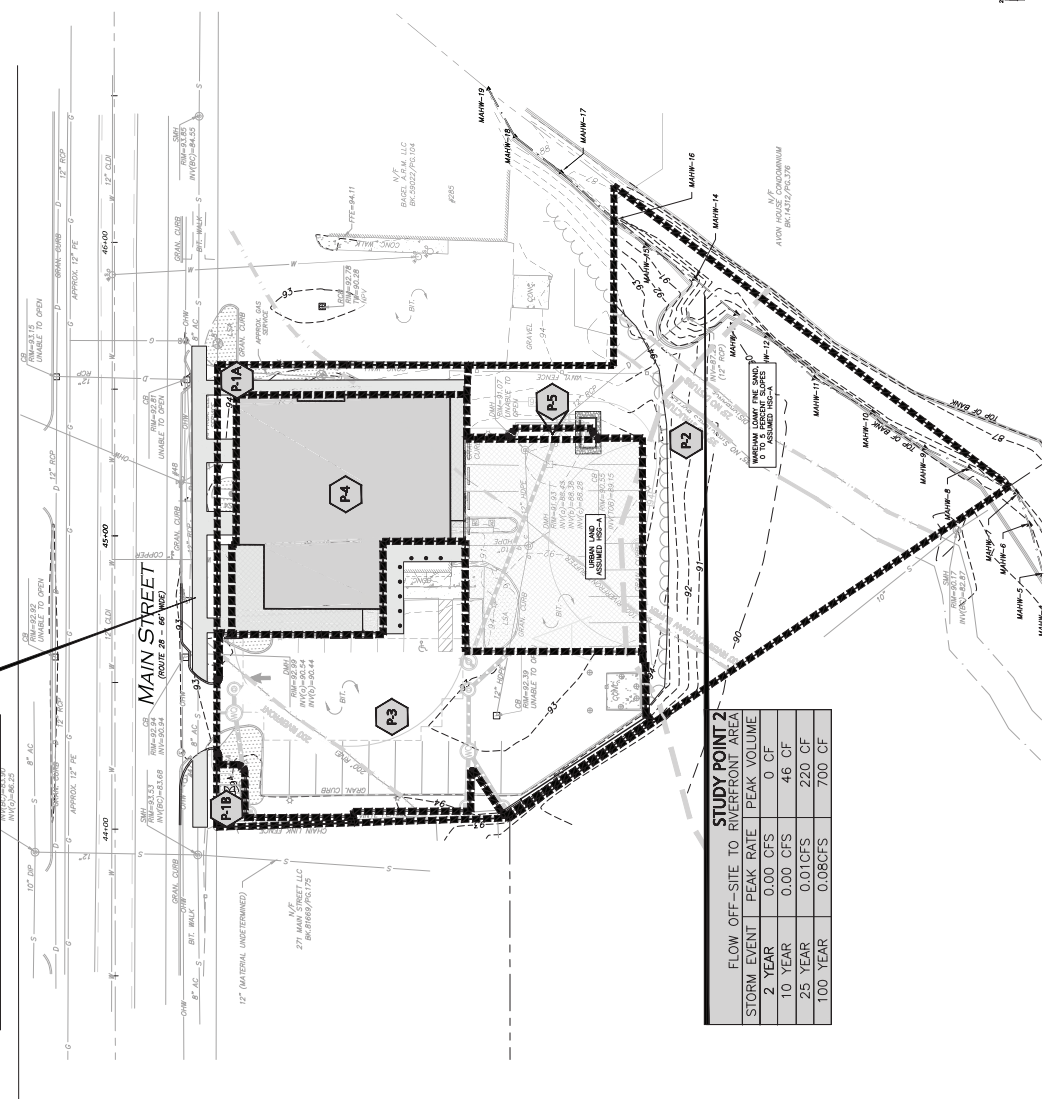
Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Year	0.02	0.02	0.00
10-Year	0.07	0.07	0.00
25-Year	0.10	0.10	0.00
100-Year	0.16	0.16	0.00

Events for Link SP2: Flow Off-Site To Riverfront Area

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Year	0.00	0.00	0.00
10-Year	0.00	0.00	0.00
25-Year	0.01	0.01	0.00
100-Year	0.08	0.08	0.00

STUDY POINT 1

FLOW OFF-SITE TO MUNICIPAL DRAINAGE	PEAK RATE	PEAK VOLUME
2 YEAR	0.02 CFS	85 CF
10 YEAR	0.07 CFS	227 CF
25 YEAR	0.10 CFS	336 CF
100 YEAR	0.16 CFS	521 CF



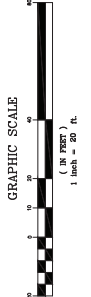
STUDY POINT 2

FLOW OFF-SITE TO RIVERFRONT AREA	PEAK RATE	PEAK VOLUME
2 YEAR	0.00 CFS	0 CF
10 YEAR	0.00 CFS	46 CF
25 YEAR	0.01CFS	220 CF
100 YEAR	0.08CFS	700 CF



LEGEND

	PROPOSED WATERSHED
	S/S SOILS BOUNDARY
	TO FLOW PATH
	SUBCATCHMENT LABEL
	SUBCATCHMENT BOUNDARY
	FLOW DIRECTION



PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

DATE	2025-11-24
PROJECT	MIXED-USE RETAIL AND RESIDENTIAL DEVELOPMENT
LOCATION	281 MAIN STREET, READING, MA 01867

PROJECT NO. 238608 DATE 2025-11-24
SCALE: 1" = 20' DWG. NAME: C138608-08
DESIGNED BY: MBI CHECKED BY: CMG



ALLEN & MAJOR ASSOCIATES, INC.
civil engineering • land surveying
environmental planning • site construction

100 CONSUMERS WAY, SUITE 2
TELE: (910) 854-0489
FAX: (910) 854-9999

STATE OF MASSACHUSETTS
REGISTERED PROFESSIONAL ENGINEER
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100 CONSUMERS WAY, SUITE 2
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TEL: (910) 854-0489
FAX: (910) 854-9999

SHEET NO. PWS
PROPOSED WATERSHED PLAN





**SECTION 6.0 -
APPENDIX**



NOAA Atlas 14, Volume 10, Version 3
Location name: Reading, Massachusetts, USA*
Latitude: 42.5154°, Longitude: -71.1033°
Elevation: 95 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.309 (0.238-0.390)	0.373 (0.287-0.471)	0.478 (0.367-0.605)	0.565 (0.431-0.720)	0.685 (0.508-0.915)	0.774 (0.564-1.06)	0.869 (0.618-1.24)	0.980 (0.658-1.42)	1.14 (0.741-1.72)	1.28 (0.813-1.97)
10-min	0.438 (0.338-0.552)	0.529 (0.407-0.667)	0.677 (0.520-0.857)	0.800 (0.611-1.02)	0.970 (0.720-1.30)	1.10 (0.799-1.50)	1.23 (0.875-1.75)	1.39 (0.932-2.01)	1.62 (1.05-2.44)	1.82 (1.15-2.79)
15-min	0.516 (0.397-0.650)	0.622 (0.479-0.785)	0.797 (0.612-1.01)	0.942 (0.719-1.20)	1.14 (0.847-1.52)	1.29 (0.940-1.76)	1.45 (1.03-2.06)	1.63 (1.10-2.37)	1.91 (1.24-2.87)	2.14 (1.35-3.28)
30-min	0.709 (0.546-0.893)	0.856 (0.659-1.08)	1.10 (0.842-1.39)	1.30 (0.990-1.65)	1.57 (1.17-2.10)	1.78 (1.30-2.43)	2.00 (1.42-2.84)	2.25 (1.51-3.27)	2.64 (1.71-3.96)	2.96 (1.87-4.54)
60-min	0.902 (0.695-1.14)	1.09 (0.839-1.38)	1.40 (1.07-1.77)	1.65 (1.26-2.10)	2.00 (1.49-2.68)	2.26 (1.65-3.10)	2.54 (1.81-3.63)	2.87 (1.93-4.17)	3.36 (2.18-5.06)	3.78 (2.39-5.79)
2-hr	1.17 (0.906-1.46)	1.42 (1.10-1.78)	1.84 (1.42-2.31)	2.18 (1.67-2.75)	2.65 (1.98-3.53)	3.00 (2.20-4.09)	3.38 (2.43-4.82)	3.84 (2.59-5.54)	4.57 (2.96-6.82)	5.20 (3.30-7.91)
3-hr	1.36 (1.06-1.69)	1.66 (1.29-2.07)	2.14 (1.66-2.68)	2.55 (1.96-3.21)	3.10 (2.33-4.12)	3.51 (2.60-4.78)	3.96 (2.86-5.64)	4.52 (3.05-6.49)	5.40 (3.51-8.02)	6.17 (3.92-9.34)
6-hr	1.75 (1.38-2.17)	2.14 (1.68-2.66)	2.78 (2.17-3.45)	3.30 (2.56-4.13)	4.03 (3.04-5.31)	4.56 (3.38-6.16)	5.14 (3.74-7.27)	5.87 (3.98-8.36)	7.02 (4.58-10.3)	8.02 (5.11-12.0)
12-hr	2.23 (1.76-2.74)	2.73 (2.15-3.36)	3.54 (2.78-4.37)	4.21 (3.29-5.23)	5.13 (3.90-6.72)	5.82 (4.34-7.80)	6.56 (4.78-9.18)	7.48 (5.09-10.6)	8.90 (5.83-13.0)	10.1 (6.48-15.1)
24-hr	2.67 (2.12-3.27)	3.31 (2.63-4.05)	4.35 (3.44-5.34)	5.21 (4.10-6.44)	6.40 (4.90-8.33)	7.28 (5.46-9.70)	8.23 (6.04-11.5)	9.44 (6.44-13.2)	11.3 (7.43-16.4)	13.0 (8.31-19.1)
2-day	3.03 (2.43-3.68)	3.83 (3.06-4.65)	5.14 (4.09-6.26)	6.22 (4.93-7.63)	7.71 (5.94-9.99)	8.80 (6.67-11.7)	10.0 (7.43-14.0)	11.6 (7.93-16.1)	14.1 (9.29-20.3)	16.4 (10.5-24.0)
3-day	3.32 (2.67-4.01)	4.18 (3.35-5.06)	5.58 (4.47-6.78)	6.75 (5.37-8.24)	8.36 (6.47-10.8)	9.52 (7.25-12.6)	10.8 (8.07-15.1)	12.5 (8.61-17.4)	15.3 (10.1-21.9)	17.8 (11.5-25.9)
4-day	3.59 (2.90-4.33)	4.48 (3.61-5.40)	5.93 (4.76-7.18)	7.13 (5.69-8.68)	8.79 (6.82-11.3)	9.99 (7.62-13.2)	11.3 (8.47-15.7)	13.1 (9.01-18.1)	16.0 (10.6-22.8)	18.5 (12.0-26.9)
7-day	4.36 (3.54-5.23)	5.28 (4.28-6.34)	6.79 (5.48-8.18)	8.04 (6.45-9.73)	9.76 (7.60-12.5)	11.0 (8.42-14.4)	12.4 (9.28-17.0)	14.2 (9.82-19.5)	17.1 (11.4-24.3)	19.7 (12.8-28.5)
10-day	5.06 (4.12-6.05)	6.01 (4.89-7.19)	7.56 (6.12-9.07)	8.84 (7.12-10.7)	10.6 (8.29-13.5)	11.9 (9.12-15.5)	13.3 (9.96-18.1)	15.2 (10.5-20.7)	18.0 (12.0-25.5)	20.6 (13.3-29.6)
20-day	7.04 (5.77-8.35)	8.08 (6.62-9.60)	9.79 (7.98-11.7)	11.2 (9.08-13.4)	13.2 (10.3-16.4)	14.6 (11.2-18.6)	16.2 (12.0-21.4)	17.9 (12.5-24.2)	20.5 (13.7-28.7)	22.7 (14.8-32.4)
30-day	8.69 (7.15-10.3)	9.80 (8.06-11.6)	11.6 (9.52-13.8)	13.1 (10.7-15.7)	15.2 (11.9-18.9)	16.8 (12.9-21.2)	18.4 (13.6-24.1)	20.2 (14.1-27.1)	22.6 (15.1-31.4)	24.5 (15.9-34.7)
45-day	10.8 (8.91-12.7)	12.0 (9.89-14.1)	13.9 (11.5-16.5)	15.5 (12.7-18.5)	17.8 (14.0-21.8)	19.5 (14.9-24.4)	21.2 (15.6-27.3)	22.9 (16.1-30.6)	25.1 (16.9-34.7)	26.7 (17.4-37.7)
60-day	12.6 (10.4-14.8)	13.8 (11.4-16.2)	15.9 (13.1-18.7)	17.6 (14.4-20.8)	19.9 (15.7-24.3)	21.7 (16.6-27.0)	23.5 (17.2-30.0)	25.1 (17.7-33.4)	27.2 (18.3-37.4)	28.6 (18.7-40.3)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic) Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgrtn.) Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
Open Channels	
Lined Channels Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet) Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Middlesex County, Massachusetts



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Middlesex County, Massachusetts.....	13
32B—Wareham loamy fine sand, 0 to 5 percent slopes.....	13
305B—Paxton fine sandy loam, 3 to 8 percent slopes.....	14
420B—Canton fine sandy loam, 3 to 8 percent slopes.....	16
602—Urban land.....	17
Soil Information for All Uses	19
Soil Properties and Qualities.....	19
Soil Qualities and Features.....	19
Hydrologic Soil Group.....	19
References	24

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.





























Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



MAP LEGEND

Area of Interest (AOI)	 Area of Interest (AOI)	 Spoil Area
Soils	 Soil Map Unit Polygons	 Stony Spot
	 Soil Map Unit Lines	 Very Stony Spot
	 Soil Map Unit Points	 Wet Spot
Special Point Features	 Blowout	 Other
	 Borrow Pit	 Special Line Features
	 Clay Spot	Water Features
	 Closed Depression	 Streams and Canals
	 Gravel Pit	Transportation
	 Gravelly Spot	 Rails
	 Landfill	 Interstate Highways
	 Lava Flow	 US Routes
	 Marsh or swamp	 Major Roads
	 Mine or Quarry	 Local Roads
	 Miscellaneous Water	Background
	 Perennial Water	 Aerial Photography
	 Rock Outcrop	
	 Saline Spot	
	 Sandy Spot	
	 Severely Eroded Spot	
	 Sinkhole	
	 Slide or Slip	
	 Sodic Spot	

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Middlesex County, Massachusetts
 Survey Area Data: Version 25, Sep 5, 2025

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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
32B	Wareham loamy fine sand, 0 to 5 percent slopes	1.7	32.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	1.0	19.4%
420B	Canton fine sandy loam, 3 to 8 percent slopes	1.2	22.0%
602	Urban land	1.4	26.5%
Totals for Area of Interest		5.3	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

Custom Soil Resource Report

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

32B—Wareham loamy fine sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: vqnd
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Wareham

Setting

Landform: Terraces, depressions, deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 10 inches: loamy fine sand
H2 - 10 to 24 inches: loamy sand
H3 - 24 to 34 inches: stratified sand to fine sand
H4 - 34 to 65 inches: stratified coarse sand to sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Sudbury

Percent of map unit: 10 percent
Landform: Terraces, plains

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Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Scarboro

Percent of map unit: 5 percent
Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Deerfield

Percent of map unit: 5 percent
Landform: Stream terraces, depressions, deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

305B—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 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

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

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Custom Soil Resource Report

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent
Landform: Ground moraines, drainageways, hills, depressions
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, base slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
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

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Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent

Landform: Ground moraines, drumlins, hills

Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Montauk

Percent of map unit: 5 percent

Landform: Ground moraines, moraines, drumlins, hills

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Charlton

Percent of map unit: 4 percent

Landform: Ground moraines, hills, ridges

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Swansea

Percent of map unit: 1 percent

Landform: Swamps, marshes, kettles, bogs, depressions

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

602—Urban land

Map Unit Setting

National map unit symbol: 9950

Elevation: 0 to 3,000 feet

Mean annual precipitation: 32 to 50 inches

Mean annual air temperature: 45 to 50 degrees F

Frost-free period: 110 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent

Minor components: 15 percent

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Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Excavated and filled land

Minor Components

Udorthents, wet substratum

Percent of map unit: 5 percent

Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent

Landform: Ledges

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Head slope

Down-slope shape: Concave

Across-slope shape: Concave

Udorthents, loamy

Percent of map unit: 5 percent

Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

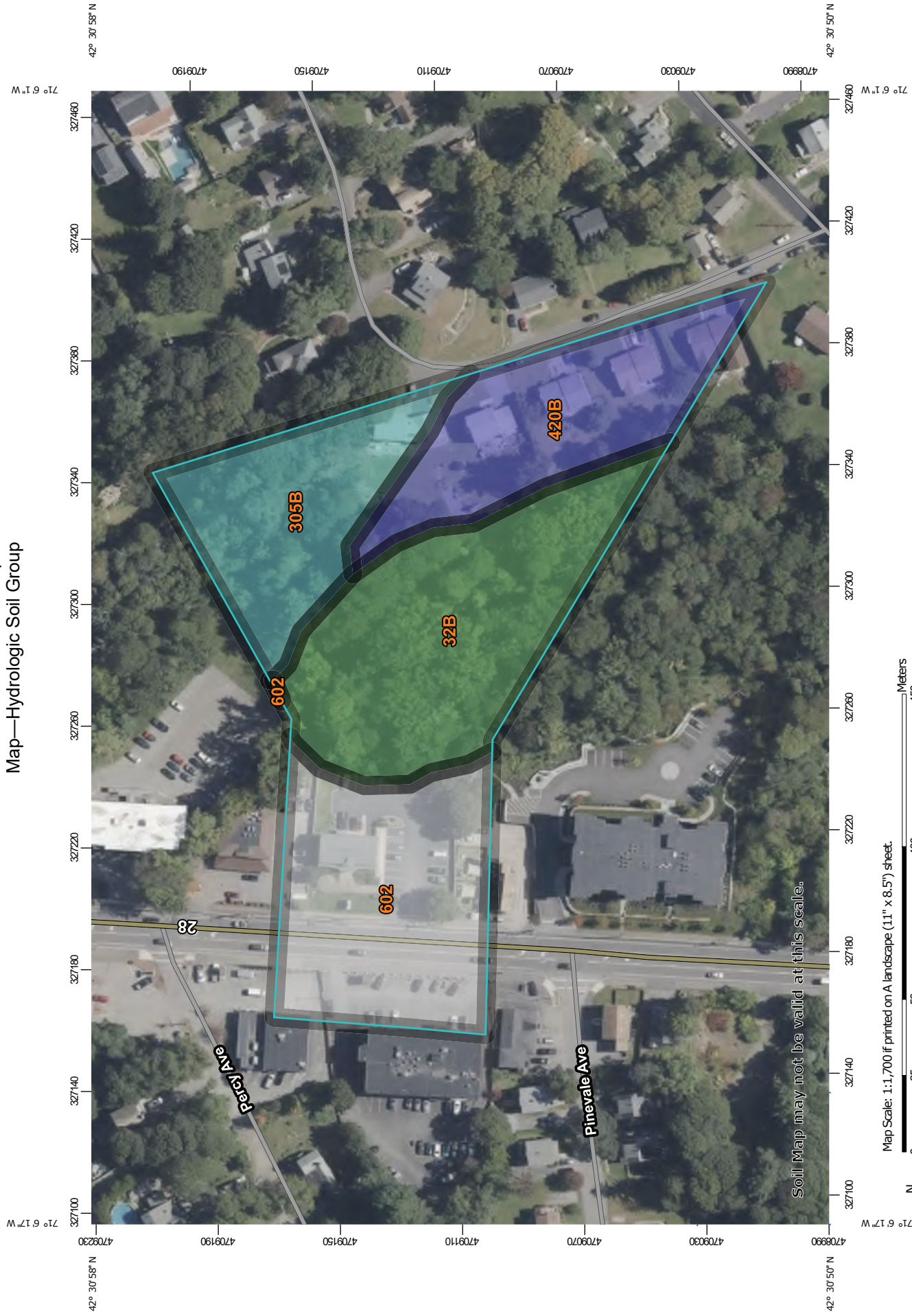
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Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

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Map—Hydrologic Soil Group



Map Scale: 1:1,700 if printed on A landscape (11" x 8.5") sheet.



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

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Middlesex County, Massachusetts
 Survey Area Data: Version 25, Sep 5, 2025








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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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 LEGEND

Area of Interest (AOI)	 C
 Area of Interest (AOI)	 C/D
Soils	 D
Soil Rating Polygons	 Not rated or not available
 A	
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	
Soil Rating Lines	
 A	
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	
Soil Rating Points	
 A	
 A/D	
 B	
 B/D	

Water Features	 Streams and Canals
Transportation	 Rails
	 Interstate Highways
	 US Routes
	 Major Roads
	 Local Roads
Background	 Aerial Photography

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
32B	Wareham loamy fine sand, 0 to 5 percent slopes	A/D	1.7	32.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	1.0	19.4%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	1.2	22.0%
602	Urban land		1.4	26.5%
Totals for Area of Interest			5.3	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

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United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

281 Reading, LLC
 Owner Name _____
 281 Main Sr
 Street Address _____ Map/Lot # _____
 Reading MA
 City State _____ Zip Code _____

B. Site Information

1. (Check one) New Construction Upgrade
 2. Soil Survey NRCs Online Map 602 Urban Land
 Source Soil Map Unit Soil Series _____
 Landform _____ Soil Limitations _____

3. Surficial Geological Report _____ Map Unit _____
 Year Published/Source _____

Description of Geologic Map Unit: _____
 4. Flood Rate Insurance Map Within a regulatory floodway? Yes No
 5. Within a velocity zone? Yes No
 6. Within a Mapped Wetland Area? Yes No
 7. Current Water Resource Conditions (USGS): 11/19/2025 Range: Above Normal Normal Below Normal
 Month/Day/ Year Wetland Type
 8. Other references reviewed: _____
 (Zone II, IWPA, Zone A, EEA Data Portal, etc.) _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Carlton Quinn, PE

Signature of Soil Evaluator

MA PE #49923

Typed or Printed Name of Soil Evaluator / License #

11/20/25

Date

6/30/26

Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:

Title	MA DEP Standard Calculations
Project	Mixed Use Development
Location	281 Main St, Reading, MA
Date	11/24/2025
Revised	02-27-2026

By	MTB
Chk'd	CMQ
Apprv'd	CMQ

Stormwater Recharge/Water Quality Volume Table

$R_v = F * Impervious Area$

R_v = Required Recharge Volume, expressed in ft^3 , cubic yards or acre-feet

F = Target Depth Factor associated with each Hydraulic Soil Group

Impervious Area = pavement & rooftop area on site

A_{wq} = Required Water Quality Treatment Volume, expressed in ft^3

D_{wq} = Water Quality Depth

A_{imp} = Impervious Area (excluding non-metal roofs)

Watershed	Area (Sq. Ft.)	Landscaped	Impervious Area (Square Feet)		Recharge Required			Water Quality Volume Required	
			HSG A (F=.6)	HSG B (F=.35)	F Avg. (Inches)	Impervious Area (Feet)	R_v (ft^3)	D_{wq} (Inch)	A_{wq}
P-1A	1,362	705	657	0	0.60	657	33	1.0	55
P-1B	297	297	0	0	0.60	0	0	1.0	0
P-2	13,348	13,348	0	0	0.00	0	0	1.0	0
P-3	8,506	0	8,506	0	0.60	8,506	425	1.0	709
P-4	9,922	0	9,922	0	0.60	9,922	496	1.0	827
P-5	119	0	119	0	0.60	119	6	1.0	10
Total	33,554	14,350	19,204	0		19,204	960		1,600

Stormwater Recharge Summary

$R_v = F * Impervious Area$

R_v = Required Recharge Volume, expressed in ft^3 , cubic yards or acre-feet

F = Target Depth Factor associated with each Hydraulic Soil Group

Impervious Area = pavement & rooftop area on site

	Total Required (cf)	Provided (cf)	
$AR_v =$	960	5,832	UIS-1

Water Quality Volume

A_{wq} = Required Water Quality Treatment Volume, expressed in ft^3

D_{wq} = Water Quality Depth

A_{imp} = Impervious Area (excluding non-metal roofs)

	Total Required (cf)	Provided (cf)	
$A_{wq} =$	1,600	5,832	UIS-1

Title	MA DEP Standard Calculations
Project	Mixed Use Development
Location	281 Main St, Reading, MA
Date	11/24/2025

By	MTB
Chk'd	CMQ
Apprv'd	CMQ

Draindown Within 72 Hours

Time_{drawdown}=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

UIS-1 (Loamy Sand)	
Infiltration Rate (in/Hr)=	2.41
Bottom Area (ft ²) =	2,400
Infiltration Volume (ft ³) =	5,832
Time _{drawdown} (Hours)=	12.10

A	B	C	D	E
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump Catch Basins	0.25	1.00	0.25	0.75
Water Quality Unit	0.80	0.75	0.60	0.15
Sub-Surface Infiltration System w/ Outlet Control	0.80	0.15	0.12	0.03
Total TSS Removal =			0.97	

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: 281 Reading , LLC

ADDRESS: 281 Main Street

Reading, MA 01867

TEL. NUMBER: (781)-389-5989

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.