DROHAN TOCCHIO & MORGAN, P.C.

ATTORNEYS AT LAW
175 DERBY STREET, SUITE 30
HINGHAM, MASSACHUSETTS 02043
Telephone: (781) 749-7200 ~ Facsimile: (781) 740-4335
www.dtm-law.com

JEFFERY A. TOCCHIO
jtocchio@dtm-law.com

May 4, 2020

Via Electronic Delivery (townclerk@hingham-ma.gov)

Eileen McCracken, Town Clerk
Town of Hingham
Clerk's Office
210 Central Street
Hingham, MA 02043

RE: 19 & 27 Whiting Street, Hingham, MA
Merhej and Sons Realty, LLC

Dear Ms. McCracken:

This office represents Merhej and Sons Realty, LLC in connection with their property located at 19 & 27 Whiting Street. Enclosed for filing please find the following documents:

1. Form 2, Application for Zoning Hearing;
2. Application for Site Plan Approval in Association with Application for Building Permit;
3. Application for Special Permit A3 Parking Determination;
4. Site Development Plans prepared by CHA;
5. Architectural Plans prepared by CHA;
6. Sight Distance Exhibit prepared by CHA;
7. Memorandum -Trip Generation Assessment prepared by CHA;
8. Stormwater Report prepared by CHA; and
9. Check in the amount of $1,000.00 representing the application fees.

Thank you for your attention to this matter.

Very truly yours,

Jeffery A. Tocchio

Enclosures
Cc: Planning Board (dunhamn@hingham-ma.gov)

TOWN OF HINGHAM *FORM 2*

BOARD OF APPEALS
781-741-1494

PLANNING BOARD
781-741-1419

APPLICATION FOR ZONING HEARING

Application Date May 4, 2020

The undersigned hereby petitions the Board of Appeals and/or the Planning Board for the following:

_____ Appeal _____ Variance _____ Special Permit A1

_____ Special Permit A2 __X__ Site Plan Review __X__ Special Permit A3

Subject Property 19 & 27 Whiting Street, Hingham, MA Zoning District Business B

Petitioner's Name Merhej and Sons Realty, LLC Address 87 Derby Street, Hingham, MA

Name _____ Address _____

Name _____ Address _____

Brief Description of Work:

Petitioner proposes to redevelop and construct a new retail building at the properties located at 19 & 27 Whiting Street, Hingham.

Applicants for an **Appeal** must complete **Form 2A**
Applicants for a **Variance** must complete **Form 2B**
Applicants for a **Special Permit A1** must complete **Form 2C**
Applicants for a **Special Permit A2** must complete **Form 2D**
Applicants for a **Special Permit A3** must complete **Form 2E**

Form 2

The undersigned is __X__ the owner of the subject property, or __X__ the holder of a written option to purchase the subject property, or _____ the holder of a valid lease to the subject property. (In this last instance written authorization from the property owner must be submitted with the other application documents.)

Record title to the subject property stands in the name(s) Merhej and Sons Realty, LLC

Address of owner of record 87 Derby Street, Hingham, MA 02043

Title Reference:
(Unregistered land) Plymouth County Registry of Deeds, Book 48377, Page 84
(Registered land) Land Court Certificate of Title No. _____, Book _____, Page _____

State briefly what is currently on the premises:
The property at 19 Whiting Street consists of .42 +/- acres of land on the north-side of Whiting Street, and has operated since approximately 1960 as an independent automotive filling station with associated improvements. The property at 27 Whiting Street consists of 1.26+/- acres of land on the north-side of Whiting Street, abutting 19 Whiting Street to the west, and is improved with a single family dwelling with attached garage, and accessory shed.

Attorney, agent, or other representative acting for petitioner:
Name Jeffery A. Tocchio, Esq. Address 175 Derby Street, Suite 30, Hingham, MA 02043

Name _____ Address _____
Written evidence of agent's standing to represent petitioner may be requested.

Signed as a statement of fact under the pains and penalties of perjury, this 4th day of May, 2020.

SIGNATURE _____
(Petitioner/Agent)
Print Name Jeffery A. Tocchio,Esq.

Address 175 Derby Street, Suite 30, Hingha, MA

Tel. No. (781) 749-7200

check all that apply:
- ☐ Property Owner(s)
- ☐ Applicant
- ☐ Owner's Agent
- ☒ Applicant's Agent

Note: Do not attempt to discuss the merits of your case with any member of the Board of Appeals and/or the Planning Board at any time after filing this application and prior to the hearing thereon.

Hingham Planning Board
APPLICATION FOR SITE PLAN APPROVAL
IN ASSOCIATION WITH APPLICATION FOR BUILDING PERMIT

Application Date: May 4, 2020

Applicant: Merhej and Sons Realty, LLC

Contact Information for Applicant or Authorized Agent (Attorney, Contractor, etc.)

Name/Title: Jeffery A. Tocchio, Esq.

Phone: (781) 749-7200

Address: 175 Derby Street, Suite 30, Hingham, MA 02043

Project Location: 19 & 27 Whiting Street, Hingham, MA 02043

Site Plan Review Submittal Requirements

Please provide to the Planning Board office seven (7) hard copies and an electronic file of the Site Plan and submittal materials, except that only two copies of the drainage report are required. Submittal Requirements:

a. locus plan; diagram and statement of the ownership, area, dimensions, boundaries and principal elevations of the subject property; location of structures within 100 feet of property line;

b. scaled and dimensioned plan of the location and footprint of existing and proposed buildings and structures; if applicable, building elevations and floor layouts;

c. if applicable, plan showing proposed circulation of traffic within the development and in all adjacent public ways; dimensioned plan of loading and parking areas, aisles and driveways; plan with detail sheets if appropriate, profile and representative cross sections of proposed driveways and parking areas;

d. analysis of compliance with all relevant dimensional provisions of this By-Law;

e. detailed information on utilities, landscaping, refuse storage and removal;

f. grading plan, estimated net import/export of material, drainage analysis, and traffic analysis, as applicable;

g. analysis of the capacity of Town soils, water supply, ways and services to absorb the impact of the proposed development;

h. analysis of compliance of the construction activities and the proposed project, including the extent the project incorporates low impact design and green infrastructure solutions, with the most current versions of the Massachusetts Department of Environmental Protection Stormwater Management Policy and Standards including (i) the Massachusetts Stormwater Handbook, (ii) Massachusetts Erosion Sediment and Control Guidelines, and (iii) if applicable, additional requirements under the Town of Hingham MS4 Permit for projects that disturb more than one acre and discharge to the Town's municipal stormwater system;

i. Site Lighting Plan showing the location, height, photometric, orientation, and specifications for all outdoor site lighting, including information on the intensity and range of illumination for each source of light proposed.

j. an erosion control plan and an Operations and Management Plan for both the construction activities and ongoing post-construction maintenance and reporting requirements; and

k. such other materials necessary to enable Town boards to make a positive determination on the proposed development.

Brief Description of Work:

Petitioner proposes to redevelop and construct a new retail building at the properties located at 19 & 27 Whiting Street, Hingham.

Request for Waiver from Site Plan Review Requirements

Upon written request of the applicant, the Planning Board may waive any of the submittal requirements set forth in Section I-I.6 deemed by the Planning Board to be not necessary for its review of the application. In addition, the Planning Board may waive other such requirements of Section I-I, including the requirement for a public hearing, where the Planning Board determines that the project constitutes a minor site plan. In order to constitute a minor site plan, the proposed work must be limited to (i) interior renovations to a building or structure that do not include a change of use or parking demand for which a Special Permit A2 or A3 is required and/or (ii) modifications to the site which, in the Planning Board's determination, do not materially or adversely affect conditions governed by the site plan review standards set forth in Section I-I.6

Please indicate requested relief (for example, "I request a waiver from the requirement for a public hearing" or "I request a waiver from the requirement to submit a utilities plan and lighting plan"):

Waiver Granted ☐

Waiver NOT Granted ☐

_____

Signature of Authorized Agent (Chairman of the Planning Board or Town Planner) Date

Hingham Planning Board
APPLICATION FOR SITE PLAN APPROVAL
IN ASSOCIATION WITH APPLICATION FOR BUILDING PERMIT

SUPPLEMENT TO APPLICATION FOR SITE PLAN APPROVAL
Merhej and Sons Realty LLC, 19 & 27 Whiting Street

Petitioner, **Merhej and Sons Realty, LLC ("Merhej" or "Petitioner")**, seeks Site Plan Approval, under Sections IV-B.6, a & b of the Zoning By-Law, in order to redevelop and construct a new retail building at the properties located at **19 & 27 Whiting Street, Hingham**. Petitioner is the owner of the property at 19 Whiting Street, operated as an independent automotive filling station, and has a written option to purchase the abutting property at 27 Whiting Street. Petitioner seeks to redevelop the combined properties in order to construct a new 2,531± s.f. retail convenience store, replacing a small retail structure, and continue the filling station use. The properties are located in the Business District B and Accord Pond Watershed and Hingham Aquifer Protection District.

I. Background

The property at 19 Whiting Street consists of .42± acres of land on the north-side of Whiting Street, with 150 linear feet of frontage with two existing curb-cuts. The property has operated as an independent automotive filling station since approximately 1960, and is improved with two fueling pump islands with four pumps (8 fueling spots), a 1,760± s.f. canopy, 10,094± s.f. of pavement, and a 192± square foot retail building. Petitioner has owned and operated the property at 19 Whiting Street since May of 2017.

The property at 27 Whiting Street consists of 1.26± acres of land on the north-side of Whiting Street, abutting 19 Whiting Street to the west, has 144 linear feet of frontage and two existing curb-cuts. The property is improved with an 884± s.f. single-family dwelling with attached garage, constructed in 1952, and accessory shed.

II. Proposed Project

Petitioner seeks to combine the properties and (i) retain the existing Hingham Gas fueling station (pumps, canopy, storage tanks, concrete pad); (ii) raze the existing structures at 27 Whiting Street; (iii) raze the 192± square foot building adjacent to the gas pumps at 19 Whiting Street; (iv) construct a new 2,531± s.f. retail/convenience store with associated storage areas; and (v) integrate the sites, including reducing the number of curb-openings accessing the combined site. The combined property will consist of 1.68± acres with 294 linear feet of frontage on Whiting Street. The proposed convenience/retail store use is a permitted use within the Business District B under Section 4.1 of the Zoning By-Law. The pre-existing filling station use will remain unchanged (gasoline pumps, canopy, fuel storage tanks); except for the removal of the small retail/convenience store.[1]

---

[1] An independent automotive filling station has existed and operated at the 19 Whiting Street property since prior to the enactment of Section III-D (Accord Pond Watershed and Hingham Aquifer Protection District) of the Zoning By-Law, and falls under the exception set forth at Section III-D(6) of the Zoning By-Law.

The proposed 1.5-story building will include 2,531± s.f. of retail space on the ground floor, 1,000± s.f. of first floor retail inventory storage and 1,000± s.f of lower level site maintenance equipment storage, accessed via a roll-up door. The proposed building will be setback 41± feet from the front lot line, 25± feet from the westerly lot line, 135± feet from the easterly lot line, and 25± feet from the closest portion of the rear lot line. The proposed building coverage is only 4.8%; significantly less than the 25% allowed within the district.

Access to the site is proposed to be provided via a total of three (3) curb-openings. The easterly curb-opening on 27 Whiting Street is proposed to be eliminated and the two (2) existing curb-openings associated with 19 Whiting Street will continue to provide access to the easterly half of the site. One of those curb-openings is the curb opening on 1217 Main Street, and the other is on Whiting Street at the southwest corner of the property. One of the two existing curb cuts at 27 Whiting will be eliminated and a single westerly curb-opening will provide egress from the site and is proposed to be restricted to right-turn only for vehicles travelling westerly on Whiting Street.[2] Sixteen (16) parking spaces are provided adjacent to the proposed building, with access to the building via a handicap accessible walkway. Access to the basement level storage area is provided via a driveway at the westerly side of the building, and accessed via a garage door opening. A dumpster, with enclosure and concrete pad, is proposed to be located behind the northeasterly portion of the building, and is accessed in the area of the proposed loading zone.

The proposed project is depicted on the following plans:

1. Site plan entitled "Hingham Gas #19 & 27 Whiting Street Hingham, MA 02043," dated May 1, 2020, prepared by CHA, submitted herewith as Exhibit A; and

2. Architectural concept plan entitled "Whiting Street Convenient Store," dated April 24, 2020, prepared by CHA Architectural, submitted herewith as Exhibit B.

III. Site Plan Approval in Association with Application for Building Permit

Petitioner submits the following to the Planning Board for their consideration under Section I-I (6) of the Hingham Zoning By-Law:

a. Protection of abutting properties against detrimental uses by provision for surface water drainage, fire hydrant locations, sound and site buffers, and preservation of views, light and air, and protection of abutting properties from negative impacts from artificial outdoor site lighting.

Petitioner does not propose to alter the existing gas station canopy, lighting, fuel pumps or underground storage tanks. The proposed redeveloped portion of the site has been designed to convey stormwater runoff to infiltration structures via roof drains and catch basins. Sanitary waste for the proposed building will be handled by a new septic system proposed on-site. Private trash pickup will be scheduled for the site, and a proposed new dumpster location and enclosure will support the uses at the site. The existing stockade fence along portions of the easterly and northerly property line will remain. Additionally, twelve (12) trees will be protected along the new property

[2] Whiting Street is a State Highway and Petitioner will require a State Highway Access Permit issued by MassDOT.

lines and a tree line will be reinforced on the northly side of the property. The sole existing residential use, which currently abuts the filling station at 19 Whiting Street, will be incorporated into the property, thus eliminating a long-standing non-conforming use. All other abutting properties are commercial. As such, the proposed redevelopment project will not result in negative impacts to adjacent properties.

b. Convenience and safety of vehicular and pedestrian movement within the site and on adjacent streets; the location of driveway openings in relation to traffic or to adjacent streets, taking account of grades, sight distances and distances between such driveway entrances, exits and the nearest existing street or highway intersections; sufficiency of access for service, utility and emergency vehicles.

All internal drive aisles and parking spaces comply with applicable dimensional requirements. In addition, Petitioner incorporates by reference the Traffic Memorandum, prepared by John G. Morgan Jr., P.E., PTOE, of CHA, submitted to the Board, herewith, in satisfaction of this standard.

c. Adequacy of the arrangement of parking, loading spaces and traffic patterns in relation to the proposed uses of the premises; compliance with the off-street parking requirements of this By-Law.

The current traffic pattern for the gas station use will not be altered by the proposed project. As reflected on the site plan and below parking table, the property will provide one (1) more parking space than is required for the uses pursuant to Section V-A. The project proposes a total of sixteen (16) parking spaces to be provided with twelve (12) parking spaces to be located south of the convenient/retail store and an additional four (4) parking spaces to be located on the east side of the structure. Two (2) of the parking spaces are proposed to be handicap (van) accessible. A concrete, handicap accessible sidewalk is proposed to separate the structure and the parking spaces. All internal drive aisles and parking spaces comply with applicable dimensional requirements. A loading area is provided in proximity to the northeasterly corner of the proposed building.

Use	Requirement	Proposed	Required
Retail Store	5 spaces/1000 SF of GFA	2,531 SF	13 spaces
Storage/Warehousing	1 space/1000 SF of GFA	2,000 SF	2 spaces
Motor Vehicle Service/ Filling Station	2 spaces per bay or work station	N/A	N/A
		Total Required	**15 Spaces**
		Total Provided	**16 Spaces**

d. Adequacy of open space and setbacks, including adequacy of landscaping of such areas.

The proposed project will provide adequate open space and setbacks. The proposed building coverage will be only 4.8% or 3,531± s.f., where a maximum building coverage of 25% is permitted. The proposed building will comply with all setback requirements, being 40.9' from the front lot line along Whiting Street (40' required), 25.1' from the closest (northeasterly) portion

of the rear lot line (25' required), and greater than 25' from the westerly and easterly side lot lines (25' required). Twelve (12) trees will be protected along the new property lines and a tree line will be reinforced on the northly side of the property. Additionally, the site maintains 10,094± square feet of paved area for the eight (8) fueling stations, thus satisfying the minimum requirement of 1,000 square feet of paved area for each filling pump. *See* Zoning By-law § III-B(3).

e. Adequacy of the methods of disposal of refuse and other wastes resulting from the uses permitted on the site.

Sanitary waste for the new structure and associated uses will be handled with a new, two-compartment septic tank with accompanying six (6) leaching trenches. The existing septic system will be removed in its entirety.

f. Prevention or mitigation of adverse impacts on the Town's resources, including, without limitation, water supply, wastewater facilities, energy and public works and public safety resources.

The proposed project will not have an adverse impact of the Town's resources. Sanitary waste for the proposed building will be handled by a new septic system proposed on-site. The redeveloped site has been designed to convey stormwater runoff to infiltration structures via roof drains and catch basins. Private trash pickup will be scheduled for the site.

g. Assurances of positive stormwater drainage and snow-melt run-off from buildings, driveways and from all parking and loading areas on the site, and prevention of erosion, sedimentation and stormwater pollution and management problems through site design and erosion controls in accordance with the most current versions of the Massachusetts Department of Environmental Protection's Stormwater Management Policy and Standards, and Massachusetts Erosion and Sediment Control Guidelines.

The proposed redevelopment has been designed to convey stormwater runoff to infiltration structures via roof drains and catch basins. A "greenscape" wastewater management system has been designed with a biodetention area in the location of an existing shed and paved driveway approximately 50' from the vegetated wetlands. Snow storage is proposed upland and south of the proposed biodetention area. Sediment and erosion control measures will be implemented prior to demolition and construction including proposed compost filters. See Exhibit A.

h. Protection of natural and historic features including minimizing: the volume of cut and fill, the number of removed trees of 6 inches caliper or larger, the removal of stone walls, and the obstruction of scenic views from publicly accessible locations.

The proposed project will have a positive impact on the natural and historic features in the area. The project proposes the removal of a shed within the 25 foot wetland buffer zone and a single family home within the 50 foot wetland buffer zone. The proposed building will be constructed farther away from the bordering vegetative wetlands on-site. Twelve (12) trees will be protected along the new property lines and a tree line will be reinforced on the northly side of the property.

i. Minimizing unreasonable departure from the character and scale of buildings in the vicinity or as previously existing on or approved for the site.

The buildings in the vicinity of the project are characterized as single- and two- story commercial buildings. The proposed project will be congruous with the character and scale of those buildings located within the vicinity of the Property. In fact, the razing of the existing non-conforming residential dwelling at 27 Whiting Street, as part of the proposed project, will allow for the construction of a commercial structure that is consistent with the character of the other commercial properties along Route 53 in the Business District B.

IV. Conclusion

For the reasons set forth above, Petitioner respectfully asserts that its application seeking Site Plan Approval, under Sections IV-B.6, a & b, satisfies the standards at Section I-I (6) of the Hingham Zoning By-Law.

Date: May 4, 2020

Respectfully submitted,

SIGNATURE: _____

Jeffery A. Tocchio, Esq., for Petitioner
Drohan Tocchio & Morgan, P.C.
175 Derby Street, Suite 30
Hingham, MA 02043
Telephone No. (781) 749-7200
jtocchio@dtm-law.com

TOWN OF HINGHAM PLANNING BOARD
210 CENTRAL STREET
HINGHAM, MA 02043

For instruction on how to complete, please see the Planning Board Regulations Relative to the Issuance of Special Permits and Site Plan Review, available at www.hingham-ma.com or at the Planning Board Office

APPLICATION FOR SPECIAL PERMIT A-3 **DATE** May 4, 2020

Parking Determination [X]

Parking Waiver [ ]

Flexible Residential Development [ ]

The undersigned hereby petitions the Hingham Planning Board for a Special Permit A-3.

Subject Property 19 & 27 Whiting Street, Hingham, MA Zoning District Business B

Petitioner's Name: Merhej and Sons Realty, LLC, c/o Jeffery Tocchio, Esq.

Petitioner's Address: 175 Derby Street, Suite 30, Hingham, MA

Brief Description of Work:

Petitioner proposes to redevelop and construct a new retail building at the properties located at 19 & 27 Whiting Street, Hingham.

Ownership and Contact Information

The undersigned is __X__ the owner of the subject property, or __X__ the holder of a written option to purchase the subject property, or _____ the holder of a valid lease to the subject property. (In this last instance written authorization from the property owner must be submitted with the other application documents.)

Record title to the subject property stands in the name(s) Merhej and Sons Realty, LLC

Address of owner of record 87 Derby Street, Hingham, MA 02043

Title Reference:

(Unregistered land) Plymouth County Registry of Deeds, Book 48377, Page 84

(Registered land) Land Court Certificate of Title No. _____, Book _____, Page _____

State briefly what is currently on the premises:

The property at 19 Whiting Street consists of .42 +/- acres of land on the north-side of Whiting Street, and has operated since approximately 1960 as an independent automotive filling station with associated improvements. The property at 27 Whiting Street consists of 1.26+/- acres of land on the north-side of Whiting Street, abutting 19 Whiting Street to the west, and is improved with a single family dwelling with attached garage, and accessory shed.

Attorney, agent, or other representative acting for petitioner:

Name Jeffery A. Tocchio, Esq. Address 175 Derby Street, Suite 30 Hingham, MA 02043

Name _____ Address _____

Written evidence of agent's standing to represent petitioner may be requested.

Signed as a statement of fact under the pains and penalties of perjury, this 4th day of May 2020

SIGNATURE _____

PRINT Jeffery A. Tocchio, Esq.

Address 175 Derby Street, Suite 30, Hingham, MA 02043

Tel. No. (781) 749-7200 Email: jtocchio@dtm-law.com

SUPPLEMENT TO APPLICATION FOR SPECIAL PERMIT A3
19 & 27 Whiting Street
Merhej and Sons Realty, LLC

Introduction:

Petitioner, **Merhej and Sons Realty, LLC** ("Merhej" or "Petitioner"), requests issuance of a Special Permit A3 Parking Determination from the Planning Board, under Section V-A, (retail store and storage/warehousing), and such other relief/waivers as necessary, relating to redevelopment of the existing Hingham Gas filling station and construction of a new 2,531± s.f. retail convenience store located at **19 & 27 Whiting Street, Hingham**. Petitioner is the owner of the property at 19 Whiting Street, operated as an independent automotive filling station, and has a written option to purchase the abutting property at 27 Whiting Street. Petitioner seeks to redevelop the combined properties in order to construct a new 2,531± s.f. retail convenience store, replacing a small retail structure, and continue the filling station use. The proposed mixture of uses are classified under Section III-A of the Zoning By-Law and identified on the Site Plan filed herewith.

Background and Proposed Use

Petitioner incorporates the information set forth in the Supplement to Application for Site Plan Approval submitted herewith.

Parking Analysis

CHA analyzed the site and has configured the parking arrangement to capture the parking capacity and maximize the efficiency of the on-site circulation of vehicular traffic. As depicted on the accompanying plan prepared by CHA (attached as "Exhibit A"), and below parking table, the project proposes a total of sixteen (16) parking spaces to be provided with twelve (12) parking spaces to be located south of the convenient/retail store and an additional four (4) parking spaces to be located on the east side of the structure. Two (2) of the parking spaces are proposed to be handicap (van) accessible. A concrete, handicap accessible, sidewalk is proposed to separate the structure and the parking spaces. All internal drive aisles and parking spaces comply with applicable dimensional requirements. A loading area is provided in proximity to the northeasterly corner of the proposed building.

Use	Requirement	Proposed	Required
Retail Store	5 spaces/1000 SF of GFA	2,531 SF	13 spaces
Storage/Warehousing	1 space/1000 SF of GFA	2,000 SF	2 spaces
Motor Vehicle Service/ Filling Station	2 spaces per bay or work station	N/A	N/A
		Total Required	**15 Spaces**
		Total Provided	**16 Spaces**

In addition, CHA has analyzed the anticipated traffic conditions and Petitioner incorporates by reference the Traffic Memorandum, prepared by John G. Morgan Jr., P.E., PTOE, of CHA, submitted to the board, herewith. The proposed configuration will allow for full circulation of vehicular traffic on-site.

Access to the site is proposed to be provided via a total of three (3) curb-openings. The easterly curb-opening on 27 Whiting Street is proposed to be eliminated and the two (2) existing curb-openings associated with 19 Whiting Street will continue to provide access to the easterly half of the site. One of those curb-openings providing access to 19 Whiting Street is the curb-opening on 1217 Main Street which has been in existence since July 27, 1956, and the other is on 19 Whiting Street at the southwest corner of the property. One of the two existing curb cuts at 27 Whiting will be eliminated and a single westerly curb-opening will provide egress from the site and is proposed to be restricted to right-turn only for vehicles travelling westerly on Whiting Street.[1] Sixteen parking spaces are provided adjacent to the proposed building, with access to the building via a handicap accessible walkway. Access to the basement level storage area is provided via a driveway at the westerly side of the building, and accessed via a garage door opening. A dumpster, with enclosure and concrete pad, is proposed to be located behind the northeasterly portion of the building, and is accessed in the area of the proposed loading zone.[2]

CHA designed the grading of the lot, including ingress and egress, around the structures sidewalk which requires compliance with the Americans with Disabilities Act. As such, the parking lot grade is approximately 4.8%, slightly exceeding the 4% maximum grade as required by Section V-A(5)(l) of the Zoning By-Law, yet maintaining ADA compliance. It is impractical to meet the 4% design standard due to the existing grade points and property width, and Petitioner respectfully requests a minor waiver under Section V-A(6)(d-e)

The project proposes an asphalt parking lot with a comprehensive stormwater management system. A "greenscape" wastewater management system has been designed with a biodetention area in the location of an existing shed and paved driveway approximately 50' from the vegetated wetlands. Snow storage is proposed upland and south of the proposed biodetention area. Additionally, a stormwater catch basin is proposed on the southwesterly portion of the site proximate to the westerly curb cut.

Conclusion:

Petitioner respectfully asserts that the parking requirements will be met for the proposed construction of the retail convenience store and existing fueling station. Petitioner further requests that the Board's determination and approval of a Special Permit A3 require the striping of the sixteen (16) proposed parking spaces and incorporate the CHA Site Plan, "Hingham Gas #19 & 27 Whiting Street Hingham, MA," dated May 1, 2020.

[1] Whiting Street is a State Highway and Petitioner will require a State Highway Access Permit issued by MassDOT.

[2] The long-existing 1217 Main Street access drive shall remain, as will the drive opening at the southwest corner of the existing filling station at Whiting Street. Petitioner asserts that this proposal remains in compliance with Section III-B(3) of the By-Law limiting driveways to two (2) per street.

SIGNATURE: _____

Jeffery A. Tocchio, Esq., for Petitioner

Address Drohan Tocchio & Morgan, P.C.
175 Derby Street, Suite 30, Hingham, MA
Tel. No. (781) 749-7200

Date: May 4, 2020

Site Development Plans

Hingham Gas
#19 & 27 Whiting Street, Hingham, MA

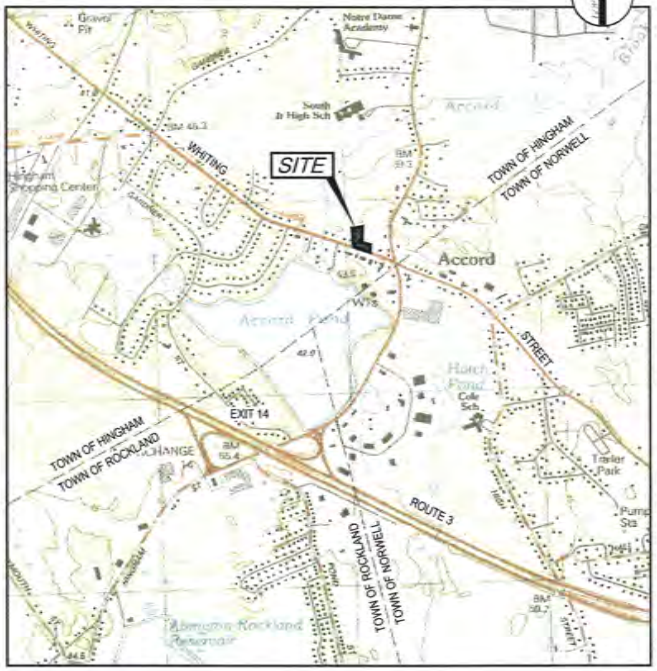
APPLICANT:
MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

CIVIL ENGINEER/ ARCHITECT:
CHA CONSULTING, INC.
141 LONGWATER DRIVE, SUITE 104
NORWELL, MA 02061

LEGAL COUNSEL:
DROHAN, TOCCHIO & MORGAN
175 DERBY STREET, SUITE 30
HINGHAM, MA 02043

LOCUS MAP

SCALE: 1" = 1000'



DRAWING INDEX

Sheet Number	Sheet Title
C-001	TITLE SHEET
C-002	NOTES & LEGEND
C-003	DEMOLITION & SEDIMENT CONTROL PLAN
C-101	SITE PLAN
C-201	GRADING & DRAINAGE PLAN
C-301	UTILITY PLAN
C-501	LANDSCAPE PLAN
C-601	SITE DETAILS
C-602	SITE DETAILS
C-603	SITE DETAILS
C-604	SITE DETAILS
C-605	SITE DETAILS
C-606	SITE DETAILS
C-607	SEPTIC DETAILS - 1
C-608	SEPTIC DETAILS - 2

SUPPLEMENTAL

Sheet Number	Sheet Title
V-101	EXISTING CONDITIONS PLAN
G-001	TEST PIT PLAN
G-002	RESOURCE AREA PLAN
G-003	SIGHT DISTANCE
--	ARCHITECTURE CONCEPT

OWNER/APPLICANT:

MERHEJ & SONS
REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING
STREET
HINGHAM, MA 02043

No.	Submittal / Revision	Appr'd	By	Date
	PERMIT SET	KK	JM	5/1/2020

TITLE SHEET

Designed By: DR/BN	Drawn By: DR/BN	Checked By: KK
Issue Date: 05/01/2020	Project No: 060903	Scale: AS SHOWN

Drawing No.:
C-001

GENERAL

1. PROTECTION:
   a. PROVIDE PROTECTION NECESSARY TO PREVENT DAMAGE TO EXISTING IMPROVEMENTS, YIELD OR VEGETATION.
   b. PROTECT IMPROVEMENTS ON ADJOINING PROPERTIES AND ON OWNERS PROPERTY.
   c. RESTORE DAMAGED IMPROVEMENTS TO ORIGINAL CONDITION AS ACCEPTABLE TO PARTIES HAVING JURISDICTION.
2. CONDUCT OPERATIONS TO ENSURE MINIMUM INTERFERENCE WITH OPERATIONS, STREETS, WALKS, AND OTHER ADJACENT FACILITIES. DO NOT CLOSE OR OBSTRUCT STREETS, WALKS OR OTHER OCCUPIED OR USED FACILITIES WITHOUT PERMISSION FROM AUTHORITIES HAVING JURISDICTION. STREETS AND ROADWAYS SHALL BE THOROUGHLY CLEANED AND OR SWEPT ON A DAILY BASIS OR MORE FREQUENTLY AS REQUIRED BY THE GOVERNING AUTHORITY.
3. UNLESS SPECIFIED OTHERWISE ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE MASSACHUSETTS DOT SPECIFICATIONS FOR HIGHWAYS AND BRIDGES AND OR THE APPROPRIATE LOCAL AUTHORITIES.
4. ALL SLOPES, UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION AS SOON AS POSSIBLE TO PREVENT EROSION INTO WETLAND RESOURCE AREAS, WATTING PROPERTIES, OR PUBLIC WAYS. EROSION CONTROL BLANKETS ARE REQUIRED FOR ALL SLOPES 15% OR GREATER.
5. ANY DEVIATIONS, I.E. "FIELD CHANGES" FROM THE DESIGN PLANS MUST BE APPROVED BY THE OBSERVATIONS ENGINEER IN WRITING. CONTRACTOR SHOULD BE AWARE THAT LOCAL AND STATE AUTHORITIES HAVE JURISDICTION AND APPROVALS MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY PRIOR TO THE IMPLEMENTATION OF THE "FIELD CHANGE". CHA, INC. ASSUMES NO LIABILITY OR RESPONSIBILITY FOR WORK ASSOCIATED WITH FIELD CHANGES COMPLETED WITHOUT REGARD TO THE "FIELD CHANGE" PROCEDURE.
6. RELOCATION OF ANY UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH THE PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.
7. ***ONE-SAFE NOTE:*** IN ACCORDANCE WITH MGL. CH. 82, SEC. 40 INCLUDING AMENDMENTS, ALL CONTRACTORS SHALL NOTIFY DIGSAFE (MASS. ONE-CALL) IN WRITING OF THE INTENT TO EXCAVATE, BLAST, DEMOLISH, GRADE, OR PERFORM OTHER EARTH-MOVING OPERATIONS NO LESS THAN 72 HOURS AND NO MORE THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF SUCH WORK (EXCLUSIVE OF SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS) BY CALL "DIG SAFE" AT 1-888-DIG-SAFE.
8. ADDITIONAL BENCHMARKS TO BE SET BY CONTRACTOR PRIOR TO CONSTRUCTION TO ENSURE QUALITY WORKMANSHIP.
9. ANY SETTLING BASIN OR DETENTION BASINS SHOULD RECEIVE PERIODIC MAINTENANCE DURING CONSTRUCTION TO REMOVE DEPOSITED SILTS AND DEBRIS TO ENSURE PROPERTY DRAINAGE AND SETTLING OF PARTICULATE MATTER.
10. ALL MANHOLE COVERS FOR CROSS-COUNTRY LOCATIONS OR IN PUBLIC GATHERING LOCATIONS SHALL BE FITTED WITH A BOLT LOCKS OR EQUIVALENT.
11. UNLESS OTHERWISE LABELED, ALL REINFORCED CONCRETE PIPE, RCP, SHALL BE CLASS V, ALL DUCTILE IRON PIPE SHALL BE CEMENT LINED CLASS 52. ALL PVC SEWER SHALL BE SDR 35. ALL HDPE PIPE TO BE HDPE STORM (AASHTO M294 - CORP.).

SITE DEMOLITION, EROSION & SEDIMENTATION CONTROL

1. ALL TEMPORARY STOCKPILE AREAS SHALL HAVE EROSION CONTROLS (HAYBALES AND SILT FENCE) AROUND THE PERIMETER.
2. UNDERGROUND UTILITIES MAY EXIST THAT ARE NOT SHOWN ON THIS PLAN. DIG SAFE MUST BE NOTIFIED (1-888-344-7233) AT LEAST 72 HOURS PRIOR TO ANY CONSTRUCTION.
3. ALL SEDIMENTATION AND EROSION CONTROL MEASURES SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD. SEDIMENTATION AND EROSION CONTROL MEASURES SHALL BE IN PLACE AND OBSERVED PRIOR TO ANY WORK BEING DONE ON THE PROJECT.
4. SITE ENTRY AND EXIT LOCATIONS SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC ROADWAYS. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ON A PUBLIC ROADWAY MUST BE REMOVED IMMEDIATELY. WHEN WASHING IS REQUIRED TO REMOVE SEDIMENT PRIOR TO ENTRANCE TO A PUBLIC ROADWAY, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN. ALL FINES IMPOSED FOR TRACKING ONTO PUBLIC ROADS SHALL BE PAID BY THE CONTRACTOR.
5. TEMPORARY SEEDING OR OTHER METHOD OF STABILIZATION SHALL BE INITIATED WITHIN 14 DAYS OF THE LAST DISTURBANCE ON ANY AREA OF THE SITE, UNLESS ADDITIONAL CONSTRUCTION OF THE AREAS IS EXPECTED WITHIN 21 DAYS OF THE LAST DISTURBANCE.
6. UPON COMPLETION OF FINE GRADING, ALL AREAS NOT OTHERWISE PERMANENTLY STABILIZED SHALL BE SEEDED AND MAINTAINED UNTIL A UNIFORM COVERAGE OF 75% MINIMUM DENSITY, AS DETERMINED BY THE OWNER'S REPRESENTATIVE, IS ACHIEVED.
7. MAINTENANCE - EROSION CONTROLS SHALL BE REPAIRED OR REPLACED AS INSPECTION DEEMS NECESSARY OR AS DIRECTED BY THE ENGINEER OR ARCHITECT. ACCUMULATED SILT AT ANY EROSION CONTROL DEVICE SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6". HAY SHALL BE DISTRIBUTED ON-SITE IN A MANNER NOT CONTRIBUTING TO ADDITIONAL SILTATION.
8. ANY CONTRACTOR IS RESPONSIBLE FOR INSECTING ANY EROSION CONTROL DEVICE, WHICH HE DISTURBS. EACH CONTRACTOR SHALL NOTIFY THE ENGINEER/ARCHITECT OF ANY DEFICIENCIES IN THE ESTABLISHED EROSION CONTROL MEASURES WHICH MAY LEAD TO UNANTICIPATED DISCHARGE OR STORM WATER POLLUTION. SEDIMENTATION OR OTHER POLLUTANTS. UNANTICIPATED POLLUTANTS INCLUDE, BUT ARE NOT LIMITED TO, EXCESS CONCRETE DUMPING OR CONCRETE RESIDUE, PAINTS, SOLVENTS, GREASE, FUEL AND LUBE OIL, PESTICIDES, ANY SOLID WASTE MATERIALS.
9. ALL SIDE SLOPES SHALL BE SEEDED WITH GRASS OR INSTALL JUTE MATTING TO PREVENT EROSION. SIDE SLOPES ALONG THE PERIMETER OF THE DEVELOPED AREA SHALL BE STABILIZED IMMEDIATELY FOLLOWING CONSTRUCTION.
10. MAINTENANCE - EROSION CONTROLS SHALL BE REPAIRED OR REPLACED AS INSPECTION DEEMS NECESSARY OR AS DIRECTED BY THE ENGINEER OR ARCHITECT. ACCUMULATED SILT AT ANY EROSION CONTROL DEVICE SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6". HAY SHALL BE DISTRIBUTED ON-SITE IN A MANNER NOT CONTRIBUTING TO ADDITIONAL SILTATION.
11. INSPECTIONS: INSPECTIONS ARE TO BE PERFORMED BY QUALIFIED PERSONNEL. DISTURBED AREAS THAT HAVE NOT BEEN FINALLY STABILIZED, AREAS USED FOR STORAGE, STRUCTURAL CONTROL MEASURES, AND LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE, MUST BE INSPECTED ONCE EVERY 7 DAYS AND WITHIN 24 HOURS OF A STORM EVENT OF 0.5 INCHES OR GREATER. STABILIZED AREAS ARE TO BE INSPECTED ONCE PER MONTH. DISTURBED AREAS AND STORAGE AREAS EXPOSED TO PRECIPITATION SHALL BE INSPECTED FOR EVIDENCE OF, OR POTENTIAL FOR, POLLUTANTS ENTERING THE DRAINAGE SYSTEM. CONTROL MEASURES SHALL BE OBSERVED TO ENSURE THEY ARE WORKING PROPERLY. DISCHARGE LOCATIONS AND POINTS SHALL BE INSPECTED TO ASCERTAIN WHETHER CONTROLS ARE PREVENTING SIGNIFICANT IMPACT. BASED ON THE RESULTS OF THE ABOVE INSPECTIONS, ANY NECESSARY CHANGES TO THE PLAN WILL BE MADE WITHIN 7 DAYS OF THE INSPECTION. THE CHANGES MUST BE IMPLEMENTED IN THE FIELD BEFORE THE NEXT STORM EVENT IF PRACTICABLE, OTHERWISE AS SOON AS POSSIBLE.
12. INSTALL AND MAINTAIN CATCH BASIN INSERTS IN ALL PROPOSED CATCH BASINS.
13. PROVIDE TEMPORARY SEDIMENTATION BASINS, HAY BALES, ETC., AS NECESSARY.
14. STOCKPILES MAY NOT BE AT LEAST 100 FEET FROM WETLAND AREAS. STOCKPILES NOT TO BE RELOCATED WITHIN 30 DAYS ARE TO BE STABILIZED WITH SEED OR MULCH.
15. POTENTIAL STOCKPILE AREA TO BE PROTECTED WITH EROSION CONTROL MEASURES.
16. THE CONTRACTOR SHALL HAVE A WATER TRUCK ON-SITE AT ALL TIMES AND SHALL PROVIDE TEMPORARY PLANTINGS OR OTHER COVERINGS SUCH AS WOOD CHIPS TO MINIMIZE THE AMOUNT OF DUST LEAVING THE PREMISES.
17. SUBJECT TO ORDER OF CONDITIONS BY HINGHAM CONSERVATION COMMISSION.

SITE WORK

1. CAUTION - NOTICE TO CONTRACTOR:

   THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON DESIGN PLANS AND LIMITED AS-BUILT INFORMATION. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS (EXCLUSIVE OF SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS) PRIOR TO ANY EXCAVATION, BLASTING, DEMOLITION, BORING, OR OTHER EARTH-MOVING OPERATIONS TO REQUEST EXACT FIELD LOCATIONS OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS AT NO ADDITIONAL EXPENSE TO OWNER.
2. FILL MATERIAL
3. ENSURE THAT AREAS TO BE FILLED ARE FREE OF STANDING WATER, FROST, FROZEN MATERIAL, TRASH, AND DEBRIS PRIOR TO FILL PLACEMENT.
4. PLACE APPROPRIATE FILL MATERIAL AS DESIGNATED BY THE GEOTECHNICAL ENGINEER IN HORIZONTAL LAYERS NOT EXCEEDING EIGHT INCHES (8") IN LOOSE DEPTH AND COMPACT EACH LAYER AT OPTIMUM MOISTURE CONTENT TO 95% GREATER OF:
   a. (1) ADJACENT UNDISTURBED SOIL, OR
   b. (2) 95% OF THE MAXIMUM DRY DENSITY OF THE EMBANKMENT MATERIAL AS DETERMINED BY ASHTO STANDARD METHOD T99, METHOD C.
5. FINISH GRADING:
6. GRADE ALL AREAS WHERE FINISH GRADE ELEVATIONS ARE INDICATED ON DRAWINGS, OTHER THAN PAVED AREAS AND BUILDINGS, INCLUDING EXCAVATED AREAS, FILLED AND TRANSITION AREAS, AND LANDSCAPED AREAS. GRADED AREAS SHALL BE UNIFORM AND SMOOTH, FREE FROM DEBRIS, OR IRREGULAR SURFACE CHANGES. FINISHED SUBGRADE SURFACE SHALL NOT BE MORE THAN 0.10 FEET ABOVE OR BELOW ESTABLISHED SUBGRADE ELEVATIONS, AND ALL GROUND SURFACES SHALL VARY UNIFORMLY BETWEEN INDICATED ELEVATIONS. FINISH DITCHES SHALL BE GRADED TO ALLOW FOR PROPER DRAINAGE WITHOUT PONDING AND BE A MANNER THAT WILL MINIMIZE EROSION POTENTIAL.
7. GRADE SURFACE TO MATCH ADJACENT GRADES AND TO PROVIDE FLOW TO SURFACE DRAINAGE STRUCTURES, OR GRADE AS DESIGNATED ON THE PLANS AFTER FILL PLACEMENT AND COMPACTION.
8. THE CONTRACTOR IS RESPONSIBLE FOR GENERAL CLEANUP OF THE PROJECT ON A DAILY BASIS AND AT THE COMPLETION OF THE PROJECT. OPEN TRENCHES, EXCAVATIONS, ETC. SHALL NOT BE PERMITTED TO BE LEFT OPEN OVERNIGHT. CONTRACTOR SHALL BACKFILL OR UTILIZE SUITABLE STEEL PLATES FOR THE REMAINDER OF THE PROJECT SITE PRIOR TO CEASING WORK EACH DAY.
9. APPROPRIATE TRAFFIC CONTROL, I.E. SIGNAGE, BARRICADES, AND OTHER MEANS, WILL BE SUPPLIED BY THE CONTRACTOR IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL AGENCIES AT NO ADDITIONAL COST TO THE OWNER.
10. UNDER NO CIRCUMSTANCES MAY ANY UTILITY, STRUCTURE, AND/OR REPAIR BE BACKFILLED UNLESS INSPECTED AND APPROVED BY THE TOWN OFFICIALS AND/OR REPRESENTATIVE. RECEIPT OF APPROVAL TO BACKFILL WILL NOT RELEASE THE CONTRACTOR FROM ANY RESPONSIBILITY OR LIABILITY FOR PERFORMANCE TESTS REQUIRED AS PART OF THIS PROJECT.
11. PROPER SHORING AND TRENCH BOXES SHALL BE UTILIZED AS REQUIRED BY LOCAL, STATE, AND FEDERAL REGULATORY AGENCIES TO PROVIDE A SAFE WORKING ENVIRONMENT. SHORING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF MASSACHUSETTS WITH EXPERIENCE IN SHORING DESIGN.
12. ALL UTILITIES DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED BY THE CONTRACTOR IN ACCORDANCE WITH THE APPLICABLE UTILITY REGULATION AT NO ADDITIONAL COST TO THE OWNER.
13. WATER
    a. ALL WATER PIPING, VALVES, HYDRANTS, AND FITTINGS ETC. TO CONFORM TO LOCAL SPECIFICATIONS OR AS DIRECTED BY THE WATER DEPARTMENT. CONSTRUCTION OF WATER LINE TO CONFORM TO ALL LOCAL AND STATE AGENCIES HAVING JURISDICTION.
    b. ALL WATER PIPE SHALL BE TO BE MINIMUM CLASS 52 DUCTILE IRON. ALL PIPES AND FITTINGS SHALL HAVE A CEMENT LINING THICKER THE THICKNESS SPECIFIED IN ANSI A21.4 AND SHALL HAVE A BITUMINOUS SEAL COAT APPLIED INSIDE AND OUTSIDE CONFORMING TO ANSI A21.4. TYTON OR MECHANICAL JOINTS ARE PERMITTED UNLESS OTHERWISE DIRECTED.
    c. REFER TO PLUMBING PLANS FOR WATER SERVICE, FIRE PROTECTION, AND SANITARY SEWER CONNECTIONS UNLESS OTHERWISE NOTED.
    d. CONTRACTOR SHALL OBTAIN APPROVAL FOR ALL FIRE DEPARTMENT CONNECTIONS FROM THE FIRE DEPARTMENT PRIOR TO CONSTRUCTION.

WATER TESTING

1. THESE NOTES ARE INTENDED TO SUPPLEMENT THE LOCAL REQUIREMENTS FOR MATERIALS AND WORKMANSHIP.
2. REQUIRED TESTS FOR WATERLINES AND SEWER MAINS:
   a. PERFORM THE FOLLOWING AFTER THE PIPE HAS BEEN INSTALLED AND PRIOR TO FINAL ACCEPTANCE:
   a.1. PRESSURE TEST / a.2. LEAKAGE TEST.
3. PRESUMPTIVE HYDROSTATIC TESTS MAY BE PERFORMED WHEN THE SYSTEM IS PARTIALLY BACKFILLED TO "CHECK" THE WORK, BUT FINAL ACCEPTANCE SHALL BE BASED ON HYDROSTATIC TESTS PERFORMED ON THE FINISHED SYSTEM AFTER IT IS COMPLETELY BACKFILLED.
4. PRESSURE TEST:
   a. TEST PIPING TO 1.5 TIMES THE PIPE WORKING PRESSURE OR 150 PSI, WHICHEVER IS GREATER, MEASURE TEST PRESSURES AT THE LOWEST POINT OF THE PIPE SECTION AND CORRECT TO THE ELEVATION OF THE GAUGE.
   b. RELIEVE TRAPPED AIR AT THE SECTION HIGH POINTS THROUGH HYDRANTS, OR TAPS INSTALLED FOR THIS PURPOSE. PROVIDED TEMPORARY INSTALLATIONS ARE REMOVED AND PLUGGED AFTER ACCEPTANCE.
   c. MAINTAIN THE TEST PRESSURE FOR A PERIOD OF TWO (2) HOURS. AT THE END OF THE TEST PERIOD IF THE TEST PRESSURE REMAINS CONSTANT, THE PIPE SECTION SHALL HAVE PASSED THE TEST. IF THE PRESSURE HAS DROPPED, IT SHALL BE BROUGHT BACK TO THE TEST PRESSURE BY PUMPING A KNOWN VOLUME OF WATER (BY PUMPING FROM A GRADUATED CONTAINER OR BY METERING BACK INTO THE PIPE. THE VOLUME OF WATER THUS USED, REPRESENTING LEAKAGE FROM THE PIPE, SHALL BE RECORDED. IF THE LEAKAGE IS LESS THAN THE ALLOWABLE LEAKAGE SPECIFIED BELOW, THE PIPE SHALL HAVE PASSED THE TEST. IF THE LEAKAGE EXCEEDS THE ALLOWABLE LEAKAGE SPECIFIED, THE CONTRACTOR SHALL LOCATE THE LEAK, PERMANENTLY REPAIR THE SECTION OF PIPE WHERE THE LEAK IS OCCURRING TO THE SATISFACTION OF THE ENGINEER, AND RETEST THE MAIN AS SPECIFIED ABOVE.
5. LEAKAGE TEST:
   a. CONDUCT THE LEAKAGE TESTS CONCURRENTLY WITH THE PRESSURE TEST.
   b. THE MAXIMUM ALLOWED LEAKAGE IS DETERMINED BY THE FOLLOWING FORMULA:

      $L = \frac{S \times D \times P^{0.5}}{7400}$ WHERE: L = ALLOWABLE LEAKAGE, IN GPH; WHERE N = NO. OF JOINTS IN TEST SECTION
      WHERE D = NOMINAL PIPE DIAMETER, IN INCHES; WHERE P = AVERAGE TEST PRESSURE, IN PSIG
6. ACCEPTANCE SHALL BE DETERMINED ON THE BASIS OF ALLOWABLE LEAKAGE. IF ANY PIPE SECTION DISCLOSES LEAKAGE GREATER THAN THAT SPECIFIED, LOCATE, REPAIR AND REPEAT UNTIL THE LEAKAGE IS WITHIN THE LIMITS SPECIFIED.
7. MAKE ALL VISIBLE LEAKS TIGHT REGARDLESS OF THE AMOUNT OF LEAKAGE, AND IF THE LINES DO NOT MEET THE ABOVE LEAKAGE TEST, REPAIR AND RETEST AS NECESSARY UNTIL THE LEAKAGE REQUIREMENT IS MET. REPAIR OR REPLACE ALL DEFECTIVE WORK.

DISINFECTION OF POTABLE WATER MAINS:

1. DISINFECT ALL POTABLE WATER MAINS IN ACCORDANCE WITH THE LATEST VERSION OF AWWA C651. EXCEPT THAT THE PLACEMENT OF CHLORINE POWDER OR TABLETS INSIDE THE PIPE DURING INSTALLATION SHALL NOT BE ALLOWED. DISINFECT WATER MAINS AFTER THE PIPING HAS PASSED THE PRESSURE AND LEAKAGE TESTING.
2. FLUSH THE PIPE WITH WATER AT A MINIMUM VELOCITY OF 2.5 FEET PER SECOND (FPS) TO CLEAR ALL FOREIGN MATERIAL FROM THE PIPE.
3. APPLY A CHLORINE SOLUTION WITH A CONCENTRATION BETWEEN 50 PARTS PER MILLION (PPM) AND 100 PPM. THE CHLORINE SOLUTION SHALL REMAIN IN THE PIPING FOR A MINIMUM OF 24 HOURS. THE CONCENTRATION AT THE END OF THIS PERIOD SHALL BE AT LEAST 25 PPM IN ALL SECTIONS OF THE MAIN. REPEAT THE ENTIRE PROCEDURE IF THE RESIDUAL IS LESS THAN 25 PPM.
   a. WHILE THE CHLORINATED WATER IS BEING ADDED, ALL APPURTENANCES (VALVES, HYDRANTS, ETC.) SHALL BE OPERATED SO AS TO COMPLETELY DISINFECT THE NEW WORK.
   b. POSITION VALVES SO THAT THE CHLORINE SOLUTION IN THE SECTION BEING DISINFECTED WILL NOT FLOW INTO WATER MAINS IN ACTIVE SERVICE.
   c. CHLORINE RESIDUAL SAMPLES SHALL BE TAKEN AS DIRECTED BY THE ENGINEER.
4. AFTER THE TWENTY FOUR (24) HOUR RETENTION PERIOD, FLUSH THE MAIN UNTIL RESIDUAL TESTING INDICATES THAT THE CHLORINE CONCENTRATION IS APPROXIMATELY THAT OF THE RECONDITIONED SERVICE AREA.
   a. DISPOSE OF HEAVILY CHLORINATED WATER INTO SANITARY SEWER OR TANK TRUCK.
   b. THE OWNER AND THE OWNER OF THE SANITARY SEWER SYSTEM SHALL BE NOTIFIED A MINIMUM OF TWENTY-FOUR (24) HOURS PRIOR TO THE DISCHARGE OF ANY WATER TO THE SANITARY SEWER. CONTRACTOR SHALL SUBMIT TO THE ENGINEER WRITTEN CONFIRMATION THAT THE OWNER OF SANITARY SEWER SYSTEM HAS APPROVED THE DISCHARGE OF WATER TO ITS SANITARY SEWER.
   c. UNDER NO CIRCUMSTANCES WILL THE EMPTYING OF WATER ONTO ROADWAYS, OR INTO DITCHES, CULVERTS, STREAMS OR WETLANDS BE ALLOWED.
5. AFTER DISINFECTION AND FINAL FLUSHING, AND PRIOR TO PLACING THE LINES IN SERVICE, THE CONTRACTOR SHALL COLLECT BACTERIOLOGICAL SAMPLES (BOTH COLIFORM AND HETEROTROPHIC PLATE COUNT) AND SUBMIT SAMPLES TO AN APPROVED TESTING LABORATORY. TWO CONSECUTIVE SETS OF SAMPLES SHALL BE TAKEN AT LEAST 24 HOURS APART IN ACCORDANCE WITH AWWA C651. THE COLLECTION POINTS SHALL BE AS DIRECTED BY THE ENGINEER AND LOCAL AUTHORITY HAVING JURISDICTION.
   a. THE TESTING LABORATORY PERFORMING THE BACTERIOLOGICAL ANALYSIS SHALL BE ACCEPTABLE TO THE ENGINEER.
   b. SUBMIT THREE (3) COPIES OF THE LABORATORY ANALYSES TO THE ENGINEER.
   c. SHOULD SAFE RESULTS NOT OCCUR AFTER LABORATORY TESTS, THE CONTRACTOR SHALL, AT HIS EXPENSE, REPEAT THE DISINFECTION PROCEDURE UNTIL SAFE RESULTS ARE OBTAINED. THIS INCLUDES A POSITIVE RESULT FOR COLIFORM OR A MEASURED HETEROTROPHIC PLATE COUNT OF GREATER THAN 500 COLONY FORMING UNITS PER ML.
   d. CONTRACTOR SHALL PAY FOR ALL TESTING REQUIRED.
6. ALL PRECAUTION SHALL BE TAKEN TO MAINTAIN DRY AND SANITARY CONDITIONS AND PREVENT CONTAMINATION OF ANY PIPING. IF, IN THE OPINION OF THE ENGINEER, CONTAMINATION HAS OCCURRED, THE CONTRACTOR SHALL REPEAT THE DISINFECTION PROCEDURE AND TESTING AT HIS COST AND EXPENSE.
7. ALL TESTING SHALL COMPLY TO THE TOWN, DPW, MWA REQUIREMENTS.

LEGEND - EXISTING

	LOCUS PROPERTY LINE		ELECTRIC TRANSFORMER
	RIGHT OF WAY LINE		ELECTRIC CONDUIT
	ABUTTER LINE		ELECTRIC HAND HOLE
	LEASE LINE		ELECTRIC METER
	MAJOR CONTOUR		UTILITY POLE W/RISER
	MINOR CONTOUR		GUY ANCHOR AND WIRE
	OVERHEAD WIRE		LIGHT POLE
	CHAIN LINK FENCE (CLF)		GROUND LIGHT
	WOODEN FENCE (WDF)		MONITORING WELL
	UNDERGROUND WATER LINE		DECIDUOUS TREE
	UNDERGROUND DRAIN LINE		ARBORVITAE TREE
	UNDERGROUND GAS LINE		DO NOT ENTER SIGN
	UNDERGROUND ELECTRIC LINE		IRRIGATION CONTROL VALVE
	UNDERGROUND SEWER LINE		PEDESTRIAN CROSSING
	UNDERGROUND TELEPHONE LINE		FINISH FLOOR ELEVATION
	SPOT ELEVATION		EDGE OF PAVEMENT
	CATCH BASIN		CONCRETE CURB
	DRAIN MANHOLE		GRANITE CURB
	SEWER MANHOLE		CONCRETE WALK
	TELEPHONE MANHOLE		CONCRETE
	ELECTRIC MANHOLE		CONCRETE RETAINING WALL
	GAS METER		METAL HANDRAIL
	WALL HYDRANT		ROOF OVERHANG
	HYDRANT		SINGLE YELLOW LINE
	DOWN SPOUT		ABOVE GROUND
	GAS GATE		STONE BOUND/CONC. BOUND W/DRILL HOLE
	WATER GATE		

LEGEND - PROPOSED

	MAJOR CONTOUR		STORM SEWER DRAIN BASIN
	MINOR CONTOUR		STORM MANHOLE
	DOMESTIC WATER		HYDRANT ASSEMBLY
	FIRE PROTECTION		LINE VALVE
	UNDERGROUND ELECTRIC		POST INDICATOR VALVE
	SANITARY SEWER		SANITARY MANHOLE
	FORCEMAIN		ELECTRIC MANHOLE
	STORM SEWER		DRILL HOLE
	BIORETENTION LIMIT LINE		CONCRETE BOUND W/DRILL HOLE
	NATURAL GAS		
	CHAINLINK FENCE		

CHA

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

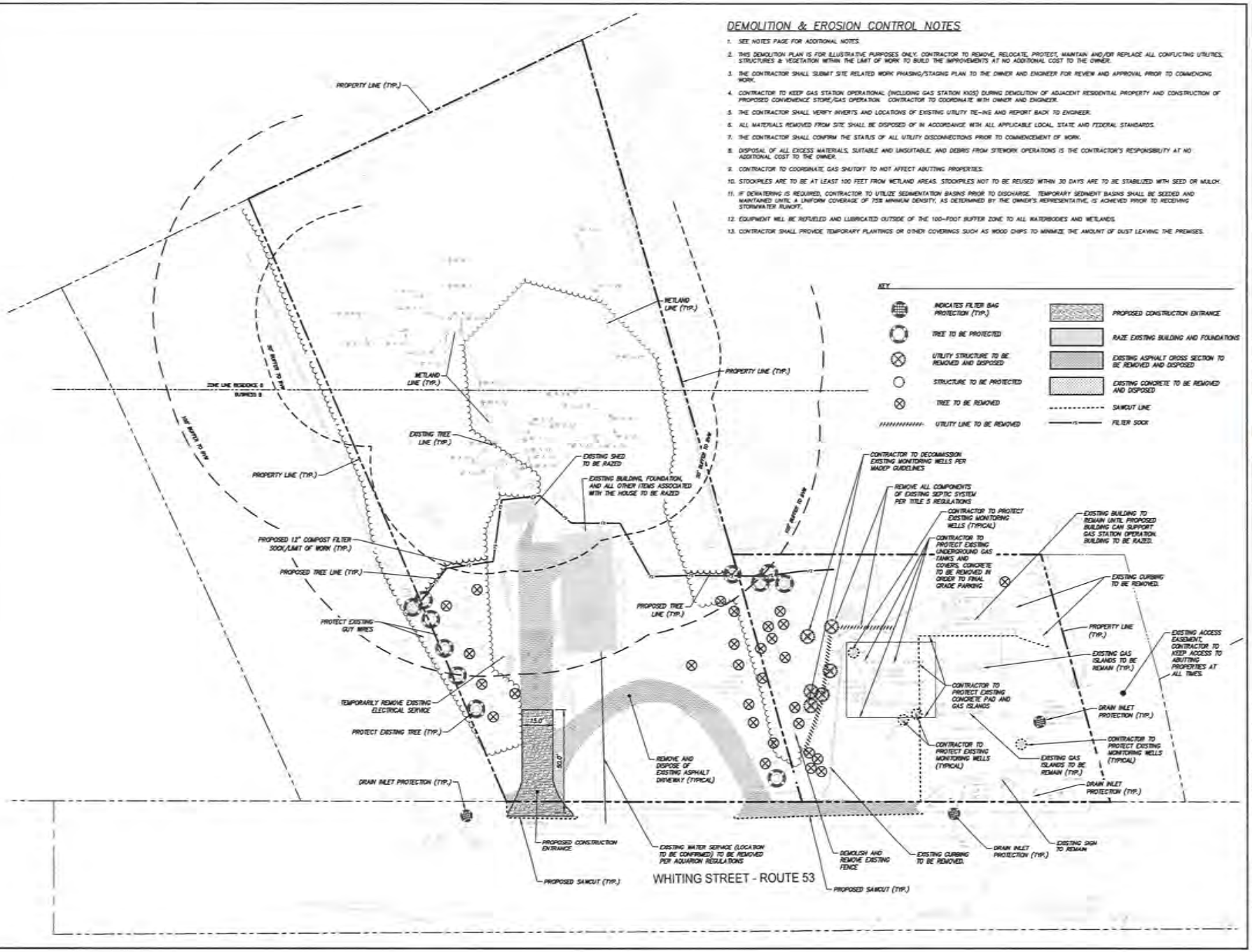
No.	Submittal / Revision	Appd.	By	Date
1	PERMIT SET	KK	AL	5/1/2020

NOTES & LEGEND

Designed By:	Drawn By:	Checked By:
CRUSN	CRVSN	KK
Issue Date:	Project No:	Scale:
05/01/2020	000003	NONE

Drawing No.:

C-002



DEMOLITION & EROSION CONTROL NOTES

1. SEE NOTES PAGE FOR ADDITIONAL NOTES.
2. THIS DEMOLITION PLAN IS FOR ILLUSTRATIVE PURPOSES ONLY. CONTRACTOR TO REMOVE, RELOCATE, PROTECT, MAINTAIN AND/OR REPLACE ALL CONFLICTING UTILITIES, STRUCTURES & VEGETATION WITHIN THE LIMIT OF WORK TO BUILD THE IMPROVEMENTS AT NO ADDITIONAL COST TO THE OWNER.
3. THE CONTRACTOR SHALL SUBMIT SITE RELATED WORK PHASING/STAGING PLAN TO THE OWNER AND ENGINEER FOR REVIEW AND APPROVAL PRIOR TO COMMENCING WORK.
4. CONTRACTOR TO KEEP GAS STATION OPERATIONAL (INCLUDING GAS STATION KIOS) DURING DEMOLITION OF ADJACENT RESIDENTIAL PROPERTY AND CONSTRUCTION OF PROPOSED CONVENIENCE STORE/GAS OPERATION. CONTRACTOR TO COORDINATE WITH OWNER AND ENGINEER.
5. THE CONTRACTOR SHALL VERIFY INVERTS AND LOCATIONS OF EXISTING UTILITY TIE-INS AND REPORT BACK TO ENGINEER.
6. ALL MATERIALS REMOVED FROM SITE SHALL BE DISPOSED OF IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL STANDARDS.
7. THE CONTRACTOR SHALL CONFIRM THE STATUS OF ALL UTILITY DISCONNECTIONS PRIOR TO COMMENCEMENT OF WORK.
8. DISPOSAL OF ALL EXCESS MATERIALS, SUITABLE AND UNSUITABLE, AND DEBRIS FROM SITEWORK OPERATIONS IS THE CONTRACTOR'S RESPONSIBILITY AT NO ADDITIONAL COST TO THE OWNER.
9. CONTRACTOR TO COORDINATE GAS SHUTOFF TO NOT AFFECT ABUTTING PROPERTIES.
10. STOCKPILES ARE TO BE AT LEAST 100 FEET FROM WETLAND AREAS. STOCKPILES NOT TO BE REUSED WITHIN 30 DAYS ARE TO BE STABILIZED WITH SEED OR MULCH.
11. IF DEWATERING IS REQUIRED, CONTRACTOR TO UTILIZE SEDIMENTATION BASINS PRIOR TO DISCHARGE. TEMPORARY SEDIMENT BASINS SHALL BE SEEDED AND MAINTAINED UNTIL A UNIFORM COVERAGE OF 75% MINIMUM DENSITY, AS DETERMINED BY THE OWNER'S REPRESENTATIVE, IS ACHIEVED PRIOR TO RECEIVING STORMWATER RUNOFF.
12. EQUIPMENT WILL BE REFUELED AND LUBRICATED OUTSIDE OF THE 100-FOOT BUFFER ZONE TO ALL WATERBODIES AND WETLANDS.
13. CONTRACTOR SHALL PROVIDE TEMPORARY PLANTINGS OR OTHER COVERINGS SUCH AS WOOD CHIPS TO MINIMIZE THE AMOUNT OF DUST LEAVING THE PREMISES.

KEY

- INDICATES FILTER BAG PROTECTION (TYP.)
- TREE TO BE PROTECTED
- UTILITY STRUCTURE TO BE REMOVED AND DISPOSED
- STRUCTURE TO BE PROTECTED
- TREE TO BE REMOVED
- UTILITY LINE TO BE REMOVED
- PROPOSED CONSTRUCTION ENTRANCE
- RAZE EXISTING BUILDING AND FOUNDATIONS
- EXISTING ASPHALT CROSS SECTION TO BE REMOVED AND DISPOSED
- EXISTING CONCRETE TO BE REMOVED AND DISPOSED
- SAWCUT LINE
- FILTER SOCK

Scale In Feet: 0, 20, 40

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HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

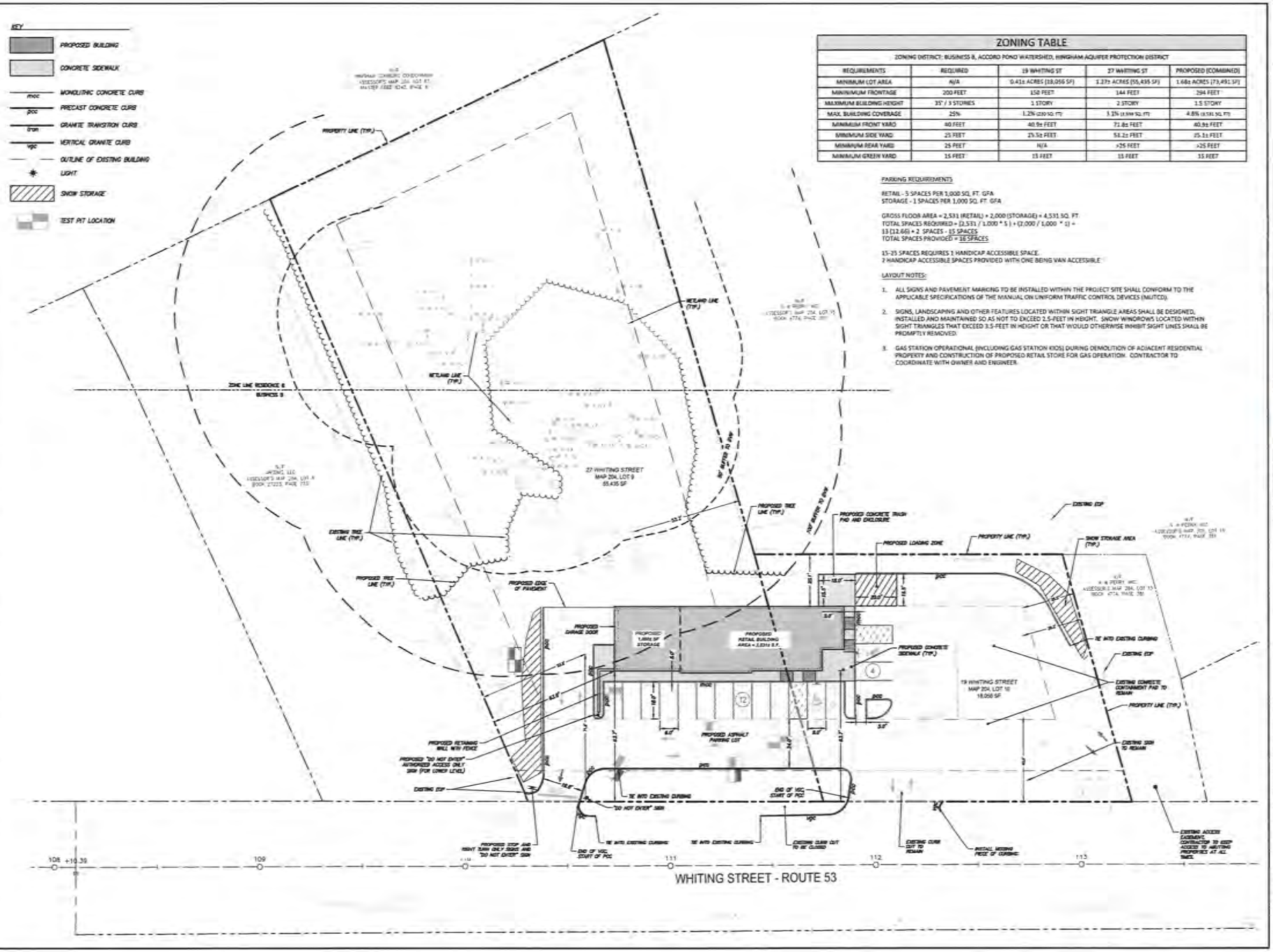
No.	Submittal / Revision	Appvd. By	Date
1	PERMIT SET	KK	JM 5/1/2020

DEMOLITION & SEDIMENT CONTROL PLAN

Designed By: DAVMH	Drawn By: DAVMH	Checked By: KK
Issue Date: 05/01/2020	Project No: 060993	Scale: 1" = 20'

Drawing No.:

C-003



ZONING TABLE

ZONING DISTRICT: BUSINESS B, ACCORD POND WATERSHED, HINGHAM AQUIFER PROTECTION DISTRICT

REQUIREMENTS	REQUIRED	19 WHITING ST	27 WHITING ST	PROPOSED (COMBINED)
MINIMUM LOT AREA	n/a	0.41± ACRES (18,056 SF)	1.27± ACRES (55,435 SF)	1.68± ACRES (73,491 SF)
MINIMUM FRONTAGE	200 FEET	150 FEET	144 FEET	294 FEET
MAXIMUM BUILDING HEIGHT	35' / 3 STORIES	1 STORY	2 STORY	1.5 STORY
MAX. BUILDING COVERAGE	25%	1.2% (220 SQ. FT)	3.1% (1,599 SQ. FT)	4.8% (2,531 SQ. FT)
MINIMUM FRONT YARD	40 FEET	40.9± FEET	71.8± FEET	40.9± FEET
MINIMUM SIDE YARD	25 FEET	25.5± FEET	51.1± FEET	25.1± FEET
MINIMUM REAR YARD	25 FEET	n/a	>25 FEET	>25 FEET
MINIMUM GREEN YARD	15 FEET	15 FEET	15 FEET	15 FEET

PARKING REQUIREMENTS

RETAIL - 5 SPACES PER 1,000 SQ. FT. GFA
STORAGE - 1 SPACES PER 1,000 SQ. FT. GFA

GROSS FLOOR AREA = 2,531 (RETAIL) + 2,000 (STORAGE) = 4,531 SQ. FT.
TOTAL SPACES REQUIRED = (2,531 / 1,000 * 5) + (2,000 / 1,000 * 1) =
13 (12.66) + 2 SPACES - 15 SPACES
TOTAL SPACES PROVIDED = 16 SPACES

15-25 SPACES REQUIRES 1 HANDICAP ACCESSIBLE SPACE.
2 HANDICAP ACCESSIBLE SPACES PROVIDED WITH ONE BEING VAN ACCESSIBLE

LAYOUT NOTES:

1. ALL SIGNS AND PAVEMENT MARKING TO BE INSTALLED WITHIN THE PROJECT SITE SHALL CONFORM TO THE APPLICABLE SPECIFICATIONS OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
2. SIGNS, LANDSCAPING AND OTHER FEATURES LOCATED WITHIN SIGHT TRIANGLE AREAS SHALL BE DESIGNED, INSTALLED AND MAINTAINED SO AS NOT TO EXCEED 2.5-FEET IN HEIGHT. SNOW WINDROWS LOCATED WITHIN SIGHT TRIANGLES THAT EXCEED 3.5-FEET IN HEIGHT OR THAT WOULD OTHERWISE INHIBIT SIGHT LINES SHALL BE PROMPTLY REMOVED.
3. GAS STATION OPERATIONAL (INCLUDING GAS STATION KIOS) DURING DEMOLITION OF ADJACENT RESIDENTIAL PROPERTY AND CONSTRUCTION OF PROPOSED RETAIL STORE FOR GAS OPERATION. CONTRACTOR TO COORDINATE WITH OWNER AND ENGINEER.

CHA

0 20 40
Scale: In - Feet

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

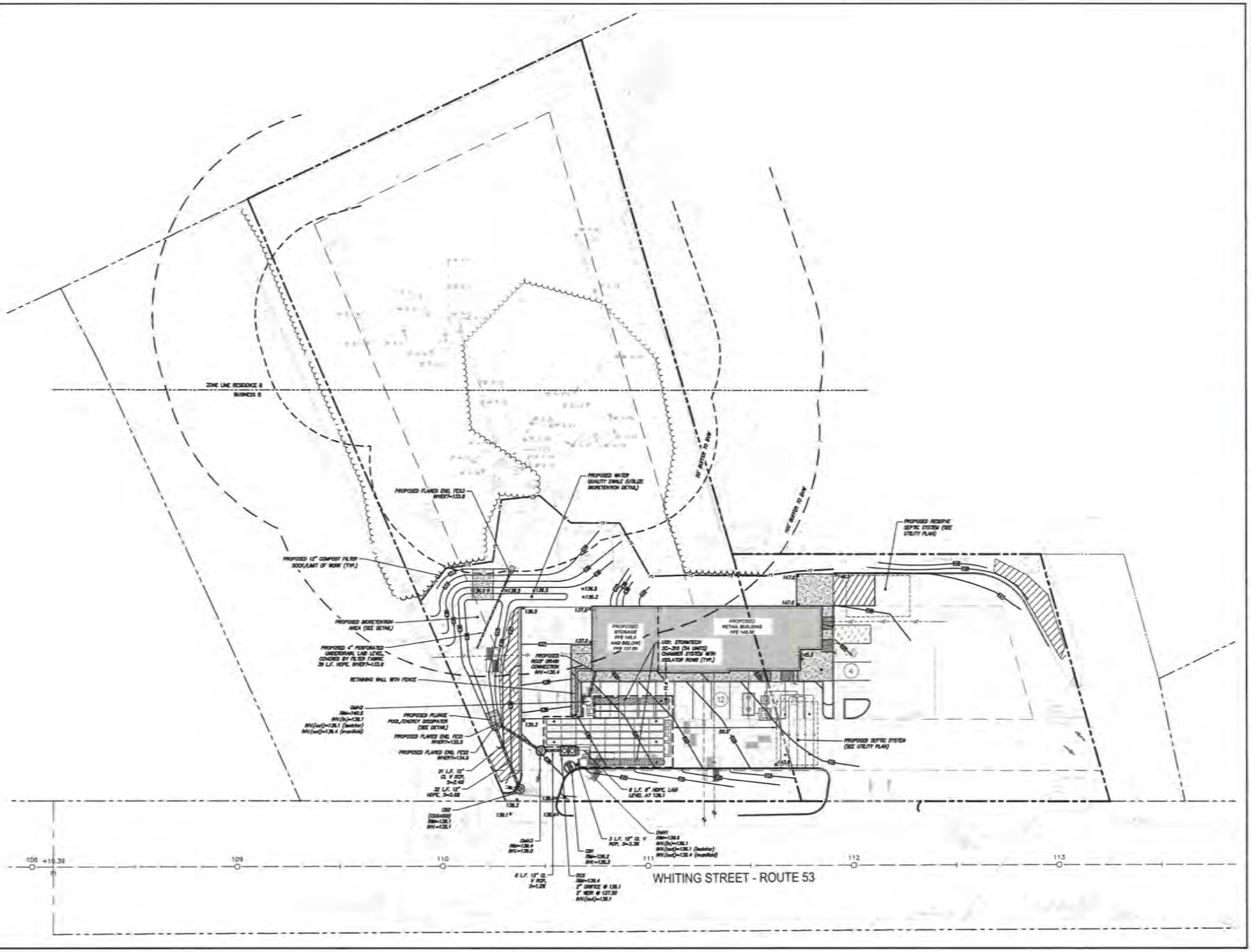
HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

No.	Submittal / Revision	Initial	By	Date
1	PERMIT SET	KK	JM	5/1/2020

SITE PLAN

Designed By: DR/BN	Drawn By: DR/BN	Checked By: KK
Issue Date: 05/01/2020	Project No: 060903	Scale: 1" = 20'

Drawing No.:
C-101



CHA

0 20 40
Scale in feet

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

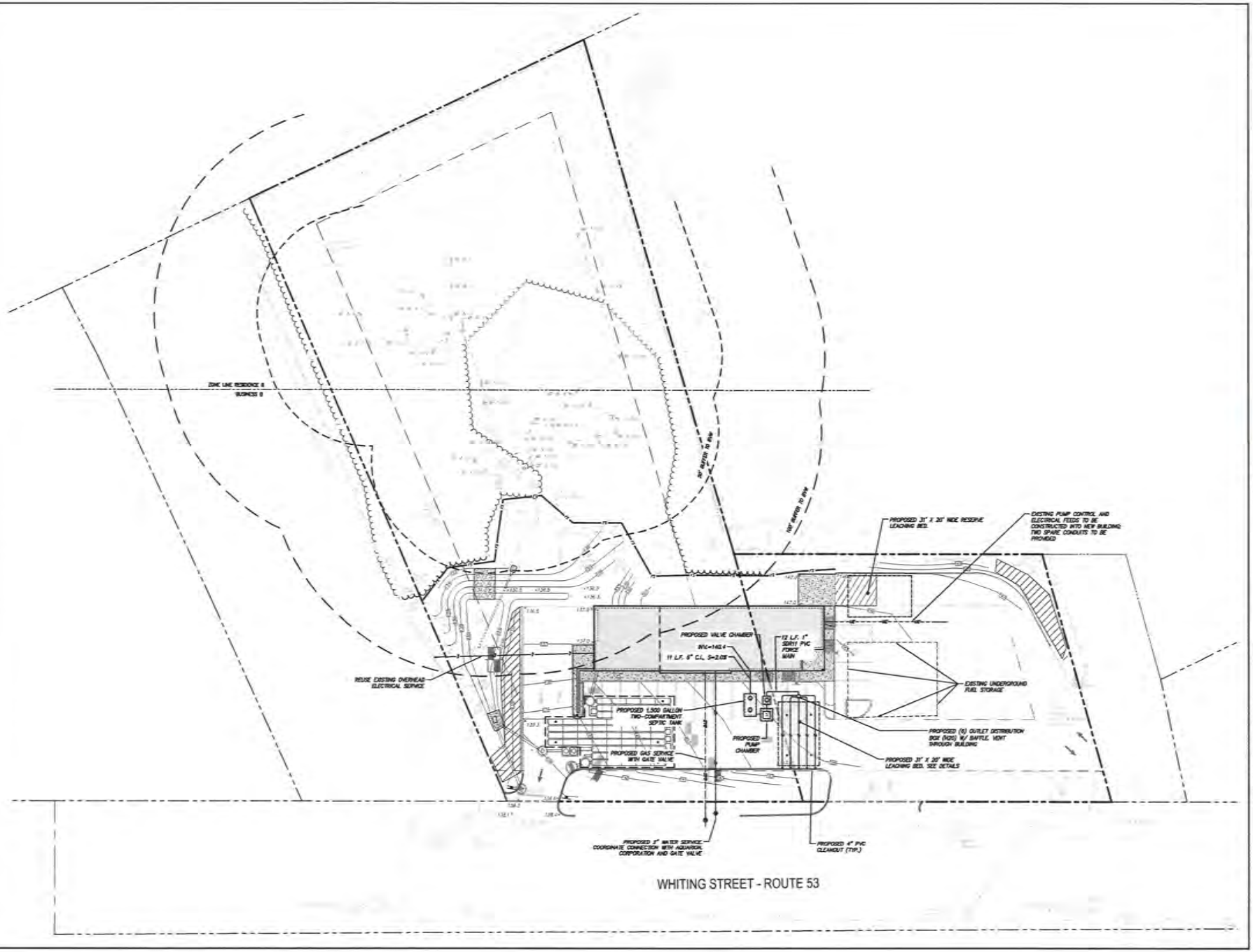
No.	Submittal / Revision	Appvd.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

GRADING & DRAINAGE PLAN

Designed By:	Drawn By:	Checked By:
DRJ/SN	DRJ/SN	KK
Issue Date:	Project No:	Scale:
05/01/2020	0901903	1" = 20'

Drawing No.:

C-201



WHITING STREET - ROUTE 53

CHA

0 20 40
Scale: In. feet

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

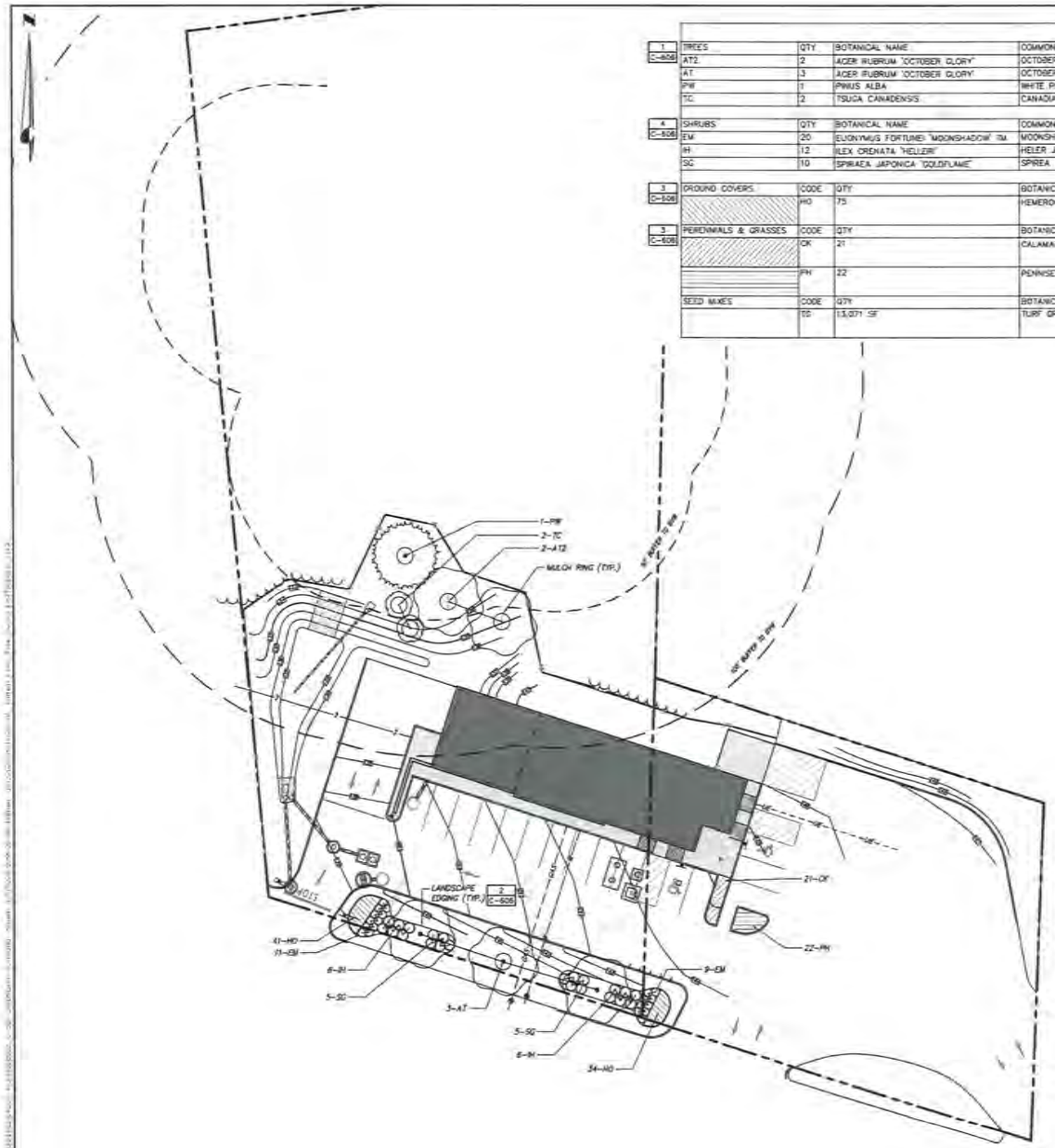
No.	Submittal / Revision	Init.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

UTILITY PLAN

Designed By:	Drawn By:	Checked By:
DR/BN	DR/BN	KK
Issue Date:	Project No:	Scale:
05/01/2020	060663	1" = 20'

Drawing No.:

C-301



1 C-606	TREES	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER		REMARKS	
	AT2	2	ACER RUBRUM 'OCTOBER GLORY'	OCTOBER GLORY RED MAPLE	1.5" CAL.	B&B		REPLACEMENT TREES	
	AT	3	ACER RUBRUM 'OCTOBER GLORY'	OCTOBER GLORY RED MAPLE	3" CAL.	B&B			
	PW	1	PINUS ALBA	WHITE PINE	1.5" CAL.	B&B			
	TC	2	TSUGA CANADENSIS	CANADIAN HEMLOCK	8'-10' HT.	B&B			
4 C-606	SHRUBS	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER		REMARKS	
	EM	20	EUONYMUS FORTUNEI 'MOONSHADOW' TM.	MOONSHADOW EUONYMUS	6-12"	7 GAL.			
	IH	12	ILEX CRENATA 'HELLERI'	HELER JAPANESE HOLLY	18-24" HT.	3 GAL.			
	SG	10	SPIRAEA JAPONICA 'GOLDFLAME'	SPIREA	18-24" HT.	3 GAL.			
3 C-606	GROUND COVERS	CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER	SPACING	REMARKS
		HO	75	HEMEROCALLIS X 'STELLA DE ORO'	STELLA DE ORO DAYLILY	1' HT.	#1 CONT.	18" o.c.	SPACE 18" O.C.
3 C-606	PERENNIALS & GRASSES	CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER	SPACING	REMARKS
		OK	21	CALAMAGROSTIS X ACUTIFLORA 'KARL FOERSTER'	FEATHER REED GRASS	1' HT.	#1 CONT.	24" o.c.	SPACE 24" O.C.
		PH	22	PENNISETUM ALOPECUROIDES 'HAMELN'	HAMELN FOUNTAIN GRASS	1' HT.	#1 CONT.	24" o.c.	SPACE 24" O.C.
	SEED MIXES	CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER	SPACING	REMARKS
		SD	13,071 SF	TURF GRASS	TURF GRASS	SEED			REFER TO SEEDING NOTES

LANDSCAPE NOTES

1. THE CONTRACTOR SHALL SUPPLY PLANT MATERIALS IN QUANTITIES SUFFICIENT TO COMPLETE THE WORK SHOWN. ANY DISCREPANCIES BETWEEN QUANTITIES SHOWN ON THE PLANT SCHEDULE AND THOSE REQUIRED BY THE CONTRACT DRAWINGS SHALL NOT ENTITLE THE CONTRACTOR TO ADDITIONAL REMUNERATION.
2. THE CONTRACTOR SHALL VERIFY AND VISUALLY INSPECT FINAL SELECTION OF PLANT MATERIALS WITH THE LANDSCAPE ARCHITECT OR OWNER PRIOR TO INSTALLATION.
3. ALL PLANTING LOCATIONS SHALL BE STAKED OUT AND APPROVED IN THE FIELD BY THE LANDSCAPE ARCHITECT OR OWNER PRIOR TO INSTALLATION.
4. NO PLANT MATERIAL WILL BE ACCEPTED WHICH DISPLAYS MAJOR IRREGULARITIES OR MECHANICAL DAMAGE. THE OWNER RETAINS THE RIGHT TO REJECT ANY PLANT MATERIAL DEEMED UNFIT.
5. CONTRACTOR MAY SUBSTITUTE ANY OF THE PLANTINGS LISTED IN THE PLANT SCHEDULE DUE TO AVAILABILITY WITH WRITTEN APPROVAL BY THE LANDSCAPE ARCHITECT OR OWNER PRIOR TO INSTALLATION.
6. EXISTING VEGETATION SHALL REMAIN UNDISTURBED IN ALL AREAS WHICH ARE NOT PART OF THE PROPOSED CONTRACT LIMIT LINE.
7. GUARANTEE:
   A. FOR A PERIOD OF [TWELVE MONTHS] FROM THE DATE THAT THE WORK UNDER THIS CONTRACT IS CERTIFIED AS COMPLETE, THE CONTRACTOR SHALL: 1) GUARANTEE ALL PLANTS AND SEEDED AREAS UNDER THIS CONTRACT; 2) REMOVE AND REPLACE DURING THIS GUARANTEE PERIOD PLANTS WHICH DIE OR ARE IN A BADLY IMPAIRED CONDITION; 3) REPLANT WITH STOCK OF SAME SIZE AND QUALITY AS ORIGINALLY SPECIFIED; 4) GUY AND MAINTAIN AS SPECIFIED HEREIN AT NO ADDITIONAL COST TO THE OWNER.
   B. REPLACEMENTS MADE WITHIN SIX MONTHS AFTER THE BEGINNING OF THE GUARANTEE PERIOD SHALL NOT EXTEND THE GUARANTEE PERIOD OF THESE PARTICULAR PLANTS. THOSE REPLACEMENTS MADE SIX MONTHS OR MORE AFTER THE BEGINNING OF THE GUARANTEE PERIOD SHALL BE MAINTAINED AND GUARANTEED FOR A PERIOD OF SIX MONTHS FROM THE TIME OF PLACEMENT.
8. WATER THOROUGHLY DURING AND IMMEDIATELY AFTER PLANTING.

SEEDING NOTES:

1. ALL AREAS TO BE SEEDED SHALL BE SOWN WITH THE FOLLOWING SEEDING MIX:

SPECIES:	% BY WEIGHT	% BY PURITY	% BY GERMINATION
KENTUCKY BLUEGRASS*	60	85	80
CREEPING RED FESCUE	20	95	85
PERENNIAL RYE	20	95	85

*KENTUCKY BLUEGRASS MUST CONSIST OF A MINIMUM OF TWO VARIETIES.

2. WEED SEED CONTENT SHALL NOT EXCEED 0.25%.
3. THE SEED MIXTURE SHALL BE DISTRIBUTED BY MEANS OF HYDRO-SEEDING.
4. THE FERTILIZER SHALL BE A 5-10-5 COMMERCIAL GRADE FERTILIZER APPLIED AT THE MANUFACTURERS RECOMMENDED APPLICATION RATE.
5. SEEDING APPLICATION RATE SHALL BE 4 LBS PER 1,000 SQ. FT.
6. WATER THOROUGHLY IMMEDIATELY AFTER SEEDING.
7. MAINTAIN AND PROTECT ALL SEEDED AREAS UNTIL A UNIFORM STAND OF GRASS HAS BEEN ESTABLISHED AND ACCEPTED BY THE [LANDSCAPE ARCHITECT/ENGINEER] [OWNER] [OWNER'S REPRESENTATIVE].

TOPSOIL NOTES:

1. ALL AREAS OF THE SITE WHICH ARE DISTURBED AND NOT PLANTED, MULCHED, PAVED, ETC. SHALL BE TOPSOILED AND SEEDED.
2. TOPSOIL TO BE INSTALLED TO A MINIMUM 4" DEPTH IN LAWN AREAS AND 12"IN PLANTING BEDS.
3. TOPSOIL SHALL CONSIST OF FERTILE, FRIABLE, NATURAL LOAM FREE OF SUBSOIL, CLAY LUMPS, BRUSH, TWIGS, ENVIRONMENTAL CONTAMINANTS, STONES OR OTHER DELETERIOUS MATERIALS LARGER THAN 1.5" IN GREATEST DIMENSION.
4. PROPOSED TOPSOIL SHALL BE TESTED BY AN INDEPENDENT TESTING FACILITY WITH TEST RESULTS SUBMITTED TO THE LANDSCAPE ARCHITECT/ENGINEER FOR APPROVAL. CONTRACTOR SHALL PAY FOR ALL TESTING. ACCEPTANCE OF TOPSOIL SHALL BE BASED UPON TEST RESULTS. ONE TEST SHALL BE PERFORMED PER 100 C.Y. OF TOPSOIL. LABORATORY TESTS SHALL INCLUDE THE FOLLOWING:
   A. SIEVE PARTICLE SIZE ANALYSIS AND GRADIENT OF MINERAL CONTENT:

SCREEN SIZE	% SOIL RETAINED	% SOIL PASSING
1"	0	100
1/4"	3	97
NO. 100	40-60	40-60

   B. CHEMICAL ANALYSIS OF THE FOLLOWING:
      I. PH (BETWEEN 5.5 AND 7.0)
      II. PERCENT OF ORGANIC CONTENT (NO LESS THAN 5% NOR MORE THAN 20%).
      III. NUTRIENT LEVELS OF PHOSPHORUS, POTASSIUM MAGNESIUM, MANGANESE, IRON, ZINC AND CALCIUM
      IV. SOLUBLE SALT
      V. CATION EXCHANGE CAPACITY (CEC)
   C. NATURAL TOPSOIL MAY BE AMENDED WITH APPROVED MATERIALS, BY APPROVED METHODS, TO MEET THE ABOVE SPECIFICATIONS.

CHA

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HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

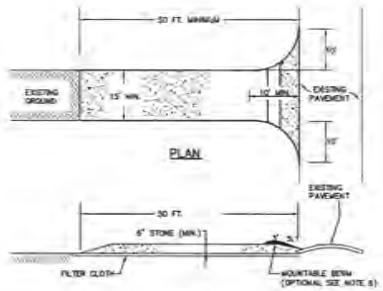
No.	Submittal / Revision	Issued By	Date
1	PERMIT SET	MJR	05/09/25

LANDSCAPE PLAN

Designed By:	Drawn By:	Checked By:
JK	JK	MJR
Issue Date: 05/01/2025	Project No.: 190801	Scale: 1" = 20'

Drawing No:

C-501

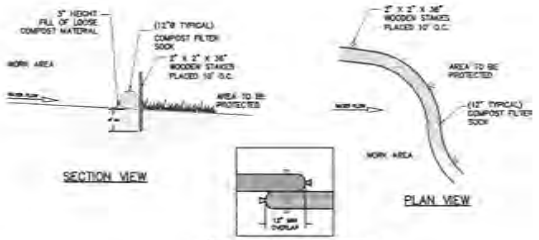


SECTION

CONSTRUCTION SPECIFICATIONS:

1. STONE SIZE: USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH: RECOMMEND GREATER THAN OR EQUAL TO 50 FEET WHERE SOILS ARE SANDS AND GRAVELS AND 100 FEET IN SILTS AND CLAYS.
3. THICKNESS: NOT LESS THAN SIX (6) INCHES.
4. WIDTH: FIFTEEN (15) FOOT, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. FILTER CLOTH: SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER: ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM SHALL BE INSTALLED.
7. MAINTENANCE: THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OF FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY AND ON AN ON GOING BASIS.
8. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED.

1 STABILIZED CONSTRUCTION ENTRANCE
SCALE: NO SCALE



COMPOST SOCK CONNECTION ATTACHMENT DETAIL

NOTES:

1. PREFABRICATED COMPOST SOCK SHALL BE FILTREXX SOXX OR APPROVED EQUAL.
2. MATERIAL FOR SOCKS SHALL CONSIST OF SANITIZED MATURE COMPOST, FREE OF VIABLE WEED SEEDS AND FOREIGN DEBRIS SUCH AS GLASS AND PLASTIC. COMPOST SHALL BE IN SHREDDED OR GRANULAR FORM AND FREE FROM HARD LUMPS. IN ADDITION, NO KILN-DRIED WOOD OR CONSTRUCTION DEBRIS SHALL BE ALLOWED. CONTRACTOR SHALL REFER TO MASSDOT SPECIFICATIONS M1.06.0 FOR MATERIAL SPECIFICATIONS.
3. SOCK SHALL CONSIST OF JUTE MESH OR OTHER APPROVED BIODEGRADABLE MATERIAL.

PRACTICE: COMPOST FILTER SOCK:

A COMPOST FILTER SOCK IS A TYPE OF CONTAINED COMPOST FILTER BERM CONSISTING OF A MESH TUBE FILLED WITH COMPOST MATERIAL THAT IS PLACED PERPENDICULAR TO SHEET FLOW RUNOFF TO RETAIN SEDIMENT FROM DISTURBED AREAS. THE COMPOST FILTER SOCK ACTS AS A FILTER TO RETAIN SEDIMENT AND OTHER POLLUTANTS (E.G., SUSPENDED SOLIDS, NUTRIENTS) WHILE ALLOWING THE WATER TO FLOW THROUGH IT. COMPOST QUALITY MUST MEET AASHTO 2010 SPECIFICATIONS.

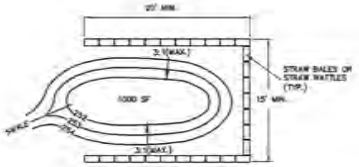
INSTALLATIONS REQUIREMENTS:

ONCE THE FILTER SOCK IS FILLED AND PUT IN PLACE, IT SHOULD BE ANCHORED TO THE SLOPE BY STAKES ALONG THE DOWNHILL SIDE OF THE SOCK AT 10' SPACING ON CENTER (O.C.) SO ENDS OF THE FILTER SOCK SHOULD BE DIRECTED UPSLOPE, TO PREVENT STORMWATER FROM RUNNING AROUND THE END OF THE TUBE.

MAINTENANCE REQUIREMENTS:

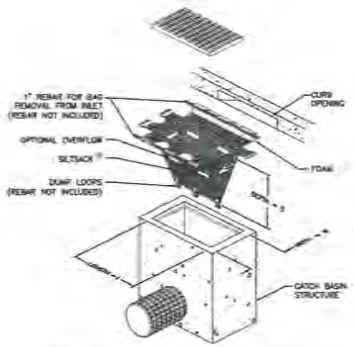
SOCK MUST BE INSPECTED FOR SEDIMENT ACCUMULATION. IF THERE IS EXCESSIVE PONDING BEHIND THE FILTER SOCK OR ACCUMULATED SEDIMENT REACHES THE TOP OF THE SOCK, AN ADDITIONAL SOCK SHOULD BE ADDED ON TOP OR INFRONT OF THE EXISTING SOCK IN THESE AREAS. AN ADEQUATE RESERVE OF SOCKS MUST BE KEPT ON SITE AT ALL TIMES FOR EMERGENCY AND/OR ROUTINE REPLACEMENT. SOCKS SHALL BE REMOVED ONLY AFTER EXPOSED SOILS IN THE CONTRIBUTING DRAINAGE AREA ACHIEVE FINAL STABILIZATION. SEDIMENT ACCUMULATION MUST BE REMOVED ONCE IT HAS REACHED 1/2 OF THE EXPOSED HEIGHT OF THE SOCK.

2 12-INCH COMPOST FILTER SOCK
SCALE: NO SCALE



1. SEDIMENT BASINS AND TRAPS SHALL BE SIZED IN ACCORDANCE WITH EPA NPDES GUIDELINES.
2. SEDIMENT TRAPS ARE UTILIZED FOR DRAINAGE AREAS SMALLER THAN 5 ACRES. THE SEDIMENT TRAP SHOULD HAVE A MINIMUM VOLUME BASED ON 1/2 INCH OF STORAGE FOR EACH ACRE OF DRAINAGE AREA. THIS VOLUME EQUATES TO 1800 CUBIC FEET OF STORAGE OR 67 CUBIC YARDS FOR EACH ACRE OF DRAINAGE AREA.
3. SEDIMENT BASIN ARE UTILIZED FOR DRAINAGE AREAS FROM 5 TO 100 ACRES. THE TEMPORARY SEDIMENT BASIN SHOULD HAVE A MINIMUM VOLUME OF 3,600 CUBIC FEET FOR EACH ACRE OF DRAINAGE AREA.
4. LOCATION DICTATED BY SEQUENCE OF CONSTRUCTION. CONTRACTOR TO PROVIDE WHERE NECESSARY TO FILTER RUNOFF FROM CONSTRUCTION AREAS PRIOR TO DISCHARGE.

3 TEMPORARY SEDIMENT BASIN
SCALE: NO SCALE

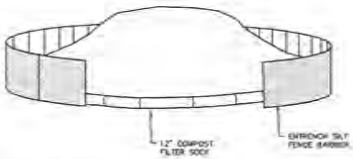


ISOMETRIC VIEW

NOTES:

1. REMOVE ACCUMULATED SEDIMENT WHEN CAPACITY IS REDUCED BY HALF OR PER MANUFACTURER'S RECOMMENDATIONS.
2. CATCH BASIN INSERT TO BE SILTSACK® BY ACF ENVIRONMENTAL, PHONE: 1-800-448-3636, acfenvironmental.com OR EQUIVALENT.
3. INSTALL ON ALL EXISTING CATCH BASINS WITHIN SNOW BIRD AVENUE AND ADJACENT CATCH BASINS ON INTERSECTION ROADS IF ROADWAY DRAINAGE CAN REACH THOSE.

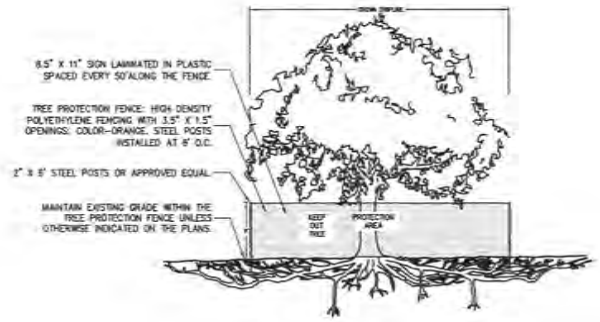
4 FILTER SACK CATCH BASIN INSERT DETAIL
SCALE: NO SCALE



INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2:1.
3. UPON COMPLETION OF STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH COMPOST FILTER SOCK, THEN STABILIZED WITH VEGETATION, OR COVERED.
4. SEE SPECIFICATIONS FOR INSTALLATION OF COMPOST FILTER SOCKS.

5 SOIL STOCKPILE
SCALE: NO SCALE



NOTES:

1. CONTRACTOR TO MAINTAIN INTEGRITY OF CONSTRUCTION FENCE FOR DURATION OF PROJECT.
2. NO PRUNING SHALL BE PERFORMED EXCEPT BY APPROVED ARBORIST.
3. NO EQUIPMENT SHALL OPERATE INSIDE THE PROTECTIVE FENCING; INCLUDING DURING FENCE INSTALLATION AND REMOVAL.
4. SEE SITE PREPARATION PLAN FOR ANY MODIFICATIONS WITH THE TREE PROTECTION AREA.

6 TREE PROTECTION
NOT TO SCALE

CHA

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87 DERBY STREET
HINGHAM, MA 02043

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#19 & 27 WHITING STREET
HINGHAM, MA 02043

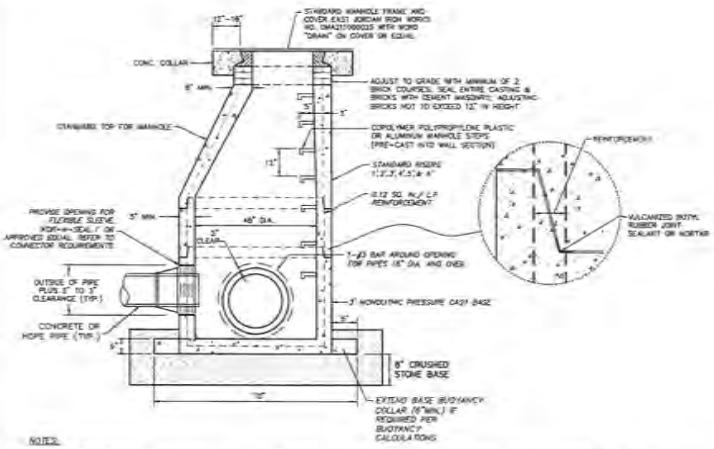
No.	Submittal / Revision	Drwn'd	By	Date
1	PERMIT SET	KM	JM	3/1/2022

SITE DETAILS

Designed By: DRJBN	Drawn By: DRJBN	Checked By: MA
Issue Date: 02/01/2022	Project No: 068003	Scale:

Drawing No.:

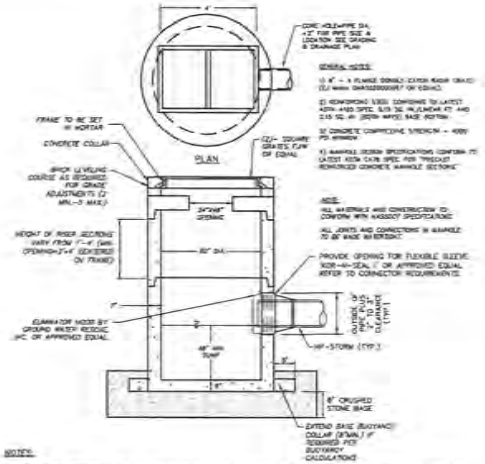
C-601



NOTES:

1. STANDARD PRECAST DRAIN MANHOLE BY SOITAIRE PRECAST OR APPROVED EQUAL CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO CONSTRUCTION.
2. CONTRACTOR SHALL PROVIDE SIGNED & SEALED BUOYANCY CALCULATIONS FOR ALL PRECAST STRUCTURES WITH SHOP DRAWINGS SUBMITTED TO CHA. CALCULATIONS SHALL ASSUME THE HIGHER OF FEMA FLOODPLAIN ELEVATION OR SEASONAL HIGH GROUNDWATER ELEVATION FOR GROUNDWATER DEPTH AT EACH STRUCTURE WITH A 1.15 FACTOR OF SAFETY APPLIED TO THE UPLIFT.

1 STANDARD PRE-CAST DRAIN MANHOLE
SCALE: NO SCALE



NOTES:

1. STANDARD PRECAST DRAIN MANHOLE BY SOITAIRE PRECAST OR APPROVED EQUAL CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO CONSTRUCTION.
2. CONTRACTOR SHALL PROVIDE SIGNED & SEALED BUOYANCY CALCULATIONS FOR ALL PRECAST STRUCTURES WITH SHOP DRAWINGS SUBMITTED TO CHA. CALCULATIONS SHALL ASSUME THE HIGHER OF FEMA FLOODPLAIN ELEVATION OR SEASONAL HIGH GROUNDWATER ELEVATION FOR GROUNDWATER DEPTH AT EACH STRUCTURE WITH A 1.15 FACTOR OF SAFETY APPLIED TO THE UPLIFT.

2 DOUBLE GRATE CATCH BASIN
SCALE: NO SCALE

PIPE DIAMETER, (inches)						
DIAMETER	12	15	18	24	30	36
A	5.5	6.3	7.0	7.0	7.5	7.5
B (max)	10.0	10.0	13.0	18.0	22.0	22.0
H	8.9	8.3	8.0	8.2	8.9	8.9
L	25.0	25.0	32.0	39.0	58.0	58.0
W	28.0	28.0	35.0	45.0	63.0	63.0

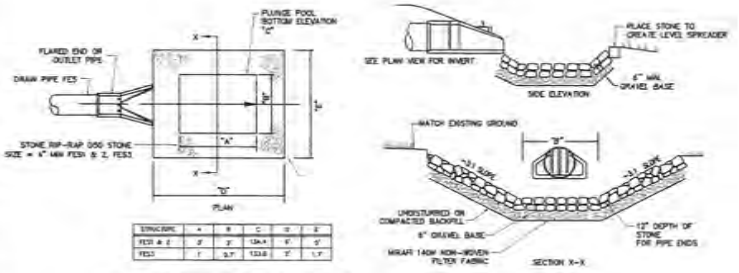
ADS FLARED END SECTION SPECIFICATION:

SCOPE:
THIS SPECIFICATION DESCRIBES 12- THROUGH 36-INCH (300 TO 900MM) ADS FLARED END SECTIONS FOR USE IN CULVERT AND DRAINAGE OUTLET APPLICATIONS.

REQUIREMENTS:
THE INVERT OF THE PIPE AND THE END SECTION SHALL BE AT THE SAME ELEVATION. SHC ADS FLARED END SECTION SHALL BE HIGH DENSITY POLYETHYLENE MEETING ASTM D3350 MINIMUM CELL CLASSIFICATION 213320C; CONTACT MANUFACTURER FOR ADDITIONAL CELL CLASSIFICATION INFORMATION. WHEN PROVIDED, THE METAL THREADED FASTENING ROD SHALL BE STAINLESS STEEL.

INSTALLATION:
INSTALLATION SHALL BE IN ACCORDANCE WITH ADS INSTALLATION INSTRUCTIONS AND WITH THOSE ISSUED BY STATE OF LOCAL AUTHORITIES.

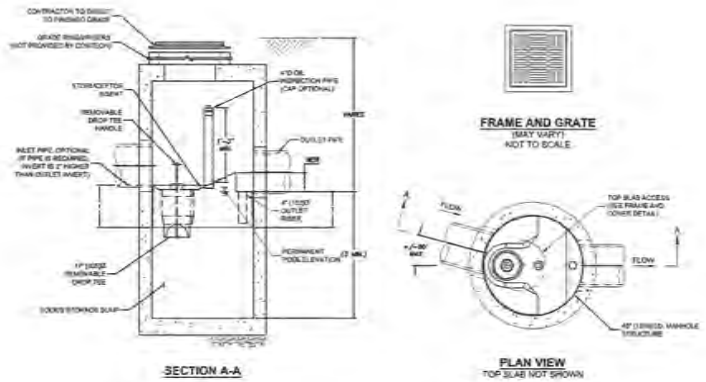
3 ADS HDPE FLARED END SECTION
SCALE: NO SCALE



STRUCTURE	A	B	C	D	E
FES1 & 2	3'	3'	1.5H:1V	6"	5'
FES3	1'	5.7'	1.5:1.0	3"	1.7'

* DIMENSIONS PROVIDED ARE GREATER THAN THE MINIMUM INDICATED IN THE CALCULATION, HOWEVER FOR CONSTRUCTIBILITY PURPOSES WE HAVE PROVIDED A LARGER RIP-RAP APRON SIZE. REFER TO GRADING & DRAINAGE PLANS FOR LOCATION AND INVERT INFORMATION.

4 PLUNGE POOL/ENERGY DISSIPATER
SCALE: NO SCALE



5 STORMCEPTOR 450i WATER QUALITY UNIT DETAIL
SCALE: NO SCALE

CHA

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

No.	Issue(s)/Revision	Appr'd. By	Date
1	FORMAT SET	KK	JM 5/1/2020

SITE DETAILS

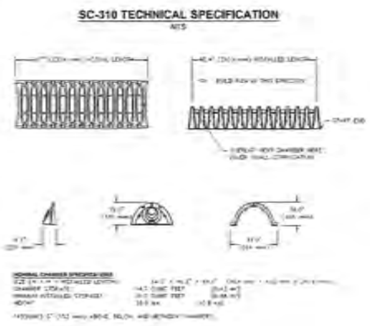
Designed By: CWS/BH	Drawn By: CP/BH/KK	Checked By: MR
Issue Date: 05/01/2020	Project No: 0006C3	Scale:

Drawing No.:

C-602

SC-310 TECHNICAL SPECIFICATION

NTS

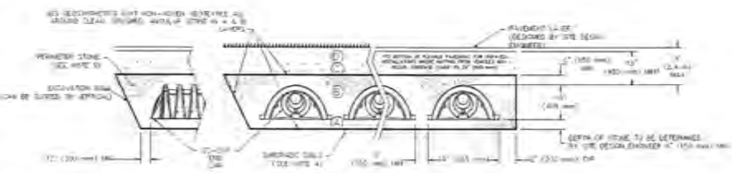


PART #	STUB	A	B	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	FINAL FILL: [illegible]	[illegible]	N/A	[illegible]
C	INITIAL FILL: [illegible]	[illegible]	[illegible]	[illegible]
B	EMBEDMENT STONE: [illegible]	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED
A	FOUNDATION STONE: [illegible]	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.

PLEASE NOTE:
1. 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".
2. 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.
3. 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.
4. 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.

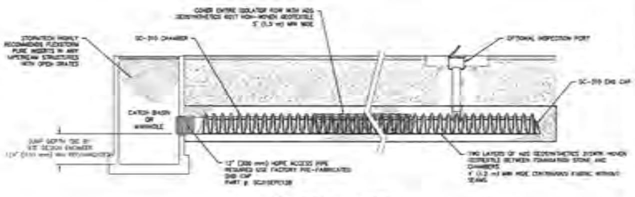


NOTES:

[illegible]

1 STORMTECH SC-310 CHAMBER UNIT SYSTEMS

SCALE: NO SCALE

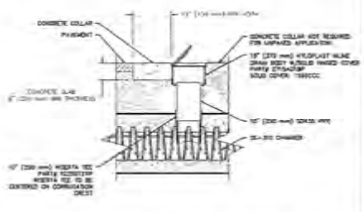


SC-310 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

[illegible]



SC-310 10" (250 mm) INSPECTION PORT DETAIL

NTS

NOTES

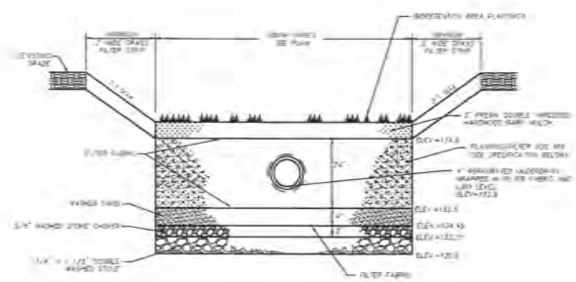
[illegible]

2 STORMTECH SC-310 CHAMBER ISOLATOR ROW

SCALE: NO SCALE

3 STORMTECH INSERTA TEE DETAIL

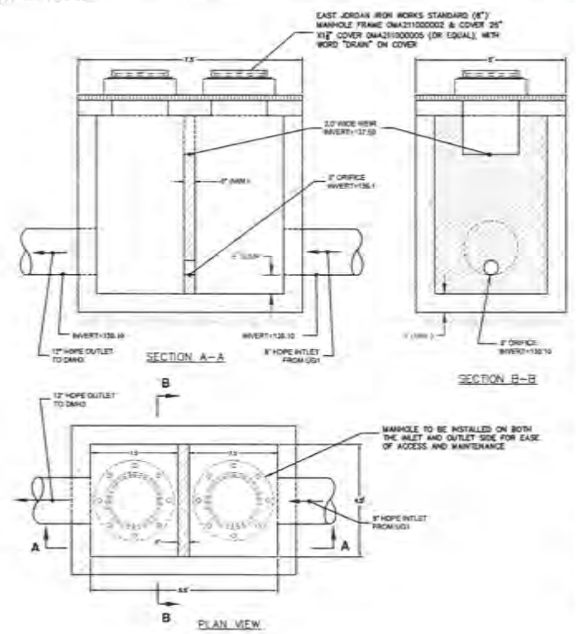
SCALE: NO SCALE



PARAMETER	VALUE
pH RANGE	[illegible]
ORGANIC MATTER	[illegible]
PHOSPHORUS	[illegible]
SOLUBLE SALTS	[illegible]
FINES (SILT & CLAY)	[illegible]
[illegible]	[illegible]

4 BIORETENTION AREA

SCALE: NO SCALE



5 OUTLET CONTROL STRUCTURE (OCS-100)

SCALE: NO SCALE

CHA

OWNER/APPLICANT:

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87 DERBY STREET
HINGHAM, MA 02043

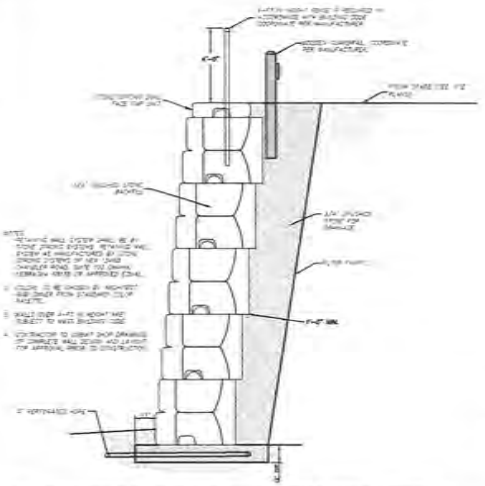
HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

PERMIT SET

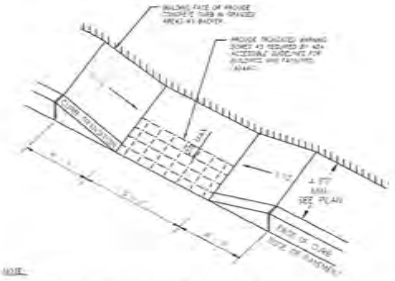
SITE DETAILS

Drawing No.:

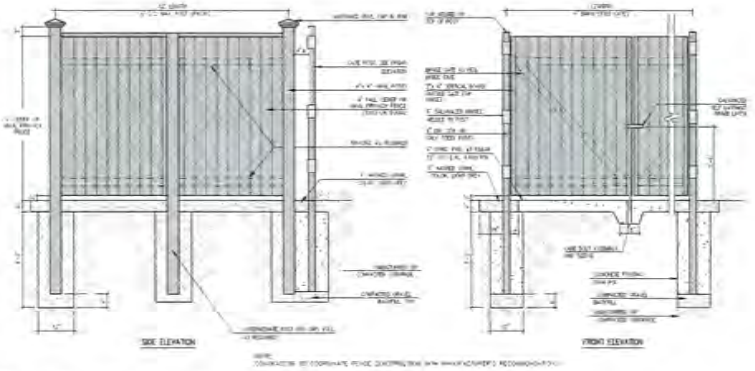
C-603



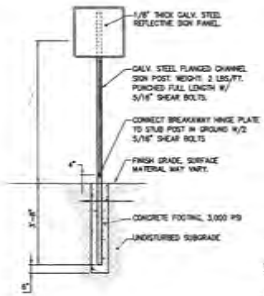
1 SEGMENTAL BLOCK RETAINING WALL BY STRONG STONE SYSTEMS
SCALE: NO SCALE



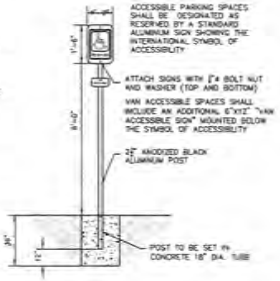
2 ADA CURB RAMP
SCALE: NO SCALE



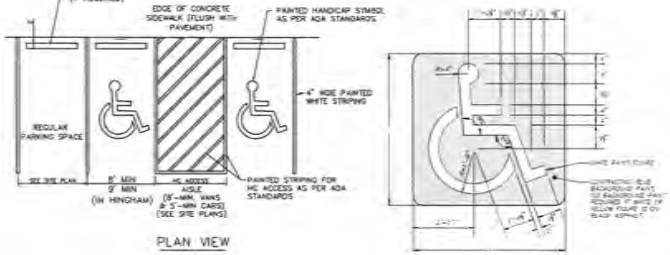
3 TRASH AND RECYCLING ARE WITH CONC. PAD DETAIL
SCALE: NO SCALE



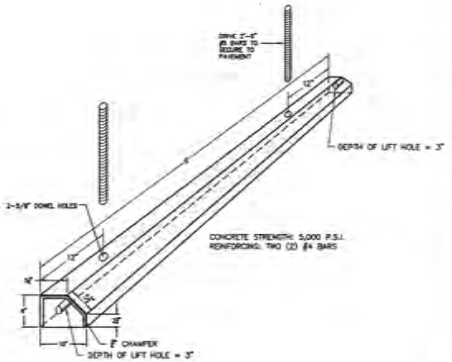
ROADWAY SIGNAGE
4 w/BREAKAWAY SUPPORT
SCALE: NO SCALE



5 ACCESSIBLE PARKING SIGN DETAIL
SCALE: NO SCALE



6 ACCESSIBLE STRIPING DETAIL
SCALE: NO SCALE

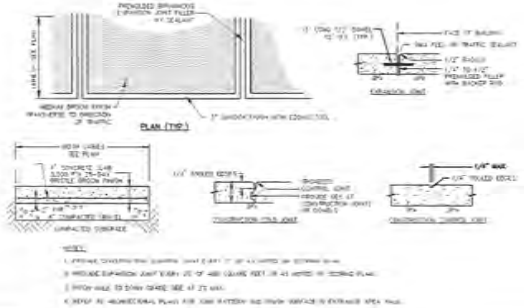


7 CONCRETE WHEEL STOP DETAIL
SCALE: NO SCALE

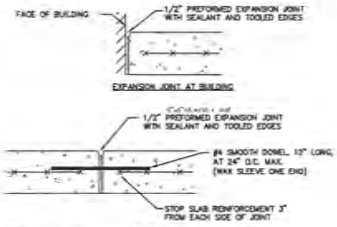
STOP SIGN
R1-1

8 SIGN DETAIL
SCALE: NO SCALE

9 PAINTED MARKING DETAIL
SCALE: NO SCALE



10 TYPICAL CONCRETE SIDEWALK
SCALE: NO SCALE



11 EXPANSION JOINT DETAIL
SCALE: NO SCALE

CHA

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REALTY, LLC
87 DERBY STREET
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HINGHAM GAS
#19 & 27 WHITING
STREET
HINGHAM, MA 02043

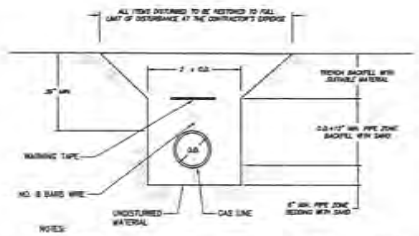
No.	Submittal / Revision	App'd	By	Date
1	PERMIT SET	KK	JM	5/1/2020

SITE DETAILS

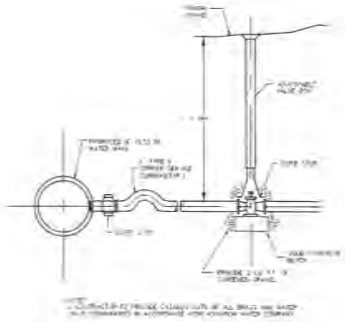
Designed By	Drawn By	Checked By
DMSBY	DR/BN	KK
Issue Date	Project No.	Scale:
05/01/2020	660803	

Drawing No.:

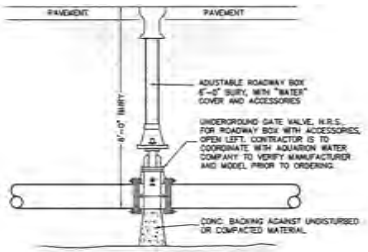
C-604



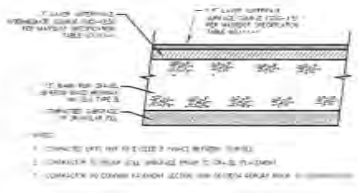
1 TYPICAL GAS UTILITY TRENCH
SCALE: N.T.S.



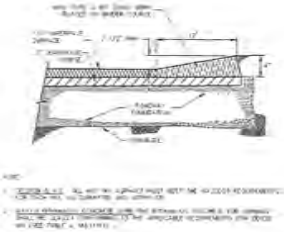
2 WATER SERVICE DETAIL
SCALE: NO SCALE



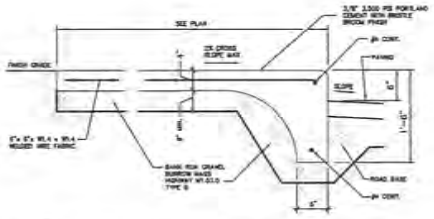
3 ROADWAY BOX VALVE DETAIL
SCALE: NO SCALE



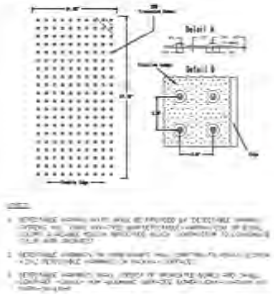
4 BITUMINOUS PAVEMENT SECTION
SCALE: NO SCALE



5 CAPE COD BERM (12")
SCALE: NO SCALE

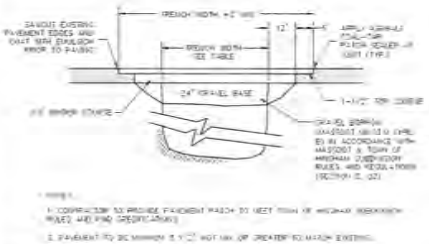


6 INTEGRAL WALK & CURB DETAIL (MONOLITHIC)
SCALE: NO SCALE

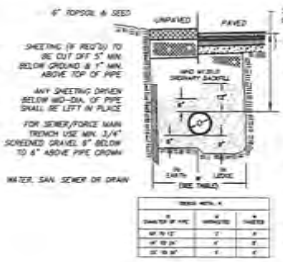


7 DETECTABLE WARNINGS AT RAMPS
SCALE: NO SCALE

TRENCH WIDTH, W		
D DIAMETER OF PIPE	W UNSHEETED	W SHEETED
TO 12"	1'-7"	4'
14" TO 24"	4'	5'
30" TO 36"	5'	6'



8 PAVEMENT PATCH DETAIL FOR TRENCH SECTIONS
SCALE: NO SCALE



TRENCH WIDTH, W		
D DIAMETER OF PIPE	W UNSHEETED	W SHEETED
UP TO 12"	2'	4'
14" TO 24"	4'	5'
30" TO 36"	5'	6'

- MATERIAL USED FOR BACKFILLING TO A POINT 2 FT OVER THE PIPE SHALL CONTAIN NO STONES LARGER THAN 3 INCHES IN GREATEST DIMENSION, EXCEPT MATERIAL USED TO BACKFILL CORRUGATED PLASTIC PIPE SHALL CONSIST OF GRAVEL BORROW MEETING THE REQUIREMENTS OF M1.03.0, GRAVEL BORROW, TYPE D, TO A DEPTH OF 2 FT OVER THE TOP OF PIPE.
- BACKFILL BELOW THE HAUNCHES SHALL BE PLACED IN 6-IN. LAYERS AND COMPACTED SIMULTANEOUSLY ON BOTH SIDES OF THE PIPE WITH RAILROAD TAMPERS OF APPROVED MECHANICAL RAMMERS WHICH SHALL NOT COME IN CONTACT WITH THE PIPE. BACKFILL ABOVE THE HAUNCHES SHALL BE PLACED IN 6-IN. LAYERS AND COMPACTED AS DIRECTED. BACKFILL MATERIAL SHALL BE MOIST PRIOR TO AND DURING COMPACTION.
- BACKFILLING FOR STRUCTURAL PLATE PIPE, PIPE-ARCHES AND ARCHES SHALL BE PLACED EVENLY ON BOTH SIDES OF THE STRUCTURE IN LAYERS NOT EXCEEDING 6 IN. IN DEPTH. BACKFILLING SHALL BE PLACED UNIFORMLY ON BOTH SIDES OF PIPE. THE FILL MATERIAL SHALL BE THOROUGHLY TAMPED AROUND THE PIPE OR PIPE-ARCH, BETWEEN THE PIPE OR PIPE-ARCH AND THE SIDES OF THE TRENCH, OR FOR A MINIMUM DISTANCE EACH SIDE OF THE PIPE OR PIPE-ARCH EQUAL TO THE DIAMETER OR SPAN OF THE STRUCTURE.
- IN ALL CASES THE FILLING MATERIAL SHALL BE THOROUGHLY TAMPED
- REMOVE UNSUITABLE MATERIAL BELOW GRADE, IF ENCOUNTERED, TO SUITABLE DEPTHS AS DIRECTED BY ENGINEER AND REPLACE WITH CLEAN GRANULAR FILL AND FILTER FABRIC.

NOTES:
1. ALL TRENCH CONSTRUCTION TO CONFORM TO APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
2. COMPACT FILL AND TAMP PIPE TO 90% MAX. DRY DENSITY IN 8" LIFTS UNLESS OTHERWISE SPECIFIED.
3. INSTALL DUCTILE IRON WATER PIPE IN ACCORDANCE WITH ANSI A21.51 (AWWA C151) LAYING CONDITION TYPE 2.
4. MATERIALS FOR SEWER BEDDING, HAUNCHING, AND BACKFILL TO CONFORM TO CLASSES I, II, OR III AS DESCRIBED IN ASTM D 2321 AND TR-16 GUIDES FOR THE DESIGN OF WASTEWATER TREATMENT WORKS.
5. PROVIDE MINIMUM 5 FT. COVER OVER WATER MAIN AS MEASURED FROM BOTTOM OF CURB LINE. INSULATE WATERMAIN IN ACCORDANCE WITH M.H.D. SECTION 301 WATER SYSTEMS IN AREAS PRONE TO FROST ACTION AND/OR LESS THAN 5' MINIMUM COVER.

9 TYPICAL TRENCH SECTION
SCALE: NO SCALE

CHA

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87 DERBY STREET
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HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

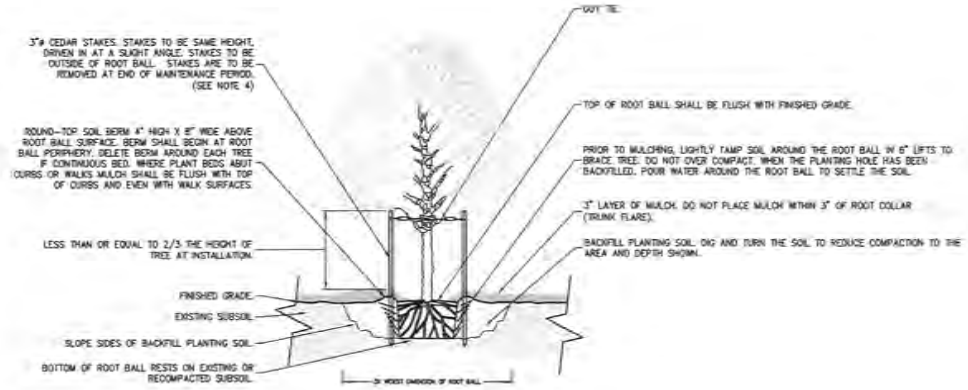
No.	Submittal/Revision	Appr.	By	Date
1	PERMIT SET	KK	JM	8/1/2020

SITE DETAILS

Designed By: DRUBN	Drawn By: DRUBN	Checked By: KK
Issue Date: 08/01/2020	Project No: 080903	Scale:

Drawing No.:

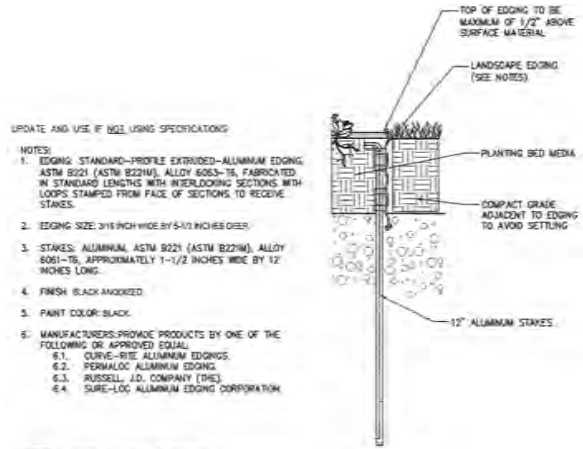
C-605



NOTES:

1. TREE SHALL BARE SAME RELATIONSHIP TO FINISH GRADE AS IN THE NURSERY.
2. PRUNE ANY BROKEN BRANCHES AFTER FINAL PLACEMENT. PRUNE PERIMETER BRANCHES AS REQUIRED BUT RETAIN NATURAL SHAPE OF TREE. NEVER CUT A LEADER. PRUNING TO BE PERFORMED BY A QUALIFIED LANDSCAPE PROFESSIONAL.
3. TREE SHALL BE PLUMB AND STRAIGHT.
4. TREES 2 1/2" CAL. OR GREATER SHALL BE GUYED AND STAKED WITH 3 EQUALLY SPACED STAKES.
5. AFTER PLACEMENT AND ROTATION OF TREE, REMOVE ALL ROPES FROM ROOT BALL AND CUT AND REMOVE TOP HALF OF BURLAP. COMPLETELY REMOVE BURLAP IF IT IS MADE OF SYNTHETIC MATERIAL.

1 DECIDUOUS TREE PLANTING & STAKING
NOT TO SCALE

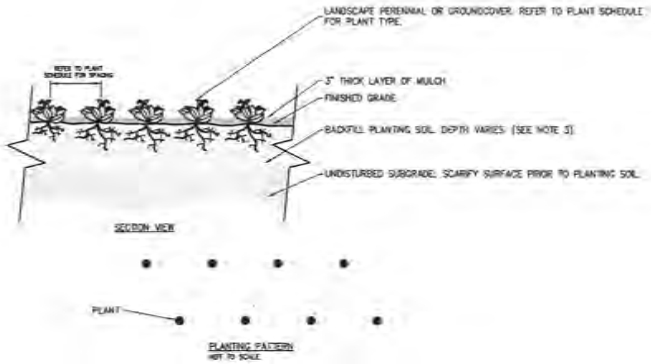


UPDATE AND USE IF NOT USING SPECIFICATIONS

NOTES:

1. EDGING: STANDARD-PROFILE EXTRUDED-ALUMINUM EDGING, ASTM B221 (ASTM B221M), ALLOY 6063-T6, FABRICATED IN STANDARD LENGTHS WITH INTERLOCKING SECTIONS WITH LOOPS STAMPED FROM FACE OF SECTIONS TO RECEIVE STAKES.
2. EDGING SIZE: 3/16 INCH WIDE BY 5-1/2 INCHES DEEP.
3. STAKES: ALUMINUM, ASTM B221 (ASTM B221M), ALLOY 6061-T6, APPROXIMATELY 1-1/2 INCHES WIDE BY 12 INCHES LONG.
4. FINISH: BLACK ANODIZED.
5. PAINT COLOR: BLACK.
6. MANUFACTURERS: PROVIDE PRODUCTS BY ONE OF THE FOLLOWING OR APPROVED EQUAL:
   - 6.1. CURVE-RITE ALUMINUM EDGINGS.
   - 6.2. PERMALOC ALUMINUM EDGING.
   - 6.3. RUSSELL, J.D., COMPANY (THE).
   - 6.4. SURE-LOC ALUMINUM EDGING CORPORATION.

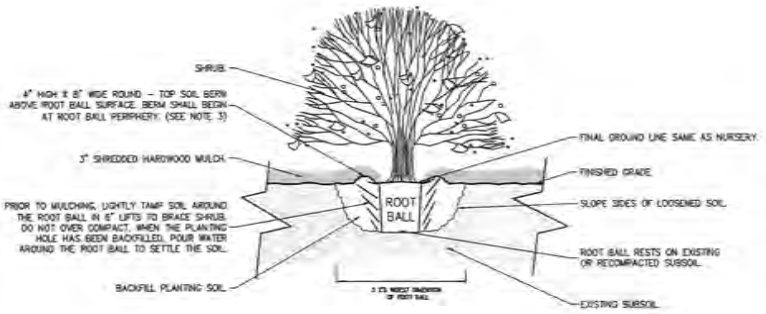
2 LANDSCAPE EDGING
NOT TO SCALE



NOTES:

1. SEE PLANTING SCHEDULE FOR GROUNDCOVER AND PERENNIAL SPECIES, SIZE, AND SPACING DIMENSION.
2. SETTLE SOIL AROUND ROOT BALL OF EACH GROUNDCOVER AND PERENNIAL PRIOR TO MULCHING.
3. PLANTING SOIL DEPTH FOR PERENNIALS SHALL BE A MINIMUM OF 12" FOR PERENNIALS AND 6" FOR GROUNDCOVERS.

3 GROUNDCOVER/PERENNIAL PLANTING
NOT TO SCALE



NOTES:

1. MIX PLANTING SOIL IN PLANTING HOLES OR CONTINUOUS BEDS AFTER PLACEMENT AND ROTATION OF SHRUB. REMOVE ALL ROPES FROM ROOT BALL AND CUT AND REMOVE TOP OF BURLAP.
2. DELETE SOIL BERM AROUND EACH SHRUB IF CONTINUOUS BED. PROVIDE NEAT TRIMMED SOIL EDGE AT CONTINUOUS BEDS AGAINST LAWN. WHERE PLANT BEDS ABUT CURBS OR WALKS MULCH SHOULD BE FLUSH WITH TOP OF CURBS AND EVEN WITH WALK SURFACES.
3. PRUNE BROKEN CANES AFTER PLANTING.

4 SHRUB PLANTING
NOT TO SCALE

CHA

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HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

No.	Submittal/Revision	Appd. By	Date
1	PERMIT SET	MJS	05/01/20

SITE DETAILS

Designed By: JK	Drawn By: JK	Checked By: MJS
Issue Date: 05-01-2020	Project No: 080903	Scale:

Drawing No.:

C-606

SEPTIC SYSTEM SIZING INFORMATION AND DESIGN DATA

- FOR RETAIL (50 GPD/ 1,000 S.F.) IS USED, AND FOR GAS ISLAND, (75 GPD/ ISLAND) IS USED BASED ON TITLE 5 (310CMR 15.203).
- TOTAL FLOW RATE REQUIRED FOR THE FACILITY, BASED ON SIZE OF RETAIL AREA AND NUMBER OF GAS ISLANDS:
  (3,531 S.F.) X (50 GPD/ 1,000 S.F.) = 176.8 GPD
  (3 GAS ISLANDS) X (75 GPD/ GAS ISLAND) = 225 GPD
  (176.8 GPD) + (225 GPD) = 401.8 GPD

THE PROPOSED DESIGN FLOW 401.8 GPD.

DESIGN FLOW FACTOR OF SAFETY= (401.8 GPD/401.8 GPD)= 1.00

- ONE TWO CHAMBER SEPTIC TANK IS PROPOSED FOR THE NEW FACILITY. THE FIRST CHAMBER OF THE SEPTIC TANK IS SIZED FOR OVER 200% OF THE DAILY DESIGN FLOW AT 1,000 GALLONS. THE SECOND CHAMBER OF THE SEPTIC TANK IS SIZED FOR OVER 100% OF THE DAILY DESIGN FLOW AT 500 GALLONS.

LIST OF LOCAL VARIANCES REQUIRED (TOWN OF HINGHAM BOH RULES & REGULATIONS)

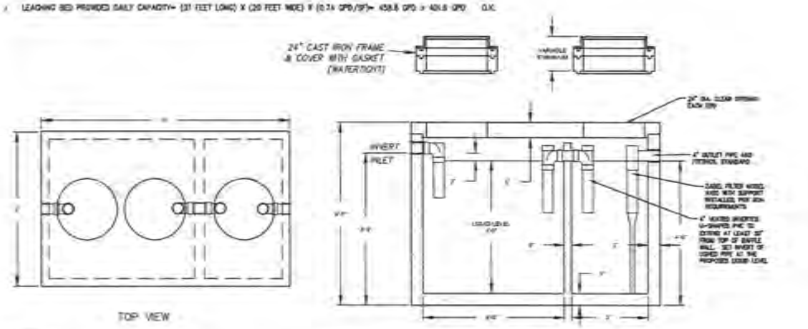
- NONE

SOIL ABSORPTION SYSTEM SIZING INFORMATION:

- SOIL ABSORPTION SYSTEM (SAS) SHALL BE EXCAVATED PRIOR TO BUILDING CONSTRUCTION.
- DESIGN FLOW = 401.8 GPD
- PER 310CMR, SECTION 15.242, LOADING RATE FOR CLASS I (<5 MIN/INCH) SOILS IS =0.74 GPD/SF

CONTROLLING SEASONAL HIGH GROUNDWATER ELEVATION IS WITHIN TEST PIT (TP4), WHICH RESULTS IN AN ESTIMATED SEASONAL HIGH GROUNDWATER (ESHGW) ELEVATION OF 134.18 (REDOXIMORPHIC FEATURES AT 83" FROM TOP OF TP-4).

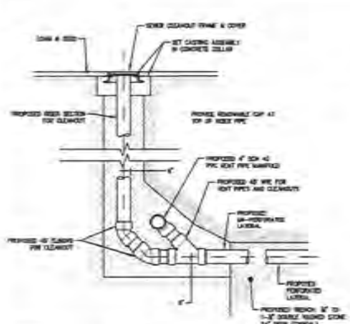
- THE SYSTEM HAS BEEN DESIGNED TO COMPLY WITH SECTION VII.J OF THE HINGHAM SUPPLEMENTARY RULES AND REGULATIONS TO PROVIDE AT LEAST 6 FEET OF NATURALLY OCCURRING PERMEABLE MATERIAL BELOW THE BOTTOM OF THE SYSTEM TO THE ESHGW FOR SOILS WITH PERCOLATION RATES BETWEEN 2 MINUTES AND 5 MINUTES PER INCH.
- USE LEACHING BED IN ACCORDANCE WITH 310CMR 15.252 WERE SELECTED
- REQUIRED AREA = (401.8 GPD/0.74 GPD/SF) = 542.7 SF
- USE 31 FT LONG X 20 FT WIDE BED:
- LEACHING BED PROVIDED DAILY CAPACITY= (31 FEET LONG) X (20 FEET WIDE) X (0.74 GPD/SF)= 458.8 GPD > 401.8 GPD O.K.



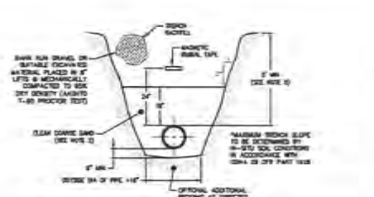
NOTES:

1. PROPERLY SIZED SEPTIC TANK SHALL CONFORM TO ALL TITLE 5 AND HINGHAM BOH REQUIREMENTS.
2. ALL TANK PENETRATIONS SHALL BE CORED IN FIELD, AFTER TANKS ARE SET IN THE GROUND AND PRIOR TO BACKFILLING.
3. STRUCTURE SHALL BE WATERTIGHT.
4. SEPTIC TANK TO WITHSTAND H-20 LOADING.
5. INLET TEE TO EXTEND A MINIMUM OF 10" BELOW FLOW LINE.
6. PROVIDE A MINIMUM 3" SPACE BETWEEN INLET AND FLOW LINE.
7. SEAL ALL JOINTS WITH WATERPROOFING MEMBRANE, TREMPROOF 60 OR APPROVED EQUAL.
8. DIMENSIONS SHOWN HEREIN ARE BASED ON SCITUATE CONCRETE PRODUCTS. PRODUCT. AN EQUAL PRODUCT CAN BE USED IF THE MINIMUM CAPACITY OF THE TANK IS 1,500 GALLONS WITH A BAFFLE.
9. A MIN. 24" DIA. MANHOLE FRAME & COVER TO GRADE OVER THE INLET AND OUTLET SHALL BE PROVIDED.
10. SHOP DRAWING SUBMITTALS SHALL INCLUDE BUOYANCY CALCULATIONS AND CONTRACTOR IS RESPONSIBLE FOR SUITABLE STRUCTURES TO RESIST BUOYANCY. ASSUME TANK SUBMERGED UP TO FEMA FLOOD PLAIN ELEVATION. (10.0 NAVD)
11. COVERS SHALL BE CAM LOCK WATERTIGHT COVERS OR APPROVED EQUAL.

1 1,500 GALLON SEPTIC TANK WITH BAFFLE
SCALE: NO SCALE



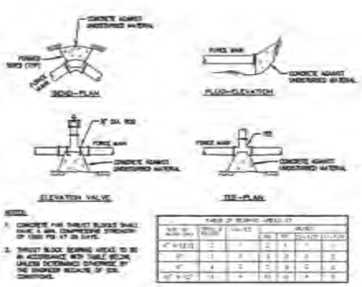
2 CLEANOUT DETAIL
SCALE: NO SCALE



NOTES:

1. NO DEBRIS, FROZEN MATERIAL, LARGE CLODS, STONES OR ORGANIC MATERIAL SHALL BE PLACED IN TRENCH BACKFILL. TRENCH BACKFILL SHALL CONSIST OF SUITABLE EXCAVATED MATERIAL OR OTHER APPROVED MATERIAL.
2. CLEAN COARSE SAND PASSING 1/4" SIEVE, EFFECTIVE GRAIN SIZE SHALL BE BETWEEN 0.5 TO 0.6 MM AND THE UNIFORMITY COEFFICIENT SHALL BE 3.5 OR LESS.
3. BURIAL TAPE MARKED "CAUTION BURIED SEWER BELOW" OVER SEWER MAIN. TRACER WIRE BELOW RECOMMENDED.
4. CONTRACTOR TO PROVIDE AS-BUILT LOCATION OF ALL FORCE MAIN AND SEPTIC TANK EFFLUENT COMPONENTS.
5. IN AREAS SUBJECT TO FROST OR < 5 FT. COVER, PROVIDE PIPE INSULATION.

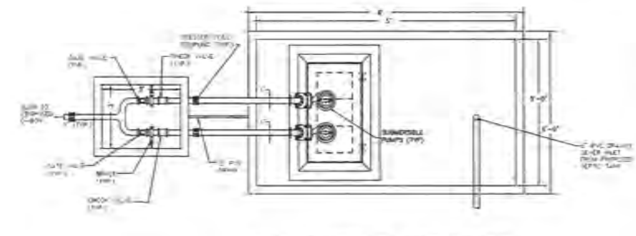
3 TYPICAL TRENCH DETAIL FOR PRESSURE FORCE MAIN
SCALE: NO SCALE



NOTES:

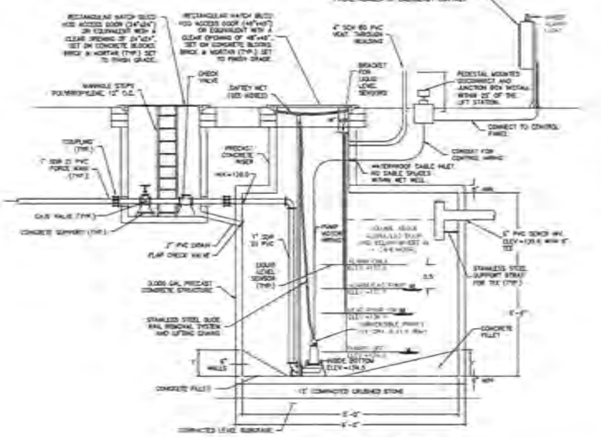
1. CONCRETE FOR THRUST BLOCKS SHALL HAVE A MIN. COMPRESSIVE STRENGTH OF 1500 PSI AT 28 DAYS.
2. THRUST BLOCK BEARING AREAS TO BE IN ACCORDANCE WITH TABLE BELOW, UNLESS DETERMINED OTHERWISE BY THE ENGINEER BECAUSE OF SOIL CONDITIONS.

4 THRUST BLOCK DETAILS
SCALE: NO SCALE



PUMP CHAMBER AND VALVE CHAMBER
PLAN VIEW

NOTE: CONTRACTOR SHALL SUBMIT SHOP DRAWING OF TANK AND HATCH. HATCH TO BE LARGE ENOUGH TO PROVIDE SUITABLE ACCESS TO OPERATE AND MAINTAIN THE VALVES.



PUMP CHAMBER AND VALVE CHAMBER
ELEVATION VIEW

1. PUMP EQUIPMENT SHALL BE DUPLEX SUBMERSIBLE PUMPS AS MANUFACTURED. THE UNITS SHALL OPERATE FROM A 230 VOLT, 1 PHASE, 3 WIRE A.C. POWER SOURCE. PUMPS SHALL BE APPROVED BY CHA BEFORE INSTALLATION.
2. PUMP STATION WET WELLS AND VALVE CHAMBERS SHALL BE PROVIDED BY THE CONTRACTOR AND SHALL BE STANDARD H20 LOADING, CONSTRUCTED OF REINFORCED CONCRETE FOR COMPRESSIVE STRENGTH TO A MINIMUM OF 5,000 PSI AND TO THE DIMENSIONS AS SHOWN ON THE DETAILS AND MANUFACTURED BY ROTONDO & SONS, REHOBOTH, MA, OR APPROVED EQUAL.
3. ALL STEEL REINFORCEMENT SHALL CONFORM TO ASTM A 615-75 GRADE 60 WITH 1" MINIMUM COVER.
4. THE SUBMERSIBLE PUMPS SHALL BE INSTALLED WITH A HYDRAULICALLY SEALED SLIDE COUPLING ARRANGEMENT SO THAT THE PUMPS CAN BE REMOVED FROM THE WET WELL FOR SERVICE AND INSPECTION AND THEN RETURNED TO SERVICE WITHOUT ENTERING THE WET WELL, OR TO UNBOLT OR UNLOCK THE CONNECTION BETWEEN THE PUMP AND PIPING.
5. THE ACCESS COVERS SHALL EXTEND TO FINISH GRADE. THE ACCESS COVERS SHALL BE GALVANIZED STEEL DOOR TO THE CLEAR DIMENSIONS AS SHOWN ON THE DETAILS DESIGNED FOR HS-20 WHEEL LOADING PLUS ADDITIONAL 30% LIVE LOAD. THE ACCESS COVERS SHALL HAVE STAINLESS STEEL HINGES WITH STAINLESS STEEL PINS, A FLUSH SPRING LOADED SNAP LOCK OPERABLE FROM THE OUTSIDE BY A REMOVABLE HANDLE AND FROM THE INSIDE BY A FIXED HANDLE, AND SURFACE MOUNTED PADLOCK.
6. EACH SUBMERSIBLE PUMP SHALL BE EQUIPPED WITH 50 FEET OF POWER CABLE WITH EPOXY SEALED HOUSING WITH SECONDARY PRESSURE GROMMET FOR SEALING AND STRAIN RELIEF. ALL INCOMING LEAD WIRES SHALL BE SPLICED IN THE MOTOR TERMINAL HOUSING.
7. THE CONTRACTOR SHALL FURNISH AND INSTALL FOUR (4) LIQUID LEVEL SENSORS WITH SUFFICIENT LENGTH OF CABLE FOR EACH PUMP STATION. SUSPENDED TYPE OF LEVEL SENSORS MOUNTED IN A CORROSION RESISTANT POLYPROPYLENE HOUSING, AND MOUNTED TO TANK INTERIOR BY A DETACHABLE BRACKET.
8. ELECTRICAL SUPPLY AND CONTROL CIRCUITS SHALL BE DESIGNED TO ALLOW DISCONNECTION AT PEDESTAL MOUNTED WATERTIGHT JUNCTION BOX LOCATED ADJACENT TO THE PUMP STATION. SUPPLY AND CONTROL WIRING SHALL BE PLACED IN SEPARATE CONDUIT.
9. THE PUMP MOTORS SHALL MEET THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE FOR CLASS 1, DIVISION 2 LOCATIONS.
10. ALL INLET AND OUTLET PIPING CONNECTIONS AT THE WET WELLS AND VALVE CHAMBERS SHALL BE MADE WATERTIGHT.
11. DISCHARGE PIPING WITHIN WET WELLS AND VALVE CHAMBERS SHALL BE PVC SCHEDULE 40. PIPING BEYOND VALVE CHAMBERS SHALL BE PVC, SDR 21.
12. CONTRACTOR SHALL VERIFY EXISTING, AVAILABLE POWER LOCATION AND PHASE ETC. PRIOR TO ORDERING AND INSTALLING PUMPS.
13. PUMP CHAMBER SHALL BE FITTED WITH A SAFETY NET MANUFACTURED BY "SAFE APPROACH" OR APPROVED EQUAL. CONTRACTOR SHALL VERIFY SAFETY NET SPECIFICATIONS WITH THE PEMBROKE BOARD OF HEALTH.
14. STAINLESS STEEL SHALL BE USED FOR BRACKETS, RAILS, LIFTING CHAINS AND SAFETY NET BRACKETS.
15. PROVIDE THRUST BLOCKING FOR ALL FITTINGS AND BENDS ETC. IN THE FORCEMAIN.

5 DUPLEX PUMP CHAMBER AND VALVE CHAMBER (H20)
SCALE: NO SCALE

CHA

OWNER/APPLICANT:

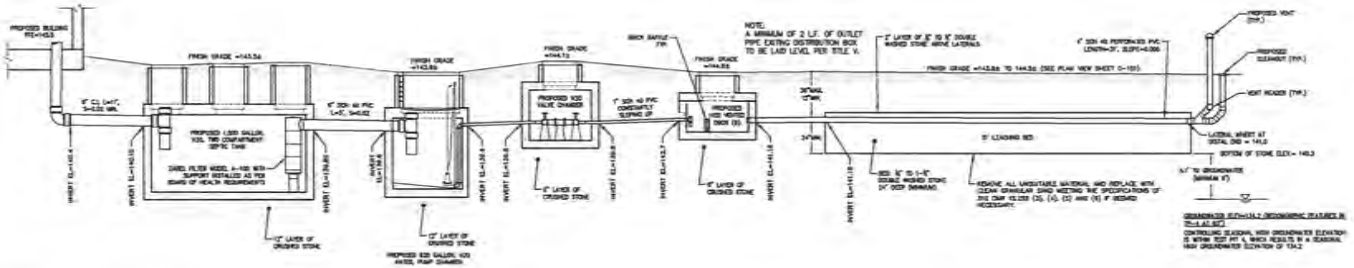
MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

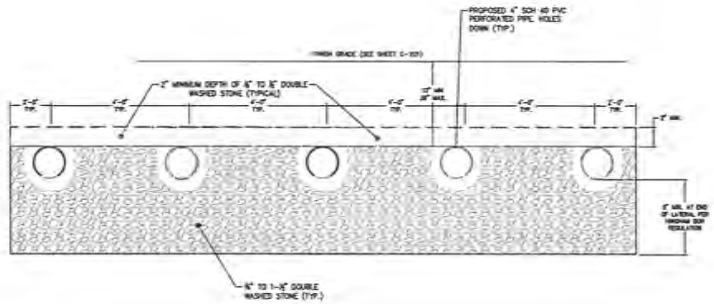
PERMIT SET

SEPTIC DETAILS - 1

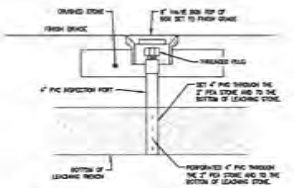
C-607



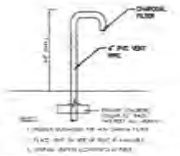
1 SANITARY SYSTEM PROFILE
SCALE: NO SCALE



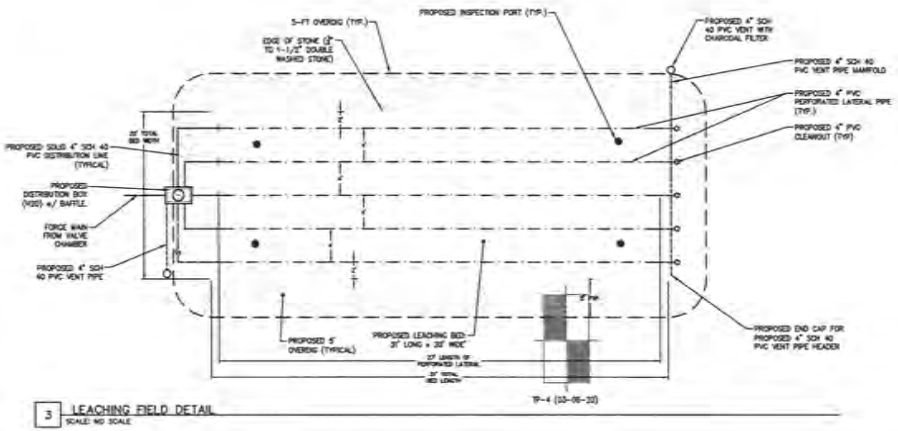
2 LEACHING BED CROSS SECTION
SCALE: NO SCALE



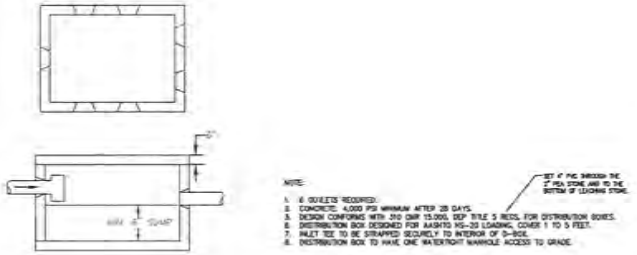
4 INSPECTION PORT DETAIL
SCALE: NO SCALE



5 4" PVC VENT DETAIL
SCALE: NO SCALE



3 LEACHING FIELD DETAIL
SCALE: NO SCALE



6 DISTRIBUTION BOX (H20)
SCALE: NO SCALE

CHA

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

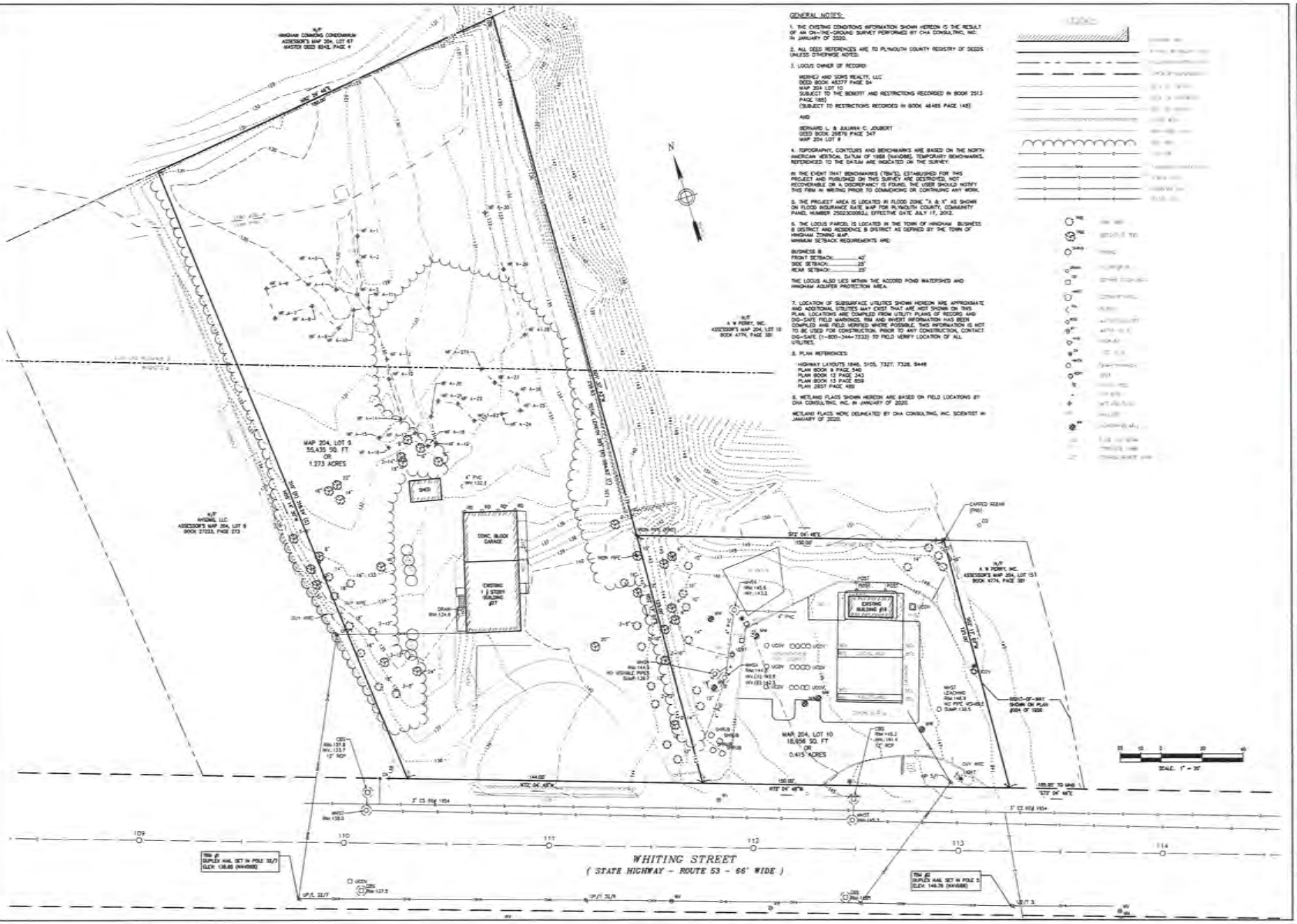
No.	Submittal - Revision	Appd.	By	Date
1	PERMIT SET	KK	AK	5/1/2020

SEPTIC DETAILS - 2

Designed By: CRSBN	Drawn By: CRSBN	Checked By: KK
Issue Date: 05/01/2020	Project No.: 060003	Scale:

Drawing No.:

C-608



CHA

PREPARED FOR:

MERHEJ AND SONS REALTY, LLC

87 DERBY STREET

HINGHAM, MA 02043

PROJECT LOCATION:

19 & 27

WHITING STREET

HINGHAM, MA

No.	Submittal / Revision	Appr'd.	By	Date
0	Issued as Final	HJD	MWC	04/07/2020

EXISTING CONDITIONS PLAN

Designed By:	Drawn By:	Checked By:
—	MWC	DJD
Issue Date:	Project No.:	Scale:
04/07/2020	060803	1" = 20'

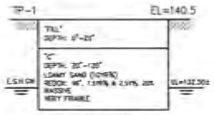
Drawing No:

SHEET 1 OF 1

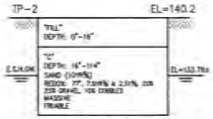
SOIL TEST DATA:

DATE: 03/06/2020
PERFORMED BY HAZEM DANI, SE#13902
WITNESSED BY JOHN CHESSIA, SE#375

TP-1 EL=140.5



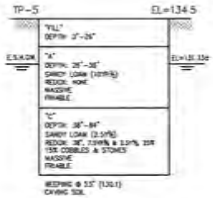
TP-2 EL=140.2



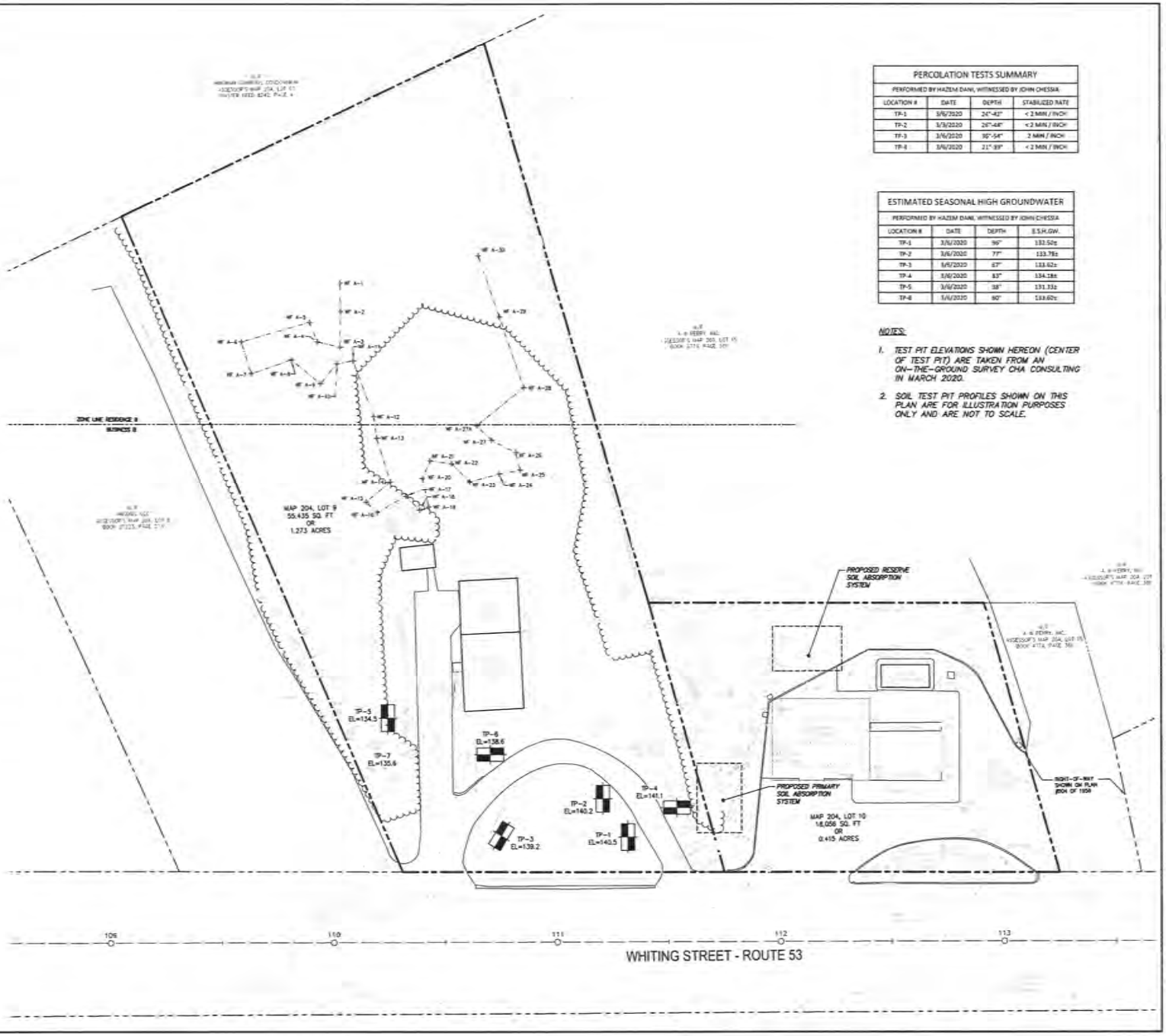
TP-3 EL=139.2

TP-4 EL=141.1

TP-5 EL=134.5



TP-6 EL=138.6



PERCOLATION TESTS SUMMARY			
PERFORMED BY HAZEM DANI, WITNESSED BY JOHN CHESSIA			
LOCATION #	DATE	DEPTH	STABILIZED RATE
TP-1	3/6/2020	24"-42"	< 2 MIN / INCH
TP-2	3/3/2020	26"-48"	< 2 MIN / INCH
TP-3	3/6/2020	30"-54"	3 MIN / INCH
TP-4	3/6/2020	21"-39"	< 2 MIN / INCH

ESTIMATED SEASONAL HIGH GROUNDWATER			
PERFORMED BY HAZEM DANI, WITNESSED BY JOHN CHESSIA			
LOCATION #	DATE	DEPTH	E.S.H.GW.
TP-1	3/6/2020	96"	132.5±±
TP-2	3/6/2020	77"	133.7±±
TP-3	3/6/2020	67"	133.62±
TP-4	3/6/2020	83"	134.18±
TP-5	3/6/2020	98"	131.33±
TP-6	3/6/2020	80"	133.60±

NOTES:

1. *TEST PIT ELEVATIONS SHOWN HEREON (CENTER OF TEST PIT) ARE TAKEN FROM AN ON-THE-GROUND SURVEY CHA CONSULTING IN MARCH 2020.*
2. *SOIL TEST PIT PROFILES SHOWN ON THIS PLAN ARE FOR ILLUSTRATION PURPOSES ONLY AND ARE NOT TO SCALE.*

CHA

N

0 20 40
Scale in Feet

OWNER/APPLICANT:

MERHEJ & SONS
REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING
STREET
HINGHAM, MA 02043

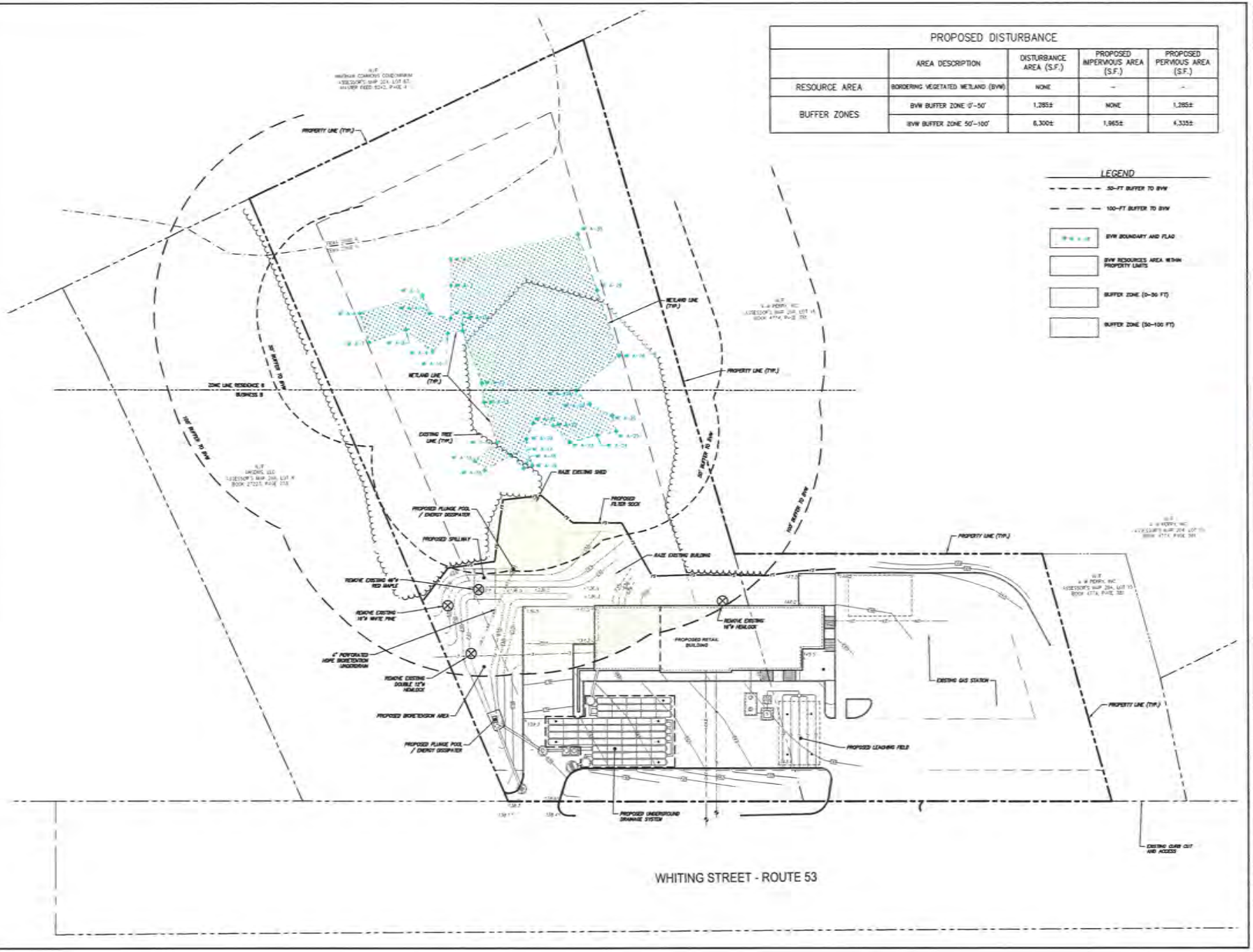
No.	Submittal / Revision	Appvd.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

TEST PIT PLAN

Designed By: DR/BN	Drawn By: DR/BN	Checked By: KK
Issue Date: 05/01/2020	Project No: 060965	Scale: 1" = 20'

Drawing No.:

G-001



PROPOSED DISTURBANCE				
	AREA DESCRIPTION	DISTURBANCE AREA (S.F.)	PROPOSED IMPERVIOUS AREA (S.F.)	PROPOSED PERVIOUS AREA (S.F.)
RESOURCE AREA	BORDERING VEGETATED WETLAND (BVW)	NONE	–	–
BUFFER ZONES	BVW BUFFER ZONE 0'–50'	1,285±	NONE	1,285±
	BVW BUFFER ZONE 50'–100'	6,300±	1,965±	4,335±

LEGEND

- 50–FT BUFFER TO BVW
- 100–FT BUFFER TO BVW
- BVW BOUNDARY AND FLAG
- BVW RESOURCES AREA WITHIN PROPERTY LIMITS
- BUFFER ZONE (0–50 FT)
- BUFFER ZONE (50–100 FT)

0 20 40
Scale in feet

OWNER/APPLICANT:

MERHEJ & SONS REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING STREET
HINGHAM, MA 02043

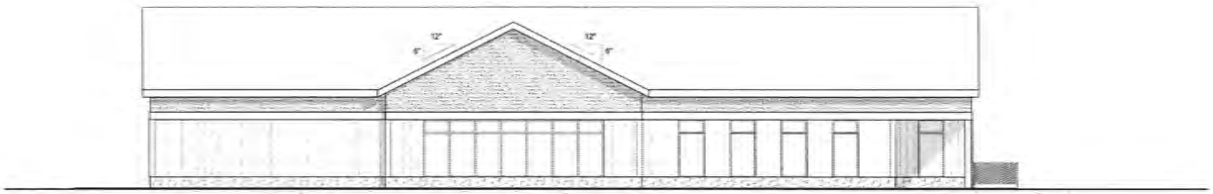
No.	Submittal / Revision	Appd.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

RESOURCE AREA PLAN

Designed By: DR/BN	Drawn By: DR/BN	Checked By: KK
Issue Date: 05/01/2020	Project No: 060503	Scale: 1" = 20'

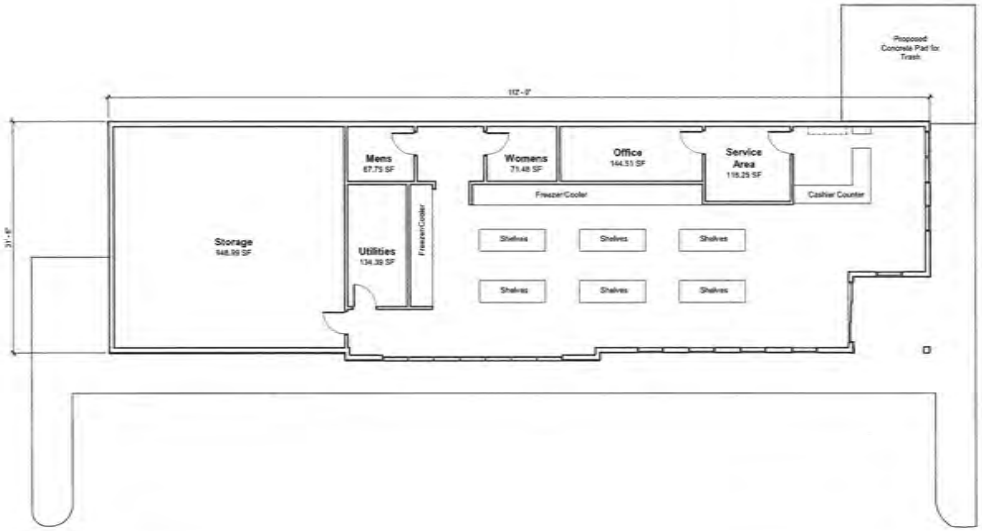
Drawing No.:

G-002



1 South Elevation
1/8" = 1'-0"

2 East Elevation
1/8" = 1'-0"



3 Top of Slab
1/8" = 1'-0"

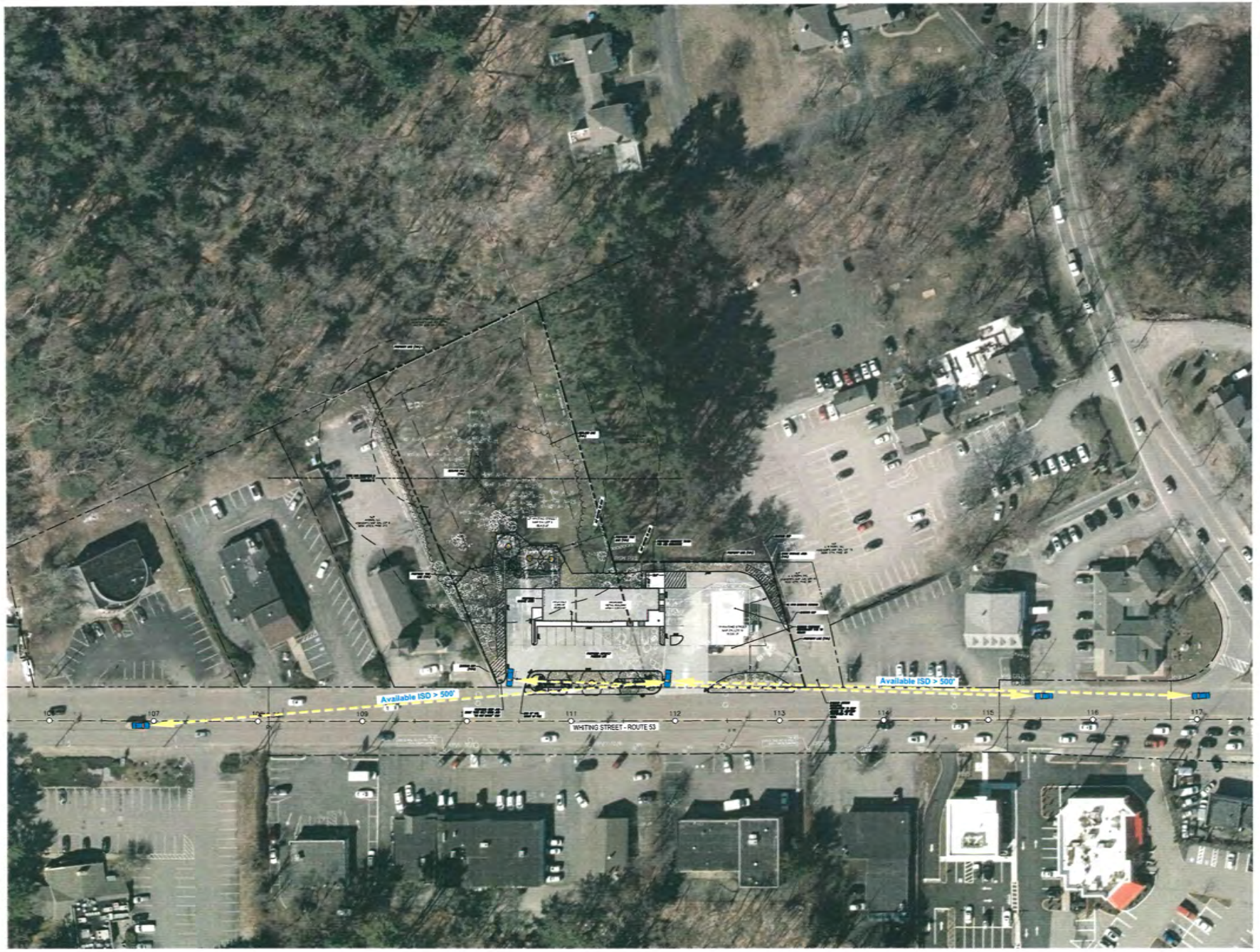
4 3D View 1

CHA ARCHITECTURE

Whiting Street Convenient Store

Concept Drawings

04/24/2020



CHA

0 20 40
Scale in Feet

OWNER/APPLICANT:

MERHEJ & SONS
REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING
STREET
HINGHAM, MA 02043

No.	Submittal / Revision	Appd.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

SIGHT DISTANCE

Designed By:	Drawn By:	Checked By:
DR/BN	DR/BN	KK
Issue Date:	Project No:	Scale:
05/01/2020	060963	1" = 20'

Drawing No.:
G-003

Memorandum

Date: April 24, 2020

To: Merhej & Sons Realty, LLC

From: John G. Morgan Jr., P.E., PTOE

Re: Trip Generation Assessment
Hingham Gas
#19 and 27 Whiting Street Redevelopment
Hingham, MA

CHA Consulting, Inc. (CHA) has performed a review of the anticipated change in traffic conditions associated with the proposed redevelopment of the existing Hingham Gas fueling station at 19 Whiting Street in Hingham. This Memorandum includes background information on the existing site and the proposed development plan, as well as documentation of the expected increase in vehicle trips at the site and on the adjacent roadway based on Institute of Transportation Engineers (ITE) methodology for calculating Trip Generation.

Background Information

Whiting Street is a State Highway (Route 53) under the jurisdiction of the Massachusetts Department of Transportation (MassDOT). The roadway includes two lanes in each direction in the vicinity of the site and is classified as an Urban Minor Arterial. This section of Whiting Street carries over 22,600 vehicles per day based on record traffic count data collected in 2011. The land use on this section of Whiting Street is primarily commercial, with more residential use to the north of the site.

The project involves the reuse of the existing gas station at 19 Whiting Street, and the demolition of a single-family house at 27 Whiting Street for the construction of a proposed retail store with gasoline station on the combined lots. The existing 200 s.f. kiosk building at the gas station would be razed as part of the re-development. Access to the proposed site will be provided via three of the four curb cut locations that exist today at the two lots. One existing driveway curb cut is proposed to be closed.

The proposed site development plan includes retaining the eight existing fueling stations at the gas station and constructing a new 2,531 s.f. retail store with 2,000 s.f. of additional storage space. The retail space is expected to be a convenience store use. The storage space will include two levels of 1,000 s.f. each with the upper level for storage of supplies, and the lower level for site maintenance equipment.

Trip Generation

A review of the expected traffic impacts of the proposed development was performed. Using information available from the Institute of Transportation Engineers (ITE) Trip Generation Manual 10th Edition, we have estimated the number vehicle trips per day at the site under the existing use conditions as a Gas Station and Single Family Home. The number of trips for the existing uses were derived using the sum of ITE Land Use Code (LUC) 944 Gasoline/Service Station and Land Use Code 210 Single-Family Detached Housing. The gasoline station trips were calculated based on the number of fueling positions, while the trips associated with Single-Family Detached Housing were calculated based on the number of dwelling units. The resultant estimate of the number of existing daily and peak hour trips at the site are depicted in Table 1.

The ITE Trip Generation Manual includes two different Land Use Codes with data relative to the proposed use as a gas station with convenience market. Land Use Code 853 Convenience Market with Gas Pumps is intended to be used when the retail is the primary use while Land Use Code 945 Gasoline / Service Station with Convenience Market is intended to be used when vehicle fueling is the primary use at the site. Trip generation for each of these Land Use Codes can also be calculated based on different variables including building square footage and number of fueling positions. The trip generation for the proposed site conditions was estimated using both Land Use Code 853 and Land Use Code 945. For each Land Use Code calculations were performed for both square footage (2,531 s.f.) and vehicle fueling positions (8), with the higher results selected for each selected in order to provide a conservative estimate of the number of proposed trips. The greatest number of trips for Land Use Code 853 was found using the vehicle fueling positions, while Lane Use Code 945 was found to have higher results using the building square footage. Table 1 depicts the number of trips expected at the proposed site using both Land Use Codes. The maximum trip generation projections for the proposed use were found to be from Lane Use Code 945. The maximum values for each analysis were chosen as a conservative measure to account for the greatest possible number of vehicles expected entering and exiting the site.

Table 1: Trip Generation Summary

	Existing Use	Proposed Use		Difference
Time Period/Direction	**LUC 944[a] Gasoline / Service Station and LUC 210[a] Single-Family Detached Housing (vehicles)**	**LUC 853[a] Convenience Market with Gasoline Pumps (vehicles)**	**LUC 945[a] Gasoline / Service Station with Convenience Market (vehicles)**	**Trip Generation (vehicles)**
Weekday Daily	**1385**	**2580**	**3645**	**2260**
Weekday AM Peak Hour	**83**	**166**	**192**	**109**
Entering	41	83	98	57
Exiting	42	83	94	52
Weekday PM Peak Hour	**113**	**184**	**224**	**111**
Entering	57	92	114	57
Exiting	56	92	110	54

[a]Institute of Transportation Engineers, Trip Generation, 10th Edition, Washington, 2017

As evident in Table 1, the anticipated trip generation of the proposed Gasoline / Service Station with Convenience Market will represent an increase from the previous use at the combined Gasoline / Service Station and Single-Family Detached Housing sites. The calculated daily trip generation increases by 2,260 vehicles per day, while the projected traffic volumes for both AM and PM Peak Hour increases by over 100 vehicles per hour.

Pass-By Traffic

Pass-by trips are vehicles that were already traveling on the roadway and turn into the site and exit the site to continue their journey. ITE data indicates that past studies of gasoline / service stations found that 60 percent of customers of these facilities were pass-by vehicles. This high percentage of pass-by trips is important to note as it indicates the majority of the new trips to the site are expected to be vehicles already on the roadway. While the increase in trip generation at the site is expected to be significant, the added vehicles to the adjacent roadway would not be as notable. Table 2 depicts the number of new vs. pass-by trips predicted for the proposed site based on the ITE data.

Table 2: Pass-By Traffic Summary

Time Period/Direction	Total New Trips to Site (vehicles)	New Pass-By Trips to Site (vehicles)	Total New Trips to Adjacent Roadway (vehicles)
Weekday Daily	**2260**	**1356**	**904**
Weekday AM Peak Hour	**109**	**65**	**44**
Entering	57	34	23
Exiting	52	31	21
Weekday PM Peak Hour	**111**	**67**	**44**
Entering	57	34	23
Exiting	54	33	21

As indicated in Table 2, the number of new vehicle trip on the existing roadway adjacent to the site expected in the peak hours is 44 vehicles. This is a combination of entering and exiting traffic and represents the number of vehicles directly in front of the site. Assuming that these trips would be distributed fairly evenly in each direction on Whiting Street, the number of new trips at other locations along Whiting Street would be less than 25 vehicles in the peak hour.

Conclusion

CHA reviewed the effect of the proposed gas station re-development project at 19 Whiting Street relative to expected traffic increases. The analysis was performed utilizing standard ITE Trip Generation methodology and is conservative in that the highest projection of the available data were used. The results of our analysis indicate that the traffic at the proposed site will increase significantly from the previous use, but that the majority of this traffic will be pass-by trips that involve vehicles already on the adjacent roadway. The number of new vehicle trips expected on Whiting Street at locations away from the site is less than 25 vehicles in the peak hours and is not expected to have a significant impact on operations of the roadway, which includes two travel lanes in each direction and carries over 22,000 vehicles per day.

If there are any questions regarding this Memorandum and the estimated change in traffic conditions expected at the site or the adjacent roadway based on the ITE data, please do not hesitate to contact us.

Stormwater Report
Hingham Gas
19 & 27 Whiting Street
Hingham, Massachusetts

CHA Project Number: 60903

Applicant:
Merhej & Sons Realty, LLC
87 Derby Street
Hingham, MA 02043

Prepared by:

141 Longwater Drive, Suite 104
Norwell, Massachusetts 02061
Phone: (781) 982-5400
Fax: (781) 982-5490

May 1, 2020

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LIST OF ACRONYMS & ABBREVIATIONS

BFE	Base Flood Elevation
BMP	Best Management Practice
BVW	Bordering Vegetated Wetland
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HSG	Hydrologic Soil Group
IWPA	Interim Wellhead Protection Area
MAHW	Mean Annual High-Water
MassDEP	Massachusetts Department of Environmental Protection
NAVD	North American Vertical Datum
NRCS	Natural Resources Conservation Service
SHGW	Seasonal High Groundwater
SWMSH	Stormwater Management Standards Handbook
Tc	Time of Concentration
TSS	Total Suspended Solids
USGS	United States Geological Survey

1.0 NARRATIVE

1.1 EXECUTIVE SUMMARY

The Applicant, Merhej & Sons Realty, LLC (Merhej), proposes to develop a new retail building adjacent to the existing gas station to replace the aging kiosk located currently on the property at 19 Whiting Street in Hingham, MA. The site consists of two parcels 19 and 27 Whiting Street which will be combined into one parcel to support the development. The proposed building has an approximate footprint of 3,500 square-feet and will consist of an approximate 2,530 square feet of retail and an approximate 1,000 square feet of storage on the main level and an approximate 1,000 square foot storage area on the lower level (under the western portion of the building). The proposed building will be served by an onsite Title 5 septic system to be permitted with the Hingham Board of Health. The proposed development has been designed to be located mainly within areas that were previously disturbed; an existing gas station on 19 Whiting St and a residential house on the 27 Whiting St parcel.

The site is bounded by Whiting Street to the south by commercial development on the east and west. The site is located in the Business C zoning district with a small rear portion of the 27 Whiting St parcel designated Residence B. The parcels are located in the Hingham Aquifer Protection District and Accord Pond Watershed. Wetland areas exist on the 27 Whiting St parcel. The site is not located within a habitat area designated by the Natural Heritage and Endangered Species Program (NHESP) (see Figure 3).

The drainage systems on the site are comprised of closed-conveyance pipe system which will collect and convey stormwater runoff from paved surfaces and half the roof area to a subsurface recharge/detention system that discharges to a bioretention system, and a bioretention system (detention) which will collect flow from one catch basin, half of the roof runoff, and overland flow from the proposed lower parking surface. The bioretention system will ultimately discharge towards the wetlands system. The underground system will also discharge to the rain garden to provide as much treatment and recharge prior to discharge to the wetland. The subsurface system and rain garden will attenuate peak rates of runoff. The systems provide the required treatment for stormwater runoff from impervious areas as required by the 2008 Massachusetts Stormwater Handbook. Refer to the attached site plans for additional information. The project will be serviced with water provided by the Aquarion Water Company (Aquarion), and the wastewater is discharged via a proposed on-site Title 5 septic system. Electricity is supplied by the Hingham Municipal Lighting Plant.

1.2 OBJECTIVE OF CALCULATIONS

The purpose of this stormwater analysis is to assess and quantify the existing and proposed stormwater runoff conditions from the site based upon the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards and the applicable provisions of the Town of Hingham Regulations.

The goals of the stormwater management system design for this project are to provide improved water quality, reduce post-development peak runoff rates as compared to pre-development peak runoff rates, maximize infiltration to the maximum extent practicable, and to protect the surrounding area from any potential flooding and/or environmental impacts. The following stormwater routing calculations were performed using the 2-year, 10-year, 25-year, and 100-year frequency. Type III, 24-hour SCS design storms and were compared for both pre-development and post-development conditions.

1.3 METHODOLOGY

The HydroCAD Stormwater Modeling System computer program, version 10.0, by Applied Microcomputer Systems, Inc. is used to develop stormwater runoff rates and volumes for the existing and proposed conditions at the project site. The HydroCAD software is a hydrograph generation and routing program similar to TR-20. The software uses Soil Conservation Service (SCS) Unit Hydrograph Methodology. This drainage analysis was developed utilizing a Type III, 24-hour storm as developed by the Soil Conservation Service (SCS). Information regarding the equations and calculation procedures utilized in HydroCAD will be made available upon request. The following basic steps are employed in the procedure:

1. A rainfall distribution is selected which indicates how the storm depth will be distributed over time. This is the standardized Type III SCS distribution based upon the project's location.
2. The design storm depth is determined from rainfall frequency atlas based upon the return period being modeled. Combined with the distribution of rainfall will yield the cumulative depth at each period during the storm.
3. Based upon the Time of Concentration (Tc), the storm is divided into bursts of equal duration. For each burst, the SCS runoff equation and the average Curve Number are used to determine the portion of that burst that will appear as runoff.
4. A unit hydrograph representing the runoff resulting from one inch of precipitation excess

generated uniformly over the watershed in conduction with the Time of Concentration is used to determine how the runoff from a burst is distributed over time. The result is a runoff hydrograph for a single burst.

5. Individual hydrographs are added together for all bursts in the storm yielding the complete runoff hydrograph for each storm.

The SCS rainfall distributions are derived from observations that were used to develop the Intensity-Duration-Frequency relationship or IDF curve. By studying the Weather Bureau's Rainfall Frequency Atlases, the SCS developed four "mass curves" that could be used to represent the characteristics of the rainfall distribution throughout the continental United States. The mass curve is a dimensionless distribution of rainfall over time, which indicates the fraction of the rainfall event that occurs at a given time within a 24-hour precipitation event. This synthetic distribution develops peak rates for storms of varying durations and intensities. The SCS distribution provides a cumulative rainfall at any point in time and allows volume dependent routing runoff calculations to occur.

The HydroCAD software has the additional capability to describe shallow concentrated flow. The "NEH-4 Upland Method" included in the HydroCAD software is applicable for conditions which occur in the headwaters of a watershed up to 2000 acres. The NEH-4 Upland Method allows the Time of Concentration (T_c) to reflect ground conditions such as overland flow, grassed waterways, paved areas and upland gullies. This results in a model that more accurately reflects the ground surface for shallow concentrated flow conditions, than TR-20, which is limited to distinguishing only paved and unpaved surfaces. T_c is the time required for water to flow from the most distant point on a runoff area to the measurement or collection point. In instances where the watersheds are small and impervious, Tc has been directly entered as a 5-minute minimum. This is consistent with standard engineering practice and Technical Release (TR-55) Urban Hydrology for Small Watersheds graphical method. A lower boundary of 5 minutes will yield a conservative, yet practical measure of stormwater runoff flow for small watersheds contained within the development.

The curve number or CN is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct stormwater runoff. Based upon the cover in each sub-watershed a weighted average CN value was determined. The area, CN values, and time of concentration were entered into HydroCAD to develop hydrographs for the pre and post developed conditions.

1.4 SITE HYDROLOGY

Hydrologic soil groups (HSG) are used primarily to estimate runoff from precipitation in engineering calculations. HSG designations vary from "A" to "D" with "A" having the highest infiltration rate and "D" the slowest. Test pits were performed by a licensed soil evaluator in locations proximate to the proposed stormwater systems to confirm the infiltration rates and groundwater data used in the design and were witnessed by a peer review consultant of the Town.

Soils on the site consist soils from hydrologic soil groups (HSG) "A" through "D" based on the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), Soil Survey of Plymouth County. Soils within the property are classified as: Urban Land towards Whiting Street, Hinckley gravely sandy loam and Newfields fine sandy loam within the interior of the parcel, and Scarboro muck within the wetland areas.

Test pits and site visits indicate permeable soils located on the south and east side of the 27 Whiting St. parcel with less permeable soils to the west and north towards the wetland resource area. In an effort to be conservative with the analysis, we utilized an HSG "B" for all areas on the site. Refer to the watershed plans in Section 3.3 of this report for more information.

Two distinct design points (DP-1 and DP-2) were chosen at down gradient points in the drainage area to compare development conditions for each of the following SCS Type III 24-hour design storm events. The design storm frequencies and corresponding rainfall depths were compiled from the "Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada" and Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and 1 to 100 Years" and have been estimated as follows for Plymouth County:

Storm Frequency (Years)	Rainfall Depth (Inches)
2	3.4
10	4.7
25	5.6
100	7.0

Drainage watershed plans for both pre- and post-development conditions have been included in Section 3.3 of this report.

1.4.1 ESTIMATED SEASONAL HIGH GROUNDWATER

Seasonal high groundwater represents the highest groundwater elevation. Depth to seasonal high groundwater may be identified based on Redoximorphic (Redox) Features in the soil.

Field test pits (TP-1 through TP-6) were conducted onsite on March 6, 2020 to identify the soils texture and determine the probable seasonal high groundwater elevation based on redox features if any were present. Redox features were observed in all six test pits. The estimated seasonal high groundwater (elevation 134.2'), from TP-4, is used for proposed Title 5 septic system. The estimated seasonal high groundwater (elevation 133.5'), from TP-3 and TP-6, is used for proposed underground drainage system. The estimated seasonal high groundwater (elevation 131.8'), from TP-5 is used for proposed bioretention system.

1.4.2 PRE-DEVELOPMENT HYDROLOGY

The total project site consists of two lots which will be combined as part of the proposed development. One lot consists of an existing gas station and the other consists of an existing residential house with driveway in a commercial district. The site predominately drains in two directions, to the south towards Whiting Street and to the North to the existing wetland. The site has been analyzed and divided into sub-watershed areas that are tributary to the design points. Times of concentration for developed areas were modeled as 5 minutes unless otherwise noted in the HydroCAD model. The sub-watershed areas are depicted on the Existing Conditions Hydrology Plan (DR-1) which is included in Section 3.3.1 of this report. The section below provides a brief description of the existing subcatchment areas. Refer to the attached HydroCAD model for additional information.

Existing Conditions Subcatchment 1

Subcatchment 1 consists of the portion of the site which drains to the South towards Whiting Street. The majority of the surface is paved with areas of woods and grass. A 5-minute direct entry Tc was utilized.

Existing Conditions Subcatchment 2

Subcatchment 2 is tributary to the existing wetland located on the 27 Whiting St parcel. The subcatchment area consists woods, impervious roof and driveway, and grass areas. A 5-minute direct entry Tc was utilized.

1.4.3 POST-DEVELOPMENT HYDROLOGY

As explained previously, the proposed project includes the proposed retail building as part of an upgrade to the existing gas station. The subcatchment areas were delineated based on the proposed drainage infrastructure for collection, treatment, and discharge. The sub-watershed areas are depicted on the Proposed Conditions Hydrology Plan (DR-2) which is included in Section 3.3.1 of this report. Refer to the attached HydroCAD model for additional information.

Post Development Subcatchment 1

Subcatchment 1 consists of the portion of the site which drains to the South towards Whiting Street. The majority of the surface is paved with areas of woods and grass. A 5-minute direct entry Tc was utilized.

Post Development Subcatchment 2a

Subcatchment 2a consists of the portion of the site which is tributary to UG-1 the underground recharge/detention system. The area consists predominantly of impervious area but includes some woods and lawn areas as well. A 5-minute direct entry Tc was utilized.

Post Development Subcatchment 2b

Subcatchment 2b consists of the paved parking and landscaped area tributary to the rain garden. A portion of the impervious area within Subcatchment 2b is collected by a catch basin proximate to an entrance to Whiting St and the other portion flows overland from either grassed or impervious area towards the rain garden. A 5-minute direct entry Tc was utilized.

Post Development Subcatchment 2c

Subcatchment 2c consists of the grassed and wooded areas which flow directly to the existing wetland. A 5-minute direct entry Tc was utilized.

1.5 STORMWATER MANAGEMENT

This project includes a Stormwater Management System that has been designed to satisfy and comply with the requirements of the MassDEP Stormwater Standards (2008).

The following is an explanation on how the proposed project will address the 2008 MassDEP Stormwater Management Policy.

Standard 1: No New Untreated Discharges – No new stormwater system conveyances will discharge untreated runoff or cause erosion in wetlands or waters of the Commonwealth.

All new stormwater system conveyances will be treated prior to discharge and will not cause erosion in wetlands or waters of the Commonwealth. Stormwater will be directed to various structural and non-structural Best Management Practices.

Standard 2: Peak Rate Attenuation – Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The peak discharge rates are calculated with the aid of a hydrograph routing program using TR-20 methodology called HydroCAD. The HydroCAD calculations of the Pre- and Post-Development runoff peak rates have been performed. The proposed stormwater system reduces post-development peak rates of runoff below that of pre-development levels at each Design Point.

Standard 3: Recharge – Loss of annual recharge to groundwater shall be eliminated or minimized using 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.

Recharge to groundwater will be provided through volume within the stone below the underground recharge/detention system UG-1. The recharge provided satisfies Standard 3 and exceeds the recharge requirement. Please see the calculations provided in this report in Section 4.3.

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).
This Standard is met when:
a. Suitable practices for source control and pollution prevention are identified in a long-term

pollution prevention plan, and thereafter are implemented and maintained;

b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The project proposes the use of deep sump hooded catch basins, Isolator Rows, proprietary separator (CDS450i), water quality swale, and a bioretention area to remove the required post-construction load of TSS to the extent practicable per the Massachusetts DEP Stormwater Management Standards. The TSS removal worksheets are located within Section 4.2 of this report. The Long-Term Pollution Prevention Plan is included in conjunction with the Operation and Maintenance Plan required by Standard 9 (see Section 2 of this report).

Standard 5: Land Uses with Higher Potential Pollutant Loads – 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 there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The site is considered a LUHPL (Land Use with Higher Potential Pollutant Load). Note that the existing gas station is a LUHPL and utilizes a canopy to limit exposure to rain, snow, snow melt, and runoff. The project provides the required TSS removal (44% or higher) prior to discharging to the recharge system through the use of a deep sump hooded catch basin and Isolator Row. Overall the project provides the required TSS removal of 80% or higher. Refer to the attached TSS removal worksheets located within Section 4.2 of this report.

Standard 6: Critical Areas – 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 (Zone Is, Zone IIs, and Interim Wellhead Protection Areas for groundwater sources and Zone (A)s for surface water sources.)

There will be no untreated stormwater discharge to a "Critical Area," however, the proposed recharge system (UG-1) is located in the Town of Hingham Aquifer Protection District. Overall the project provides the required TSS removal of 80% or higher. Refer to the attached TSS removal worksheets located within Section 4.2 of this report.

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

This project is a mix of new and redevelopment under the Stormwater Management Standards. The project has been designed to meet and provide full compliance with the Stormwater Management Standards for the new proposed areas and to the extent practicable for the existing impervious areas.

Standard 8: Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control – 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 Pollution Prevention Plan has been prepared for the project (see Section 2). Provisions to maintain runoff control devices have been assured through non-structural, structural, and construction management approaches.

Standard 9: Operation and Maintenance Plan – A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

An Operation and Maintenance Plan has been prepared for the project (see Section 2). Provisions to maintain runoff control devices have been assured through non-structural, structural, and construction management approaches.

Standard 10: Prohibition of Illicit Discharges – All illicit discharges to the stormwater

management system are prohibited.

The Operation and Maintenance plan required by Standard 9 includes measures to prevent illicit discharges (see Section 2). An Illicit Discharge Compliance Statement is included in Section 4.5.

1.6 BEST MANAGEMENT PRACTICES (BMPs)

A treatment train of deep sump catch basins, StormTech Isolator Rows, and subsurface infiltration chamber systems are proposed to treat stormwater runoff on the site. See Section 4 for the Total Suspended Solids (TSS) Calculations. A description of the devices incorporated is indicated below.

1.6.1 PROPOSED STRUCTURAL AND TREATMENT BMPs

1. DEEP SUMP HOODED CATCH BASINS

Deep sump catch basins are modified versions of inlet structures installed to collect and convey stormwater on the site. The deep sumps, typically a 4-ft dimension below the outlet pipe invert, are most effective if placed "off-line" which means that they do not have inlet pipes. The catch basins contain traps or hoods on the outlet pipes and serve as pretreatment for other downstream BMPs. Deep sump catch basins will be installed throughout the site to remove trash, debris, sediment and a limited amount of oil and grease from stormwater runoff. To ensure maximum capacity and efficiency, the catch basins shall be inspected monthly and cleaned, in dry weather, when half of the sump capacity is filled or at a minimum quarterly or as required and at the end of construction.

2. ISOLATOR ROWS

The Isolator Row is a series of StormTech chambers surrounded with filter fabric and connected to one or more manholes for access. The chambers are wrapped in fabric and provide settling and filtration. Stormwater runoff is first directed to the Isolator Row where sediments are captured, thereby protecting the rest of the underground system consisting of standard chambers in a stone bed. This technology will be used as a part of a treatment train consisting of other structural and non-structural approaches such as street sweeping and reduced road salt alternatives. Isolator Rows will be inspected routinely and cleaned in accordance with manufacturer's recommendations.

3. BIORETENTION AREAS

The design will incorporate a bioretention area located to the west of the lower parking lot servicing the storage area at the lower level of the proposed commercial building. The bioretention area utilizes a column of engineered soil media and both woody and herbaceous plants to remove the pollutants from stormwater runoff. Runoff is generally conveyed as sheet flow through vegetated buffers before flowing to a ponding area consisting of mulch, planting soil, and plants.

4. SUBSURFACE RECHARGE/ DETENTION SYSTEM (UG-1)

A subsurface drainage system consisting of high-density polyethylene plastic chambers (StormTech SC310) set in a stone bed that is proposed to retain, recharge, and infiltrate storm runoff. The chamber system aims to provide peak flow reduction, stormwater runoff volume reduction, and TSS removal for various storm events. The proposed system drains down completely between storm events as required by the Massachusetts Stormwater Policy. Manhole risers or manufacturer recommended inspection ports are proposed at the ground surface to allow inspection and maintenance access. Once the system goes online, inspections should occur after each storm event for the first few months to ensure proper stabilization, function, and to ensure that the outlets remain free of obstructions. Preventative maintenance shall be performed at least twice per year and after every major storm event (> 1.5" of rainfall) and shall include removal of accumulated sediment, inspection of the undergound structure, and monitoring of groundwater to ensure proper operation of the system. Important items to check for include differential settlement, cracking, breakout, clogging of outlets and vents, and root infestation. Water levels should be checked and recorded against rainfall amounts to verify that the drainage system is working properly and draining within 72 hours. If they do not drain within 72 hours, corrective action should be taken.

5. HYDRODYNAMIC SEPARATORS

Hydrodynamic separators are a type of water quality manhole that relies on flow through the structures to promote settling and separation within the unit in order to remove sediments and other pollutants that are widely found in storm water. This technology will be used as a part of a treatment train consisting of other structural and non-structural approaches. Each device has been sized using the 1.0" equivalent water quality flow and will be reviewed per manufacturer's recommendations and checked by the representative. The hydrodynamic separators shall be inspected twice per year and cleaned at least once per year or in accordance with the manufacturer's recommendations.

6. OUTLET CONTROL STRUCTURES

The outlet control structures (OCS) detain the water utilizing orifices to control the outlet flow and are below grade with access via covers to grade. Although the outlet control structures should not have much debris, they should be inspected to make sure there are not concrete issues or residual debris. Sand accumulation within the OCS is a sign there is an issue with the upstream stormwater treatment device. The OCS shall be inspected once per year. It may be necessary to clean the structure and the use of a vacuum truck may be necessary.

7. LEVEL SPREADER/PLUNGE POOL / ENERGY DISSIPATER AND DOWNSTREAM SLOPES

The level spreader/plunge pool/energy dissipaters are utilized at the outlet pipes prior to discharge to the wetland to prevent erosions. The level spreader/plunge pool/energy dissipaters should be inspected at least once a year for sand accumulation and debris which may impact their effectiveness to slow water. Cleaning should take place during the early spring, although, additional inspections and cleaning may be needed.

In order to ensure that the level spreader systems are working, the outlets as well as slopes downstream for the first three years of operation, should be inspected after every storm of 1" or greater to assure no erosion of the slope. After the first three years, we recommend inspections after any large storm (25+ year event) for erosion. If no erosion is evident, then the stone size and level spreader design is adequate. Should there be erosion evident at the outlet, stone size should be increased, or additional large stones added to enhance energy dissipation of water. If downstream slopes exhibit signs of erosion, repairs to soils and slope should be made and then a treatment such as an erosion control matting should be instituted to reinforce soils until vegetative cover can be restored. We recommend that the aprons and downstream slopes be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

1.7 HYDRAULICS AND PIPE SIZING

The closed-conveyance storm drain collection system was analyzed using the Rational Method. **Q = CiA,** for estimating runoff where "C" is a coefficient dependent on land cover, "i" is storm intensity in in/hr based upon published I-D-F curves, and "A" is area in acres. "Q" is flow in cubic feet per second.

The project site and access road were subdivided by catch basin or inlets based upon drainage areas tributary to each. A "C" value for each area was assigned based upon overall character of land. "C" values ranged from 0.9 in paved/impervious conditions to 0.3 for grass and landscaped areas. IDF curves from Quincy, Massachusetts are used to establish the rainfall rate for the 100-year event. Pipe hydraulic design was completed using Manning's full flow capacity equation for circular pipe with an n-value of 0.013

$Q = 1.49/n\ AR^{2/3}\ S^{1/2}$, where, n is coefficient depending on channel roughness, A is area of flow, R is the hydraulic radius, and S is the channel slope.

1.8 SUMMARY OF HYDROLOGY & STORMWATER CALCULATIONS

The results of the pre and post-development hydrology calculations provided in Section 3 are summarized in the following tables. The table corresponds to the design points as indicated on the drainage area maps and hydrograph routing calculations.

- **Summary of Design Point 1 (DP-1):**

TOTAL RUNOFF PEAK FLOW RATE (CFS) - DESIGN POINT 1 (DP-1)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	1.08	0.92	-0.16
10-YEAR	1.71	1.42	-0.29
25-YEAR	2.14	1.76	-0.38
100-YEAR	2.82	2.29	-0.53

TOTAL RUNOFF VOL. (AC-FT) - DESIGN POINT 1 (DP-1)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.077	0.066	0.011
10-YEAR	0.122	0.103	0.019
25-YEAR	0.155	0.128	0.027
100-YEAR	0.206	0.169	0.037

The project design reduces the peak flow rates and volumes in the post-developed condition at the DP-1 in all storms.

- **Summary of Design Point 2 (DP-2):**

TOTAL RUNOFF PEAK FLOW RATE (CFS) - DESIGN POINT 2 (DP-2)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.63	0.61	-0.02
10-YEAR	1.79	1.38	-0.41
25-YEAR	2.75	2.02	-0.73
100-YEAR	4.42	3.81	-0.61

TOTAL RUNOFF VOL. (AC-FT) - DESIGN POINT 2 (DP-2)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.063	0.128	0.065
10-YEAR	0.142	0.227	0.085
25-YEAR	0.207	0.305	0.098
100-YEAR	0.321	0.436	0.115

The project design meets or reduces the peak flow rates in the post-developed condition at the DP-2 in all storm events.

1.9 CONCLUSION

In conclusion, the project incorporates a series of structural and nonstructural Best Management Practices (BMPs) that are designed to reduce stormwater runoff rates and increase the detention time for the site and enhance the stormwater runoff quality by providing the required TSS removal.

The stormwater system has been designed to control peak discharge rates up to and including the 100-yr design storm event. The proposed stormwater system has been designed to meet Massachusetts Stormwater Management Standards for TSS removal and water quality treatment.

It is our professional opinion that the proposed development project does not adversely affect the surrounding drainage patterns. The following routing calculations, Best Management Practices design, and associated documentation within this report have been prepared to illustrate that runoff

discharge rates from the project has been mitigated and that the design provides the required recharge for the increase in proposed impervious area.

REFERENCES

1. Commonwealth of Massachusetts, Department of Environmental Protection, Stormwater Management Standards Handbook. Volumes 1-3 February 2008 (DEP Stormwater Management Policy 2008).

2. Commonwealth of Massachusetts, Department of Environmental Protection. 310 CMR 10.00: Massachusetts Wetlands Protection Act Regulations. 2008.

3. Commonwealth of Massachusetts, Department of Environmental Protection. 314 CMR 4.00: Massachusetts Surface Water Quality Standards. 2007.

4. Commonwealth of Massachusetts, Department of Environmental Protection. 314 CMR 9.00: Massachusetts Water Quality Regulations. 2008.

5. United States Department of Agriculture, Natural Resources Conservation Services Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55). June 1986.

6. United States Department of Agriculture, Natural Resources Conservation Services Project Formulation Hydrology Program System, Technical Release 20 (TR-20). Oct. 2004.

1.10 GENERAL CONSTRUCTION SEQUENCING

The following section provides construction details and highlights the construction sequence and timing of earthmoving activities. The overall project will be broken down into the following phases:

- Establish Erosion and Sediment Controls around the project site
- Demolition (ex. building, structures, driveways, septic systems)
- Site clearing and grading, drainage, utility, and roadway installation
- Building construction
- Final utility connections, and permanent stabilization

A. Pre-construction Meeting

An on-site meeting will be conducted by the Owner's Representative prior to the start of construction activity.

B. Installation of Erosion Controls

Erosion and sedimentation controls (i.e. silt fence, straw bales, and inlet protection) will be installed at the limits of work and within the existing catch basins, as applicable. Tree protection will be installed around trees specified to remain within the limit of work. Structures to remain shall also be visibly flagged/protected.

C. Installation of Construction Entrance

A construction entrance will be installed in the location as shown on the Erosion Control Plan in accordance with the construction detail provided in the plan set. Existing pavement will be removed within the limits of the proposed construction entrance to accommodate the crushed stone entrance.

D. Demolition

Any existing building, utilities services, and pavement within the project area will be demolished in accordance with the Construction Plans. Those utilities effected by construction activates shall be coordinated with the utility purveyors and Dig Safe procedures taken prior to implementation of agreed upon connections/disconnections/abandonment of services. Materials that are to be removed from the site will be transported to an appropriate facility or will be disposed of elsewhere according to Federal, State, and Local guidelines. Inactive stockpiles or areas of granular material or topsoil shall be temporarily secured in order to control sediment laden runoff.

E. Site Clearing and Rough Grading

The site will be cleared and rough graded in accordance with the proposed grading as shown on the plans. If suitable topsoil is found, it will be removed and stockpiled within the project limits. Areas which have been cleared (outside of the right-of-way) will be stabilized.

F. Building Construction

This phase of construction will involve the installation of the building including the proposed foundation and vertical construction of the building. All building waste is to be properly disposed of in dumpsters. While this phase commences, other site construction activities will be taking place.

G. Installation of Drainage and Utilities

Utility relocations and modifications, including water, gas, and electric, are anticipated to occur in conjunction with the drainage work. Temporary sediment basins will be constructed at this time

on an as-needed basis to collect stormwater runoff during construction. Stockpiles will be established in designated areas as shown on project plans. All temporary/inactive stockpile areas will be encompassed by straw bales or other approved erosion control devices to control sediment laden runoff as necessary and will be temporarily seeded, mulched or covered with plastic, as necessary.

H. Fine Grading, Paving, Etc.

The fine grading and shaping will commence along with the installation of curbing to prepare for paving operations. Areas outside of the parking lot will be shaped and prepped for loam, seed, or other treatments. Paving operations will begin with the installation of both binder and finish course layers.

I. Permanent / Final Site Stabilization

The final phase of the project consists of landscaping and restoration and stabilization of all exposed surfaces. Final landscaping will be performed upon completion of earthwork and completion of all curbing and sidewalk construction. Disturbed areas will be landscaped, mulched or seeded in accordance with the landscape requirements. Permanent restoration and revegetation measures serve to control erosion and sedimentation by establishing a vegetative cover. In the event that weather conditions prevent final restoration, temporary erosion and sedimentation measures will be employed until the weather is suitable for final cleanup. A final inspection will ensure that the project site is cleared of all project debris and that erosion and sedimentation controls are functioning properly. Once the site has been stabilized, newly installed catch basins and the subsurface infiltration and detention systems will be inspected for sediment deposits and cleaned if necessary.

Section 1.12

Figures

LEGEND:

APPROXIMATE PROPERTY LINE

N

0 600 1200

Scale in feet

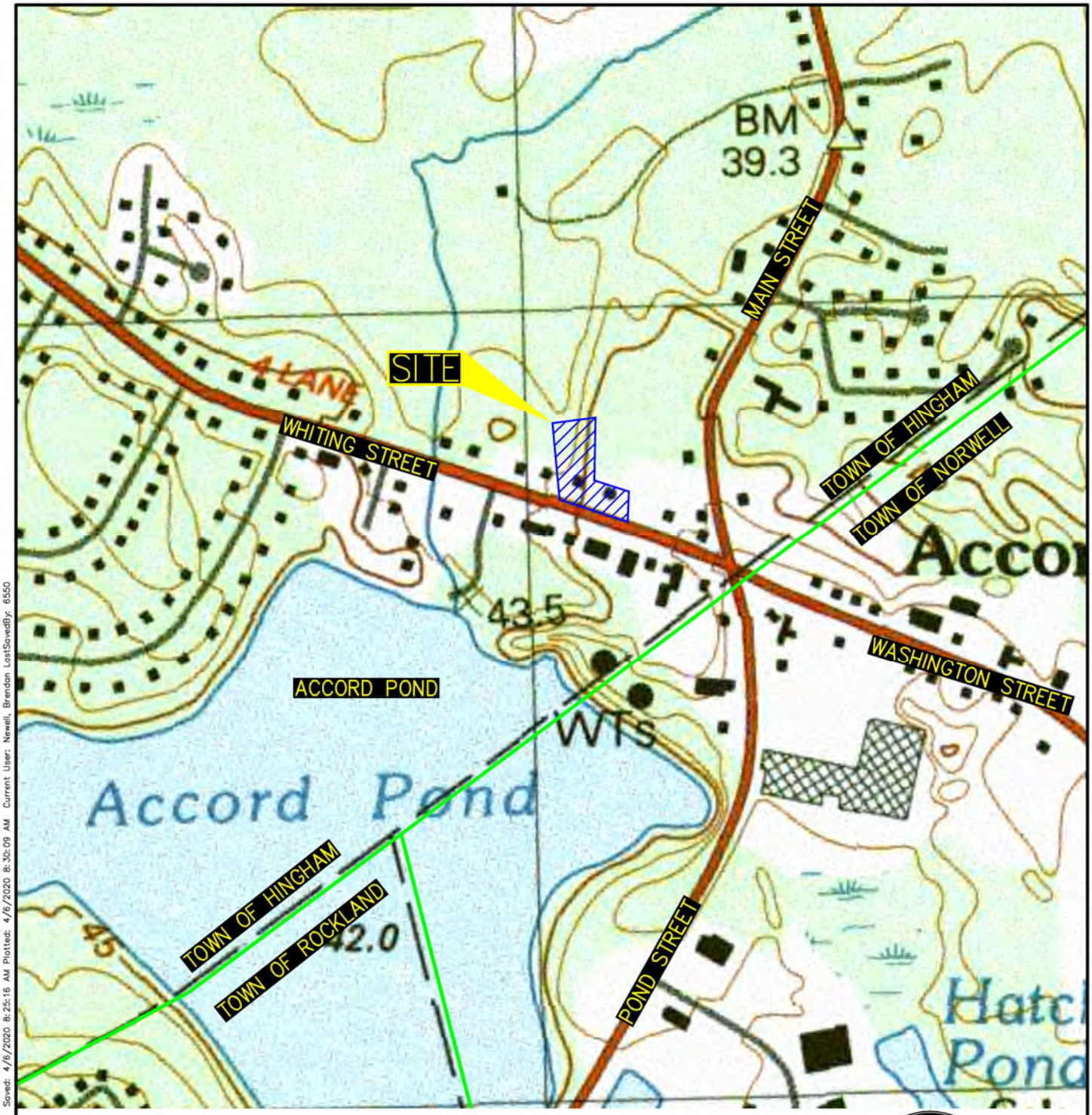
CHA
141 Longwater Drive - Suite 104
Norwell, MA 02061
781.982.5400 - www.chacompanies.com

ORTHOPHOTO PLAN
19 AND 27 WHITING STREET
HINGHAM, MA 02043

PROJECT NO. 060903

DATE: 04/06/20

FIGURE 1



LEGEND:

APPROXIMATE PROPERTY LINE

N

0 600 1200

Scale in feet

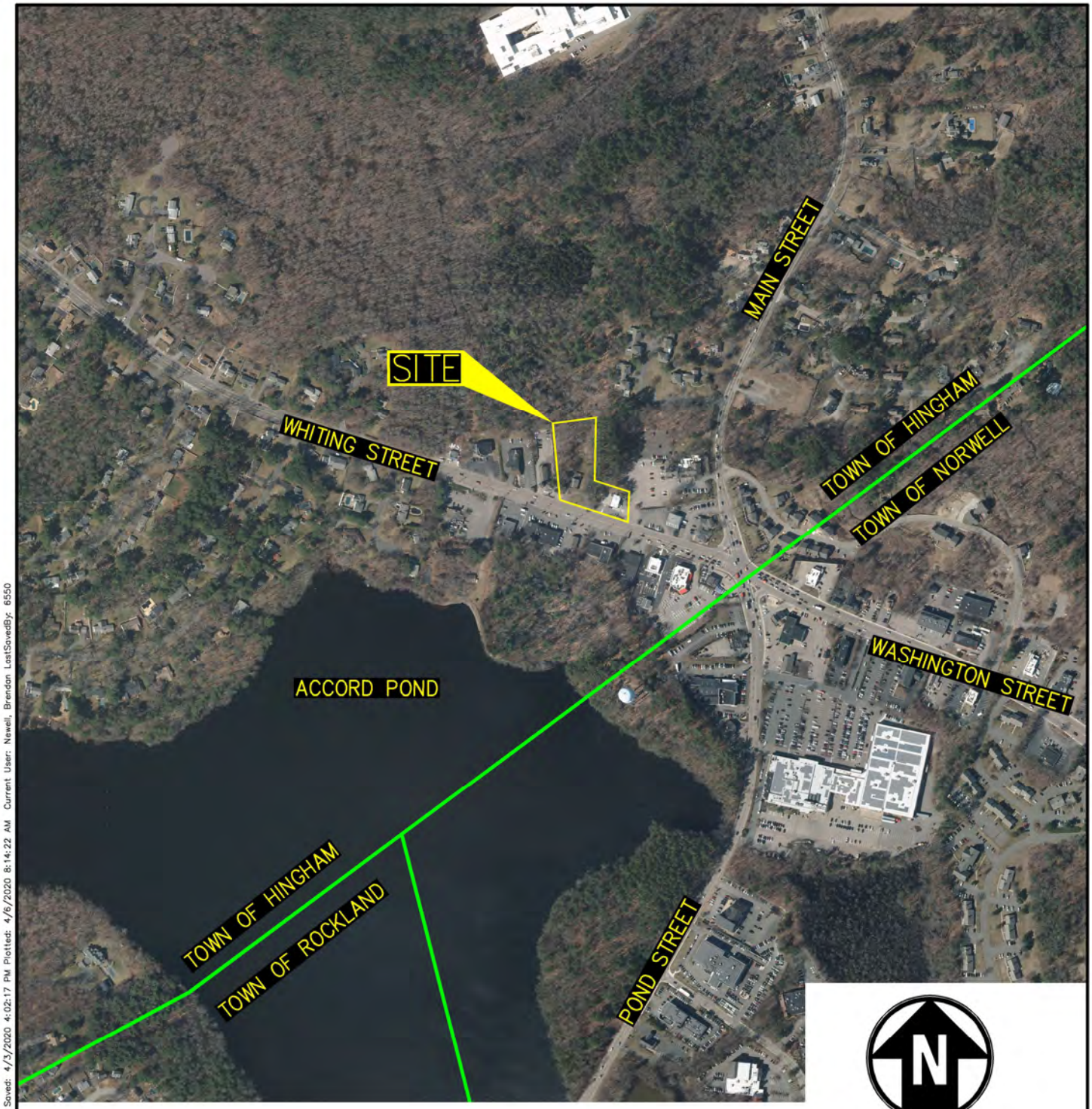
CHA
141 Longwater Drive - Suite 104
Norwell, MA 02061
781.982.5400 - www.chacompanies.com

USGS PLAN
19 AND 27 WHITING STREET
HINGHAM, MA 02043

PROJECT NO. 060903

DATE: 04/06/20

FIGURE 2



LEGEND:

- APPROXIMATE PROPERTY LINE
- NHESP ESTIMATED HABITATS OF RARE WILDLIFE
- POTENTIAL VERNAL POOL
- CERTIFIED VERNAL POOL
- NHESP PRIORITY HABITATS OF RARE SPECIES

0 600 1200
Scale in feet

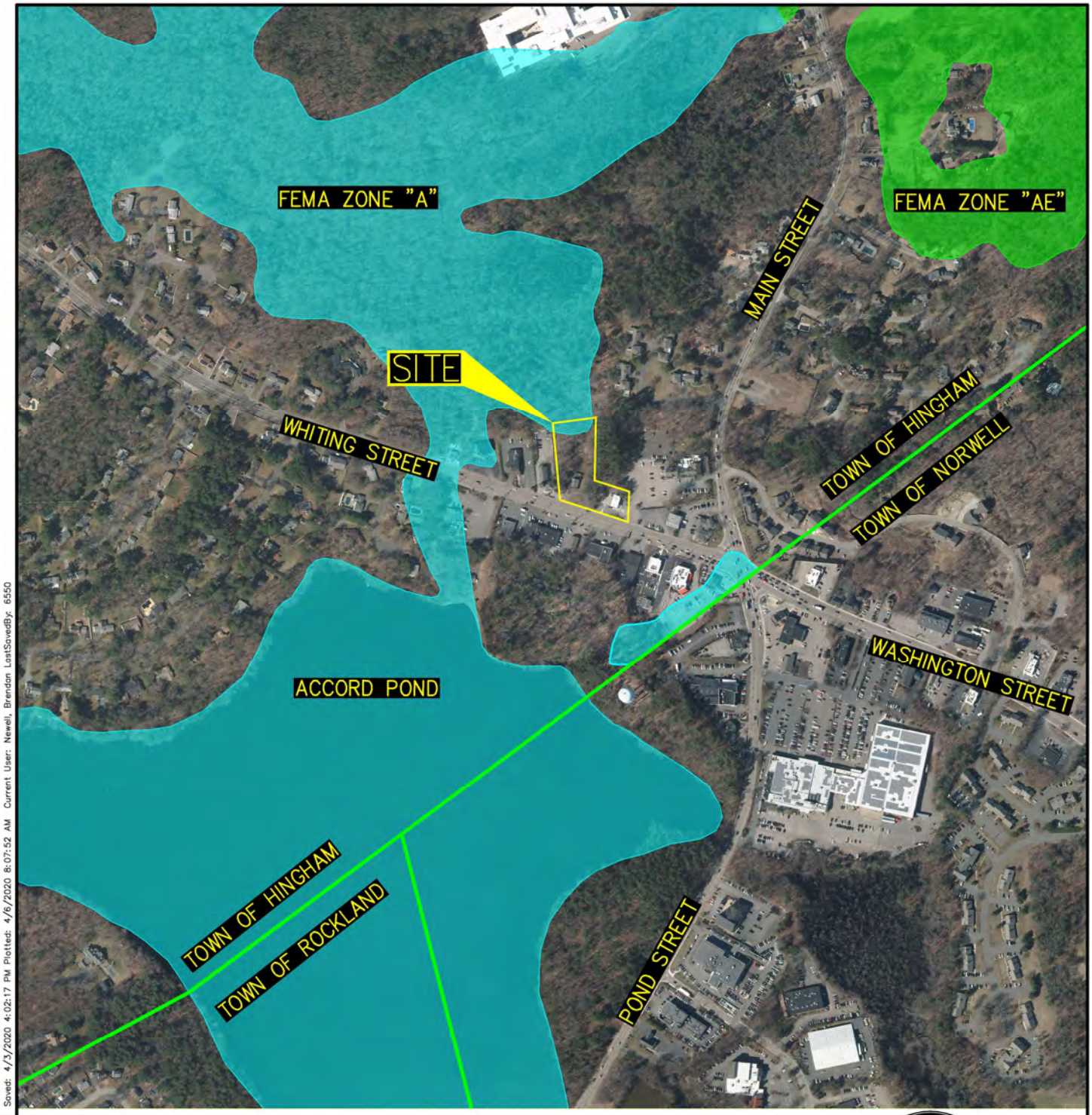
CHA
141 Longwater Drive - Suite 104
Norwell, MA 02061
781.982.5400 - www.chacompanies.com

NHESP HABITAT MAP
19 AND 27 WHITING STREET
HINGHAM, MA 02043

PROJECT NO. 060903

DATE: 04/06/20

FIGURE 3



LEGEND:

APPROXIMATE PROPERTY LINE

FEMA ZONE "A" 1% CHANCE OF FLOODING

FEMA ZONE "AE" 1% CHANCE OF FLOODING

N

0 600 1200

Scale in feet

CHA
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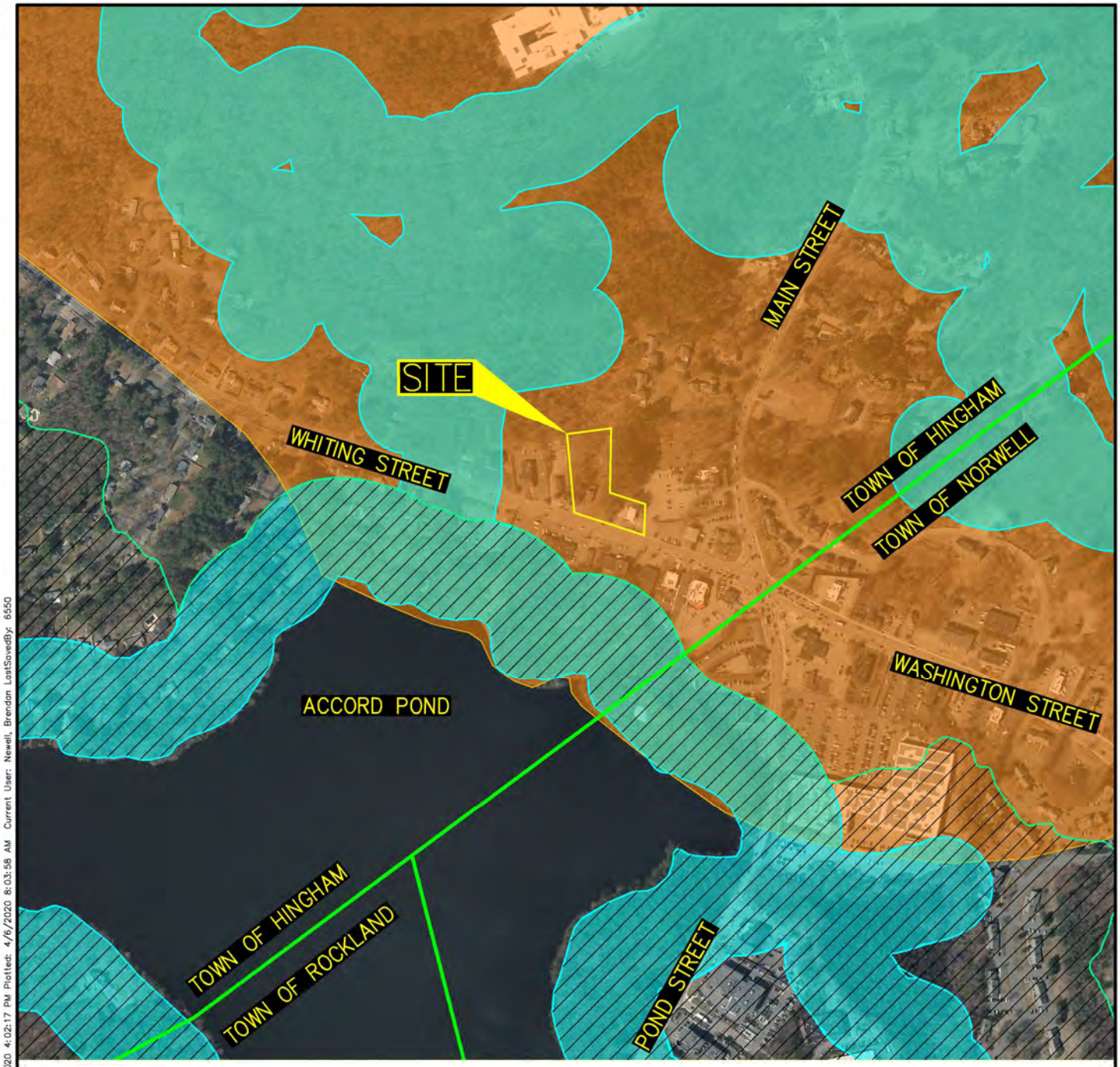
Norwell, MA 02061
781.982.5400 - www.chacompanies.com

FEMA FLOOD MAP
19 AND 27 WHITING STREET
HINGHAM, MA 02043

PROJECT NO. 060903

DATE: 04/06/20

FIGURE 4



LEGEND:

- APPROXIMATE PROPERTY LINE
- ZONE A SURFACE WATER SUPPLY
- ZONE B SURFACE WATER SUPPLY
- ZONE 1 WELLHEAD PROTECTION AREA
- ZONE 2 WELLHEAD PROTECTION AREA
- INTERIM WELLHEAD PROTECTION AREA

N

0 600 1200

Scale in feet

CHA
141 Longwater Drive - Suite 104
Norwell, MA 02061
781.982.5400 - www.chacompanies.com

WATER SUPPLY PLAN
19 AND 27 WHITING STREET
HINGHAM, MA 02043

PROJECT NO. 060903

DATE: 04/06/20

FIGURE 5

Section 2.0

Long-Term Pollution Prevention and Operation and Maintenance Plan

LONG-TERM STORMWATER POLLUTION PREVENTION AND OPERATION & MAINTENANCE PLAN TO COMPLY WITH STORMWATER STANDARDS 4, 6, & 9

APPLICABILITY

This document identifies constituents of concern that have the potential to contaminate stormwater from the proposed Hingham Gas project located at 19 and 27 Whiting Street and provides a framework of Best Management Practices (BMPs) for handling stormwater runoff. It also outlines an inspection and maintenance program to ensure continued effectiveness of the proposed stormwater management system. The proposed BMP's are shown on the plans prepared by CHA, 141 Longwater Drive, Suite 104, Norwell, Massachusetts.

PROJECT OVERVIEW:

The proposed project located on Whiting Street in Hingham includes a new commercial building to service an existing gas station and associated parking and utilities. The project is a redevelopment of a residential site. The project has been designed to meet State standards for TSS removal through the use of BMPs. Runoff from half of the roof and other impervious surfaces will be collected by a deep sump hooded catch basin and conveyed to isolator rows and then underground drainage chamber systems. Runoff from impervious surfaces will also be collected or drain overland toward a bioretention area.

Appended to this document is a sample maintenance form and a chart describing the anticipated frequency of tasks.

OWNER AND RESPONSIBLE PARTY:

Owner:

Merhej & Sons Realty, LLC
87 Derby Street
Hingham, MA 02043

Day-to-day Operation and Maintenance:

Merhej & Sons Realty, LLC
87 Derby Street
Hingham, MA 02043

CONSTRUCTION MANAGEMENT:

A construction manager with adequate knowledge and experience on projects of similar size and scope shall be employed to oversee all site construction. The contractor shall incorporate the appropriate techniques to control sediment and erosion pollution during construction in accordance with the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas and any conditions of approval from the local conservation commission.

The design incorporates measures to control construction-related impacts including erosion,

sedimentation and other pollutant sources during construction and land disturbance activities. The information contained herein and within the engineering drawings identifies construction period pollution prevention measures, responsible parties, erosion control measures (straw bales, filter socks, and silt fence, etc.), BMPs for collecting and treating runoff and groundwater during construction[1], site stabilization measures (i.e. gravel, seed, pavement, etc.), an operations and maintenance plan & long-term pollution prevention plan contained herein.

Care should be taken when constructing stormwater control structures. Light earth-moving equipment shall be used when operating over top of buried utilities or drain or chambers.

ON-GOING MAINTENANCE CONTRACT

The non-structural and structural approaches recommended below, as well as the required BMP maintenance, will be completed by an appropriate contractor. Adequate personnel with appropriate training and access to proper equipment will be available to complete the tasks. Future responsible parties must be notified of their responsibility to operate and maintain the system in perpetuity.

LIVING DOCUMENT PROVISIONS

Due to the difficulty of identifying all sources of potential stormwater contamination and maintenance activities, this document should be updated as necessary to reflect new procedures, technologies or requirements.

MAINTENANCE LOG

The Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including location of disposal) during the life of the project. Records will be maintained for at least 3 years and be made available to the Massachusetts Department of Environmental Protection or the Town of Hingham in accordance with the provisions of the Massachusetts Stormwater Handbook.

GOOD HOUSEKEEPING PRACTICES DURING CONSTRUCTION

The Responsible Party shall maintain good housekeeping practices by maintaining a clean and orderly facility to prevent potential pollution sources, including debris, from coming into contact with stormwater and degrading water quality. This includes establishing protocols to reduce the possibility of mishandling materials or equipment and training employees in good housekeeping techniques. Common areas where good housekeeping practices should be followed includes: material storage areas, vehicle and equipment maintenance areas, and loading areas. Good

[1] Should the need for de-watering arise during construction at the site, groundwater will be pumped directly from the work area into geotextile filter bags, temporary settling basins, or portable fractionation tanks (depending on the nature and volume of water encountered) which will act as sediment traps during construction. Discharge points will be set outside of all resource areas and buffers monitored by qualified personnel (wetland scientist, licensed site professional, civil engineer, etc.) to ensure no impacts to resource areas and compliance with applicable Federal and state regulations. All discharges will be free from visible floating, suspended, and settleable solids that would impair the functions of the nearby drainage systems, wetlands, or downstream rivers. Refer to the details provided on the drawing set for additional information.

housekeeping practices must include a designated and secure location for garbage. A schedule for regular pickup and disposal of garbage and waste materials and routine inspections of containers for leaks and structural integrity shall be developed.

Specific good housekeeping practices that will be implemented include routine removal of trash. items including scrap, metal, wood, plastic, miscellaneous trash, paper, glass, insulation, misc. building materials, and packaging. Additional practices include securing and covering any containers, supplies, or equipment that could become sources of stormwater pollution.

MINIMIZING EXPOSURE DURING CONSTRUCTION

The Responsible Party shall minimize exposure of potential pollutant sources, including debris from coming into contact with precipitation and being picked up by stormwater and carried into drains and surface waters using the following steps:

- Storing all containerized materials in a protected, secure location away from drains and plainly labeled.
- Containing all activities that can generate sources of contaminants from reaching the receiving water or the stormwater management system.
- Securing any equipment or supplies so that they are not transported during storm events into receiving waters or stormwater management system.

BEST MANAGEMENT PRACTICES (BMP) MAINTENANCE

The proposed stormwater management system has been designed with appropriate BMPs aimed at reducing the pollutants discharge based upon the intended use of the proposed development. All BMPs require regular maintenance to function as intended. Some management measures have simple maintenance requirements; others are more involved. The Responsible Party must have all BMPs regularly inspected to ensure they are operating properly on an as-needed basis, including during runoff events exceeding 0.5 inches of rainfall.

A description of the non-structural and structural approaches to be incorporated is indicated below. The following Best Management Practices are proposed to be incorporated into the stormwater management design to reduce source runoff and improve stormwater runoff discharge quality. The Responsible Party will regularly inspect all BMPs to ensure they are operating properly. If any deficiencies are identified during these inspections, action to resolve it will be initiated and documented on the maintenance log.

NON-STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

STREET/PARKING LOT SWEEPING

This practice, considered by MassDEP to be a non-structural BMP, provides effective removal of Total Suspended Solids (TSS) in a comprehensive stormwater management program. A maintenance program of roadway/driveway sweeping with a High Efficiency Vacuum Sweeper or a Regenerative Air Sweeper to reduce sediment accumulation in the

deep sump catch basins and subsurface systems shall be implemented based on the owner discretion. Sweeping can be conducted on a quarterly basis (primarily in the spring and fall) to keep low impact BMPs operating effectively.

GRADING

The impervious areas of the site shall be graded as gently as possible, generally not more than 6% slopes, to reduce runoff velocities. Steep slopes will be permanently vegetated to dissipate energy and reduce potential erosion. No constructed vegetated slopes shall exceed 3H:1V without providing additional reinforcement. Steep slopes may require soil reinforcement and additional vegetation.

SNOW STORAGE AND DEICING

Snow storage will be located adjacent to parking and drive areas. In the event of a large snow event that exceeds snow storage on the site, snow will be removed and hauled off-site.

In the interest of reducing the volume of dissolved salt that enters the watershed, the operator of the development will rely on sand alone where traction on snowy surfaces is the primary objective. However, parking areas, driveways, and sidewalks which require deicing for safety during winter months will typically be treated with a mixture of 90% sand and 10% road salt (NaCl).

FERTILIZER:

Slow release organic fertilizers are recommended to be used in landscape areas to limit nutrient transport to groundwater. It is recommended that application be limited to 5 lbs. per 1,000 square feet of lawn area.

WASTE MANAGEMENT:

Solid waste will be contained within dumpsters. Waste deposition in these receptacles will be consistent with state and local permits. The covers and doors of the dumpsters will be kept closed to limit rainwater/wildlife intrusion.

STRUCTURAL BEST MANAGEMENT PRACTICES:

Prior to final completion and full occupancy of the development, it is recommended that a representative of the Contractor, Manufacturer, and/or Engineer either designing or building the facility for the Owner properly instruct the Responsible Party as to the maintenance practices required to responsibly maintain the effectiveness of the drainage system. These frequencies and requirements are recommendations to maintain minimum effectiveness in most typical environments. Ultimately, the Responsible Party will implement the procedures and frequencies as they see fit under their current plan and inspect the systems as needed to maintain minimum effectiveness as recommended by the manufacturer. The following maintenance of structural BMPs will be implemented:

DEEP SUMP CATCH BASINS AND MANHOLE STRUCTURES

Catch basins shall be cleaned, in dry weather, when half of the sump capacity is filled or at a minimum quarterly or as required through periodic inspection. Cleaning will take place at the completion of construction and in early spring after sanding of roadways has ceased or as needed depending on the frequency of major storm events (greater than 1-inch of rainfall). All manholes shall be inspected at least once annually or as dictated by the Responsible Party. Any obstructions, sediment, and debris that could potentially cause clogging shall be removed within the conveyance system as necessary. Inverts, grates, and hoods shall be checked and replaced as necessary to maintain hydraulic effectiveness.

ISOLATOR ROW

The Isolator Rows in the underground chamber systems shall be inspected twice per year and cleaned at least once per year and in accordance with the manufacturer's recommendations. Periodic inspections performed by the responsible party may dictate cleaning on a more frequent basis depending on the suspended solids loading. During construction accumulated sediment may need to be removed more frequently. Conduct jetting and vactoring annually or when inspection shows that maintenance is necessary. See attached maintenance documentation from the manufacturer.

SUBSURFACE STORMTECH CHAMBERS SYSTEM

Subsurface system consisting of high-density polyethylene plastic chambers (ADS StormTech®) set in a stone bed are proposed to remove TSS. The chamber system can provide TSS removal for various storm events for the stormwater runoff. The proposed system drains down completely between storm events due to the large footprint of the stone beds. Manhole risers and manufacturer recommended inspection ports are proposed at the ground surface to allow inspection and maintenance access. Once the system goes online, inspections should occur after each storm event for the first few months to ensure proper stabilization, function, and to ensure that the outlets remain free of obstructions. Preventative maintenance shall be performed at least twice per year and after every major storm event (> 1.5" of rainfall) and shall include removal of accumulated sediment, inspection of the detention structure, and monitoring of groundwater to ensure proper operation of the system.

Important items to check for include differential settlement, cracking, breakout, clogging of outlets and vents, and root infestation. Water levels should be checked and recorded against rainfall amounts to verify that the drainage system is working properly and draining within 72 hours. If they do not drain within 72 hours, corrective action should be taken.

BIORETENTION AREA/ WATER QUALITY SWALE

Bioretention areas and water quality swales require frequent attention while plantings are being established and seasonal maintenance afterwards. During construction the bioretention area and water quality swale shall be protected by an erosion control barrier (e.g. Silt sock) to prevent silt laden runoff from entering BMP. After installation and site stabilization, inspect monthly for erosion and remove trash/debris. Remove dead vegetation annually (spring or fall) and replace vegetation annually in the spring. The use of fertilizers and

pesticides should be avoided. Remove invasive species in and around the BMP as needed to prevent these species from spreading into the bioretention area. Inspect annually in the spring, after sanding operations have ceased, for sediment accumulation and remove as necessary.

The soil matrix captures contaminants from runoff and the cation exchange capacity (CEC) of the soil media will eventually be exhausted. If determined by soil testing that the CEC has diminished excavate the bioretention area, replace the soil matrix, replant, and re-mulch. No snow shall be stored in the bioretention area or water quality swale.

HYDRODYNAMIC SEPARATORS

Hydrodynamic Separators shall be inspected twice per year and cleaned at least once per year and in accordance with the manufacturer's recommendations. Periodic inspections performed by the responsible party may dictate cleaning on a more frequent basis depending on the suspended solids loading. During construction accumulated sediment may need to be removed more frequently. Usually a vacuum truck removes accumulated sediment and oil most efficiently. See maintenance documentation from the manufacturer.

OUTLET CONTROL STRUCTURES

The outlet control structures (OCS) detain the water utilizing orifices to control the outlet flow and are below grade with access via covers to grade. Although the outlet control structures should not have much debris, they should be inspected to make sure there are not concrete issues or residual debris. Sand accumulation within the OCS is a sign there is an issue with the upstream stormwater treatment device. The OCS shall be inspected once per year. It may be necessary to clean the structure and the use of a vacuum truck may be necessary.

PLUNGE POOL/ENERGY DISSIPATER AND DOWNSTREAM SLOPES

The level spreader/plunge pool/energy dissipaters are utilized at the outlet pipes prior to discharge to the wetland to prevent erosions. The level spreader/plunge pool/energy dissipaters should be inspected at least once a year for sand accumulation and debris which may impact its effectiveness to slow water. Cleaning should take place during the early spring, although, additional inspections and cleaning may be needed.

In order to ensure that the level spreader systems are working, the outlets as well as slopes downstream for the first three years of operation, should be inspected after every storm of 1" or greater to assure no erosion of the slope. After the first three years, we recommend inspections after any large storm (25+ year event) for erosion. If no erosion is evident, then the stone size and level spreader design is adequate. Should there be erosion of the level spreader, stone size should be increased, or additional large stones added to enhance energy dissipation of water. If downstream slopes exhibit signs of erosion, repairs to soils and slope should be made and then a treatment such as an erosion control matting should be instituted to reinforce soils until vegetative cover can be restored. We recommend that the aprons and downstream slopes be inspected and cleaned annually as part of the outlet maintenance to

ensure future adequacy.

SPILL CONTROL:

The development consists of a gas station and associated commercial building. It is recommended that if there is no existing contingency plan to address the spillage/release of petroleum products and any hazardous material be implemented for the development the one be fully developed. The recommendation includes that the Owner have all MassDEP emergency spill response information posted onsite at all times. It is also recommended an emergency spill response kit including absorbent pillows be stored on-site along with instructions for the kit, a copy of applicable regulations regarding spills, and a list of individuals to contact (local and state officials) in the event of a spill.

Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.

LONG-TERM OPERATION AND MAINTENANCE BUDGET:

Consistent with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008) the approximate cost of inspections and maintenance based on the abovementioned post-construction activities and frequencies is as follows:

- Pavement Sweeping - $3,000 per year based on annual sweepings.
- Deep Sump Catch Basins - inspection/cleaning - $1,000 per year/per catch basin based on quarterly inspections and sediment removal of both single and double grate deep sump catch basins.
- Underground Infiltration/Detention System - inspection - $1,000 per year based on semi-annual inspections. Cleaning/debris removal - $1,000 per year for accumulated sediment and trash removal.
- Bioretention System - inspection - $1,000 per year based on semi-annual inspections. Cleaning/debris removal/maintenance - $1,000 per year for accumulated sediment and trash removal.

Additional costs may be incurred if it is determined during routine inspections of the BMP's that further corrective actions are necessary.

LONG TERM STRUCTURAL BEST MANAGEMENT PRACTICE INSPECTION & MAINTENANCE MATRIX AFTER CONSTRUCTION

Note: BMP's shall be visually inspected and repaired by a qualified party in accordance with the following chart. Note these are minimum inspection criteria/frequencies and should be adjusted throughout the project lifespan as required to maintain effectiveness. Refer to maintenance standards for drainage facilities and structural best management practices in the "Recommended Long-Term Stormwater Pollution Prevention Plan."

Conventional & LID Best Management Practices	Recommended Minimum Inspection & Maintenance Frequency	Erosion/Scouring	Tree Growth Hazards	Differential Settlement/Seepage	Structural Damage/Obstructions	Trash & Debris	Removal of Accumulated Sediment	Slope Integrity	*Mow Vegetation/Poor Vegetation Coverage	Remove/Reset Filter Fabric & Stone As Required	Remove & Replace Hardwood mulch/media	Vac Truck Sediment & Contaminants	Remove/Reset Riprap as Required
Catch Basin, OCS, and Hydrodynamic Separator	*Quarterly*		☑	☑	☑	☑	☑					☑	
Isolator Row	*Semi-Annual / Per Manufacturer*			☑	☑	☑	☑					☑	
Bioretention/ Water quality swale	*Semi-Annual*	☑	☑	☑	☑	☑	☑				☑		
Detention/Recharge	*Semi-Annual*	☑	☑	☑	☑	☑	☑					☑	
Outfall Structure	*Semi-Annual*	☑	☑	☑	☑	☑	☑	☑		☑			☑

Stormwater BMP Inspection and Maintenance Log

Facility Name	
Address	
Begin Date	End Date

Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions: Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary.

- BMP ID# — Always use ID# from the Operation and Maintenance Manual or Approved Plans.
- Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
- Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
- Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
- Comments and actions taken — Describe any maintenance done and need for follow-up.

StormTech®

Detention • Retention • Water Quality

A division of ADS

Save Valuable Land and Protect Water Resources

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 patented 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-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 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 sidewalls (SC-310, SC-310-3 and SC-740 models) 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.

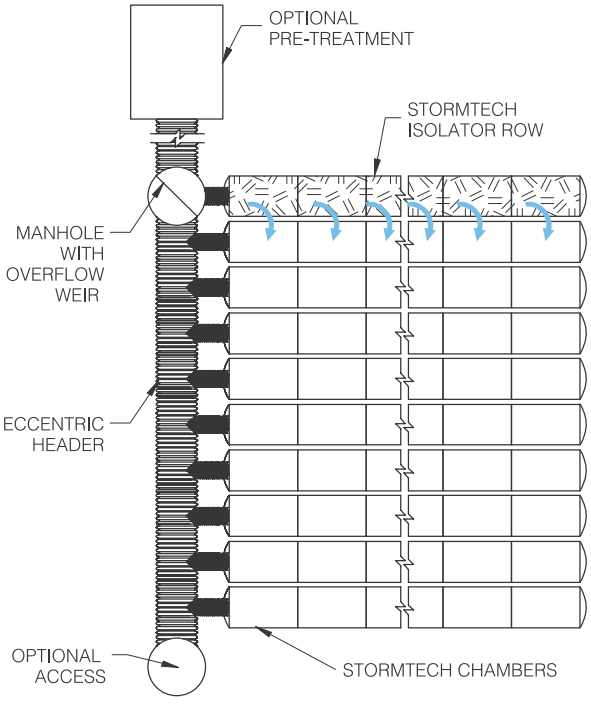
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of 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 non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

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.

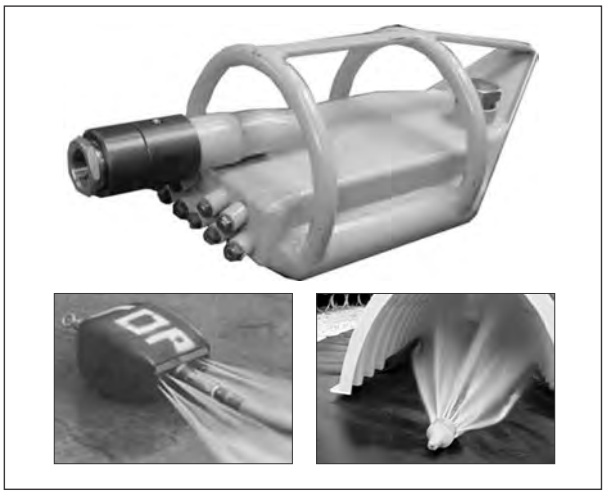
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

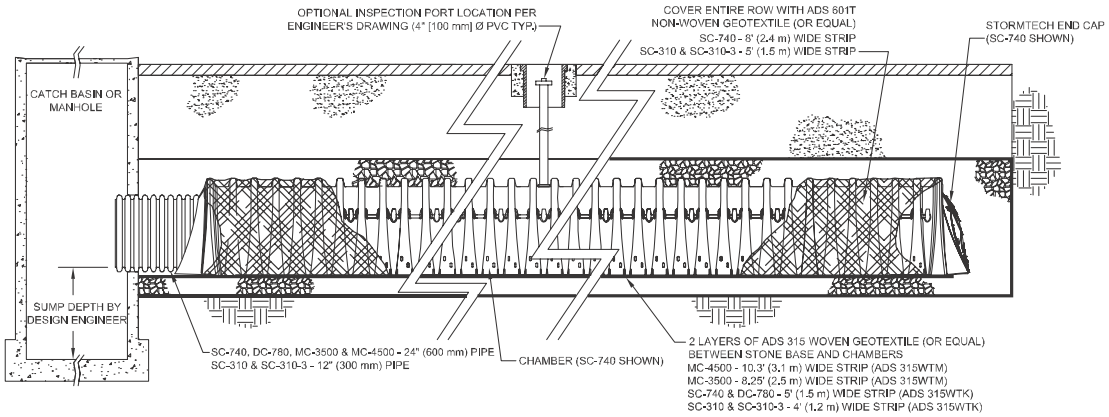
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via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



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

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

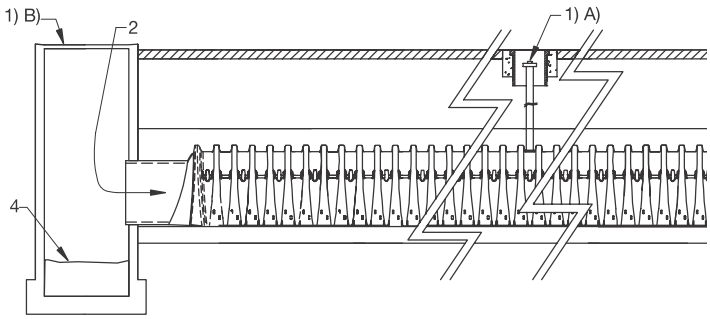
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

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

StormTech®

Detention • Retention • Water Quality

A division of ADS

70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067

860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

CONTECH®
ENGINEERED SOLUTIONS

Stormceptor® STC
Owner's Manual

Stormceptor® STC

Table of Contents

For patent information, go to www.ContechES.com/ip.

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a "Hydrodynamic Separator (HDS)" or an "Oil Grit Separator (OGS)", engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- "STORMCEPTOR" is clearly marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site's tailwater conditions)
- Series Unit (combines treatment in two systems)

PLEASE MAINTAIN YOUR STORMCEPTOR

To ensure long-term environmental protection through continued performance as originally designed for your site, Stormceptor must be maintained, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call Contech at 1-800-338-1122.

2 – Stormceptor Operation and Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology. Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

Figure 1.

Inline Stormceptor

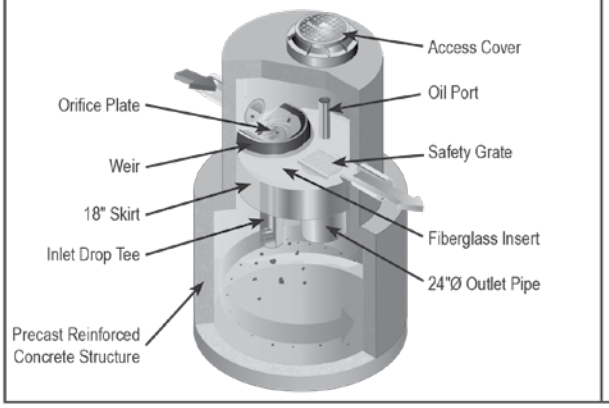
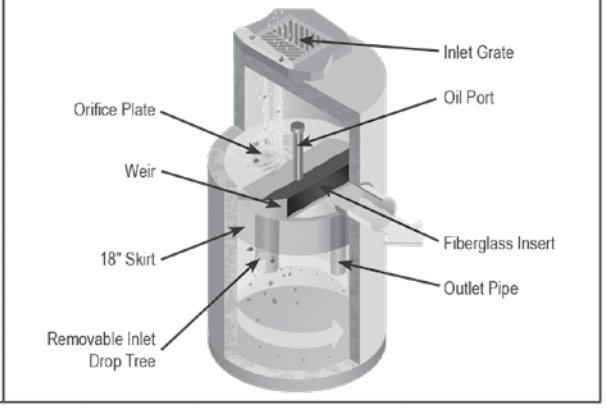


Figure 2.

Inlet Stormceptor



3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS and MAX) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using Table 1.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Contech Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS and OSR Stormceptor models are provided in Tables 1 and 2. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1. Stormceptor Dimensions - Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

Notes:

1. Depth Below Pipe Inlet Invert to the Inside Top Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2. Storage Capacities

STC Model	Hydrocarbon Storage Capacity (gal)	Sediment Capacity (ft^3)
450	86	46
900	251	89
1200	251	127
1800	251	207
2400	840	205
3600	840	373
4800	909	543
6000	909	687
7200	1059	839
11000*	2797	1089
13000*	2797	1374
16000*	3055	1677

Notes:

1. Hydrocarbon and Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series*

4 – Stormceptor Inspection and Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see Table 3). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.
- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in Table 2, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins.

For typical inspection and maintenance activities, no specific supplemental training is required

Recommended Stormceptor Inspection Procedure:

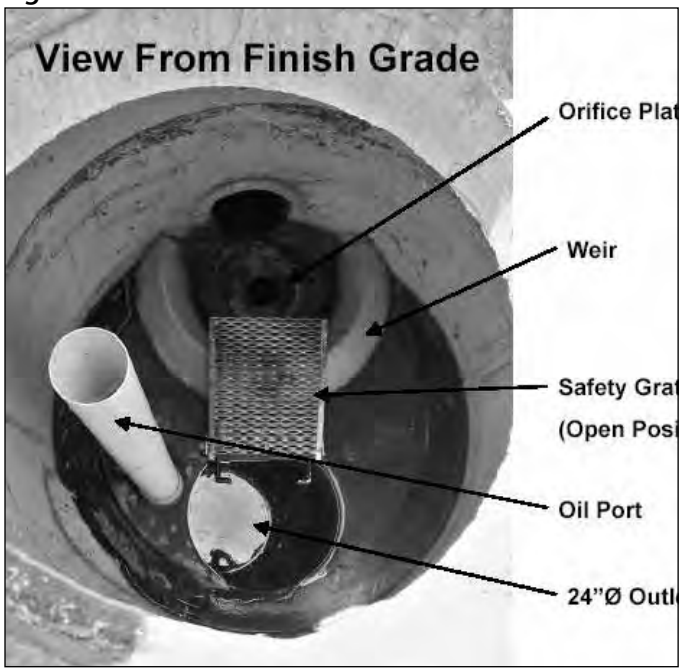
- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch or 6-inch diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, hoist and safety harness for specially trained personnel if confined space entry is required

Figure 3.

Figure 4.



Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck. No entry into the unit is required for maintenance. DO NOT ENTER THE STORMCEPTOR CHAMBER unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
  - » For 6-ft diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch outlet riser pipe (See Fig. 5).
  - » For 4-ft diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch drop tee hole (See Fig. 6).

Figure 5.

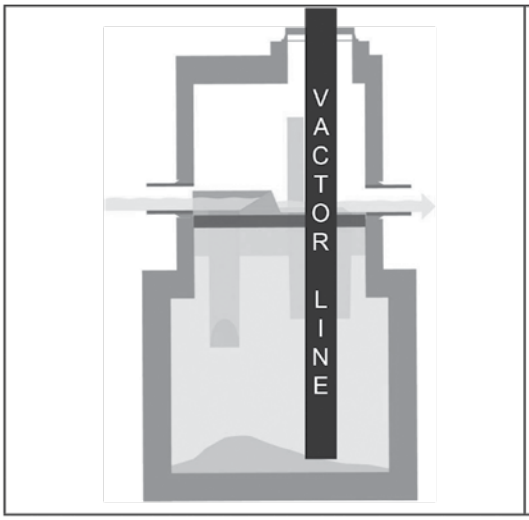
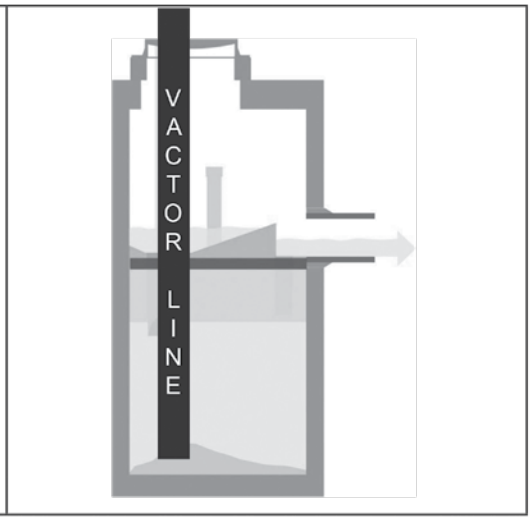


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in Table 3 based on the unit size.

Table 3. Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment Depth (in)
450	8
900	8
1200	10
1800	15
2400	12
3600	17
4800	15
6000	18
7200	15
11000*	17
13000*	20
16000*	17

Notes:

1. The values above are for typical standard units.

** Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Contech Representative or call 800-338-1122.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

5 – Contact Information

Questions regarding the Stormceptor can be addressed by contacting your local Contech representative or by calling 800-338-1122.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

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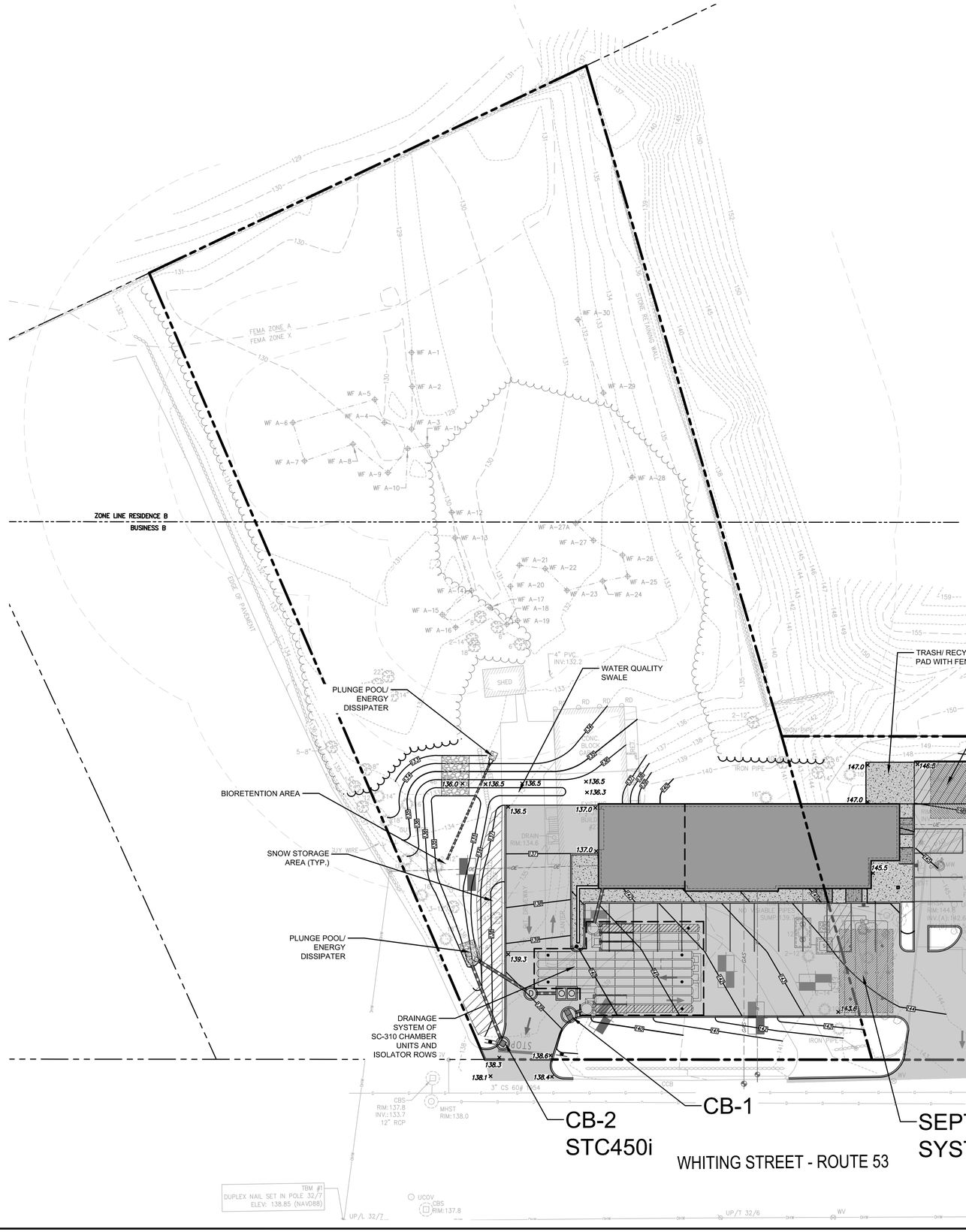


0 20 40
Scale in feet

OWNER/APPLICANT:

MERHEJ & SONS
REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING
STREET
HINGHAM, MA 02043

No.	Submittal / Revision	App'd.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

OPERATION AND
MAINTENANCE PLAN

Designed By:	Drawn By:	Checked By:
DR/BN	DR/BN	KK
Issue Date:	Project No:	Scale:
05/01/2020	060903	1" = 20'

Drawing No.:

O&M

Section 3.0

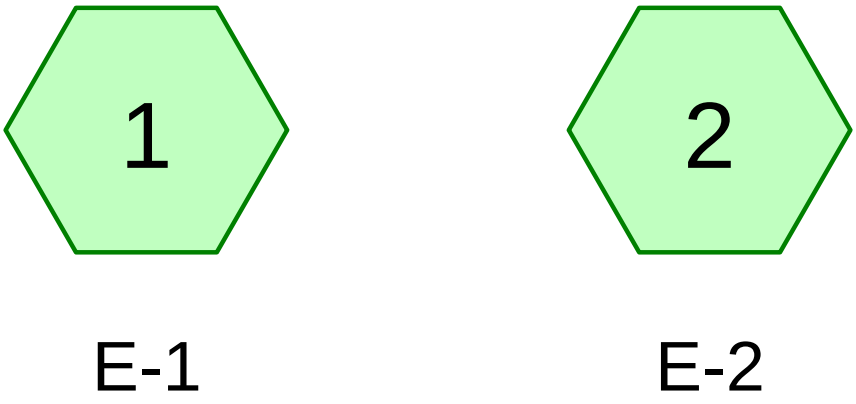
Hydrology and Hydraulic Modeling

Section 3.1

HydroCAD Site Hydrology Calculations

Section 3.1.1

Pre-Developed Stormwater Report Calculations



Subcat Reach Pond Link

Routing Diagram for 27 Whiting Existing Hydrology
Prepared by CHA, Printed 4/30/2020

Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: E-1 Runoff Area=20,042 sf 69.80% Impervious Runoff Depth=2.01"
Tc=5.0 min CN=86 Runoff=1.08 cfs 0.077 af

Subcatchment 2: E-2 Runoff Area=62,036 sf 8.95% Impervious Runoff Depth=0.53"
Tc=5.0 min CN=61 Runoff=0.63 cfs 0.063 af

Total Runoff Area = 1.884 ac Runoff Volume = 0.140 af Average Runoff Depth = 0.89"
76.19% Pervious = 1.436 ac 23.81% Impervious = 0.449 ac

Summary for Subcatchment 1: E-1

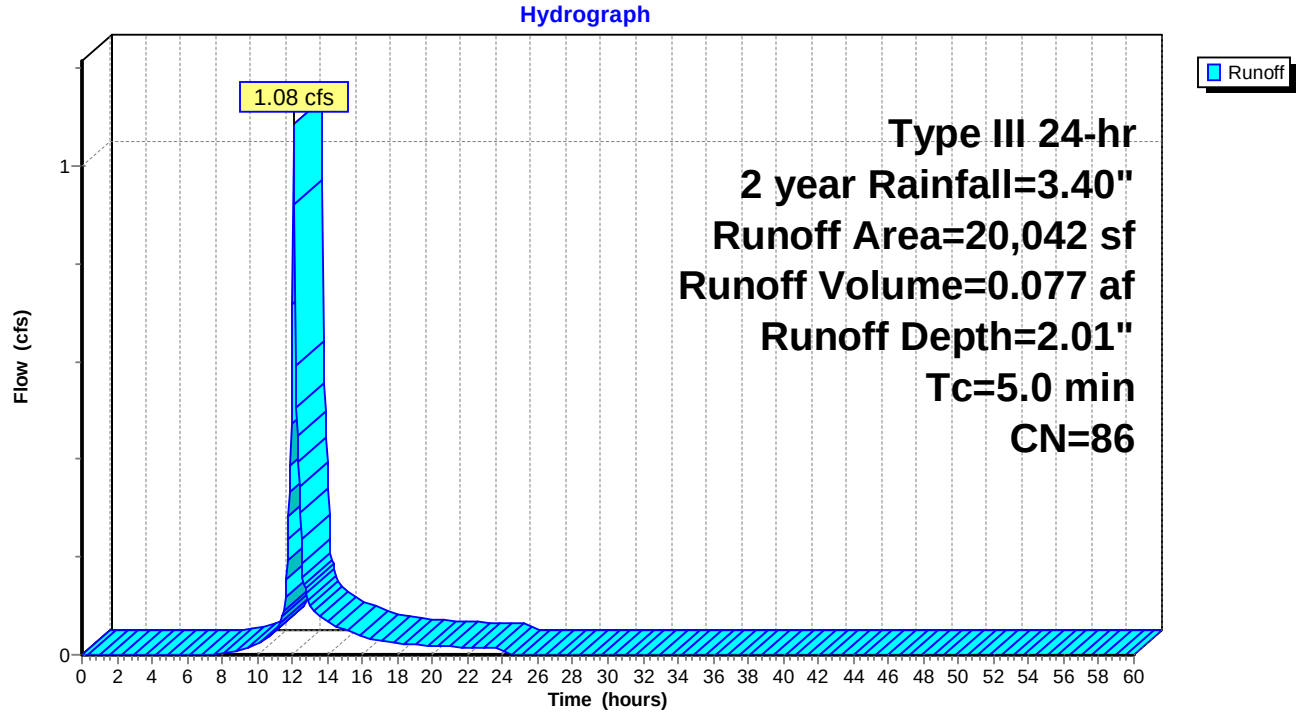
Runoff = 1.08 cfs @ 12.08 hrs, Volume= 0.077 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.40"

	Area (sf)	CN	Description
*	13,990	98	Impervious
	1,257	55	Woods, Good, HSG B
	4,795	61	>75% Grass cover, Good, HSG B
	20,042	86	Weighted Average
	6,052		30.20% Pervious Area
	13,990		69.80% Impervious Area

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

Subcatchment 1: E-1



Summary for Subcatchment 2: E-2

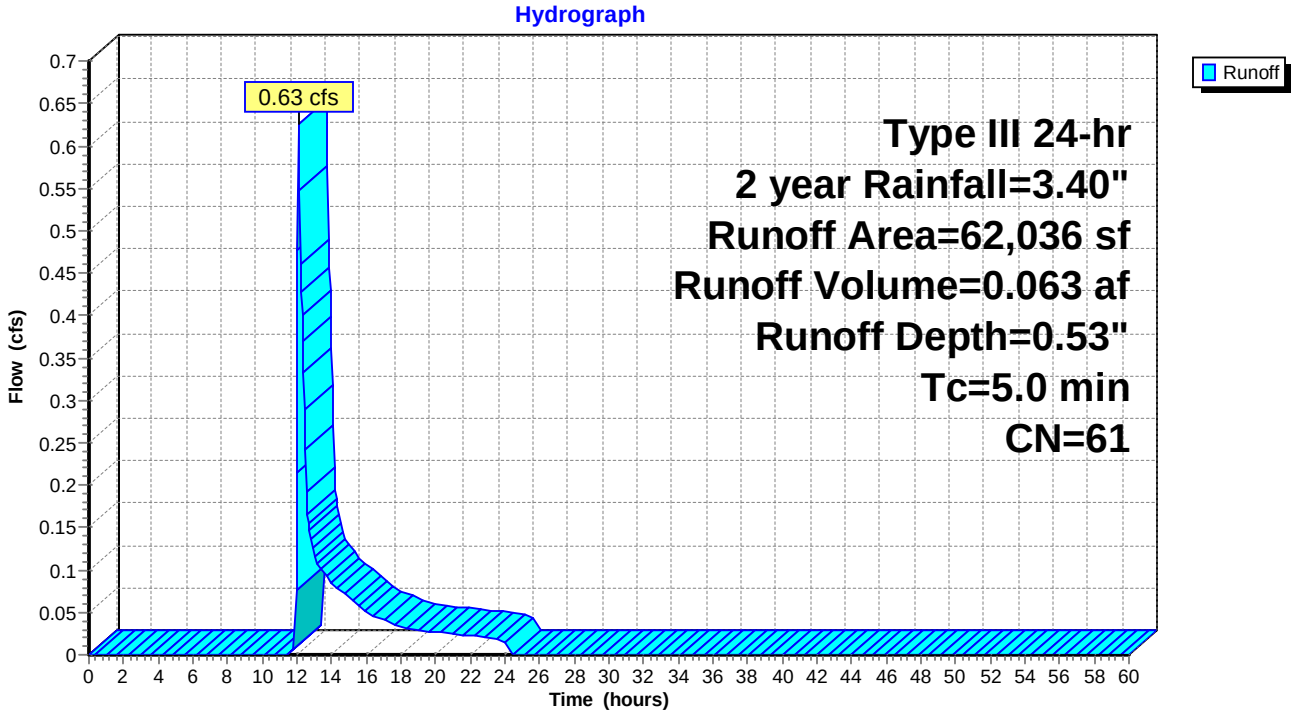
Runoff = 0.63 cfs @ 12.11 hrs, Volume= 0.063 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.40"

	Area (sf)	CN	Description
	35,322	55	Woods, Good, HSG B
	21,163	61	>75% Grass cover, Good, HSG B
*	5,551	98	Impervious
	62,036	61	Weighted Average
	56,485		91.05% Pervious Area
	5,551		8.95% Impervious Area

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

Subcatchment 2: E-2



Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: E-1 Runoff Area=20,042 sf 69.80% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=86 Runoff=1.71 cfs 0.122 af

Subcatchment 2: E-2 Runoff Area=62,036 sf 8.95% Impervious Runoff Depth=1.19"
Tc=5.0 min CN=61 Runoff=1.79 cfs 0.142 af

Total Runoff Area = 1.884 ac Runoff Volume = 0.264 af Average Runoff Depth = 1.68"
76.19% Pervious = 1.436 ac 23.81% Impervious = 0.449 ac

Summary for Subcatchment 1: E-1

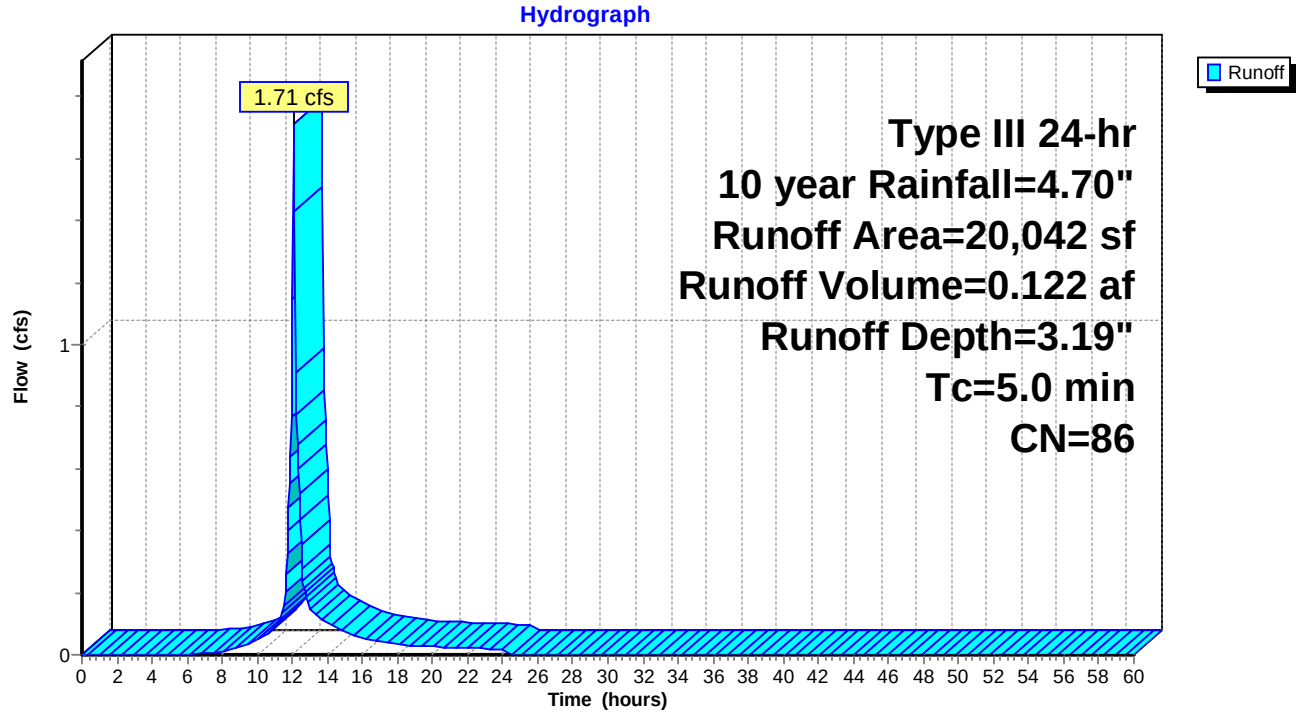
Runoff = 1.71 cfs @ 12.07 hrs, Volume= 0.122 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
*	13,990	98	Impervious
	1,257	55	Woods, Good, HSG B
	4,795	61	>75% Grass cover, Good, HSG B
	20,042	86	Weighted Average
	6,052		30.20% Pervious Area
	13,990		69.80% Impervious Area

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

Subcatchment 1: E-1



Summary for Subcatchment 2: E-2

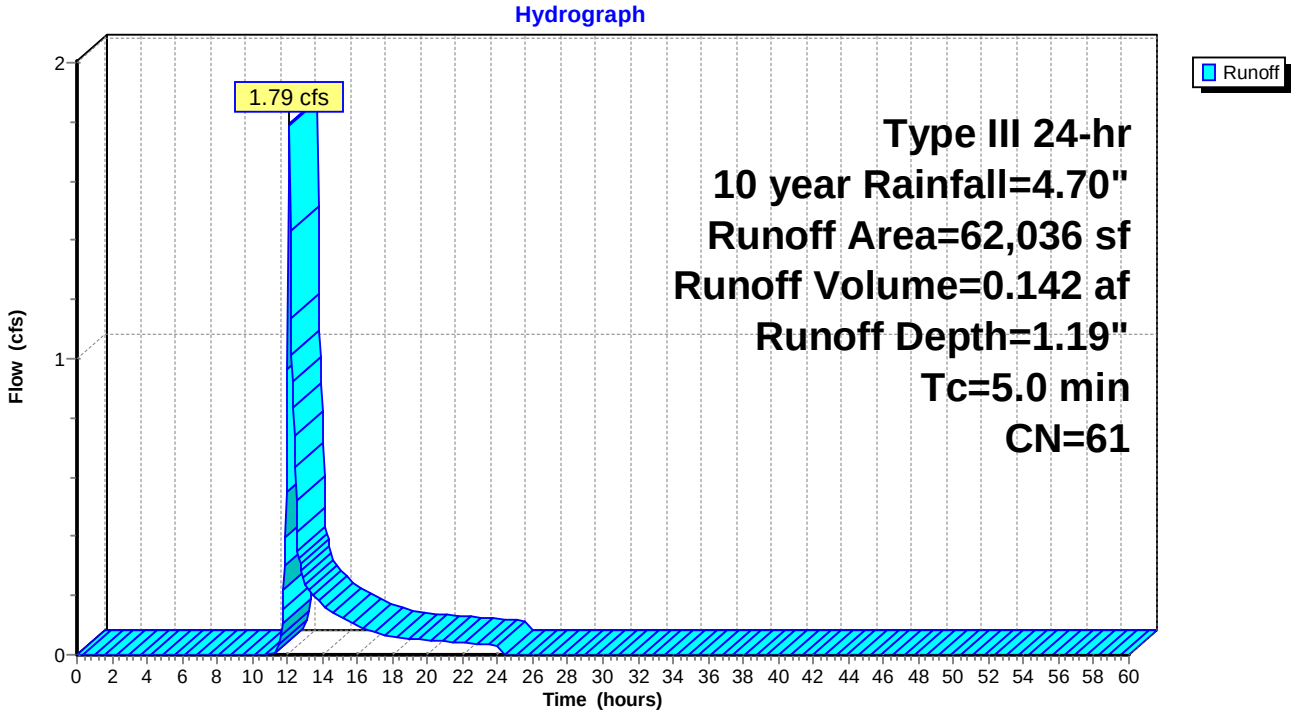
Runoff = 1.79 cfs @ 12.09 hrs, Volume= 0.142 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
	35,322	55	Woods, Good, HSG B
	21,163	61	>75% Grass cover, Good, HSG B
*	5,551	98	Impervious
	62,036	61	Weighted Average
	56,485		91.05% Pervious Area
	5,551		8.95% Impervious Area

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

Subcatchment 2: E-2



Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: E-1 Runoff Area=20,042 sf 69.80% Impervious Runoff Depth=4.03"
Tc=5.0 min CN=86 Runoff=2.14 cfs 0.155 af

Subcatchment 2: E-2 Runoff Area=62,036 sf 8.95% Impervious Runoff Depth=1.74"
Tc=5.0 min CN=61 Runoff=2.75 cfs 0.207 af

Total Runoff Area = 1.884 ac Runoff Volume = 0.361 af Average Runoff Depth = 2.30"
76.19% Pervious = 1.436 ac 23.81% Impervious = 0.449 ac

Summary for Subcatchment 1: E-1

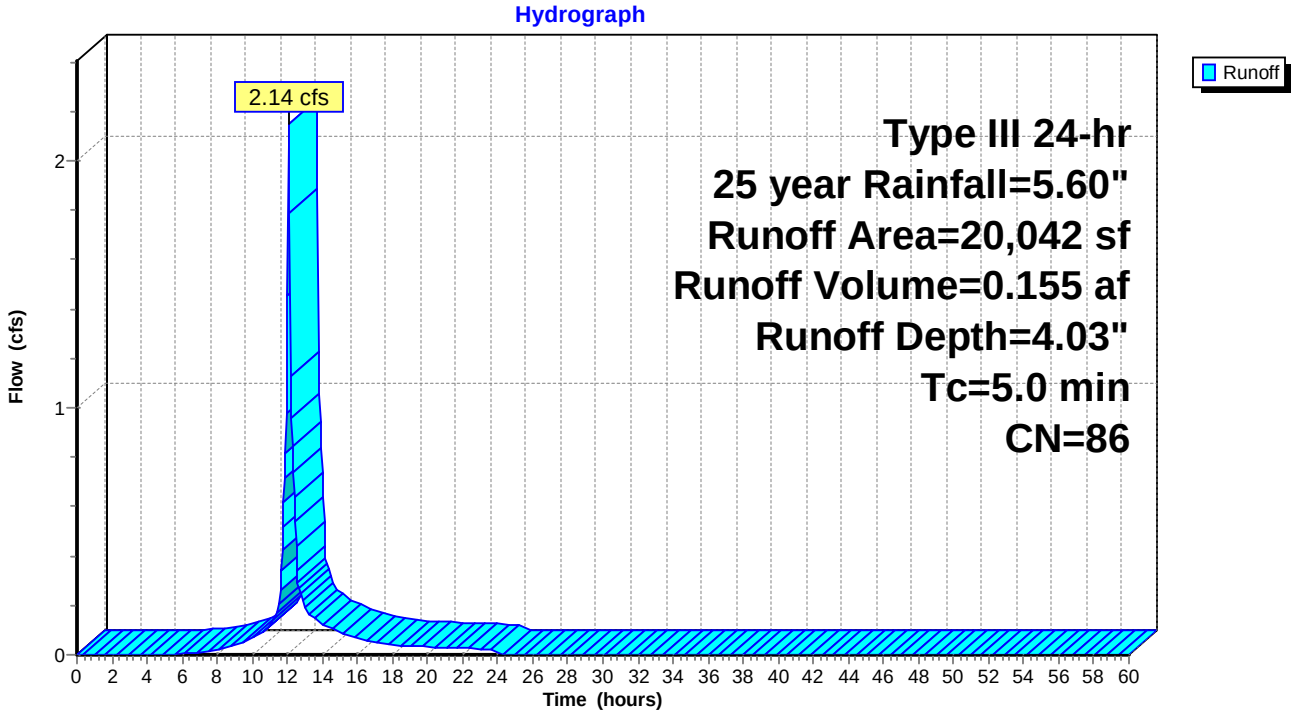
Runoff = 2.14 cfs @ 12.07 hrs, Volume= 0.155 af, Depth= 4.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.60"

	Area (sf)	CN	Description
*	13,990	98	Impervious
	1,257	55	Woods, Good, HSG B
	4,795	61	>75% Grass cover, Good, HSG B
	20,042	86	Weighted Average
	6,052		30.20% Pervious Area
	13,990		69.80% Impervious Area

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

Subcatchment 1: E-1



Summary for Subcatchment 2: E-2

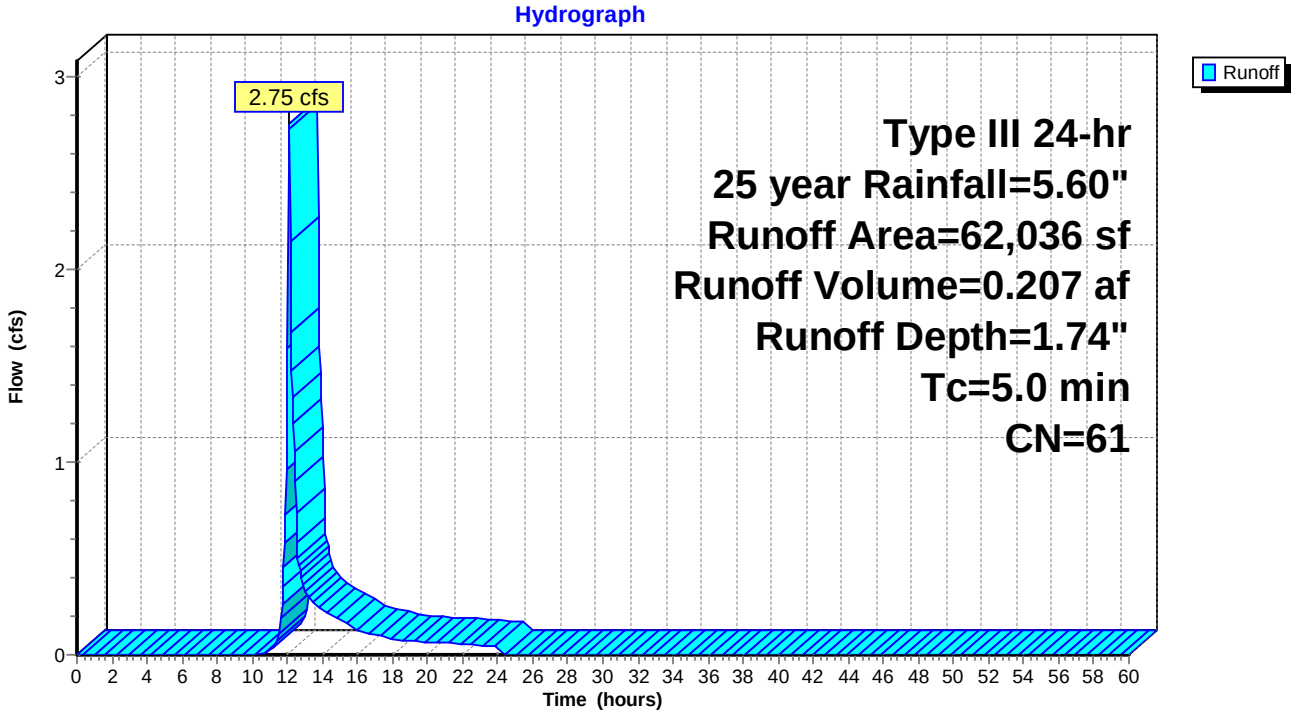
Runoff = 2.75 cfs @ 12.09 hrs, Volume= 0.207 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.60"

	Area (sf)	CN	Description
	35,322	55	Woods, Good, HSG B
	21,163	61	>75% Grass cover, Good, HSG B
*	5,551	98	Impervious
	62,036	61	Weighted Average
	56,485		91.05% Pervious Area
	5,551		8.95% Impervious Area

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

Subcatchment 2: E-2



Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: E-1 Runoff Area=20,042 sf 69.80% Impervious Runoff Depth=5.37"
Tc=5.0 min CN=86 Runoff=2.82 cfs 0.206 af

Subcatchment 2: E-2 Runoff Area=62,036 sf 8.95% Impervious Runoff Depth=2.70"
Tc=5.0 min CN=61 Runoff=4.42 cfs 0.321 af

Total Runoff Area = 1.884 ac Runoff Volume = 0.526 af Average Runoff Depth = 3.35"
76.19% Pervious = 1.436 ac 23.81% Impervious = 0.449 ac

Summary for Subcatchment 1: E-1

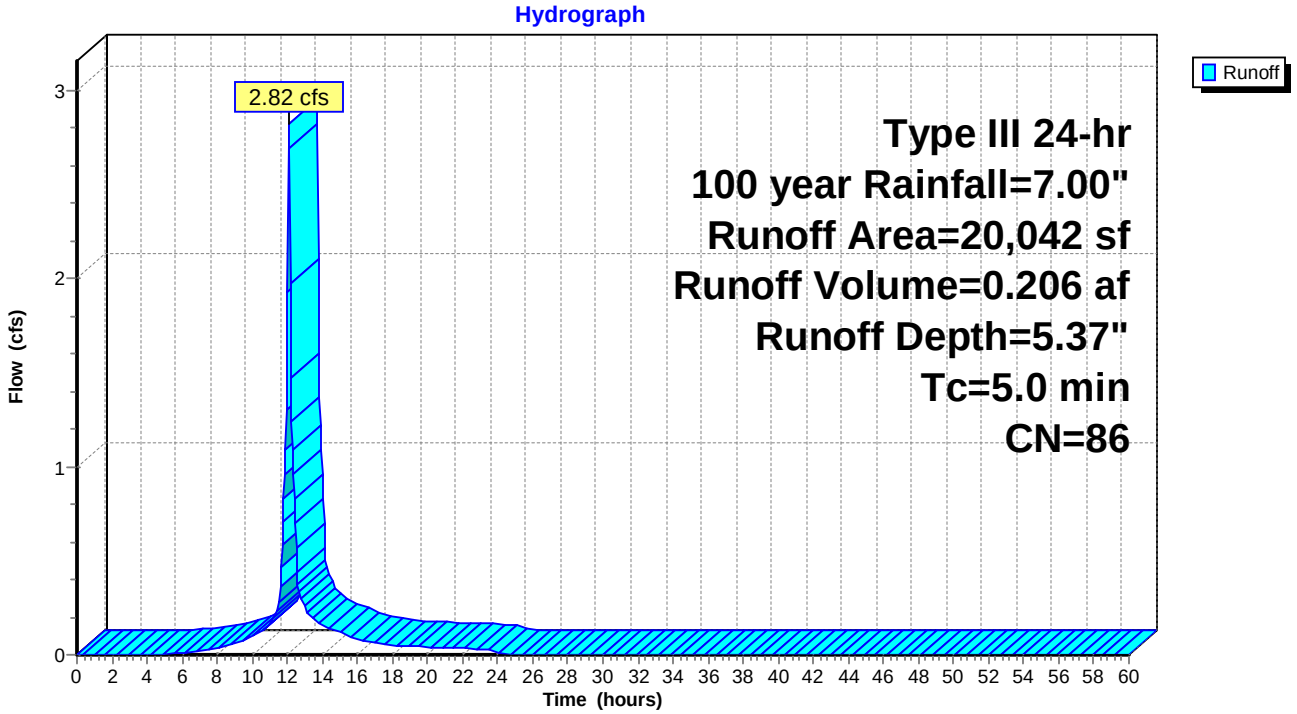
Runoff = 2.82 cfs @ 12.07 hrs, Volume= 0.206 af, Depth= 5.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.00"

	Area (sf)	CN	Description
*	13,990	98	Impervious
	1,257	55	Woods, Good, HSG B
	4,795	61	>75% Grass cover, Good, HSG B
	20,042	86	Weighted Average
	6,052		30.20% Pervious Area
	13,990		69.80% Impervious Area

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

Subcatchment 1: E-1



Summary for Subcatchment 2: E-2

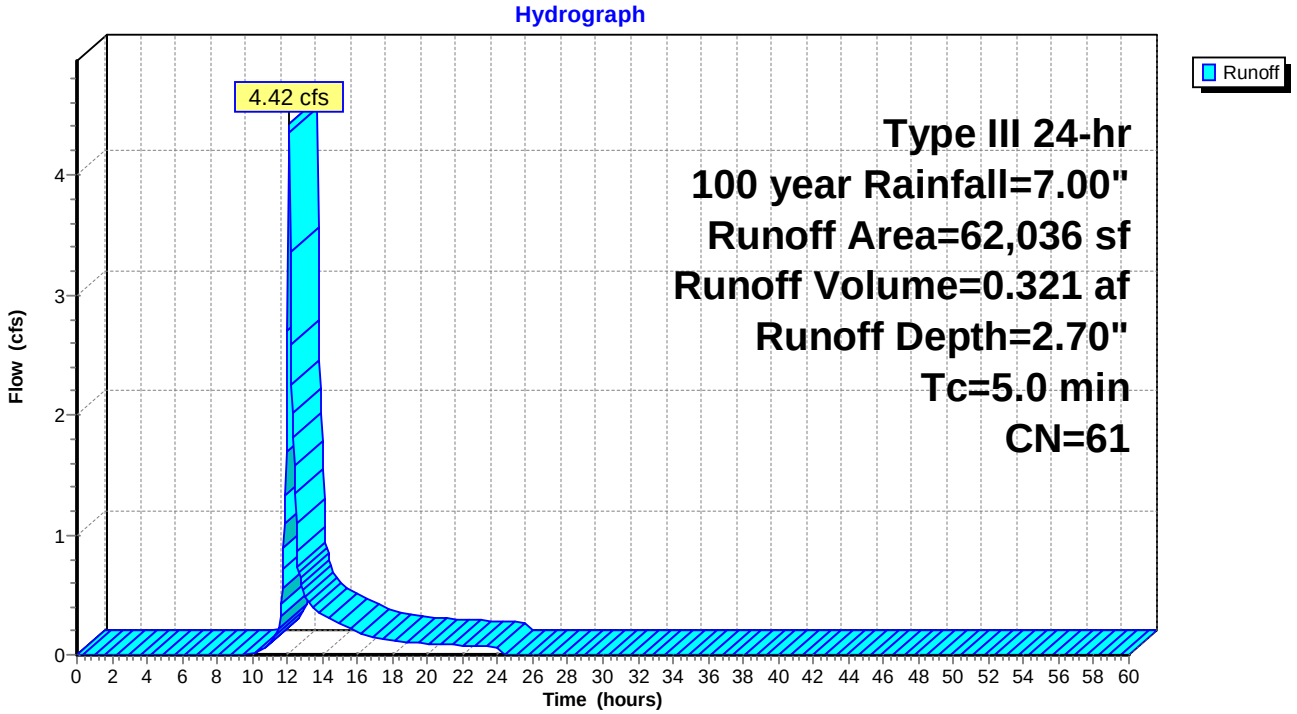
Runoff = 4.42 cfs @ 12.08 hrs, Volume= 0.321 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.00"

	Area (sf)	CN	Description
	35,322	55	Woods, Good, HSG B
	21,163	61	>75% Grass cover, Good, HSG B
*	5,551	98	Impervious
	62,036	61	Weighted Average
	56,485		91.05% Pervious Area
	5,551		8.95% Impervious Area

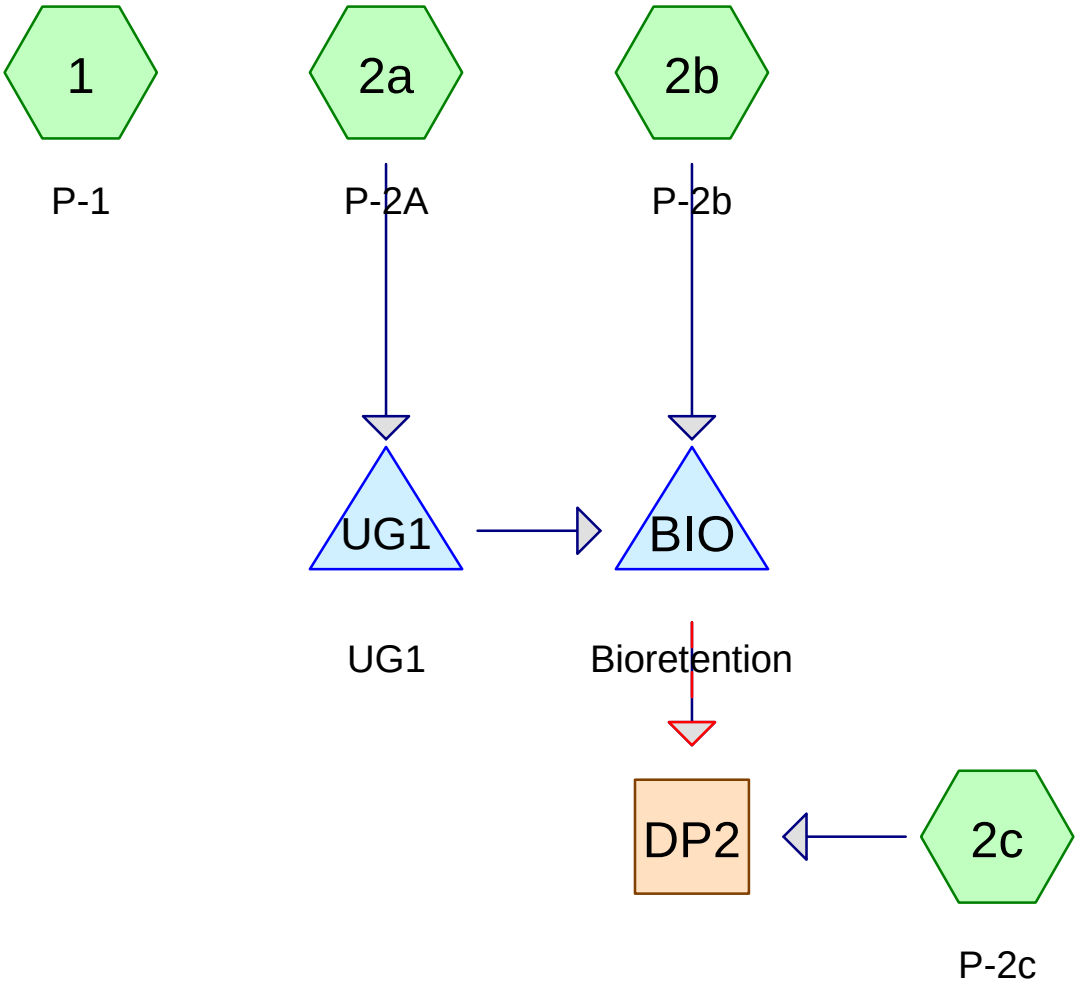
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**

Subcatchment 2: E-2



Section 3.1.2

Post-Developed Stormwater Report Calculations



Subcat Reach Pond Link

Routing Diagram for 27 Whiting Proposed Hydrology
Prepared by CHA, Printed 4/30/2020

Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: P-1 Runoff Area=15,833 sf 74.12% Impervious Runoff Depth=2.18"
Tc=5.0 min CN=88 Runoff=0.92 cfs 0.066 af

Subcatchment 2a: P-2A Runoff Area=12,585 sf 84.32% Impervious Runoff Depth=2.54"
Tc=5.0 min CN=92 Runoff=0.84 cfs 0.061 af

Subcatchment 2b: P-2b Runoff Area=9,328 sf 65.97% Impervious Runoff Depth=1.93"
Tc=5.0 min CN=85 Runoff=0.48 cfs 0.034 af

Subcatchment 2c: P-2c Runoff Area=44,460 sf 0.00% Impervious Runoff Depth=0.38"
Tc=5.0 min CN=57 Runoff=0.22 cfs 0.032 af

Reach DP2: Inflow=0.61 cfs 0.128 af
Outflow=0.61 cfs 0.128 af

Pond BIO: Bioretention Peak Elev=134.82' Storage=189 cf Inflow=0.56 cfs 0.096 af
Primary=0.39 cfs 0.096 af Secondary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.096 af

Pond UG1: UG1 Peak Elev=137.13' Storage=1,563 cf Inflow=0.84 cfs 0.061 af
Outflow=0.10 cfs 0.061 af

Total Runoff Area = 1.887 ac Runoff Volume = 0.194 af Average Runoff Depth = 1.23"
65.33% Pervious = 1.233 ac 34.67% Impervious = 0.654 ac

Summary for Subcatchment 1: P-1

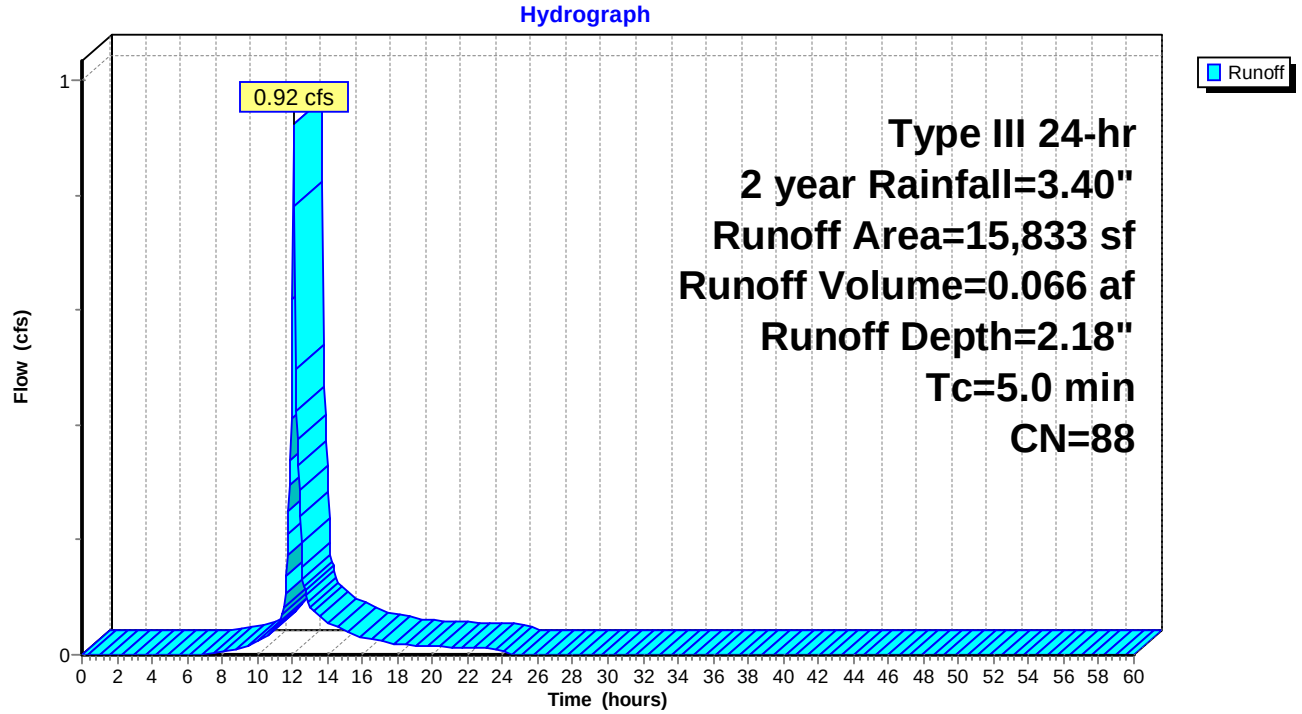
Runoff = 0.92 cfs @ 12.08 hrs, Volume= 0.066 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.40"

	Area (sf)	CN	Description
*	11,736	98	Impervious
	174	55	Woods, Good, HSG B
	3,923	61	>75% Grass cover, Good, HSG B
	15,833	88	Weighted Average
	4,097		25.88% Pervious Area
	11,736		74.12% Impervious Area

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

Subcatchment 1: P-1



Summary for Subcatchment 2a: P-2A

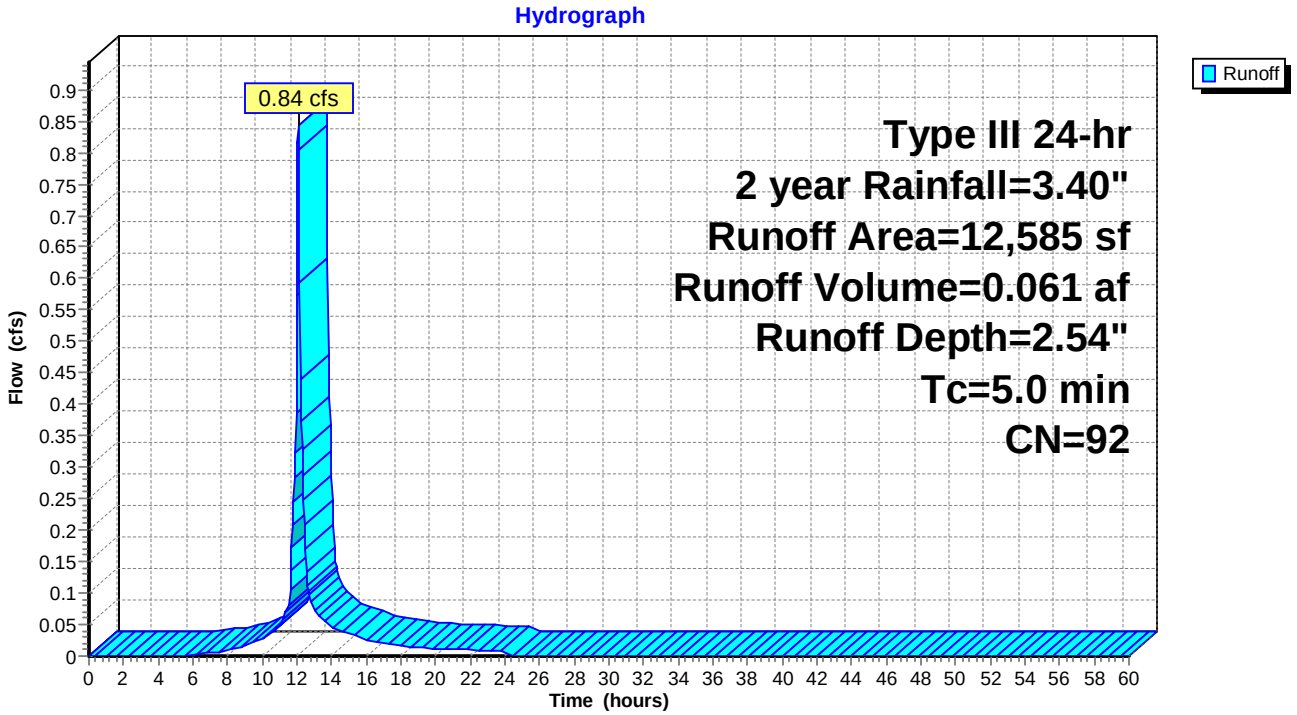
Runoff = 0.84 cfs @ 12.07 hrs, Volume= 0.061 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.40"

	Area (sf)	CN	Description
*	8,846	98	Impervious
	1,125	55	Woods, Good, HSG B
	848	61	>75% Grass cover, Good, HSG B
*	1,766	98	Roof
	12,585	92	Weighted Average
	1,973		15.68% Pervious Area
	10,612		84.32% Impervious Area

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

Subcatchment 2a: P-2A



Summary for Subcatchment 2b: P-2b

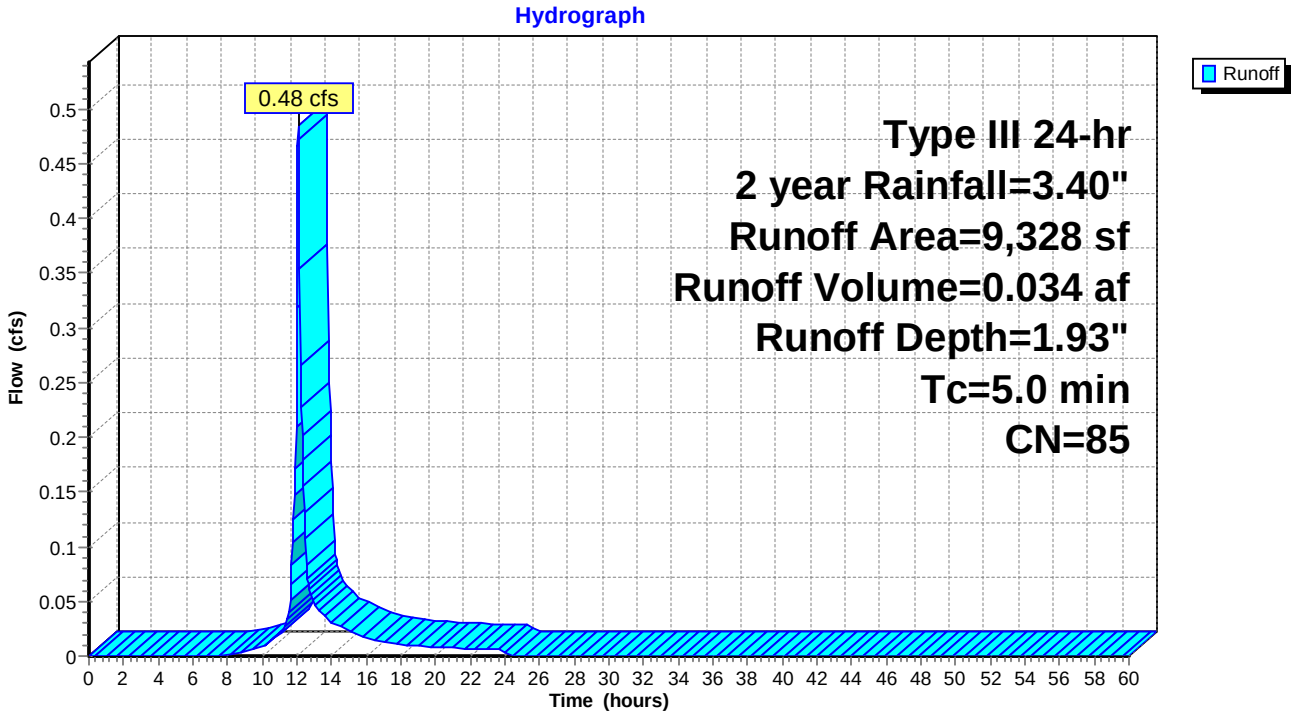
Runoff = 0.48 cfs @ 12.08 hrs, Volume= 0.034 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.40"

	Area (sf)	CN	Description
*	1,698	98	Impervious
	3,174	61	>75% Grass cover, Good, HSG B
*	2,690	98	CB2
*	1,766	98	Roof
	9,328	85	Weighted Average
	3,174		34.03% Pervious Area
	6,154		65.97% Impervious Area

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

Subcatchment 2b: P-2b



Summary for Subcatchment 2c: P-2c

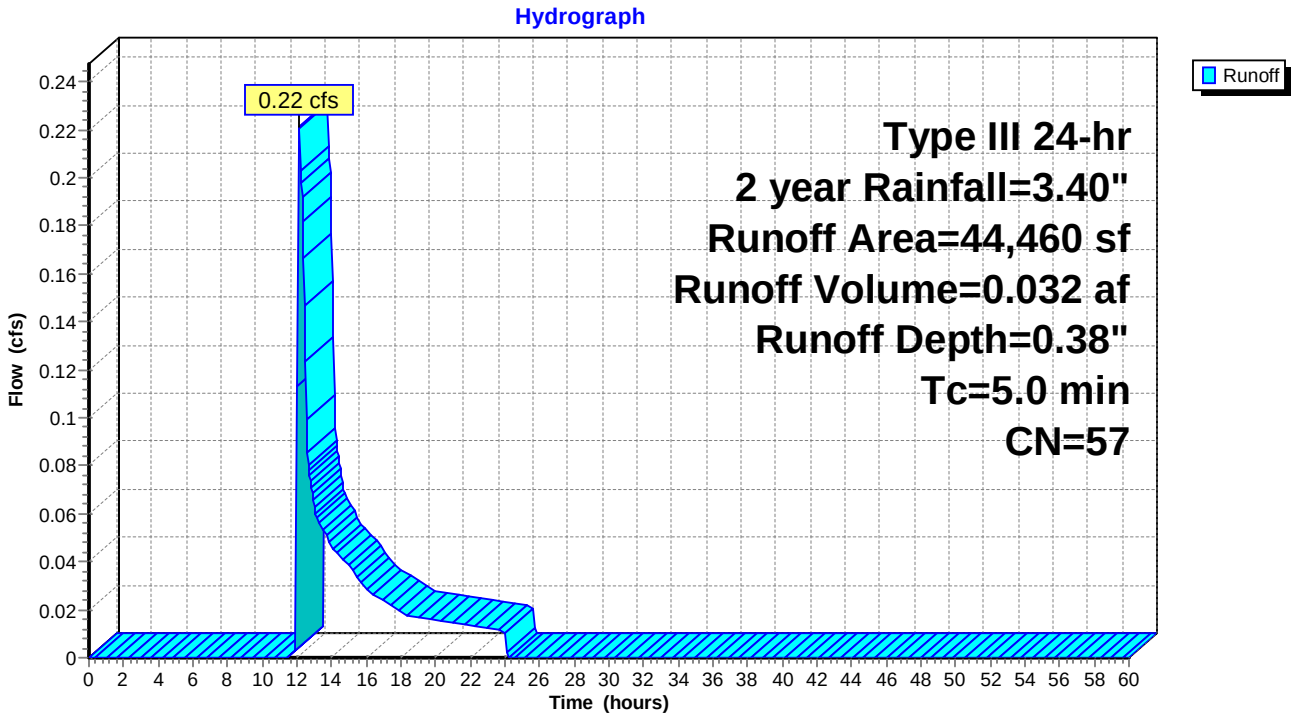
Runoff = 0.22 cfs @ 12.14 hrs, Volume= 0.032 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.40"

Area (sf)	CN	Description
30,989	55	Woods, Good, HSG B
13,471	61	>75% Grass cover, Good, HSG B
44,460	57	Weighted Average
44,460		100.00% Pervious Area

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

Subcatchment 2c: P-2c

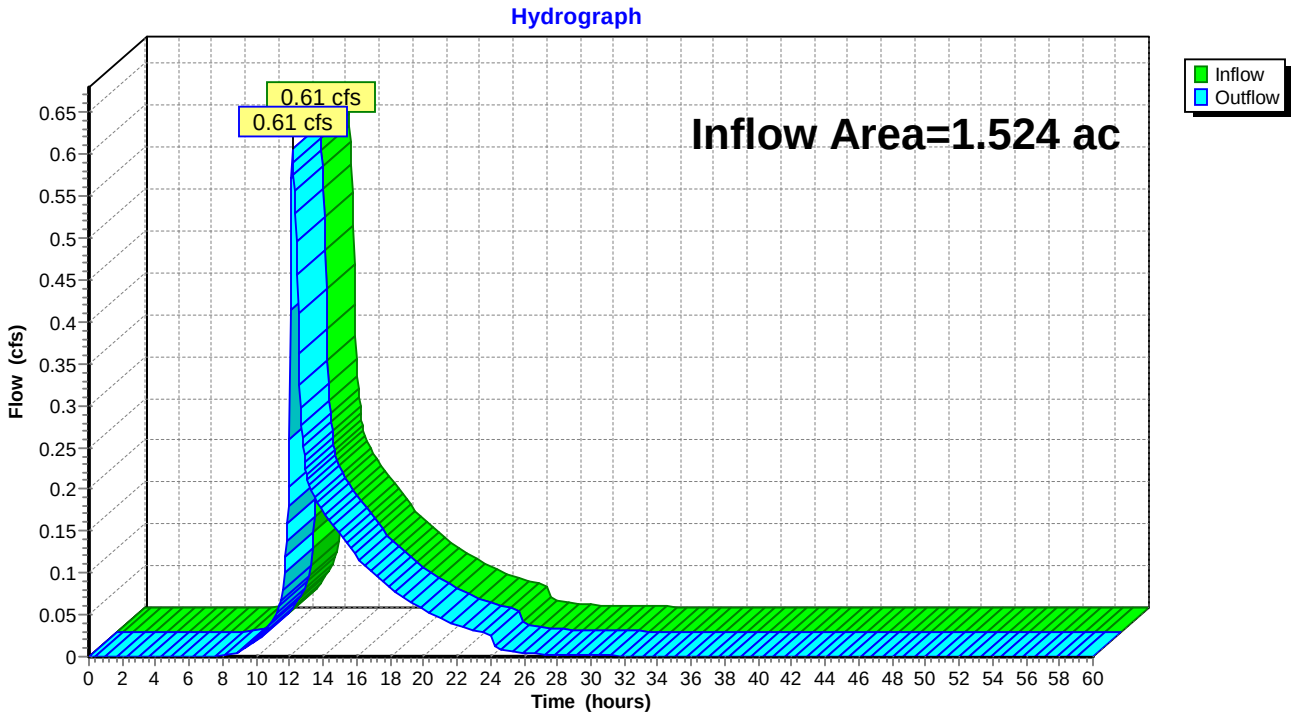


Summary for Reach DP2:

Inflow Area = 1.524 ac, 25.26% Impervious, Inflow Depth > 1.01" for 2 year event
Inflow = 0.61 cfs @ 12.16 hrs, Volume= 0.128 af
Outflow = 0.61 cfs @ 12.16 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs

Reach DP2:



Summary for Pond BIO: Bioretention

Inflow Area = 0.503 ac, 76.51% Impervious, Inflow Depth > 2.28" for 2 year event
Inflow = 0.56 cfs @ 12.08 hrs, Volume= 0.096 af
Outflow = 0.39 cfs @ 12.18 hrs, Volume= 0.096 af, Atten= 31%, Lag= 6.2 min
Primary = 0.39 cfs @ 12.18 hrs, Volume= 0.096 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 134.82' @ 12.18 hrs Surf.Area= 528 sf Storage= 189 cf

Plug-Flow detention time= 8.7 min calculated for 0.096 af (100% of inflow)
Center-of-Mass det. time= 8.6 min (923.6 - 915.1)

Volume	Invert	Avail.Storage	Storage Description
#1	133.80'	1,750 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

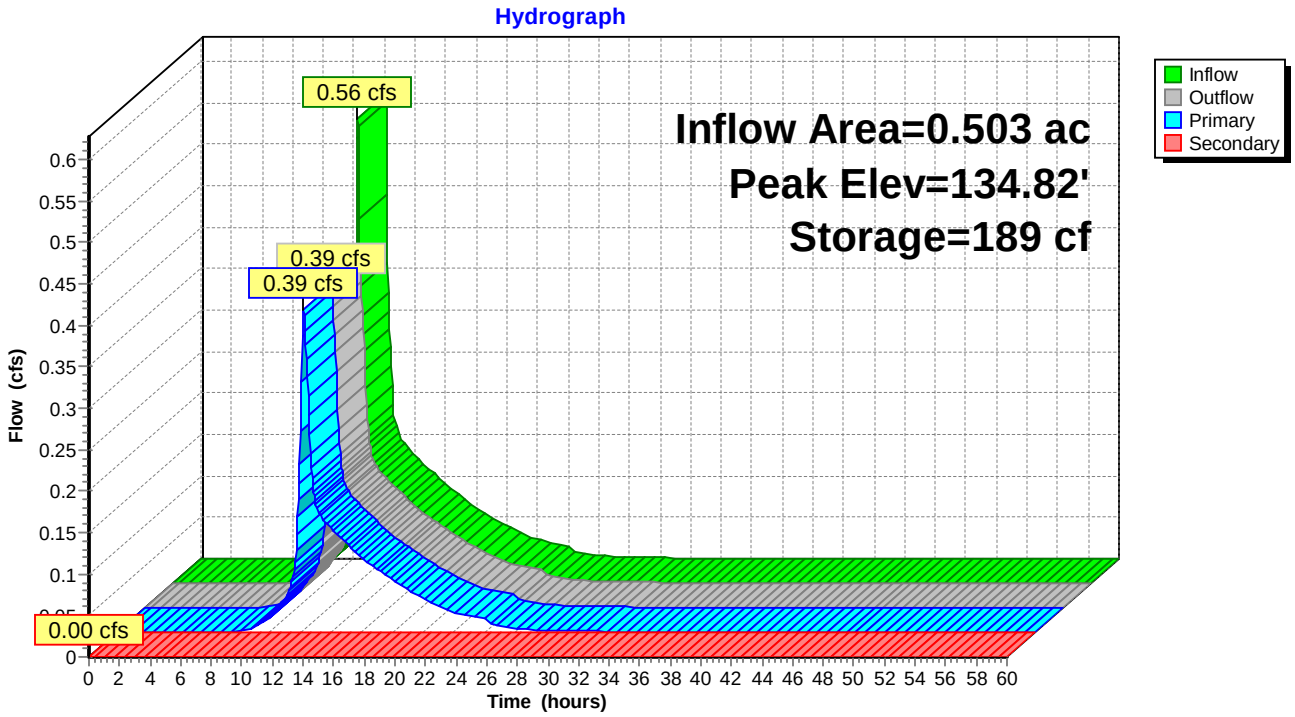
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
133.80	528	0.0	0	0
134.00	528	35.0	37	37
134.90	528	35.0	166	203
135.00	605	100.0	57	260
136.00	1,105	100.0	855	1,115
136.50	1,437	100.0	636	1,750

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	136.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.39 cfs @ 12.18 hrs HW=134.82' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.39 cfs @ 4.44 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=133.80' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BIO: Bioretention



Summary for Pond UG1: UG1

Inflow Area = 0.289 ac, 84.32% Impervious, Inflow Depth = 2.54" for 2 year event
Inflow = 0.84 cfs @ 12.07 hrs, Volume= 0.061 af
Outflow = 0.10 cfs @ 12.67 hrs, Volume= 0.061 af, Atten= 88%, Lag= 35.6 min
Primary = 0.10 cfs @ 12.67 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Starting Elev= 136.10' Surf.Area= 1,867 sf Storage= 327 cf
Peak Elev= 137.13' @ 12.67 hrs Surf.Area= 1,867 sf Storage= 1,563 cf (1,236 cf above start)

Plug-Flow detention time= 268.8 min calculated for 0.054 af (88% of inflow)
Center-of-Mass det. time= 172.6 min (967.2 - 794.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.60'	969 cf	**36.83'W x 40.80'L x 2.33'H Field A** 3,507 cf Overall - 737 cf Embedded = 2,769 cf x 35.0% Voids
#2A	136.10'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 10 Rows
#3B	135.60'	236 cf	**14.83'W x 24.56'L x 2.33'H Field B** 850 cf Overall - 177 cf Embedded = 673 cf x 35.0% Voids
#4B	136.10'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 4 Rows
		2,119 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.10'	**12.0" Round Culvert** L= 8.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 136.10' / 136.00' S= 0.0125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Device 1	136.10'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.10 cfs @ 12.67 hrs HW=137.13' (Free Discharge)
└**1=Culvert** (Passes 0.10 cfs of 2.33 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 4.69 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UG1: UG1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

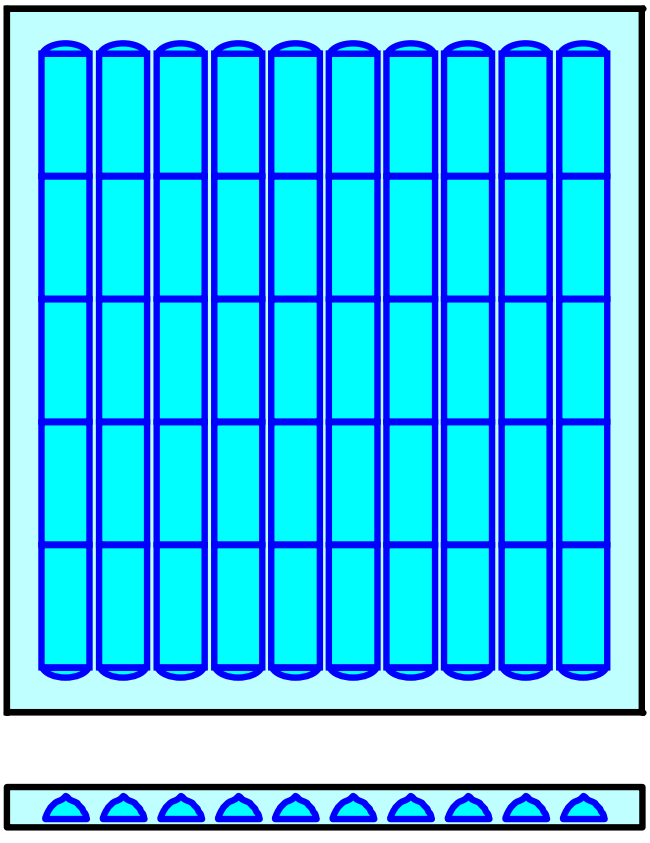
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +24.0" End Stone x 2 = 40.80' Base Length
10 Rows x 34.0" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 36.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,506.5 cf Field - 737.1 cf Chambers = 2,769.4 cf Stone x 35.0% Voids = 969.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,706.4 cf = 0.039 af
Overall Storage Efficiency = 48.7%
Overall System Size = 40.80' x 36.83' x 2.33'

50 Chambers
129.9 cy Field
102.6 cy Stone



Pond UG1: UG1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

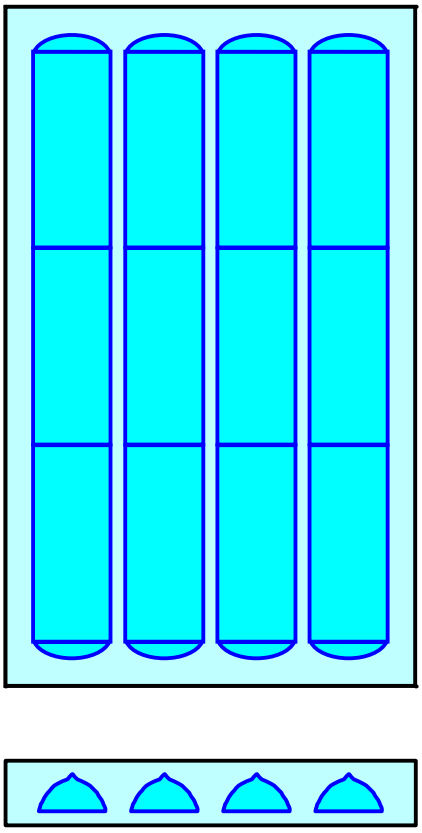
3 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 22.56' Row Length +12.0" End Stone x 2 = 24.56' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

12 Chambers x 14.7 cf = 176.9 cf Chamber Storage

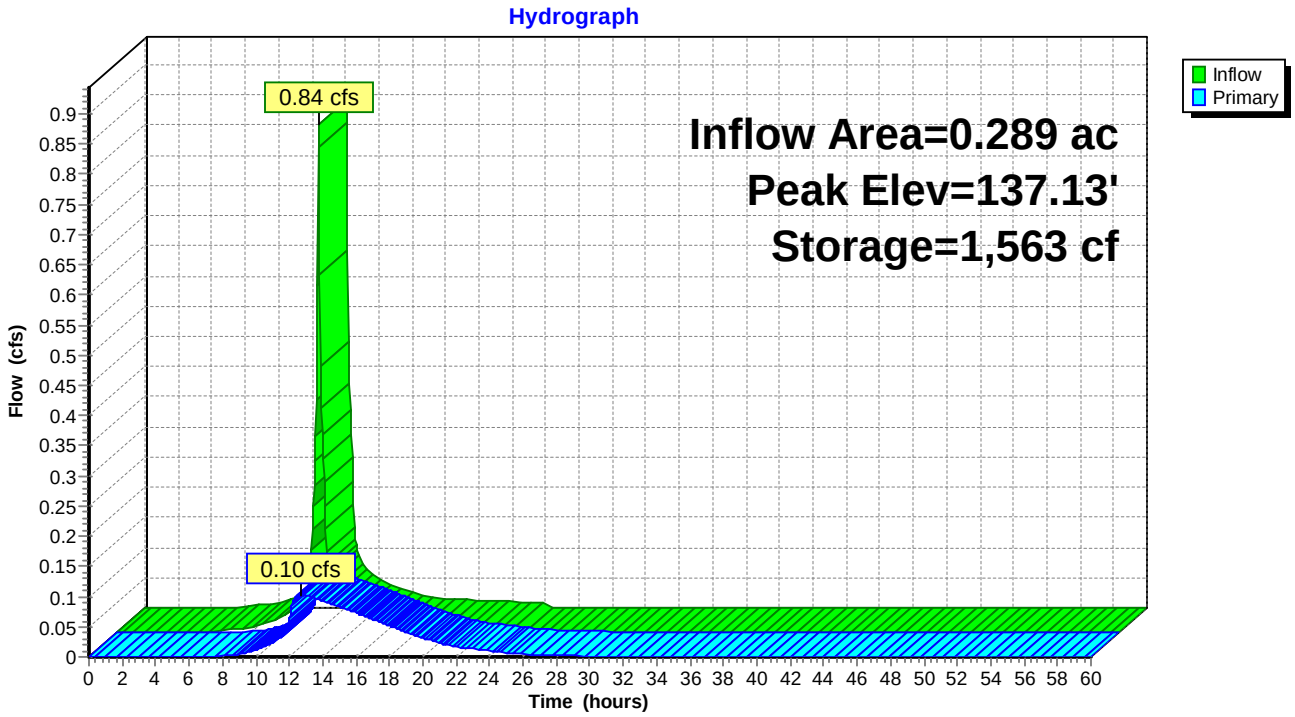
850.0 cf Field - 176.9 cf Chambers = 673.1 cf Stone x 35.0% Voids = 235.6 cf Stone Storage

Chamber Storage + Stone Storage = 412.5 cf = 0.009 af
Overall Storage Efficiency = 48.5%
Overall System Size = 24.56' x 14.83' x 2.33'

12 Chambers
31.5 cy Field
24.9 cy Stone



Pond UG1: UG1


Hydrograph
Inflow
Primary
0.84 cfs
0.10 cfs
Inflow Area=0.289 ac
Peak Elev=137.13'
Storage=1,563 cf
Flow (cfs)
Time (hours)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60

Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: P-1 Runoff Area=15,833 sf 74.12% Impervious Runoff Depth=3.38"
Tc=5.0 min CN=88 Runoff=1.42 cfs 0.103 af

Subcatchment 2a: P-2A Runoff Area=12,585 sf 84.32% Impervious Runoff Depth=3.80"
Tc=5.0 min CN=92 Runoff=1.23 cfs 0.091 af

Subcatchment 2b: P-2b Runoff Area=9,328 sf 65.97% Impervious Runoff Depth=3.09"
Tc=5.0 min CN=85 Runoff=0.77 cfs 0.055 af

Subcatchment 2c: P-2c Runoff Area=44,460 sf 0.00% Impervious Runoff Depth=0.95"
Tc=5.0 min CN=57 Runoff=0.94 cfs 0.081 af

Reach DP2: Inflow=1.38 cfs 0.227 af
Outflow=1.38 cfs 0.227 af

Pond BIO: Bioretention Peak Elev=135.43' Storage=570 cf Inflow=0.87 cfs 0.146 af
Primary=0.51 cfs 0.146 af Secondary=0.00 cfs 0.000 af Outflow=0.51 cfs 0.146 af

Pond UG1: UG1 Peak Elev=137.64' Storage=1,929 cf Inflow=1.23 cfs 0.091 af
Outflow=0.47 cfs 0.091 af

Total Runoff Area = 1.887 ac Runoff Volume = 0.330 af Average Runoff Depth = 2.10"
65.33% Pervious = 1.233 ac 34.67% Impervious = 0.654 ac

Summary for Subcatchment 1: P-1

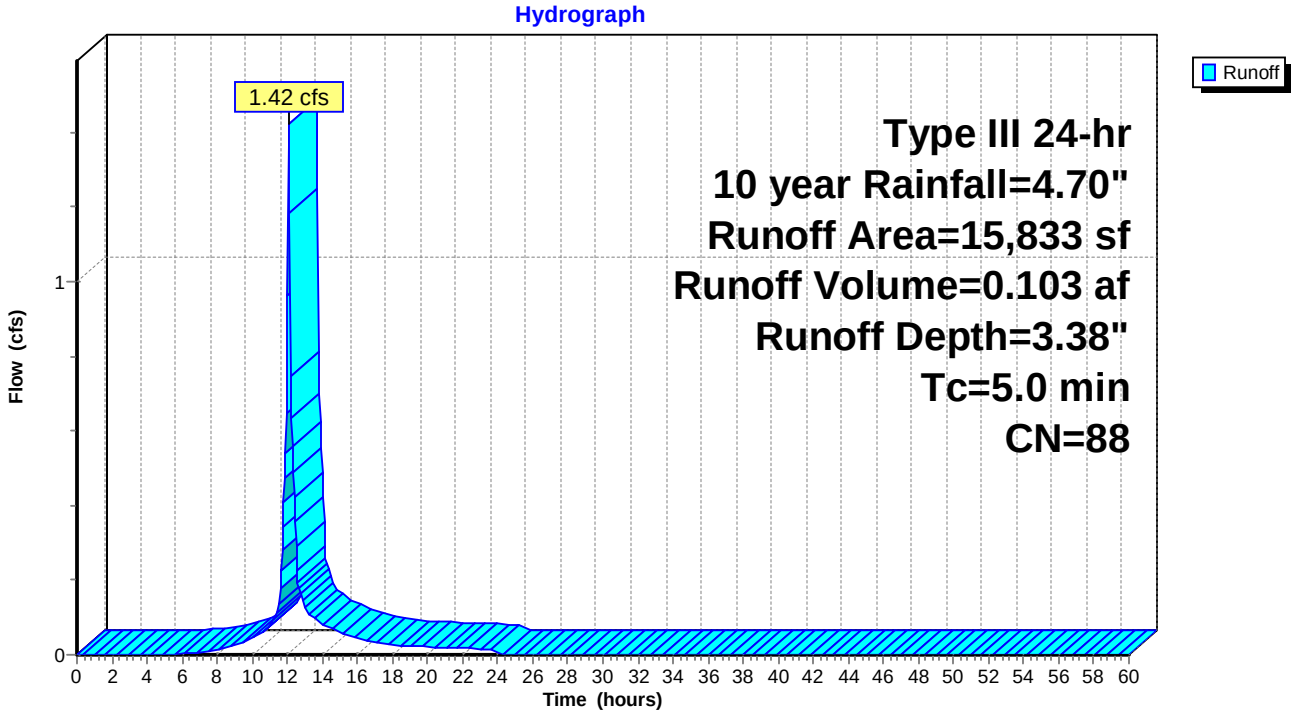
Runoff = 1.42 cfs @ 12.07 hrs, Volume= 0.103 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
*	11,736	98	Impervious
	174	55	Woods, Good, HSG B
	3,923	61	>75% Grass cover, Good, HSG B
	15,833	88	Weighted Average
	4,097		25.88% Pervious Area
	11,736		74.12% Impervious Area

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

Subcatchment 1: P-1



Summary for Subcatchment 2a: P-2A

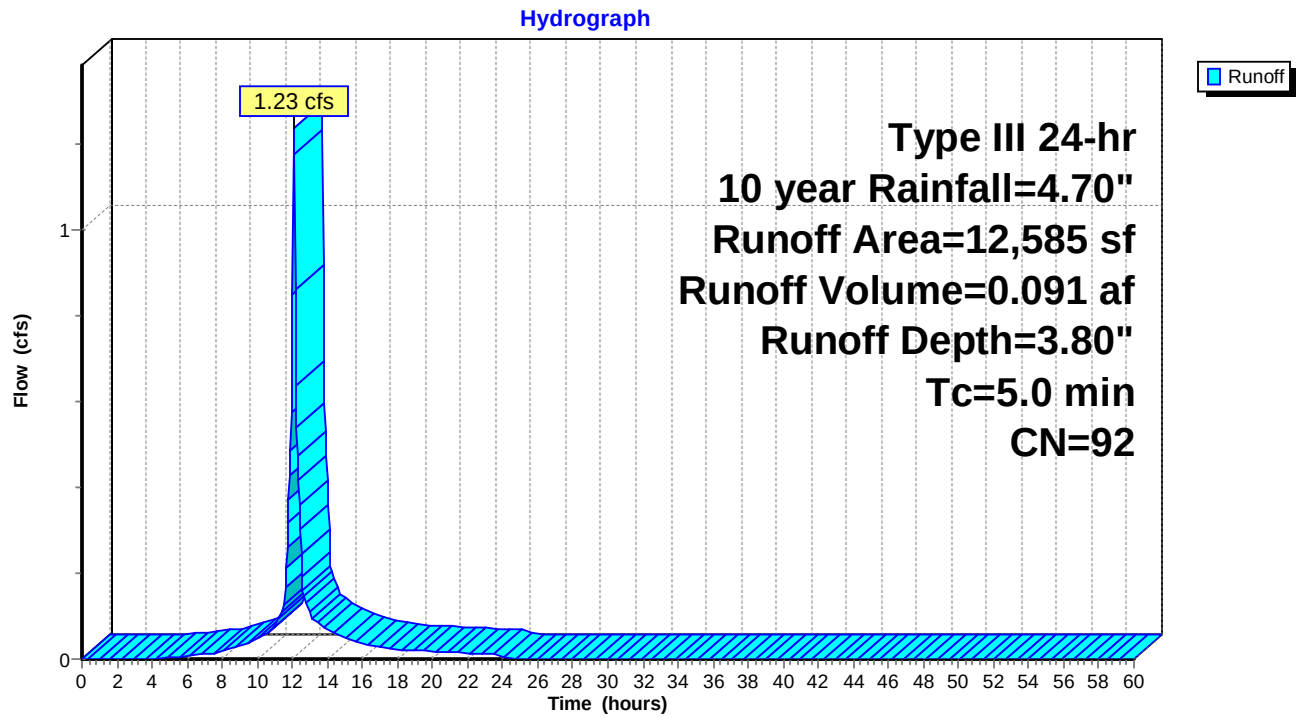
Runoff = 1.23 cfs @ 12.07 hrs, Volume= 0.091 af, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
*	8,846	98	Impervious
	1,125	55	Woods, Good, HSG B
	848	61	>75% Grass cover, Good, HSG B
*	1,766	98	Roof
	12,585	92	Weighted Average
	1,973		15.68% Pervious Area
	10,612		84.32% Impervious Area

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

Subcatchment 2a: P-2A



Summary for Subcatchment 2b: P-2b

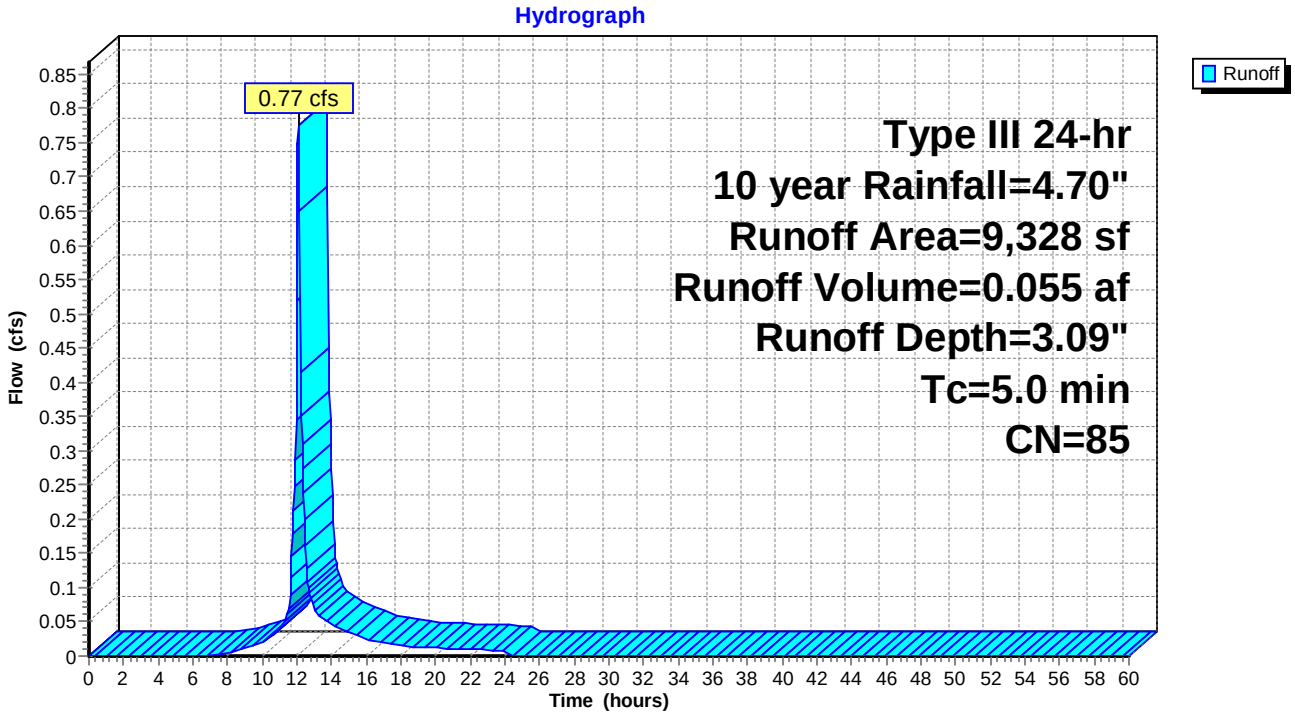
Runoff = 0.77 cfs @ 12.07 hrs, Volume= 0.055 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
*	1,698	98	Impervious
	3,174	61	>75% Grass cover, Good, HSG B
*	2,690	98	CB2
*	1,766	98	Roof
	9,328	85	Weighted Average
	3,174		34.03% Pervious Area
	6,154		65.97% Impervious Area

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

Subcatchment 2b: P-2b



Summary for Subcatchment 2c: P-2c

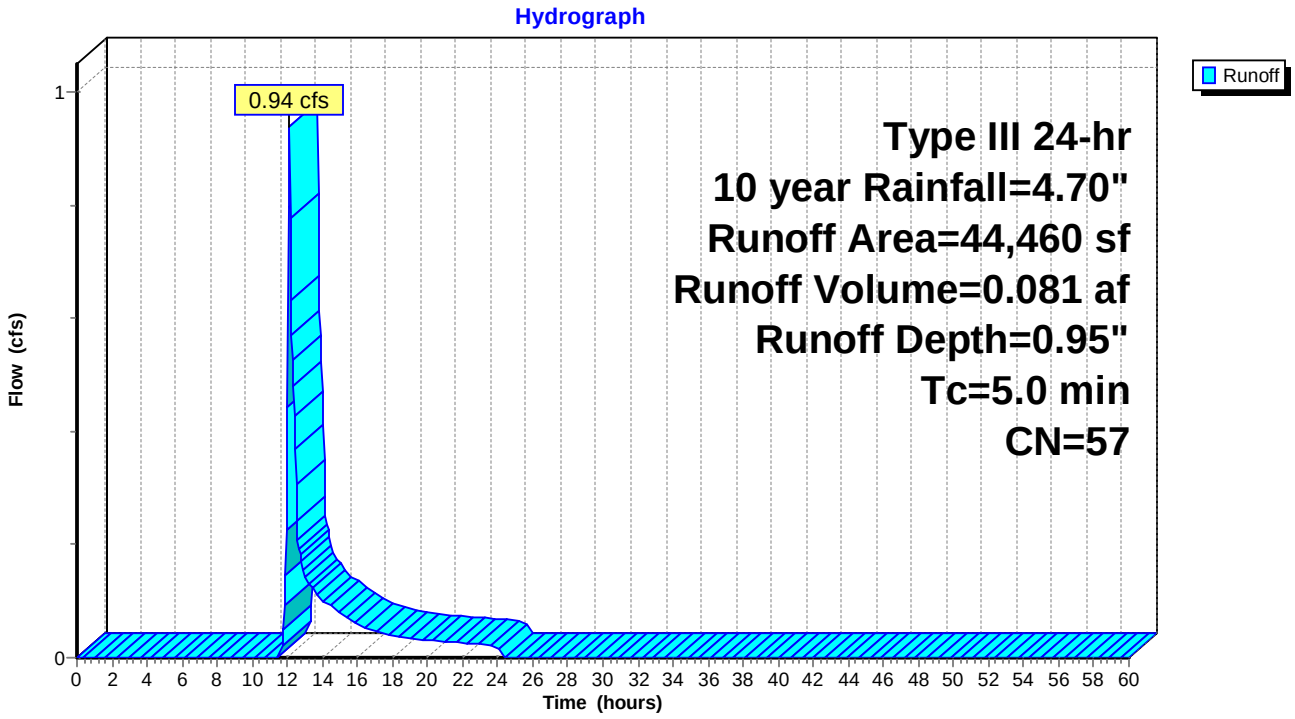
Runoff = 0.94 cfs @ 12.10 hrs, Volume= 0.081 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
30,989	55	Woods, Good, HSG B
13,471	61	>75% Grass cover, Good, HSG B
44,460	57	Weighted Average
44,460		100.00% Pervious Area

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

Subcatchment 2c: P-2c

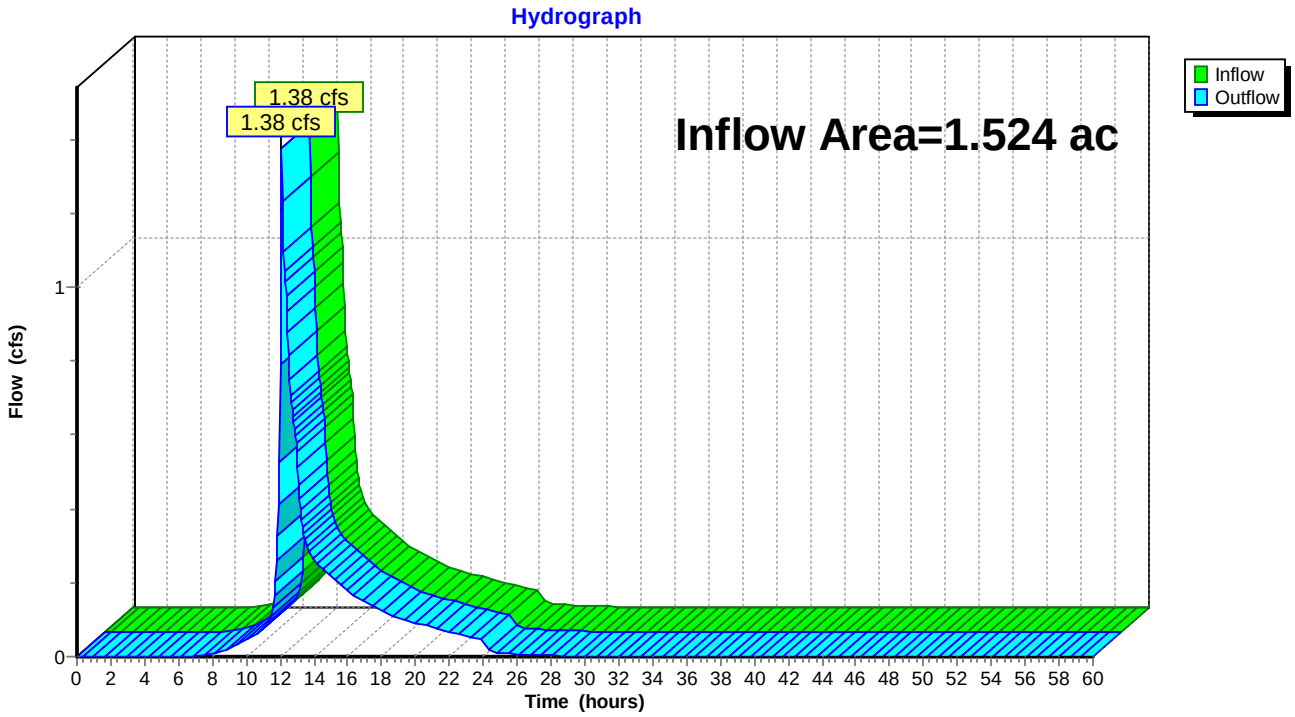


Summary for Reach DP2:

Inflow Area = 1.524 ac, 25.26% Impervious, Inflow Depth = 1.79" for 10 year event
Inflow = 1.38 cfs @ 12.10 hrs, Volume= 0.227 af
Outflow = 1.38 cfs @ 12.10 hrs, Volume= 0.227 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs

Reach DP2:



Summary for Pond BIO: Bioretention

Inflow Area = 0.503 ac, 76.51% Impervious, Inflow Depth = 3.49" for 10 year event
Inflow = 0.87 cfs @ 12.08 hrs, Volume= 0.146 af
Outflow = 0.51 cfs @ 12.48 hrs, Volume= 0.146 af, Atten= 41%, Lag= 24.0 min
Primary = 0.51 cfs @ 12.48 hrs, Volume= 0.146 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 135.43' @ 12.48 hrs Surf.Area= 822 sf Storage= 570 cf

Plug-Flow detention time= 9.9 min calculated for 0.146 af (100% of inflow)
Center-of-Mass det. time= 9.9 min (903.9 - 894.0)

Volume	Invert	Avail.Storage	Storage Description
#1	133.80'	1,750 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

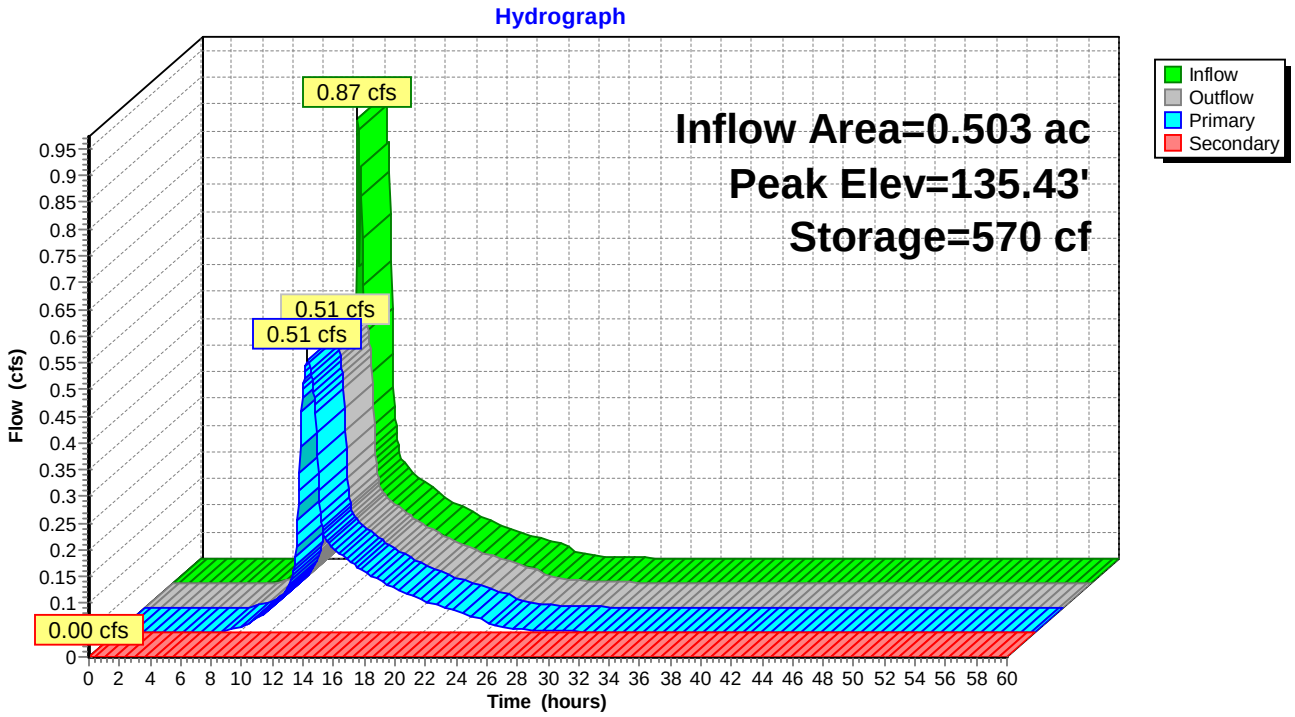
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
133.80	528	0.0	0	0
134.00	528	35.0	37	37
134.90	528	35.0	166	203
135.00	605	100.0	57	260
136.00	1,105	100.0	855	1,115
136.50	1,437	100.0	636	1,750

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	136.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.51 cfs @ 12.48 hrs HW=135.43' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.51 cfs @ 5.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=133.80' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BIO: Bioretention



Summary for Pond UG1: UG1

Inflow Area = 0.289 ac, 84.32% Impervious, Inflow Depth = 3.80" for 10 year event
Inflow = 1.23 cfs @ 12.07 hrs, Volume= 0.091 af
Outflow = 0.47 cfs @ 12.31 hrs, Volume= 0.091 af, Atten= 62%, Lag= 14.5 min
Primary = 0.47 cfs @ 12.31 hrs, Volume= 0.091 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Starting Elev= 136.10' Surf.Area= 1,867 sf Storage= 327 cf
Peak Elev= 137.64' @ 12.31 hrs Surf.Area= 1,867 sf Storage= 1,929 cf (1,602 cf above start)

Plug-Flow detention time= 234.9 min calculated for 0.084 af (92% of inflow)
Center-of-Mass det. time= 161.6 min (945.4 - 783.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.60'	969 cf	**36.83'W x 40.80'L x 2.33'H Field A** 3,507 cf Overall - 737 cf Embedded = 2,769 cf x 35.0% Voids
#2A	136.10'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 10 Rows
#3B	135.60'	236 cf	**14.83'W x 24.56'L x 2.33'H Field B** 850 cf Overall - 177 cf Embedded = 673 cf x 35.0% Voids
#4B	136.10'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 4 Rows
		2,119 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.10'	**12.0" Round Culvert** L= 8.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 136.10' / 136.00' S= 0.0125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Device 1	136.10'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.46 cfs @ 12.31 hrs HW=137.64' (Free Discharge)
└**1=Culvert** (Passes 0.46 cfs of 3.40 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 5.81 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.34 cfs @ 1.22 fps)

Pond UG1: UG1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

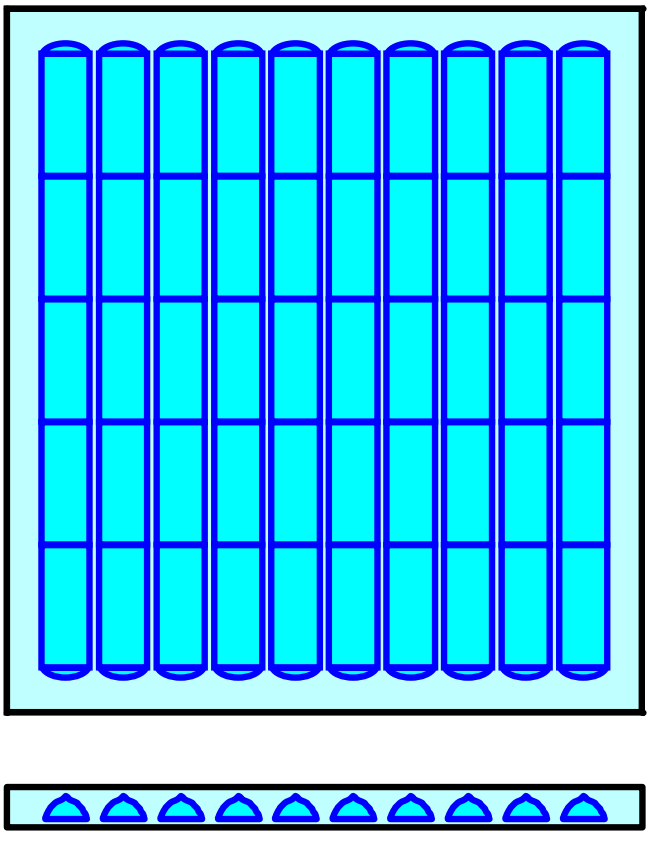
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +24.0" End Stone x 2 = 40.80' Base Length
10 Rows x 34.0" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 36.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,506.5 cf Field - 737.1 cf Chambers = 2,769.4 cf Stone x 35.0% Voids = 969.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,706.4 cf = 0.039 af
Overall Storage Efficiency = 48.7%
Overall System Size = 40.80' x 36.83' x 2.33'

50 Chambers
129.9 cy Field
102.6 cy Stone



Pond UG1: UG1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

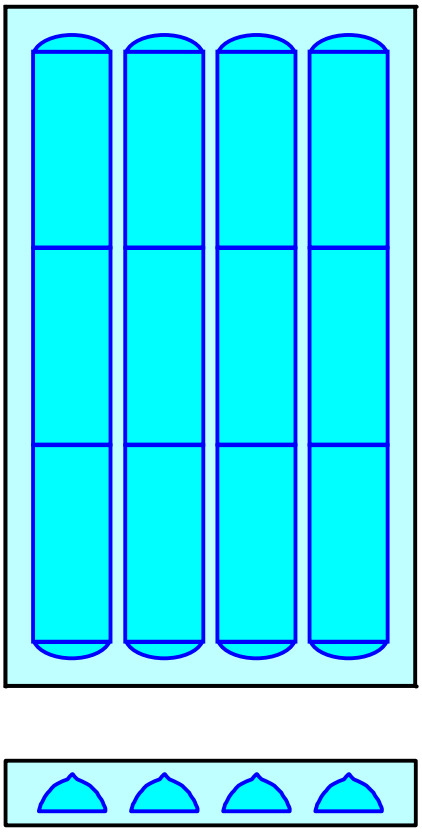
3 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 22.56' Row Length +12.0" End Stone x 2 = 24.56' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

12 Chambers x 14.7 cf = 176.9 cf Chamber Storage

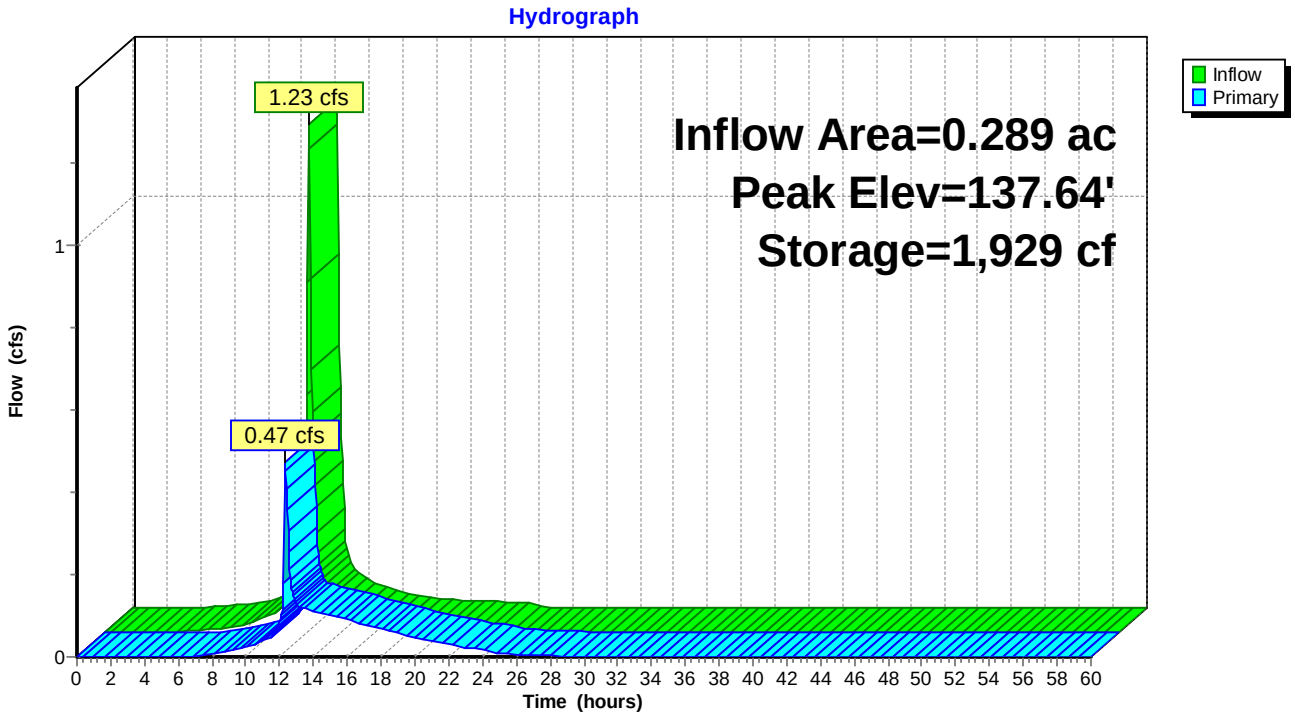
850.0 cf Field - 176.9 cf Chambers = 673.1 cf Stone x 35.0% Voids = 235.6 cf Stone Storage

Chamber Storage + Stone Storage = 412.5 cf = 0.009 af
Overall Storage Efficiency = 48.5%
Overall System Size = 24.56' x 14.83' x 2.33'

12 Chambers
31.5 cy Field
24.9 cy Stone



Pond UG1: UG1


Hydrograph
Inflow
Primary
1.23 cfs
0.47 cfs
Inflow Area=0.289 ac
Peak Elev=137.64'
Storage=1,929 cf
Flow (cfs)
0
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Time (hours)

Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: P-1 Runoff Area=15,833 sf 74.12% Impervious Runoff Depth=4.24"
Tc=5.0 min CN=88 Runoff=1.76 cfs 0.128 af

Subcatchment 2a: P-2A Runoff Area=12,585 sf 84.32% Impervious Runoff Depth=4.68"
Tc=5.0 min CN=92 Runoff=1.50 cfs 0.113 af

Subcatchment 2b: P-2b Runoff Area=9,328 sf 65.97% Impervious Runoff Depth=3.93"
Tc=5.0 min CN=85 Runoff=0.98 cfs 0.070 af

Subcatchment 2c: P-2c Runoff Area=44,460 sf 0.00% Impervious Runoff Depth=1.44"
Tc=5.0 min CN=57 Runoff=1.55 cfs 0.122 af

Reach DP2: Inflow=2.02 cfs 0.305 af
Outflow=2.02 cfs 0.305 af

Pond BIO: Bioretention Peak Elev=136.02' Storage=1,137 cf Inflow=1.66 cfs 0.183 af
Primary=0.60 cfs 0.182 af Secondary=0.07 cfs 0.001 af Outflow=0.68 cfs 0.183 af

Pond UG1: UG1 Peak Elev=137.77' Storage=2,015 cf Inflow=1.50 cfs 0.113 af
Outflow=1.03 cfs 0.113 af

Total Runoff Area = 1.887 ac Runoff Volume = 0.433 af Average Runoff Depth = 2.76"
65.33% Pervious = 1.233 ac 34.67% Impervious = 0.654 ac

Summary for Subcatchment 1: P-1

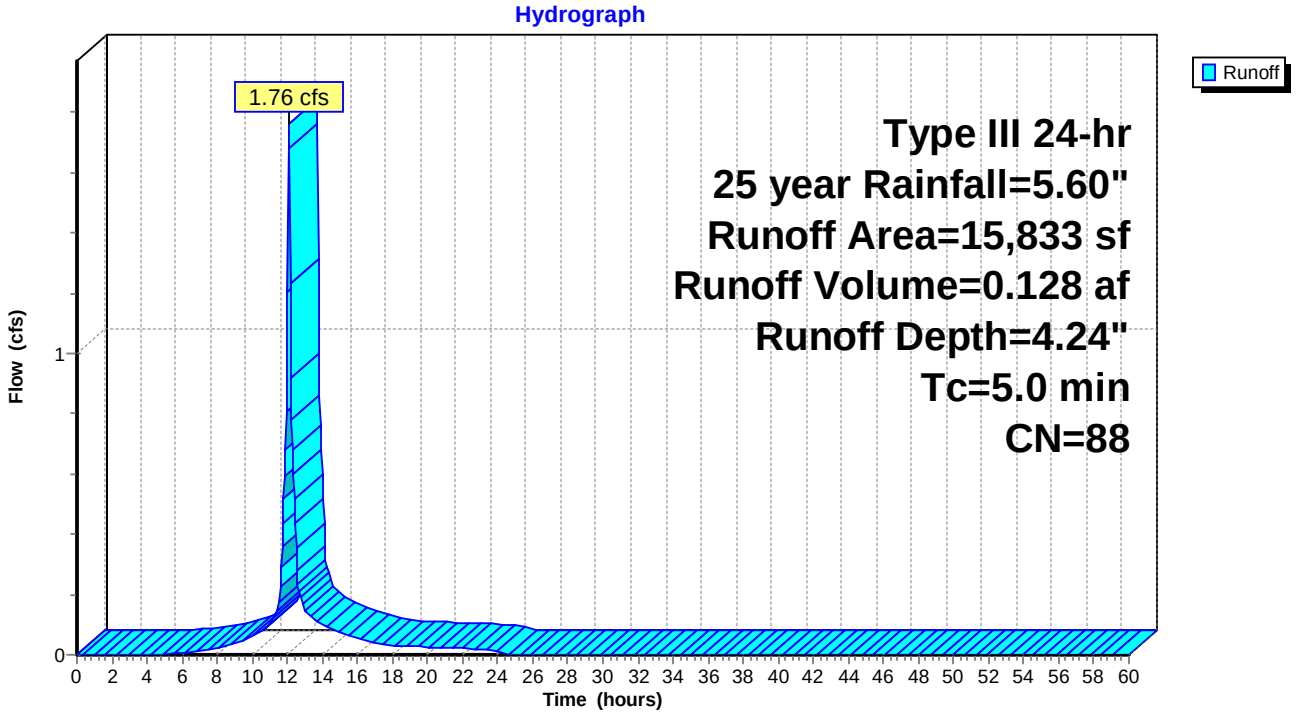
Runoff = 1.76 cfs @ 12.07 hrs, Volume= 0.128 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.60"

	Area (sf)	CN	Description
*	11,736	98	Impervious
	174	55	Woods, Good, HSG B
	3,923	61	>75% Grass cover, Good, HSG B
	15,833	88	Weighted Average
	4,097		25.88% Pervious Area
	11,736		74.12% Impervious Area

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

Subcatchment 1: P-1



Summary for Subcatchment 2a: P-2A

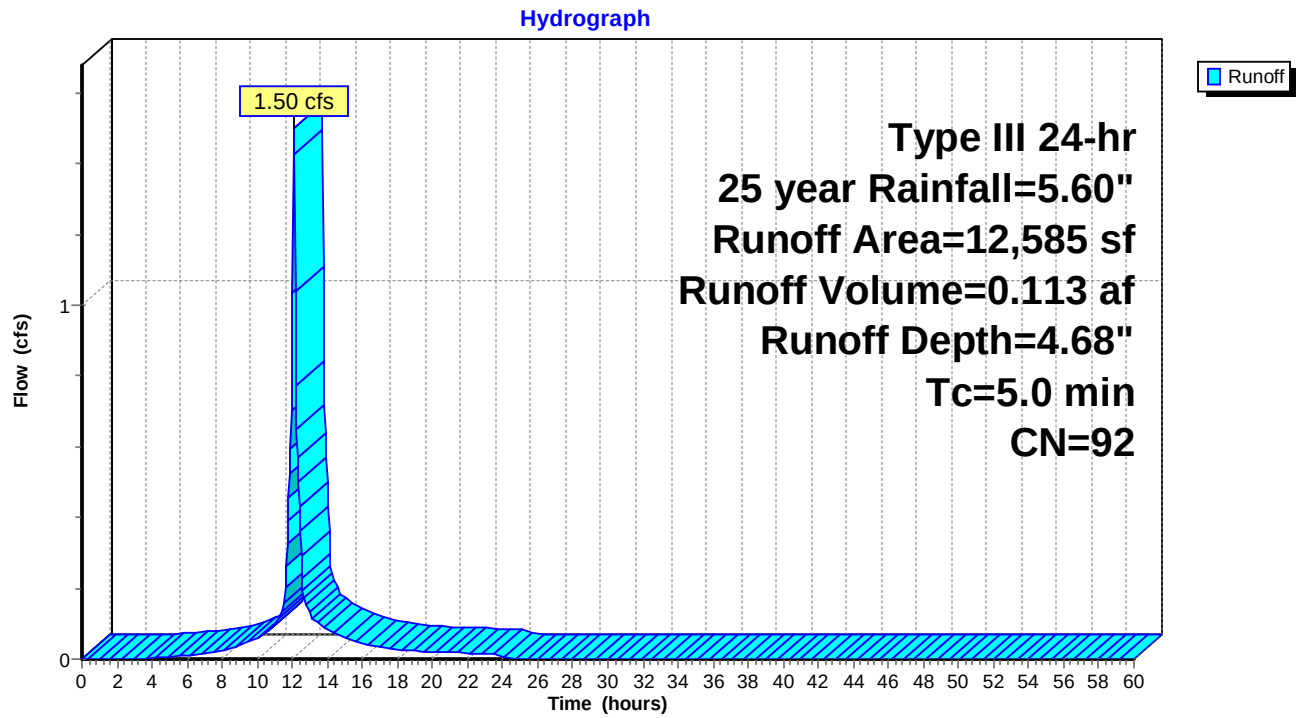
Runoff = 1.50 cfs @ 12.07 hrs, Volume= 0.113 af, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.60"

	Area (sf)	CN	Description
*	8,846	98	Impervious
	1,125	55	Woods, Good, HSG B
	848	61	>75% Grass cover, Good, HSG B
*	1,766	98	Roof
	12,585	92	Weighted Average
	1,973		15.68% Pervious Area
	10,612		84.32% Impervious Area

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

Subcatchment 2a: P-2A



Summary for Subcatchment 2b: P-2b

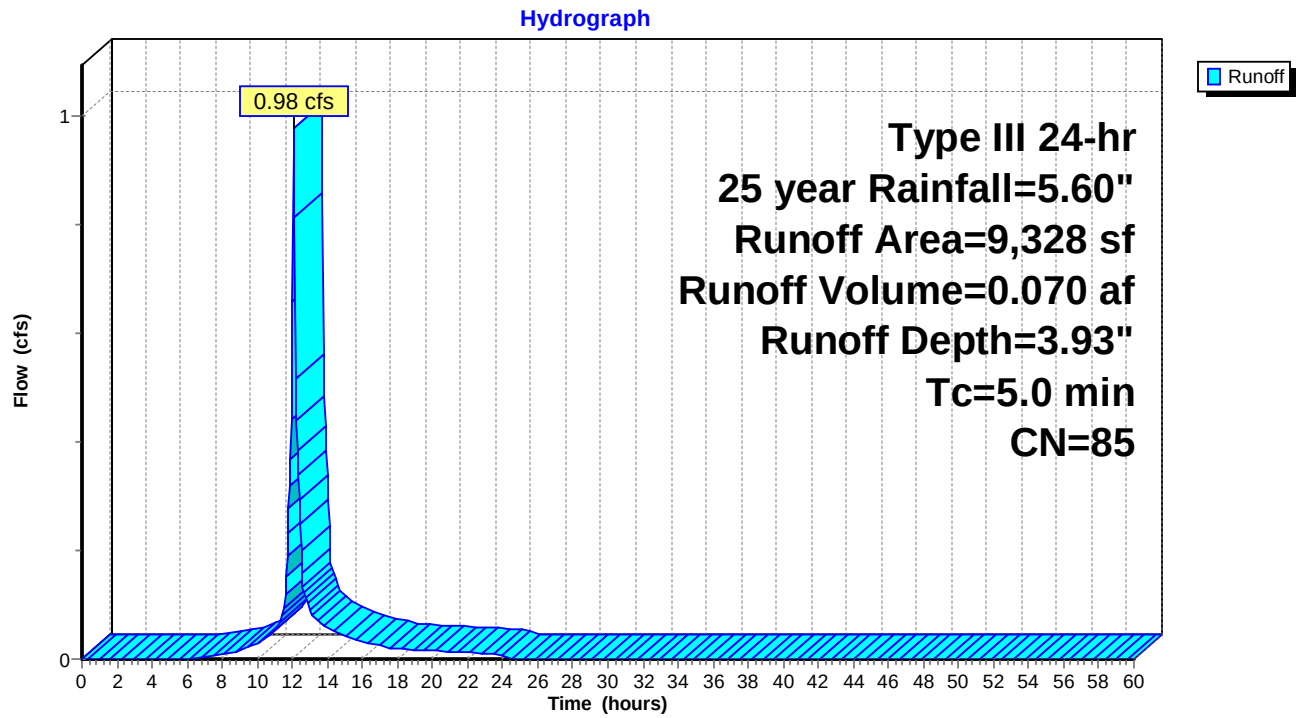
Runoff = 0.98 cfs @ 12.07 hrs, Volume= 0.070 af, Depth= 3.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.60"

	Area (sf)	CN	Description
*	1,698	98	Impervious
	3,174	61	>75% Grass cover, Good, HSG B
*	2,690	98	CB2
*	1,766	98	Roof
	9,328	85	Weighted Average
	3,174		34.03% Pervious Area
	6,154		65.97% Impervious Area

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

Subcatchment 2b: P-2b



Summary for Subcatchment 2c: P-2c

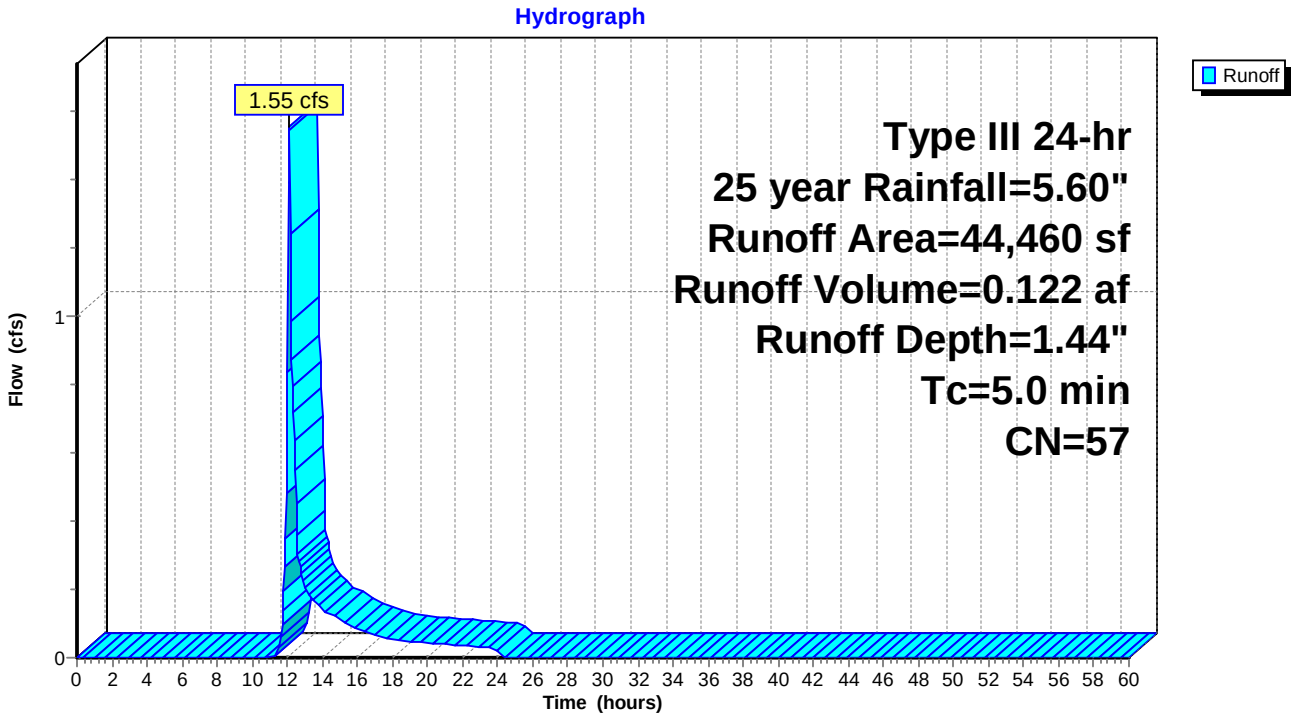
Runoff = 1.55 cfs @ 12.09 hrs, Volume= 0.122 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.60"

Area (sf)	CN	Description
30,989	55	Woods, Good, HSG B
13,471	61	>75% Grass cover, Good, HSG B
44,460	57	Weighted Average
44,460		100.00% Pervious Area

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

Subcatchment 2c: P-2c

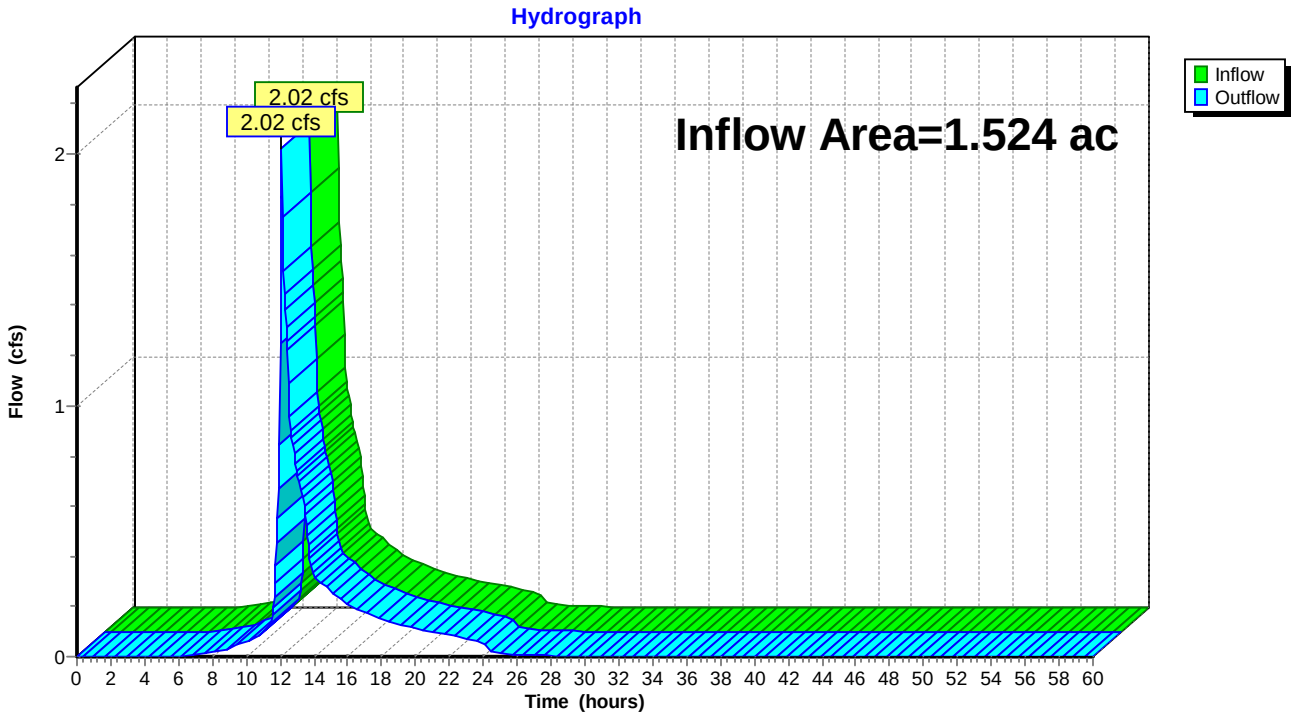


Summary for Reach DP2:

Inflow Area = 1.524 ac, 25.26% Impervious, Inflow Depth = 2.40" for 25 year event
Inflow = 2.02 cfs @ 12.10 hrs, Volume= 0.305 af
Outflow = 2.02 cfs @ 12.10 hrs, Volume= 0.305 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs

Reach DP2:



Summary for Pond BIO: Bioretention

Inflow Area = 0.503 ac, 76.51% Impervious, Inflow Depth = 4.36" for 25 year event
Inflow = 1.66 cfs @ 12.16 hrs, Volume= 0.183 af
Outflow = 0.68 cfs @ 12.46 hrs, Volume= 0.183 af, Atten= 59%, Lag= 17.9 min
Primary = 0.60 cfs @ 12.46 hrs, Volume= 0.182 af
Secondary = 0.07 cfs @ 12.46 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 136.02' @ 12.46 hrs Surf.Area= 1,118 sf Storage= 1,137 cf

Plug-Flow detention time= 13.3 min calculated for 0.182 af (100% of inflow)
Center-of-Mass det. time= 13.3 min (890.9 - 877.6)

Volume	Invert	Avail.Storage	Storage Description
#1	133.80'	1,750 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

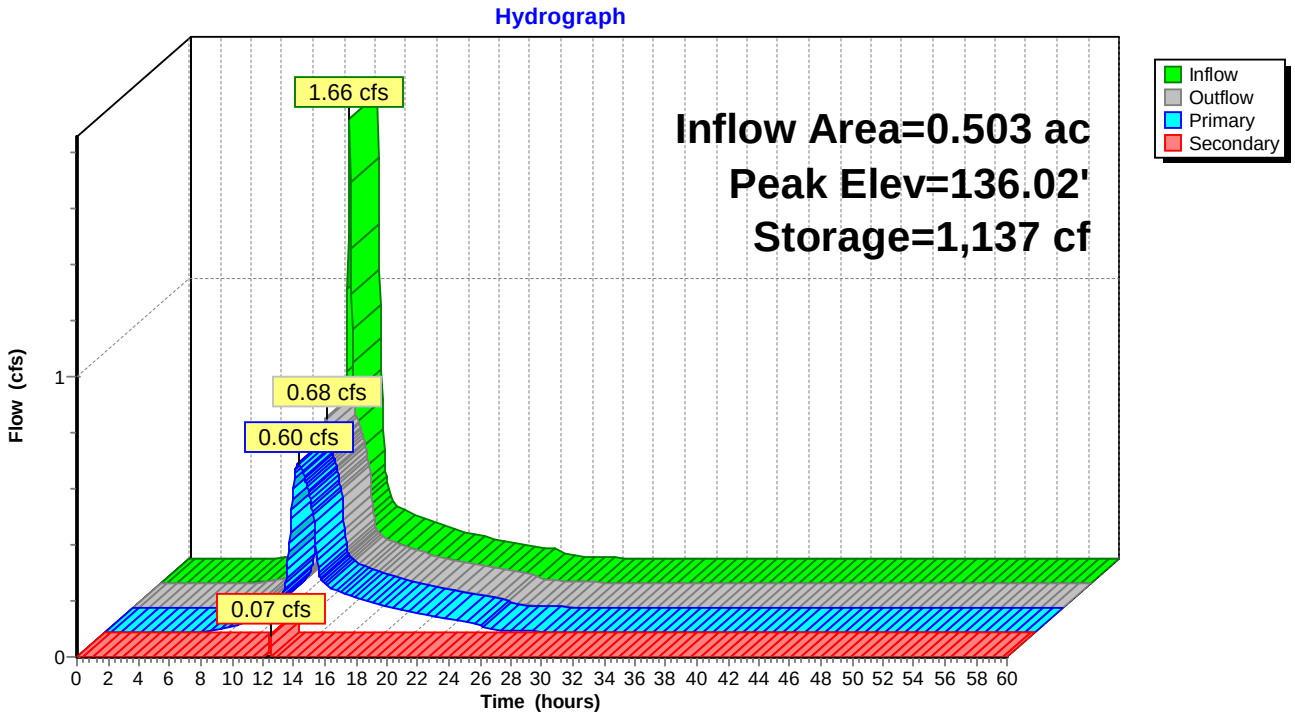
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
133.80	528	0.0	0	0
134.00	528	35.0	37	37
134.90	528	35.0	166	203
135.00	605	100.0	57	260
136.00	1,105	100.0	855	1,115
136.50	1,437	100.0	636	1,750

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	136.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.60 cfs @ 12.46 hrs HW=136.02' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.60 cfs @ 6.90 fps)

Secondary OutFlow Max=0.06 cfs @ 12.46 hrs HW=136.02' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.06 cfs @ 0.33 fps)

Pond BIO: Bioretention



Summary for Pond UG1: UG1

Inflow Area = 0.289 ac, 84.32% Impervious, Inflow Depth = 4.68" for 25 year event
Inflow = 1.50 cfs @ 12.07 hrs, Volume= 0.113 af
Outflow = 1.03 cfs @ 12.17 hrs, Volume= 0.113 af, Atten= 32%, Lag= 6.0 min
Primary = 1.03 cfs @ 12.17 hrs, Volume= 0.113 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Starting Elev= 136.10' Surf.Area= 1,867 sf Storage= 327 cf
Peak Elev= 137.77' @ 12.17 hrs Surf.Area= 1,867 sf Storage= 2,015 cf (1,688 cf above start)

Plug-Flow detention time= 207.1 min calculated for 0.105 af (93% of inflow)
Center-of-Mass det. time= 146.3 min (924.6 - 778.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.60'	969 cf	**36.83'W x 40.80'L x 2.33'H Field A** 3,507 cf Overall - 737 cf Embedded = 2,769 cf x 35.0% Voids
#2A	136.10'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 10 Rows
#3B	135.60'	236 cf	**14.83'W x 24.56'L x 2.33'H Field B** 850 cf Overall - 177 cf Embedded = 673 cf x 35.0% Voids
#4B	136.10'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 4 Rows
		2,119 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.10'	**12.0" Round Culvert** L= 8.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 136.10' / 136.00' S= 0.0125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Device 1	136.10'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.94 cfs @ 12.17 hrs HW=137.75' (Free Discharge)
└**1=Culvert** (Passes 0.94 cfs of 3.58 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 6.03 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.81 cfs @ 1.64 fps)

Pond UG1: UG1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

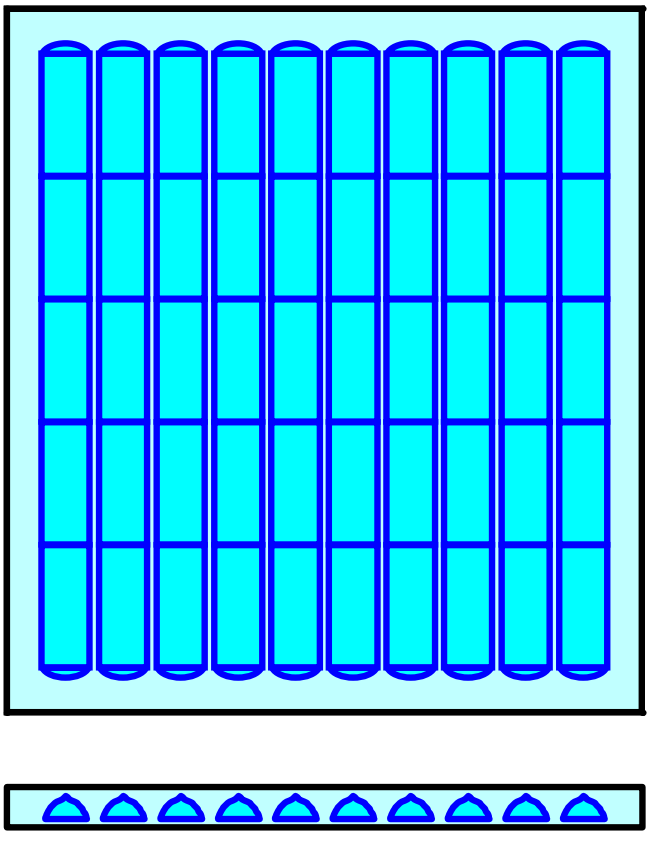
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +24.0" End Stone x 2 = 40.80' Base Length
10 Rows x 34.0" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 36.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,506.5 cf Field - 737.1 cf Chambers = 2,769.4 cf Stone x 35.0% Voids = 969.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,706.4 cf = 0.039 af
Overall Storage Efficiency = 48.7%
Overall System Size = 40.80' x 36.83' x 2.33'

50 Chambers
129.9 cy Field
102.6 cy Stone



Pond UG1: UG1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

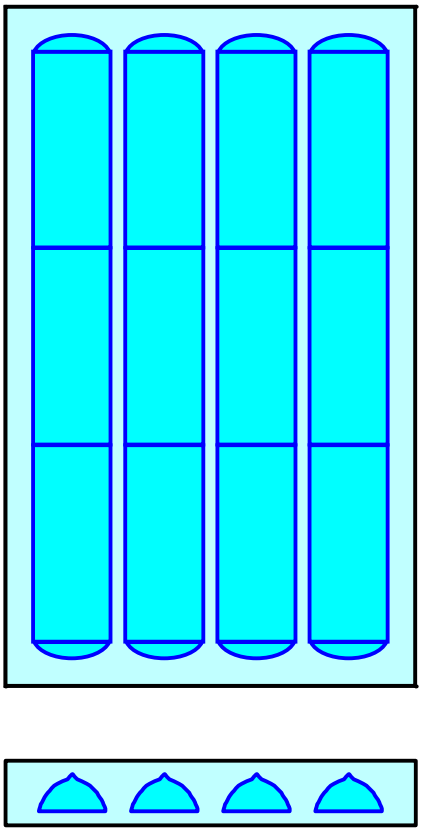
3 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 22.56' Row Length +12.0" End Stone x 2 = 24.56' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

12 Chambers x 14.7 cf = 176.9 cf Chamber Storage

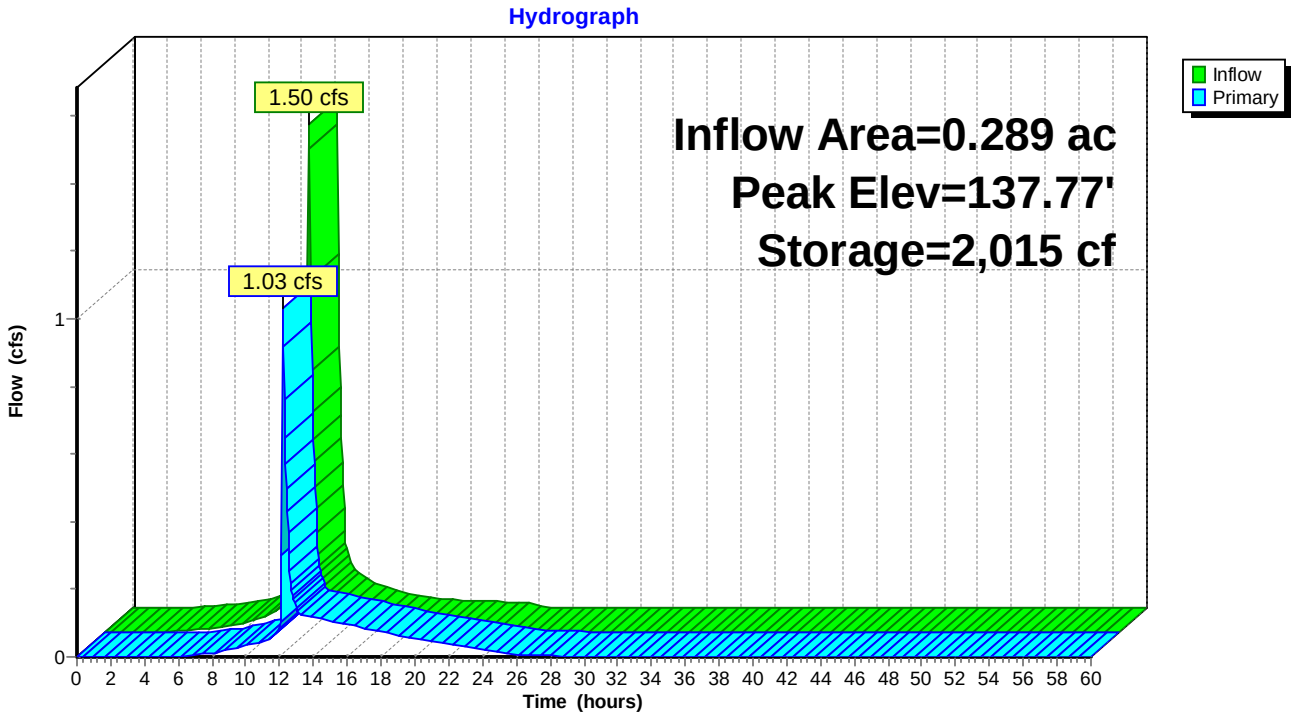
850.0 cf Field - 176.9 cf Chambers = 673.1 cf Stone x 35.0% Voids = 235.6 cf Stone Storage

Chamber Storage + Stone Storage = 412.5 cf = 0.009 af
Overall Storage Efficiency = 48.5%
Overall System Size = 24.56' x 14.83' x 2.33'

12 Chambers
31.5 cy Field
24.9 cy Stone



Pond UG1: UG1


Hydrograph
Inflow
Primary
1.50 cfs
1.03 cfs
Inflow Area=0.289 ac
Peak Elev=137.77'
Storage=2,015 cf
Flow (cfs)
0
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Time (hours)

Time span=0.00-60.00 hrs, dt=0.05 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: P-1 Runoff Area=15,833 sf 74.12% Impervious Runoff Depth=5.59"
Tc=5.0 min CN=88 Runoff=2.29 cfs 0.169 af

Subcatchment 2a: P-2A Runoff Area=12,585 sf 84.32% Impervious Runoff Depth=6.05"
Tc=5.0 min CN=92 Runoff=1.92 cfs 0.146 af

Subcatchment 2b: P-2b Runoff Area=9,328 sf 65.97% Impervious Runoff Depth=5.25"
Tc=5.0 min CN=85 Runoff=1.29 cfs 0.094 af

Subcatchment 2c: P-2c Runoff Area=44,460 sf 0.00% Impervious Runoff Depth=2.31"
Tc=5.0 min CN=57 Runoff=2.65 cfs 0.197 af

Reach DP2: Inflow=3.81 cfs 0.436 af
Outflow=3.81 cfs 0.436 af

Pond BIO: Bioretention Peak Elev=136.16' Storage=1,302 cf Inflow=2.97 cfs 0.239 af
Primary=0.62 cfs 0.214 af Secondary=1.58 cfs 0.025 af Outflow=2.20 cfs 0.239 af

Pond UG1: UG1 Peak Elev=137.91' Storage=2,103 cf Inflow=1.92 cfs 0.146 af
Outflow=1.77 cfs 0.146 af

Total Runoff Area = 1.887 ac Runoff Volume = 0.606 af Average Runoff Depth = 3.85"
65.33% Pervious = 1.233 ac 34.67% Impervious = 0.654 ac

Summary for Subcatchment 1: P-1

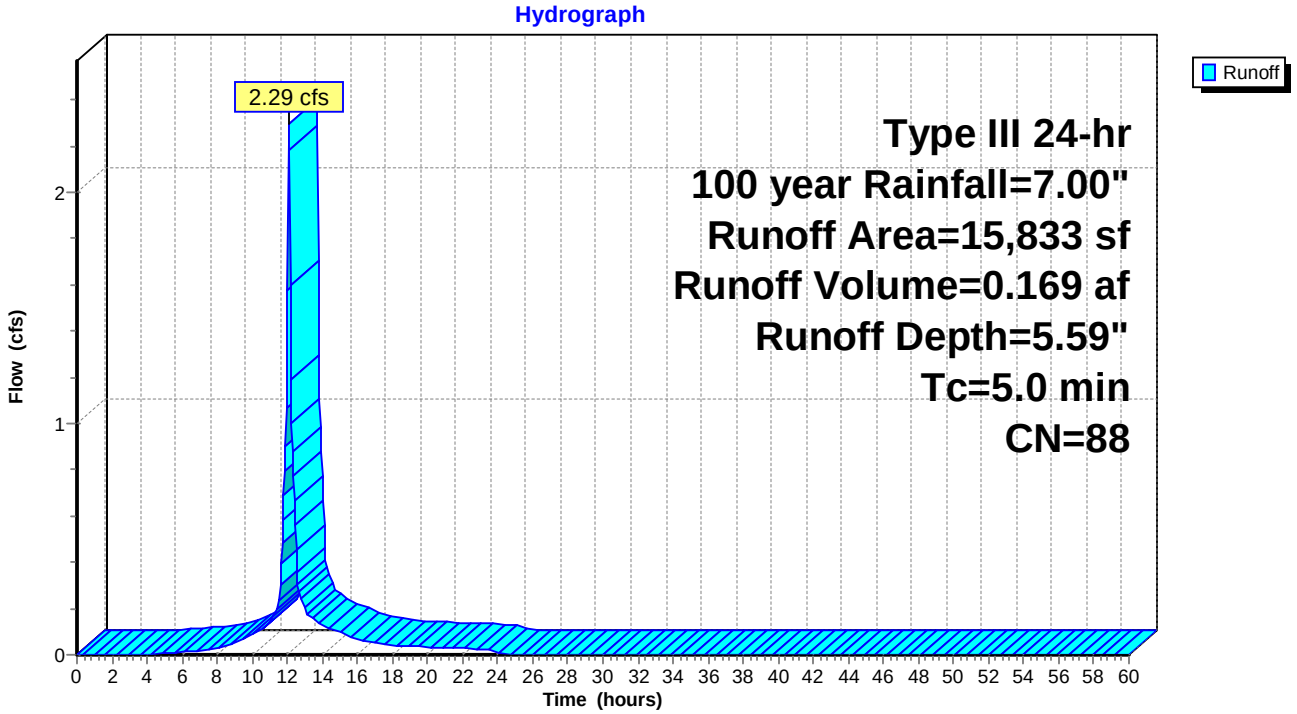
Runoff = 2.29 cfs @ 12.07 hrs, Volume= 0.169 af, Depth= 5.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.00"

	Area (sf)	CN	Description
*	11,736	98	Impervious
	174	55	Woods, Good, HSG B
	3,923	61	>75% Grass cover, Good, HSG B
	15,833	88	Weighted Average
	4,097		25.88% Pervious Area
	11,736		74.12% Impervious Area

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

Subcatchment 1: P-1



Summary for Subcatchment 2a: P-2A

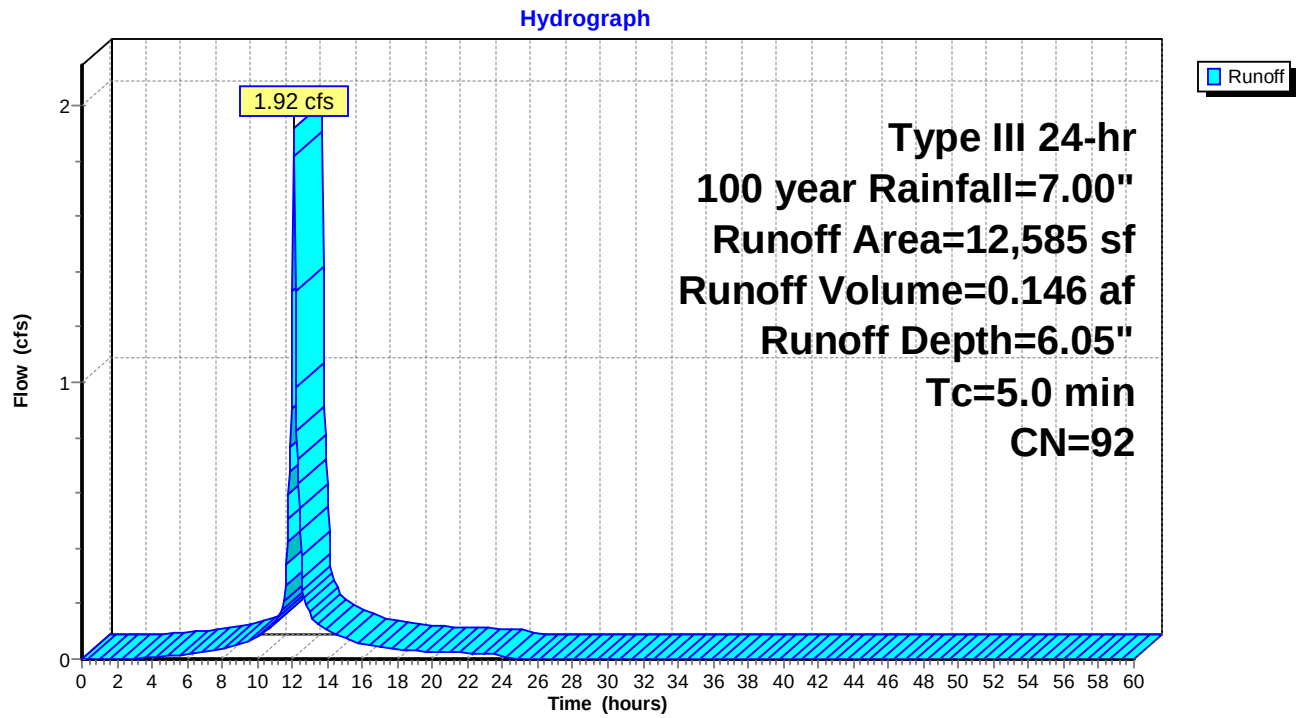
Runoff = 1.92 cfs @ 12.07 hrs, Volume= 0.146 af, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.00"

	Area (sf)	CN	Description
*	8,846	98	Impervious
	1,125	55	Woods, Good, HSG B
	848	61	>75% Grass cover, Good, HSG B
*	1,766	98	Roof
	12,585	92	Weighted Average
	1,973		15.68% Pervious Area
	10,612		84.32% Impervious Area

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

Subcatchment 2a: P-2A



Summary for Subcatchment 2b: P-2b

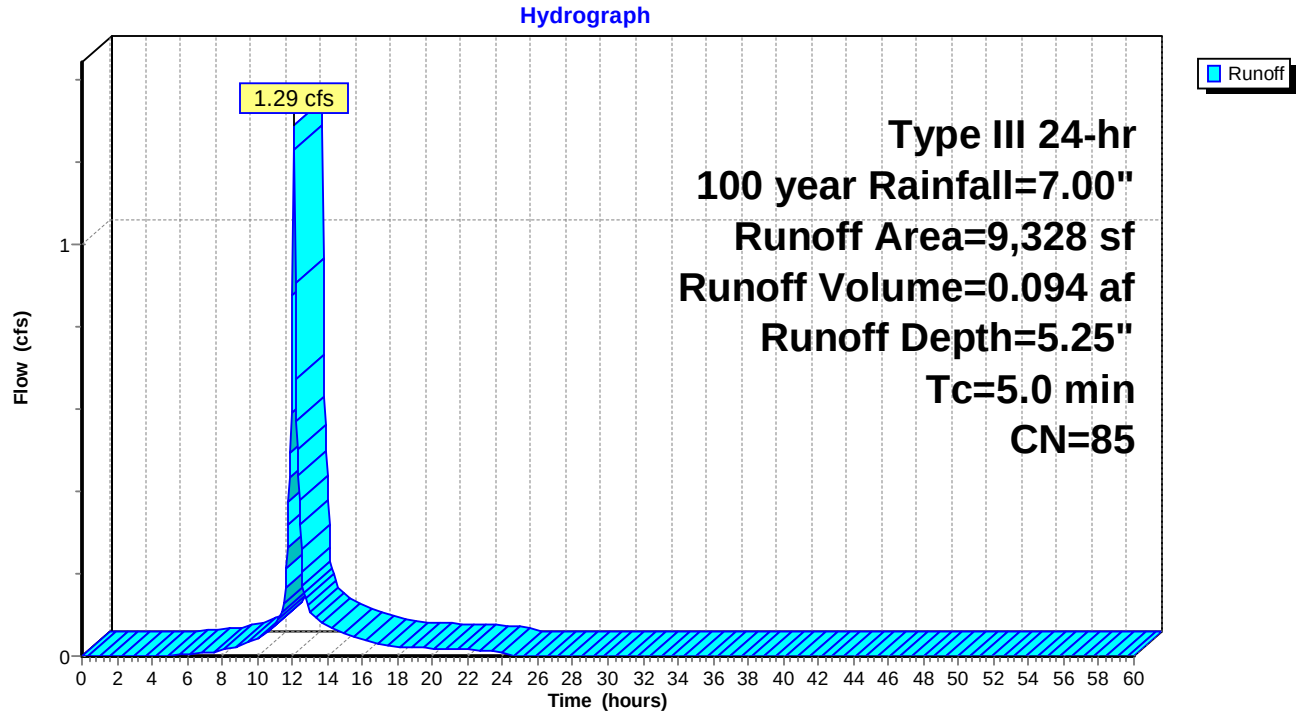
Runoff = 1.29 cfs @ 12.07 hrs, Volume= 0.094 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.00"

	Area (sf)	CN	Description
*	1,698	98	Impervious
	3,174	61	>75% Grass cover, Good, HSG B
*	2,690	98	CB2
*	1,766	98	Roof
	9,328	85	Weighted Average
	3,174		34.03% Pervious Area
	6,154		65.97% Impervious Area

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

Subcatchment 2b: P-2b



Summary for Subcatchment 2c: P-2c

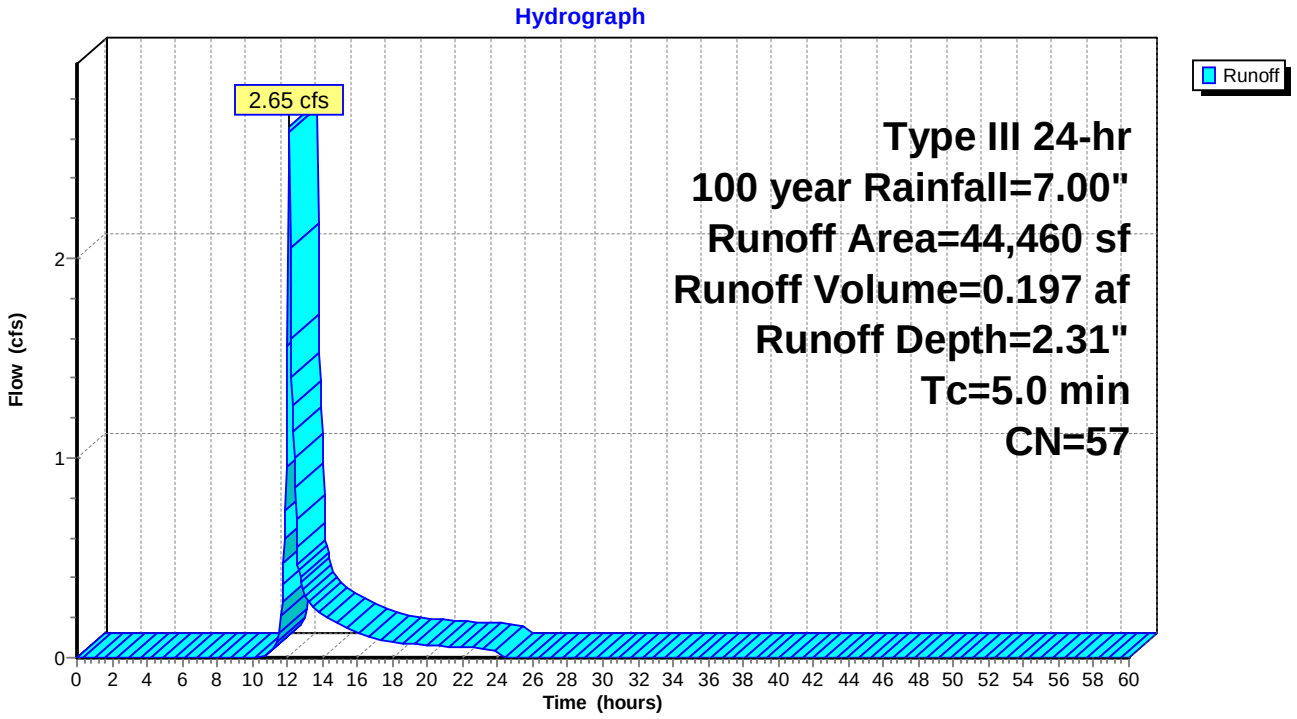
Runoff = 2.65 cfs @ 12.09 hrs, Volume= 0.197 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
30,989	55	Woods, Good, HSG B
13,471	61	>75% Grass cover, Good, HSG B
44,460	57	Weighted Average
44,460		100.00% Pervious Area

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

Subcatchment 2c: P-2c

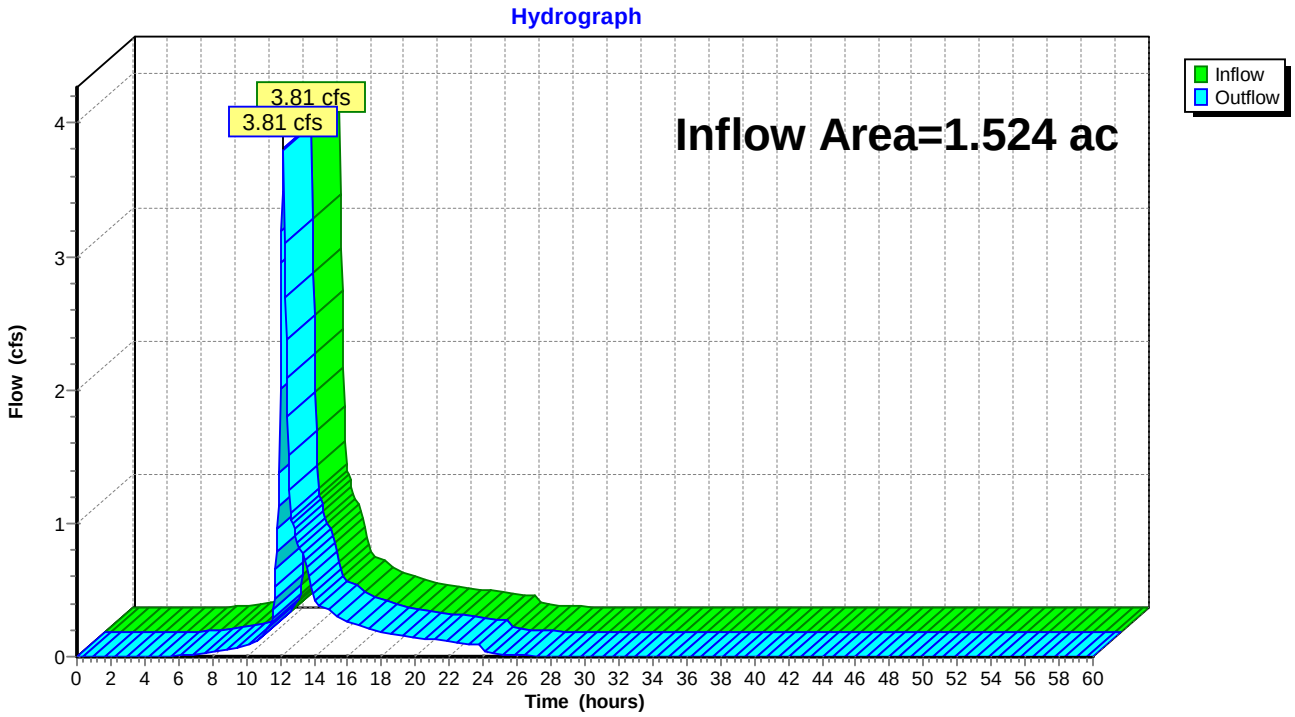


Summary for Reach DP2:

Inflow Area = 1.524 ac, 25.26% Impervious, Inflow Depth = 3.43" for 100 year event
Inflow = 3.81 cfs @ 12.19 hrs, Volume= 0.436 af
Outflow = 3.81 cfs @ 12.19 hrs, Volume= 0.436 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs

Reach DP2:



Summary for Pond BIO: Bioretention

Inflow Area = 0.503 ac, 76.51% Impervious, Inflow Depth = 5.71" for 100 year event
Inflow = 2.97 cfs @ 12.10 hrs, Volume= 0.239 af
Outflow = 2.20 cfs @ 12.21 hrs, Volume= 0.239 af, Atten= 26%, Lag= 6.1 min
Primary = 0.62 cfs @ 12.21 hrs, Volume= 0.214 af
Secondary = 1.58 cfs @ 12.21 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 136.16' @ 12.21 hrs Surf.Area= 1,212 sf Storage= 1,302 cf

Plug-Flow detention time= 12.5 min calculated for 0.239 af (100% of inflow)
Center-of-Mass det. time= 12.4 min (872.2 - 859.8)

Volume	Invert	Avail.Storage	Storage Description
#1	133.80'	1,750 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

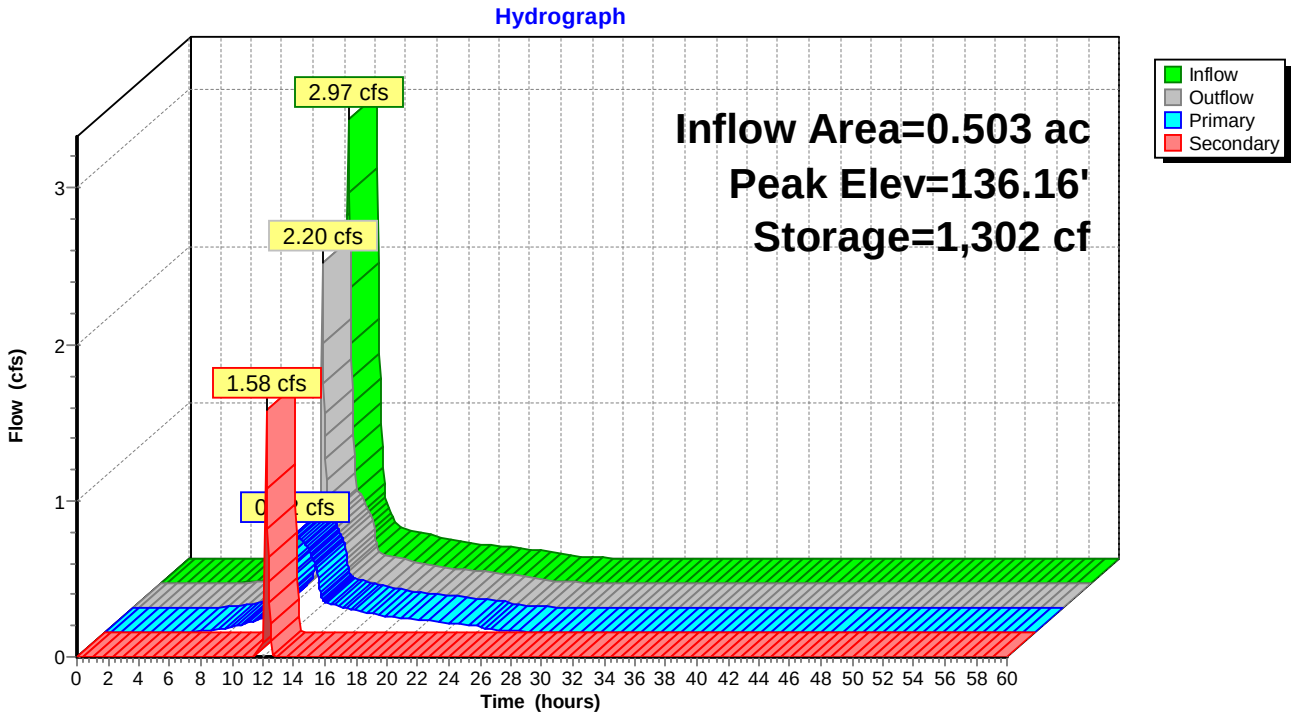
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
133.80	528	0.0	0	0
134.00	528	35.0	37	37
134.90	528	35.0	166	203
135.00	605	100.0	57	260
136.00	1,105	100.0	855	1,115
136.50	1,437	100.0	636	1,750

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	136.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.62 cfs @ 12.21 hrs HW=136.16' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.62 cfs @ 7.13 fps)

Secondary OutFlow Max=1.52 cfs @ 12.21 hrs HW=136.16' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 1.52 cfs @ 0.97 fps)

Pond BIO: Bioretention



Summary for Pond UG1: UG1

Inflow Area = 0.289 ac, 84.32% Impervious, Inflow Depth = 6.05" for 100 year event
Inflow = 1.92 cfs @ 12.07 hrs, Volume= 0.146 af
Outflow = 1.77 cfs @ 12.12 hrs, Volume= 0.146 af, Atten= 7%, Lag= 2.7 min
Primary = 1.77 cfs @ 12.12 hrs, Volume= 0.146 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Starting Elev= 136.10' Surf.Area= 1,867 sf Storage= 327 cf
Peak Elev= 137.91' @ 12.12 hrs Surf.Area= 1,867 sf Storage= 2,103 cf (1,776 cf above start)

Plug-Flow detention time= 181.4 min calculated for 0.138 af (95% of inflow)
Center-of-Mass det. time= 130.2 min (902.0 - 771.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.60'	969 cf	**36.83'W x 40.80'L x 2.33'H Field A** 3,507 cf Overall - 737 cf Embedded = 2,769 cf x 35.0% Voids
#2A	136.10'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 10 Rows
#3B	135.60'	236 cf	**14.83'W x 24.56'L x 2.33'H Field B** 850 cf Overall - 177 cf Embedded = 673 cf x 35.0% Voids
#4B	136.10'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 4 Rows
		2,119 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.10'	**12.0" Round Culvert** L= 8.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 136.10' / 136.00' S= 0.0125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Device 1	136.10'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.69 cfs @ 12.12 hrs HW=137.89' (Free Discharge)
└**1=Culvert** (Passes 1.69 cfs of 3.80 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.30 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.55 cfs @ 2.05 fps)

Pond UG1: UG1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

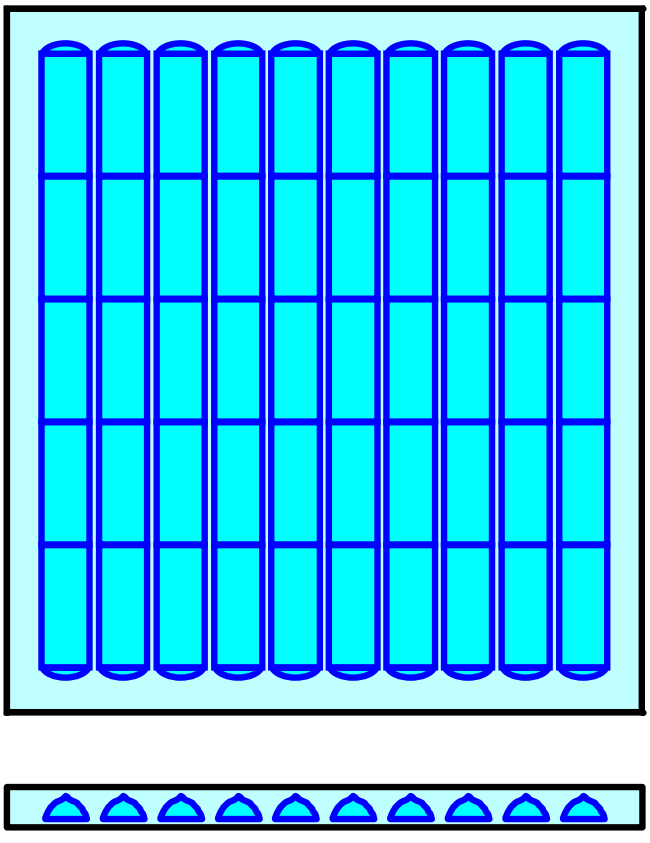
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +24.0" End Stone x 2 = 40.80' Base Length
10 Rows x 34.0" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 36.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,506.5 cf Field - 737.1 cf Chambers = 2,769.4 cf Stone x 35.0% Voids = 969.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,706.4 cf = 0.039 af
Overall Storage Efficiency = 48.7%
Overall System Size = 40.80' x 36.83' x 2.33'

50 Chambers
129.9 cy Field
102.6 cy Stone



Pond UG1: UG1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

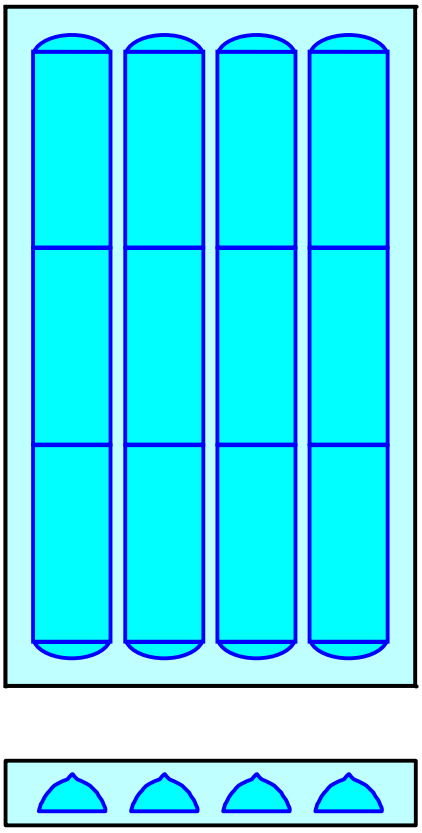
3 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 22.56' Row Length +12.0" End Stone x 2 = 24.56' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

12 Chambers x 14.7 cf = 176.9 cf Chamber Storage

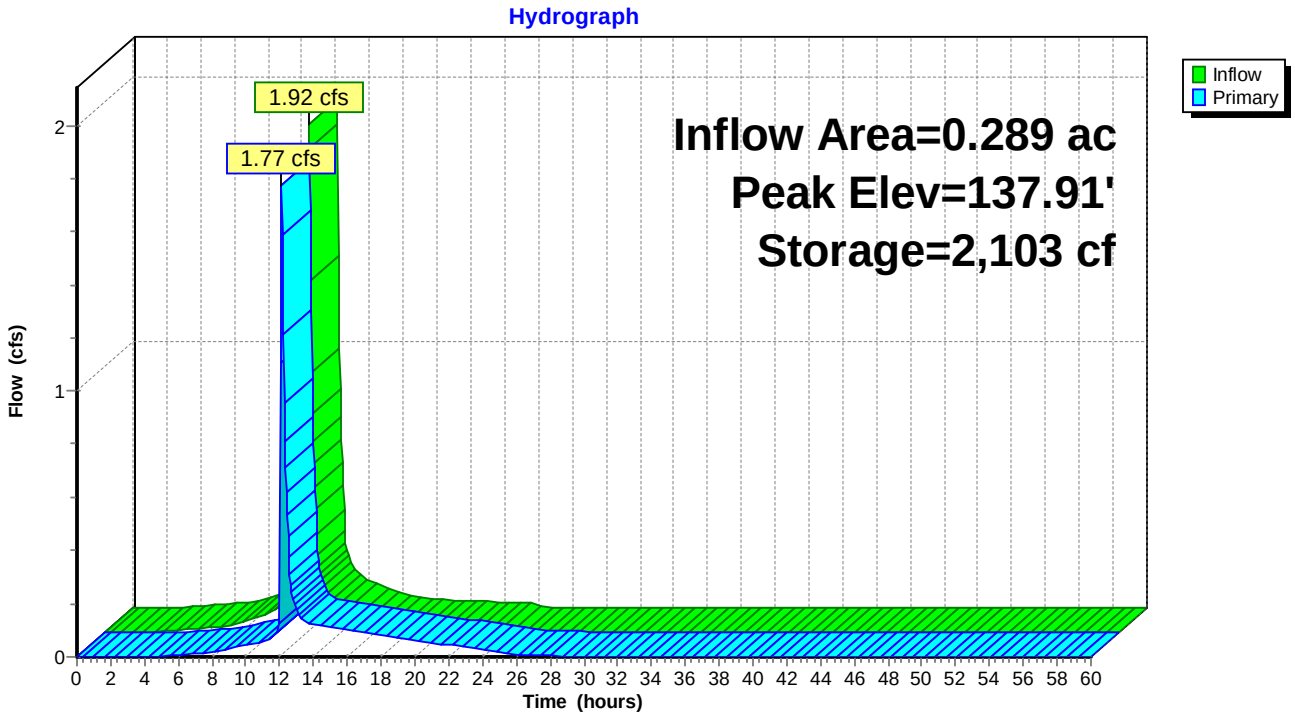
850.0 cf Field - 176.9 cf Chambers = 673.1 cf Stone x 35.0% Voids = 235.6 cf Stone Storage

Chamber Storage + Stone Storage = 412.5 cf = 0.009 af
Overall Storage Efficiency = 48.5%
Overall System Size = 24.56' x 14.83' x 2.33'

12 Chambers
31.5 cy Field
24.9 cy Stone



Pond UG1: UG1


Hydrograph
1.92 cfs
1.77 cfs
Inflow Area=0.289 ac
Peak Elev=137.91'
Storage=2,103 cf
Inflow
Primary
Flow (cfs)
0
1
2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Time (hours)

Section 3.2

Proposed Pipe Hydraulic Calculations

OCEAN HONDA - STORM SEWER DESIGN

Design Assumptions

Project No. 360903
Project 19 & 27 Whiting Street
Location Whiting St
Hingham MA

100 Year Storm
5 Minute Duration
7 in/hr Intensity for Boston, MA IDF Curve

Pipe Coefficient "n" 0.013 HDPE/RCP

SHEET 1 OF 1
COMPUTED BY DR DATE 3/27/2020
CHECKED BY DR DATE

DRAINAGE STRUCTURE		TRIBUTRARY AREA		RUNOFF COEFFICIENT	RUNOFF RATIONAL METHOD Q=Ca x C x i x A				RAINFALL INTENSITY	DISCHARGE (Q)		PIPE							FROM STRUCTURE
FROM STRUCT.	TO STRUCT.	INCREM. (AC)	TOTAL	"C"	"Ca"	"Ca" X "C" X "A"	TIME OF FLOW TC(MIN)	TF(MIN)	(IN/HR)	INCREM (CFS)	TOTAL (CFS)	LENGTH (FT)	DIA (IN)	SLOPE (FT/FT)	CAPACITY Q (CFS)	MEAN VELOCITY VF (FT/S)	AVAILABLE CAPACITY	FROM INVERT	TO INVERT	RIM
CB1	DMH1	0.25		0.80	1.1	0.22	5		7	1.51		3	12	0.033	6.52	8.30	5.00	136.20	136.10	139.20
ROOF	DMH2	0.04		0.90	1.1	0.04	5		7	0.28		17	12	0.018	4.74	6.04	4.46	136.40	136.10	145.50
OCS	DMH3		0.29								1.77	8	12	0.012	3.99	5.08	2.22	136.10	136.00	139.40
DMH3	FES1		0.29								1.77	21	12	0.024	5.51	7.02	3.74	136.00	135.50	138.90
CB-2	FES2	0.06		0.90	1.1	0.06	5		7	0.43		32	12	0.006	2.79	3.55	2.36	135.10	134.90	138.10

Section 3.3

Drainage Area Plans

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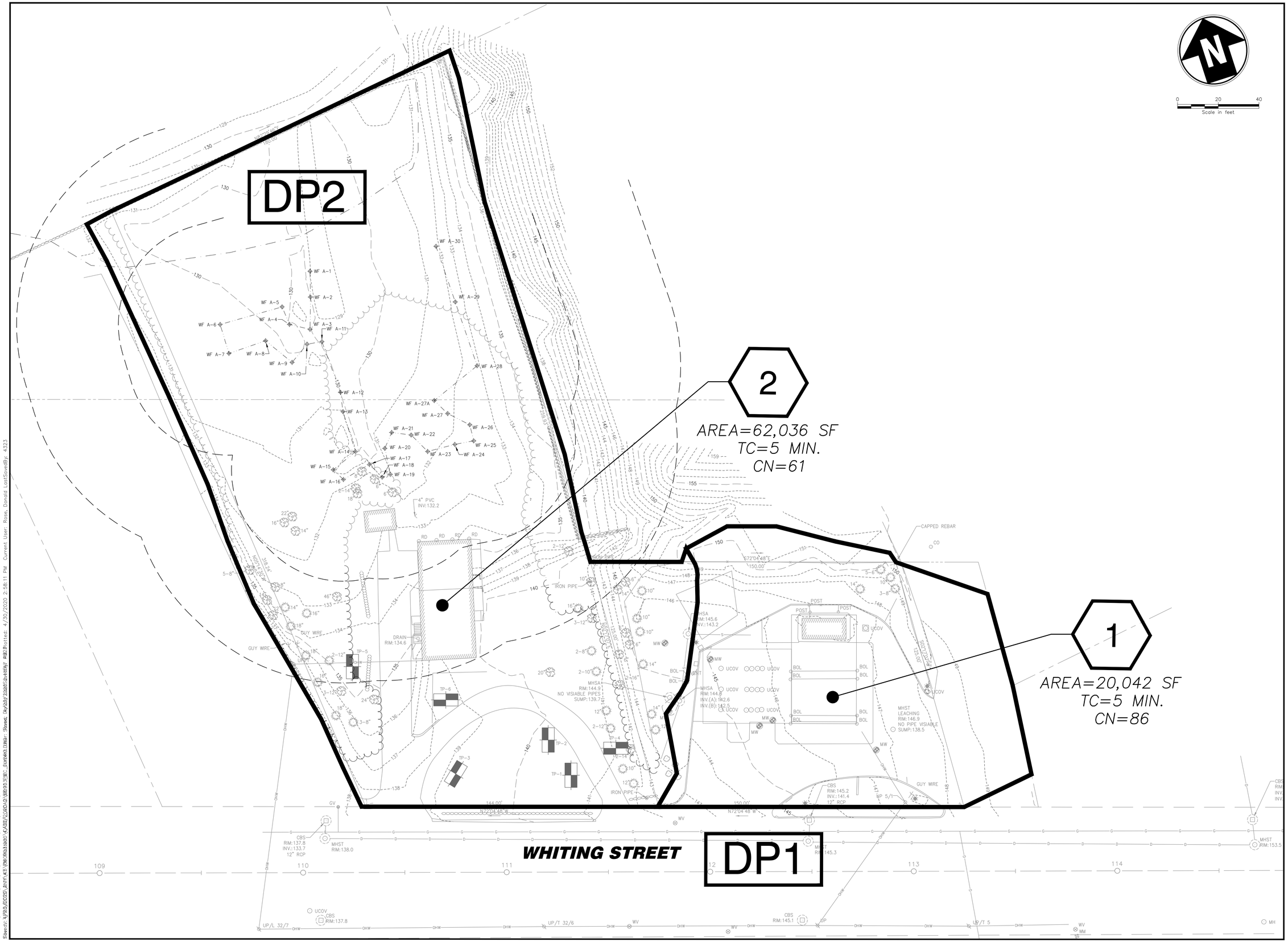

OWNER/APPLICANT:

MERHEJ & SONS
REALTY, LLC
87 DERBY STREET
HINGHAM, MA 02043

HINGHAM GAS
#19 & 27 WHITING
STREET
HINGHAM, MA 02043

No.	Submittal / Revision	Appld.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

EXISTING
CONDITIONS
HYDROLOGY

Designed By:	Drawn By:	Checked By:
DR/BN	DR/BN	KK
Issue Date:	Project No:	Scale:
05/01/2020	060903	

Drawing No.:
DR-1

File: V:\PROJECTS\ANY\VS\060903.000\CADD_ACAD\60903_EC_HYDRO.DWG
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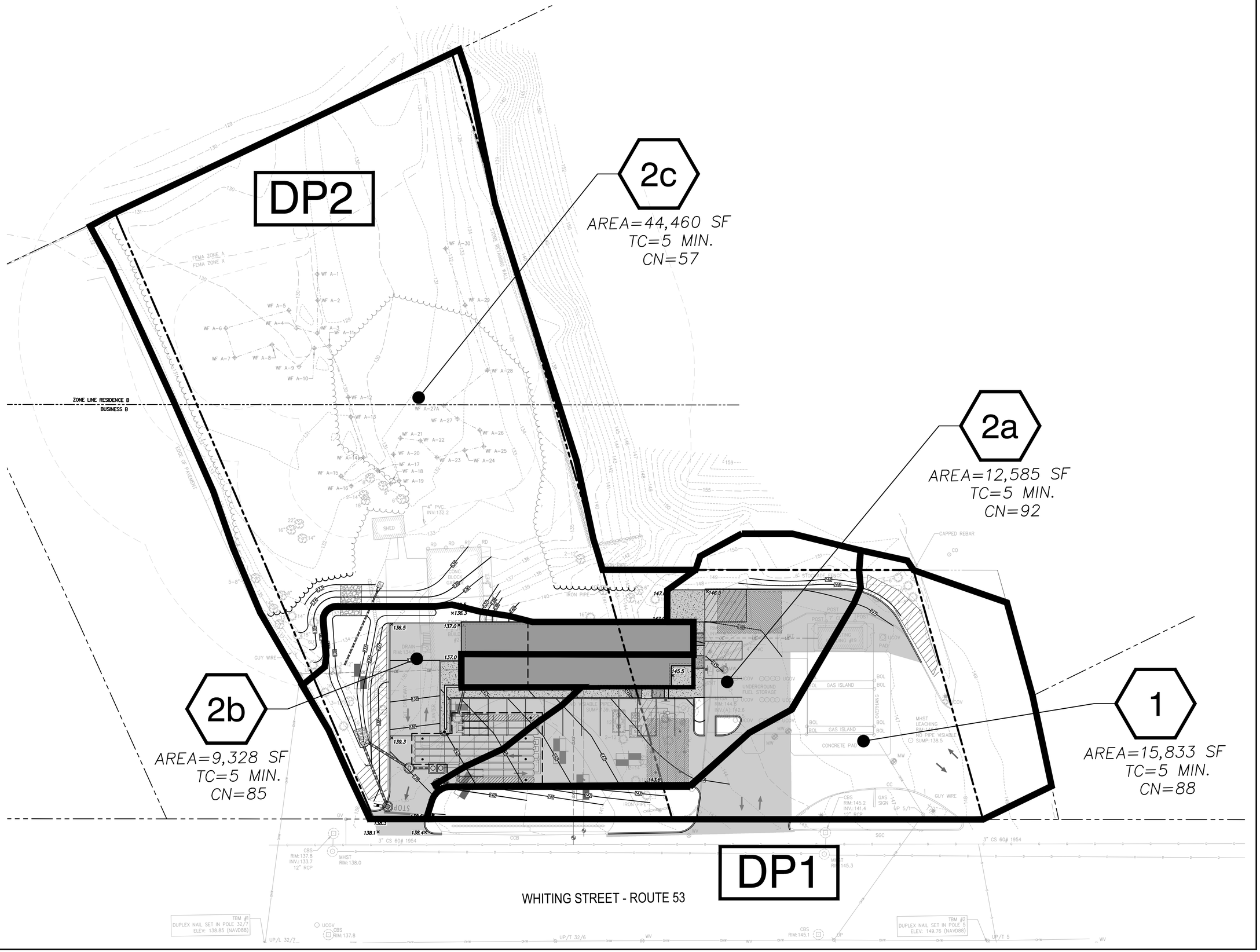

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0 20 40
Scale in feet

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STREET
HINGHAM, MA 02043

No.	Submittal / Revision	App'd.	By	Date
1	PERMIT SET	KK	JM	5/1/2020

PROPOSED
CONDITIONS
HYDROLOGY

Designed By:	Drawn By:	Checked By:
DR/BN	DR/BN	KK
Issue Date:	Project No:	Scale:
05/01/2020	060903	1" = 20'

Drawing No.:
DR-2

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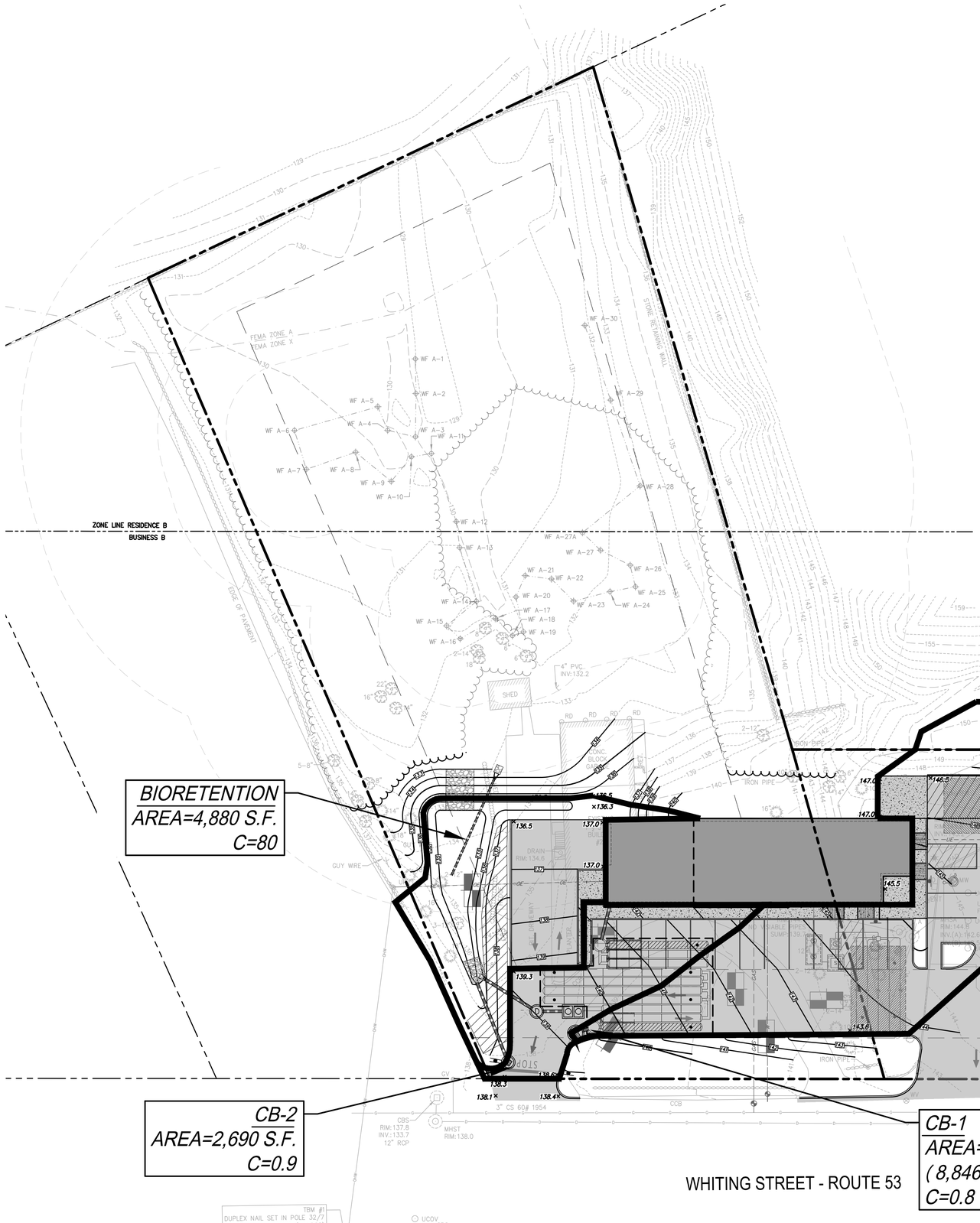

0 20 40
Scale in feet

OWNER/APPLICANT:

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#19 & 27 WHITING
STREET
HINGHAM, MA 02043

No.	Submittal / Revision	App'd.	By	Date
⚠	PERMIT SET	KK	JM	5/1/2020

TREATMENT AREA
PLAN

Designed By:	Drawn By:	Checked By:
DR/BN	DR/BN	KK
Issue Date:	Project No:	Scale:
05/01/2020	060903	1" = 20'

Drawing No.:
DR-3

Section 4.0

Stormwater Management Calculations

Section 4.1

Water Quality

WATER QUALITY

The water quality volume has been calculated based on 1" of rainfall over the net new impervious area. The calculation is shown below.

Existing Impervious	**= 19,541 sq. ft.**	**= 0.449 ac.**
Proposed Impervious	**= 28,220 sq. ft**	**= 0.648 ac**
Net New Impervious On-Site	**= 8,769 sq. ft.**	**= 0.201 ac.**

WQV (Water Quality Volume) based on 1-inch rainfall event

Required WQV = (1"/12") ft. x (8,769) sq. ft. = 730.8 cu. ft.

The treatment units are sized based on flow capacity not volume per MassDEP's requirements for flow through devices. The calculations that follow convert the runoff volume to a 1.0" Equivalent Water Quality Flow rate. See the document that follows with the flows and the proposed treatment units.

Sizing using the equivalent water quality flow from 1.0" rainfall depth

Basin	Structure	Tributary Area (acres)	Tributary Area (sq miles)	% Impervious	CN Value (Estimated)	WQV (Watershed Inches)	Tc (min)	qu (csm/in)	WQF = qu A Q (cfs)	Unit
UG-1	Roof-1/2	0.04	0.0001	100%	98	1.0	5	795	0.05	SC-310
	CB1	0.25	0.0004	100%	98	1.0	5	795	0.31	SC-310
	CB2	0.06	0.0001	100%	98	1.0	5	795	0.08	STC450i

Isolator Row #	Unit Type	Treated flow per unit* (cfs)	Flow Required to be Treated (cfs)	Number of Units Provided	Treated Flow per Isolator Row (cfs)
ROOF	SC-310	0.11	0.05	5	0.55
CB1	SC-310	0.11	0.31	5	0.55

Section 4.2

Total Suspended Solids (TSS) Removal Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: CB1 - UG-1 - Bio

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
StormTech Isolator Row and Detention	**0.80**	**0.75**	**0.60**	**0.15**
Bioretention	**0.90**	**0.15**	**0.14**	**0.02**

Total TSS Removal = **99%**

Project: **Hingham Gas**
Prepared By: **DR**
Date: **5/1/2020**

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

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Roof - UG-1 - Bio

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
StormTech Isolator Row and Detention	**0.80**	**1.00**	**0.80**	**0.20**
Bioretention	**0.90**	**0.20**	**0.18**	**0.02**

Total TSS Removal = **98%**

Project: **Hingham Gas**
Prepared By: **DR**
Date: **5/1/2020**

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

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: CB2 (STC450i) - Bioretention

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
STC450i	**0.65**	**1.00**	**0.65**	**0.35**
Bioretention	**0.90**	**0.35**	**0.32**	**0.04**

Total TSS Removal = **97%** **>80% O.K.**

Project: **Hingham Gas**

Prepared By: **DR**

Date: **5/1/2020**

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

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: WQ Swale - Bioretention

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Water Quality Swale (Pretreatment)	**0.00**	**1.00**	**0.00**	**1.00**
Bioretention	**0.90**	**1.00**	**0.90**	**0.10**

Total TSS Removal = **90%** **>80% O.K.**

Project: **Hingham Gas**

Prepared By: **DR**

Date: **5/1/2020**

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

StormTech®

Detention - Retention - Water Quality

Division of ADS

STORMTECH ISOLATOR ROW SIZING CHART					
	SC-310	SC-740	DC-780	MC-3500	MC-4500
Chamber Area (Sq.Ft.)	20	27.8	27.8	43.2	30.1
Treated Flow Rate per chamber (CFS)	0.11	0.15	0.15	0.24	0.17

NOTE: *Testing of the Isolator Row completed by Tennesse Tech has been verified by NJCAT and it has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250*

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

UNHSC Pollutant Removal Efficiencies

Treatment Unit Description	Reference	TSS Total Suspended Solids (% Removal)	TPH-D Total Petroleum Hydrocarbons in the Diesel Range (% Removal)	NO3-N (DIN) Dissolved Inorganic Nitrogen (% Removal)	TZn Total Zinc (% Removal)	TP Total Phosphorus (% Removal)	Average Annual Peak Flow Reduction (% Removal)	Average Annual Lag Time (Minutes)
Conventional Treatment Devices								
Retention Pond	UNH	68	82	33	68	NT	86	455
Stone (rip-rap) Swale	UNH	50	33	NT	64	–	6	7
Vegetated Swale	UNH	58	82	NT	88	NT	52	38
Berm Swale	UNH	50	81	NT	50	8	24	58
Deep Sump Catch Basin	UNH	9	14	NT	NT	NT	NT	NT
Manufactured Treatment Devices (MTDs)								
ADS Infiltration Unit	UNH	99	99	NT	99	81	87	228
StormTech	UNH	80	93	NT	56	49	76	274
Aquafilter	UNH	62	26	NT	52	59	NT	NT
Hydrodynamic Separators	UNH	27	1	NT	24	42	NT	NT
Low Impact Development (LID)								
Surface Sand Filter	UNH	51	98	NT	77	33	69	187
Bioretention								
Bio I - 48" depth	UNH	97	99	44	99	–	75	266
Bio II - 30" depth	UNH	87	99	NT	68	34	79	309
Gravel Wetland	UNH	99	99	98	99	56	87	251
Porous Asphalt	UNH	99	99	NT	75	60	82	1,275
Pervious Concrete	UNH	97	99	NT	99	NT	93	1,144
Tree Filter	UNH	93	99	3	78	NT	NT	62

Reference Published Pollutant Removal Efficiencies

Treatment Unit Description	Reference	TSS Total Suspended Solids (% Removal)	TPH-D Total Petroleum Hydrocarbons in the Diesel Range (% Removal)	NO3-N (DIN) Dissolved Inorganic Nitrogen (% Removal)	TZn Total Zinc (% Removal)	TP Total Phosphorus (% Removal)
Sub Surface Detention/Infiltration	EPA Fact Sheet: Infiltration Trenches	–	–	–	–	60
Sand Filter	EPA Fact Sheet: Sand Filters	70	–	NT	45	33
	Claytor & Schueler, 1996	85	–	–	71	50
	Bell, W., et al, 1995	61-70	–	–	>82	–
	Winer, R., 2000	87	–	NT	80	59
Retention Pond	EPA Fact Sheet: Wet Detention Ponds	50-90	–	–	40-50	30-90
	EPA Fact Sheet: Wet Detention Ponds	80-90	–	–	–	–
Bioretention	Winer, R., 2000	79	–	36	65	49
	EPA Fact Sheet: Bioretention	90	–	–	–	70-83
Bio - 12" depth	Winogradoff, 2001	–	–	-97	87	NT
Bio - 24" depth	Winogradoff, 2001	–	–	-194	98	73
Bio - 36" depth	Winogradoff, 2001	–	–	23	99	81
	EPA website	84	–	–	–	–
Hydrodynamic Separators	various	52-84	–	–	–	30
Gravel Wetland	Claytor & Schueler, 1996	80-93	–	75	55-90	80-89
	Winer, R., 2000	83	–	81	55	64
Vegetated Swale	EPA Fact Sheet: Vegetated Swales	81	–	38	71	9
	Claytor & Schueler, 1996	30-90	–	0-80	71	10-65
Porous Pavement	NAPA, undated	89-95	–	–	62-99	65-71
	EPA Fact Sheet: Porous Pavement	82-95	–	–	–	65
	Winer, R., 2000	95	–	–	99	65

StormTech Isolator Row

The StormTech Isolator Row is an effective filtration/infiltration system best suited to locations where space is at a premium and the system's relatively expensive installation cost can be offset by increasing available space for development.

About the StormTech Isolator Row

The StormTech Isolator Row is a manufactured system designed to provide subsurface water quality treatment and easy access for maintenance. It is typically used to remove pollution from runoff before it flows into unlined infiltration chambers designed for detention and water quantity control. The Isolator Row consists of a series of StormTech chambers installed over a layer of woven geotextile, which sits on a crushed stone infiltration bed surrounded with filter fabric. The bed is directly connected to an upstream manhole for maintenance access and large storm bypass. At UNHSC, the Isolator Row has met a TSS median annual removal standard of 80 percent, and exhibited an enhanced capacity to remove phosphorus. The Isolator Row is well suited for urban environments where space is at a premium.

Implementation

The StormTech Isolator Row is part of a class of manufactured, subsurface filtration/infiltration systems that are being used more and more throughout the United States. In general, these systems are best suited to locations where above ground space is at a premium. They are often used in urban areas, where they are located beneath parking lots and other infrastructure. As with any infiltration system, care must be taken when locating these systems near pollution hotspots, or where seasonal high groundwater levels may lead to groundwater contamination. In such cases, if installed, the systems should be lined to prevent infiltration into groundwater, and outfitted with subdrains that discharge to the surface. Designs for the StormTech Isolator Row are available from the manufacturer.

System Performance

Cost & Maintenance

While subsurface HDPE systems such as the Isolator Row tend to be more expensive than conventional stormwater treatments like retention ponds, the costs are ameliorated by the increase in available space for development. The cost to install a StormTech Isolator Row system large enough to treat runoff from one acre of impervious surface was $34,000 in 2006.

In more than two years of operation, the system is at less than 50 percent of its recommended maintenance trigger point. Maintenance should be conducted when the sediment in the chambers reaches approximately three inches in depth according to recommendations from the manufacturer. Sediment accumulation can be monitored through inspection ports. When maintenance is needed, the entire row can be

Fast Facts

CATEGORY / BMP TYPE
Filtration, Infiltration, Manufactured Treatment Device

UNIT OPERATIONS & PROCESSES
Hydrologic (Flow Alteration)

Water Quality: Physical (Sedimentation, Filtration) & Chemical (Sorption)

DESIGN SOURCE
StormTech, LLC

BASIC DIMENSIONS
Chamber: 51" wide X 30" high X 85.4" long

SPECIFICATIONS
Catchment Area: 1 acre

Water Quality Flow: 1 cfs

Water Quality Volume: 3,300 cf

INSTALLATION COST
$34,000 per acre treated

MAINTENANCE
Maintenance Sensitivity: Low

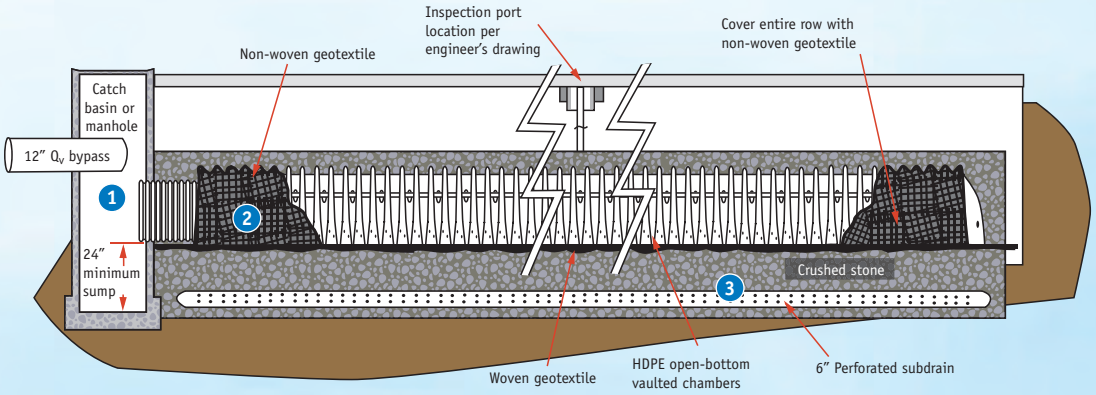
Inspections: High

Sediment Removal: Moderate

How the System Works

WATER QUALITY TREATMENT PROCESS ▼

1. Runoff flows into the Isolator Row chambers from a catchbasin or pipe.
2. Runoff slowly passes from the chambers through a woven geotextile fabric and into the crushed stone reservoir below the system. The runoff passes through the fabric, leaving behind sediments and associated contaminants through the physical unit operations of filtration and sedimentation. As an organic filter cake develops over the fabric, phosphorus is also removed via the chemical process of sorption.
3. Filtered runoff collects in a perforated subdrain and returns to a storm drain system, infiltrates into the subgrade, or is discharged to the surface.



washed clean through an access manhole and by a hydro-jet with sediment removed by vactoring (vacuuming). Entry into the system is considered a confined space entry and requires trained personnel and equipment.

During two years of evaluation at UNHSC, the Isolator Row has accumulated, at most, one and one half inches of sediment in its chambers. As a result, researchers have not performed maintenance on the system. The Isolator Row presents an interesting opportunity to study the relationship between maintenance and performance. Researchers have observed enhanced phosphorus removal as the system develops an organic filter cake between the chambers and the woven geotextile fabric that lies beneath them. This enhancement is tempered by the likelihood that, as the filter cake continues to grow, hydraulic efficiency will decline and more runoff will bypass the system untreated until maintenance is performed. Analyses are underway to develop maintenance recommendations that balance and optimize the water quality and water quantity management abilities of this system.

Cold Climate

This system's water quality treatment and volume control capacity remained strong in all seasons, reinforcing the conclusion that filtration and infiltration systems perform well, even in cold climates.

Water Quality Treatment

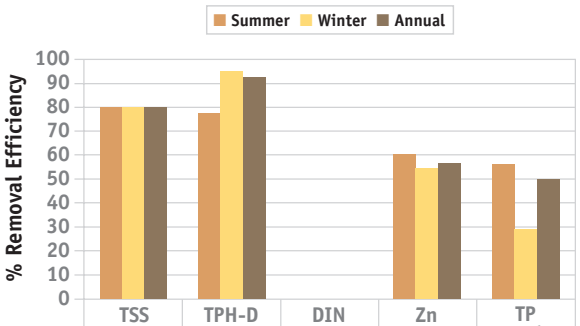
The StormTech Isolator Row system does a good job of reducing the concentration of common pollutants associated with stormwater performance assessment with the exception of nitrogen. It generally meets EPA's recommended level of removal for total suspended solids, and meets regional ambient water quality criteria for heavy metals and petroleum hydrocarbons. The system has a capacity to achieve modest levels of total phosphorus removal, which may be enhanced over time. (See Cost & Maintenance Section.) The lack of nitrogen treatment is typical for non-vegetated aerobic systems. Nutrient load reduction would be further increased through volume reduction by infiltration. Like all other systems monitored at UNHSC, it does not provide chloride removal.

The chart at top right reflects the system's performance in removing total suspended solids, total petroleum hydrocarbons, dissolved inorganic nitrogen, total phosphorus, and zinc. Values represent results recorded over a two-year monitoring period, with the data further divided into summer and winter components.

Water Quantity Control

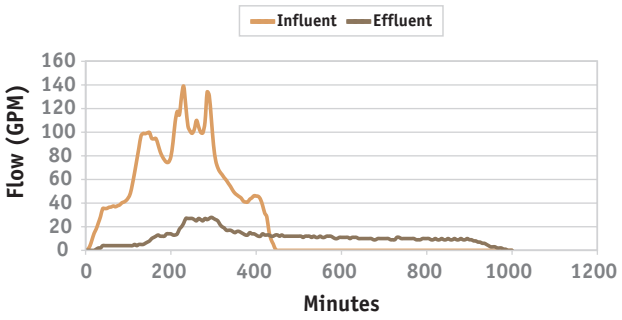
Like other infiltration and filtration systems, the StormTech Isolator Row system exhibits the capacity to reduce peak flows and could be used to reduce runoff volume in appropriate soils, such as those belonging to groups "A" or "B." The figure at bottom right provides information on peak flow reduction and lag times for the system.

POLLUTANT REMOVAL: 2006–2008



Median Annual Influent Event Mean Concentrations (EMC) in mg/L				
48	860 ug/L	.2	.04	.08

HYDRAULIC PERFORMANCE



	Winter	Summer	Annual Average
Average Peak Flow Reduction	71%	81%	76%
Average Lag Time (minutes)	358	190	274

SYSTEM DESIGN ▼

The StormTech Isolator Row is designed to provide subsurface water quality treatment for small storms. The manufacturer adapts the system's design in accordance with local watershed conditions and target treatment objectives.

Chamber units are made of high-density polyethylene (HDPE) pipe and are designed to bear loads consistent with those experienced by parking lots. The UNHSC chamber dimensions are 51 x 30 x 85.4 inches and can be linked together to form linear rows up to 200 feet long. The chambers are laid over woven geotextile, which rests on an infiltration base composed of one foot of three quarter inch crushed stone. The entire excavation is then wrapped in nonwoven geotextile to protect the system from the migration of fine particles from the surrounding soil.

A three- to five-foot separation from seasonal high groundwater table (as designated by regulations) is necessary to minimize the potential for groundwater contamination. Stormwater flows of up to one cubic foot per second (cfs) enter the system through an upstream manhole or other flow diverter. This is representative of flow-based sizing of a BMP common for devices that have limited detention or storage. Such devices are often better described by a maximum treatable flow rate as opposed to a treatment volume.

A bypass is incorporated in the StormTech system where flows exceeding the design rate are bypassed around the device and flow directly into adjacent chambers that can be sized to treat the CP_v and Q_p. Because of the bypass design, maintenance requirements are extremely important. A poorly maintained device would bypass prematurely into the unlined chamber systems and eventually clog subsurface soils resulting in system failure.

Section 4.3

Required Recharge Volume

RECHARGE

The *Required Recharge Volume* is calculated using the equation in the 2008 Massachusetts Stormwater Handbook. The *Required Recharge Volume* equals a depth of runoff corresponding to the soil type multiplied by the new impervious areas covering that soil type at the post-development site. The *Required Recharge Volume* is based on the *Static* method.

The project is a mix of new and redevelopment and subject to the Recharge Standard to the extent practicable.

Soils on the site consist soils from hydrologic soil groups (HSG) "A" through "D" based on the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), Soil Survey of Plymouth County. Soils within the property are classified as: Urban Land towards Whiting Street, Hinckley gravely sandy loam and Newfields fine sandy loam within the interior of the parcel, and Scarboro muck within the wetland areas.

Test pits and site visits indicate permeable soils located on the south and east side of the 27 Whiting St. parcel with less permeable soils to the west and north towards the wetland resource area. In an effort to be conservative with the analysis, a HSG "B" was utilized for all areas on the site. Refer to the watershed plans in Section 3.3 of this report for more information.

The project has been designed to integrate recharge BMP's consisting of a StormTech subsurface chamber systems with stone beds receive stormwater runoff collected through the use of a catch basin and roof drains. The following equation can be used to determine the Required Recharge Volume.

Rv = F x increase in impervious area (Equation 1) Volume 3, Ch 1, page 15

Rv = Required Recharge Volume, expressed in cubic feet, cubic yards, or acre-feet
F = Target Depth Factor associated with each Hydrologic Soil Group (HSG)
Impervious Area = new pavement and new rooftop area

F for A soils = 0.60 inches (Table 2.3.2) Volume 3, Ch 1, page 16
***F* for B soils = 0.35 inches**
F for C soils = 0.25 inches
F for D soils = 0.10 inches

Using the formula above, the following table shows the site's proposed impervious surface area and the calculated *Required Recharge Volume*.

Existing Impervious	= 19,541 sq. ft.	= 0.449 ac.
Proposed Impervious	= 28,220 sq. ft	= 0.648 ac
Net New Impervious On-Site	= 8,769 sq. ft.	= 0.201 ac.

Required Recharge Volume

$Rv_1 = (F_B \times \text{increase in impervious area})_{HSGB}$

$Rv_1 = 0.35$ in x (0.201 ac) x 1 ft/12 in

$Rv_1 = 0.00586$ ac-ft or 255.8 cu. ft.

Impervious Areas Tributary to Systems

UG-1 = 12,184 sq. ft. = 0.280 ac.

The amount of impervious area proposed to be collected and directed towards the recharge system is greater than the total new impervious proposed on the site. Thus, the project does not require an additional capture area adjustment.

Storage volume in UG-1 for Recharge (in the stone below elevation 136.1) calculated in HydroCAD

Storage in UG-1 = **327 cu. ft.** or 0.0075 ac-ft

Conclusion:

Hence, the storage available in UG-1 is greater than the Required Recharge Volume:

327 cu. ft. >> 255.8 cu. ft.

The recharge volume provided by the proposed subsurface chamber system and bioretention system exceeds the Required Recharge Volume for the net impervious proposed on the site. The project's stormwater management system satisfies Standard 3 of the MassDEP Stormwater Regulations.

Section 4.4

Drawdown Time Calculations

DRAWDOWN TIME

Below are the drawdown time calculations for the recharge systems proposed on the site. The calculation uses an estimated hydraulic conductivity value "*K*." Soils on the site consist soils from hydrologic soil groups (HSG) "A" through "D" based on the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), Soil Survey of Plymouth County. Soils within the property are classified as: Urban Land towards Whiting Street, Hinckley gravely sandy loam and Newfields fine sandy loam within the interior of the parcel, and Scarboro muck within the wetland areas. Test pits and site visits indicate permeable soils located on the south and east side of the 27 Whiting St. parcel with less permeable soils to the west and north towards the wetland resource area.

A reasonable value of a conservative and composite hydraulic conductivity "K" of 0.52 inches per hour which corresponds to HGS "B" loam was selected for the basis of design.

The formula below is the recommended method of calculating drawdown times from the Massachusetts Stormwater Management Handbook

DRAWDOWN TIME CALCULATION

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:
Rv = Storage Volume
K = Saturated Hydraulic Conductivity, Rawls Rate
Bottom Area = Bottom Area of Recharge Structure

See the following Drawdown Calculation table for infiltration rates, bottom area, and drawdown times.

Drawdown Calculation

Recharge BMP	*Infiltration Rate (in/hr) k*	*Storage Volume (c.f.) Rv*	*Bottom Area (s.f.)*	*Draw Down Time (hrs.)*
UG-1	*0.52*	*327*	*1,754*	4.3

Conclusion:

The calculations show that the drawdown times for the infiltration BMPs is less than 72 hours, as required. The drawdown number shown above can be also confirmed using the attached HydroCAD calculations.

Section 4.5

Rip-Rap Calculations

RIP RAP SPLASH PAD

Rip rap splash pads are designed to dissipate energy, prevent scour at the stormwater outlet, and minimize the potential for downstream erosion. A riprap splash pad was sized for each of the outlets of the drainage system. Below is presented the evaluation of the riprap splash pads to prevent scour as required by the Standard 1 of Stormwater Management Checklist. The calculations below are in accordance with the methodology of the "2002 Connecticut Guidelines for Soil Erosion and Sediment Control" produced by The Connecticut Council on Soil and Water Conservation.

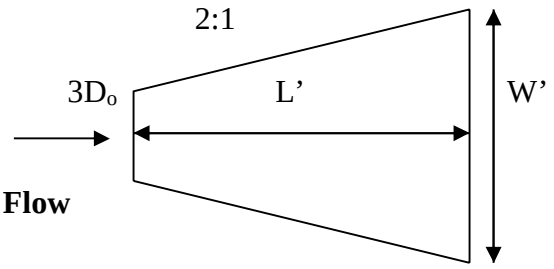
Apron Length

$L_a = 1.7Q/(D_o^{3/2}) + 8\ D_o$ L_a = Length of Apron.

D_o= Maximum inside culvert width.

Apron Width

$W = 3D_o + L_a$



Stone Diameter

$d_{50} = 0.02/TW * (Q/ D_o)^{4/3}$ d_{50} = median diameter size of rip-rap stone (inches)

TW = tail water, assumed to be 0.3

Outlet	Pipe Diameter (feet)	Q Flow (cfs)* 100-yr	La (Length of Apron - feet)	W (Width of Apron – feet)	d_{50} (inches)
FES1&2	1.0	2.2	11.8'	14.8'	2.3"**
FES3	0.33	0.6	8.2'	9.2'	1.83**

*This is the actual 100-year flow as calculated through basin design software (HydroCAD) if flow was unimpeded by the underground system

**A minimum rip-rap size of 4" should be utilized

Preformed Scour Hole Calculation Results

	Q* (cfs)	Do (ft.)	TW* (ft.)	Depression (F) (ft.)	C (ft.)	3Sp (ft.)	B (ft.)	2Sp (ft.)	d50*** (ft.)	d50*** (in.)
FES1&2	2.2	1.0	0.30	0.50	6.0	3.0	5.0	2.0	0.12	1.5
FES3	0.6	0.33	0.30	0.20	2.0	1.0	1.7	0.7	0.10	1.2

*This is the actual 100-year flow as calculated through basin design software (HydroCAD) if flow was unimpeded by the underground system
**A conservative tail-water of 0.30 was utilized.
***A minimum rip-rap size of 4" should be utilized for FES1&2 and FES3

Conclusion:

As shown in the first table above, the proposed flows from the 100-year storm event result in rip-rap aprons which are adequately sized to dissipate the runoff discharge energy without causing scour but are extremely long and would cause more disruption and/or be difficult to construct.

To reduce the amount of rip-rap as well as provide enhanced scour protection, we are proposing a different mechanism of slowing the water as we feel additional slowing of the water over the calculated rip-rap pads would be beneficial. The detail provided is a combination of a Plunge Pool/ Energy Dissipater. The detail uses a plunge pool to dissipate the energy and level spreader to disperse the water to prevent erosion. The calculations for the flared end and outlet presented above are for a preformed scour hole. The calculations were performed in accordance with the ConnDOT Drainage Manual. As the system is multi-faceted (plunge pool, rip-rap, and level spreader), we feel it is more than adequately designed to prevent scour at the outlets.

In order to ensure that the rip rap / level spreader systems are working, the outlets should be inspected after the first large storm 10+ year event to inspect for erosion. If no erosion is evident, then the stone size is adequate. We recommend that the aprons be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

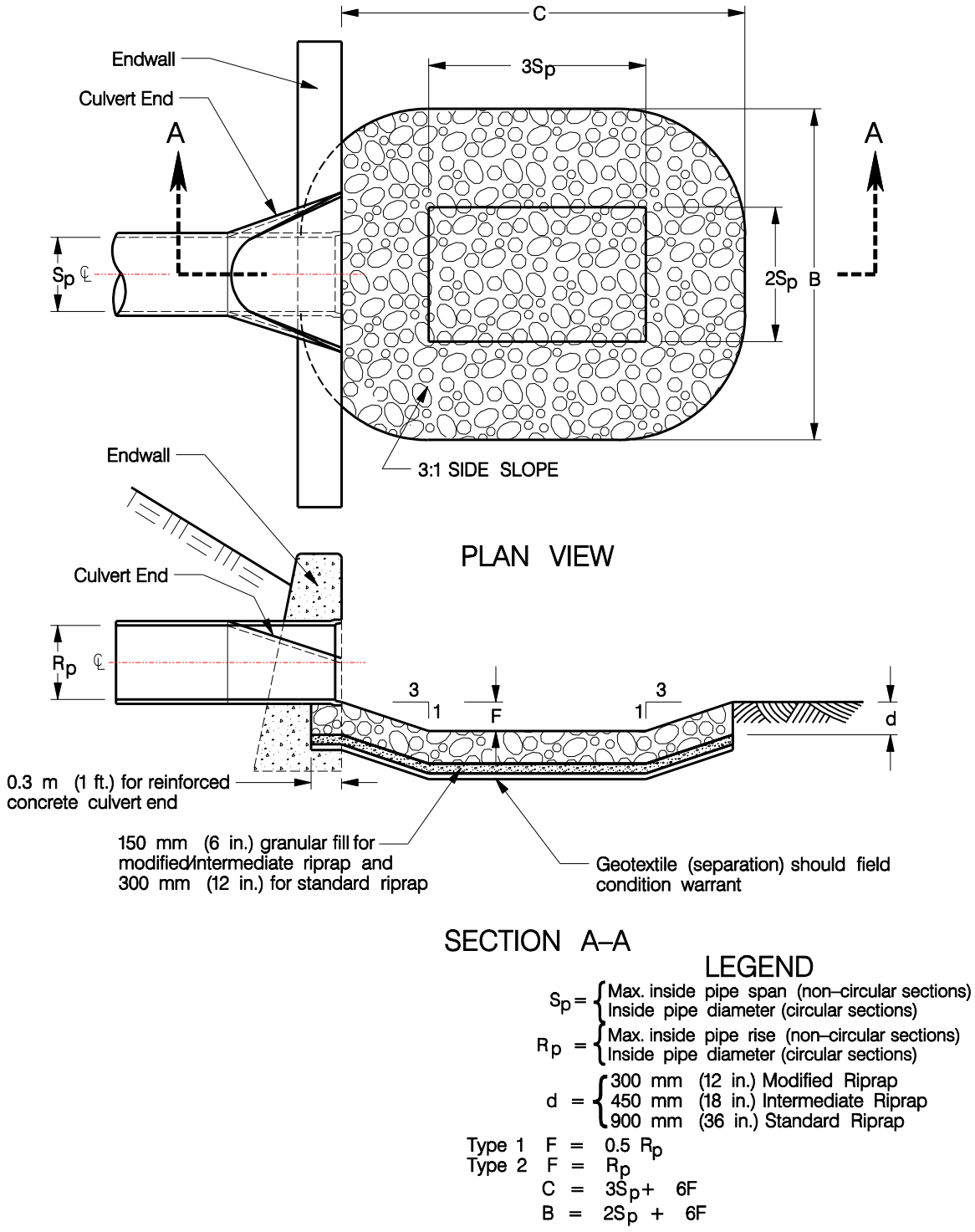


Figure 11-15 Preformed Scour Hole Type 1 and Type 2

Section 4.6

Illicit Discharge Statement

ILLICIT DISCHARGE COMPLIANCE STATEMENT

Standard 10: Massachusetts Stormwater Standards Handbook

Illicit discharges are defined as discharges into waters of the State or municipal separate stormwater system (MS4) that are not entirely comprised of stormwater. Exclusions for non-stormwater discharges into drainage systems include activities or facilities for firefighting, water line flushing, landscape irrigation, uncontaminated groundwater discharge, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, water used to clean residential buildings without detergents, water used for street washing, and flows from riparian habitats/wetlands. These exclusions are subject to change and are under the discretion of the local governing authority.

To the best of our knowledge and professional belief no illicit discharges to the stormwater system, surface waters, or wetland resource areas will remain on the site after construction. We will agree to implement a pollution prevention plan to prevent illicit discharges into the stormwater management system. The design of the site based on the plans prepared by CHA, 141 Longwater Drive, Suite104, Norwell, Massachusetts show a separation and no direct connection between the stormwater management systems and the wastewater and/or groundwater on the site. To the maximum extent practicable, the design prevents entry of illicit discharges into the stormwater management system.

Engineer's Name: Kelly Killeen, P.E.
(please print)

Engineer's Signature: _____

Company: CHA Consulting, Inc.

Section 5.0

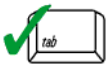
Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

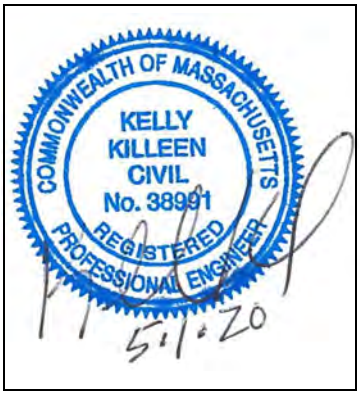
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Kelly Killeen, P.E.
CHA Consulting, Inc.
141 Longwater Drive, Suite 104
Norwell, MA 02061
(781) 982-5400

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): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Appendix A

Soils

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 Plymouth County, Massachusetts

27 Whiting Street

February 26, 2020

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

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

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.

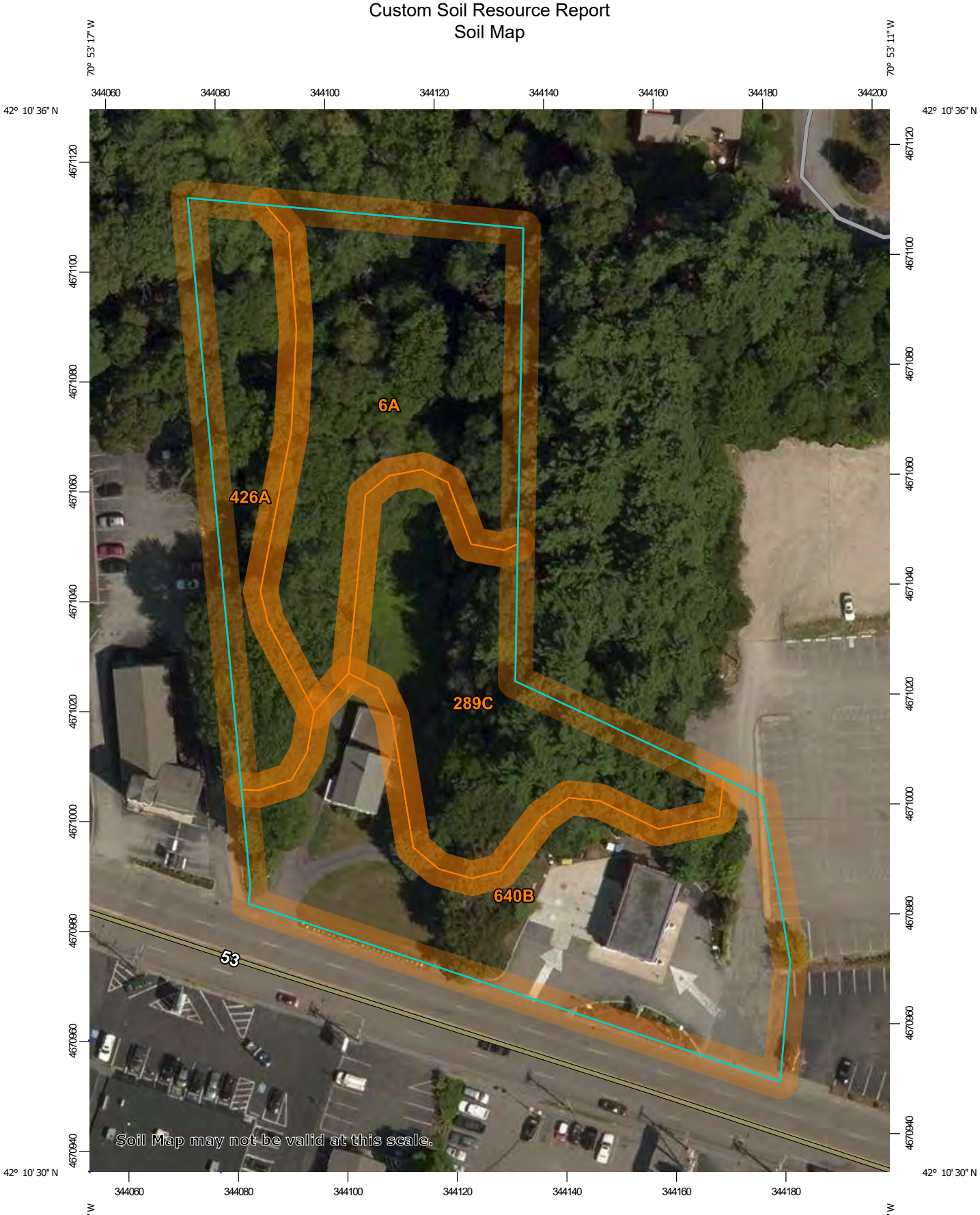
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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 Scale: 1:942 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 45 90 180 270

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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
6A	Scarboro muck, coastal lowland, 0 to 3 percent slopes	0.7	27.7%
289C	Hinckley gravelly sandy loam, 8 to 15 percent slopes, bouldery	0.6	23.0%
426A	Newfields fine sandy loam, 0 to 3 percent slopes	0.3	14.4%
640B	Urban land, till substratum, 0 to 8 percent slopes	0.9	35.0%
Totals for Area of Interest		**2.4**	**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 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.

Plymouth County, Massachusetts

6A—Scarboro muck, coastal lowland, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkw
Elevation: 0 to 650 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: Not prime farmland

Map Unit Composition

Scarboro, coastal lowland, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro, Coastal Lowland

Setting

Landform: Outwash deltas, depressions, drainageways, outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave, linear
Parent material: Sandy glaciofluvial deposits derived from schist and/or gneiss and/or granite

Typical profile

Oa - 0 to 8 inches: muck
A - 8 to 14 inches: mucky fine sandy loam
Cg1 - 14 to 22 inches: sand
Cg2 - 22 to 65 inches: gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Mashpee

Percent of map unit: 5 percent
Landform: Depressions, drainageways, terraces
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

289C—Hinckley gravelly sandy loam, 8 to 15 percent slopes, bouldery

Map Unit Setting

National map unit symbol: bd1l
Elevation: 0 to 400 feet
Mean annual precipitation: 41 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

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

Description of Hinckley, Bouldery

Setting

Landform: Terraces, outwash deltas, kames, eskers
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 3 inches: gravelly sandy loam
Bw - 3 to 19 inches: very gravelly loamy coarse sand
C1 - 19 to 33 inches: very gravelly coarse sand
C2 - 33 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 28.34 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 10 percent
Landform: Terraces, outwash plains, kames
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Gloucester, bouldery

Percent of map unit: 7 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Barnstable, bouldery

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

426A—Newfields fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: bcxx
Elevation: 10 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Newfields

Setting

Landform: Till plains, moraines, hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy eolian deposits over sandy and gravelly supraglacial meltout till

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 3 inches: fine sandy loam
Bs - 3 to 4 inches: fine sandy loam
Bw1 - 4 to 16 inches: fine sandy loam
Bw2 - 16 to 28 inches: gravelly fine sandy loam
2C - 28 to 63 inches: gravelly loamy coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

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

Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Barnstable
Percent of map unit: 8 percent
Landform: Moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Norwell
Percent of map unit: 7 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scituate
Percent of map unit: 5 percent
Landform: Ridges, drumlins
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

640B—Urban land, till substratum, 0 to 8 percent slopes

Map Unit Composition
Urban land, till substratum: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

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

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

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

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

Commonwealth of Massachusetts
City/Town of Hingham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Merhej And Sons Realty LLC
Owner Name

87 Derby Street
Street Address

204-0-9
Map/Lot #

Hingham
City

MA
State

02043
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: USGS and UCDavis (Soil Map Unit: 640B)

Urban land, till substratum
Soil Name

Excessively Drained
Soil Limitations

Urban land, till substratum
Soil Parent material

Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2018/ USGS
Year Published/Source

Map Unit

Coarse-Glacial Stratified Deposits
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 If yes, MassGIS Wetland Data Layer:
Wetland Type

7. Current Water Resource Conditions (USGS): 02/21/2020
Month/Day/ Year
Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: MassGIS Oliver

Commonwealth of Massachusetts
City/Town of Hingham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 (Hole #) | 03/06/2020 (Date) | 9:15 am (Time) | 30/47 Sunny (Weather) | 42.175 N (Latitude) | -70.887 W (Longitude:)

1. Land Use: Single-Family (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: Near Garage Building

2. Soil Parent Material: Glacial Stratified Deposits | Kame Terrace (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >20 feet | Wetlands >100 feet | Property Line 40 feet | Drinking Water Well ____feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 102-inch Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-20	Fill										
20-120	C	Loamy Sand	10YR5/4	96	7.5yr5/8 2.5y4/3	20%	25%	10%	Massive	Very Friable	

Additional Notes:
Weeping at 102 inches.

Commonwealth of Massachusetts
City/Town of Hingham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 (Hole #) | 03/06/2020 (Date) | 10:00 am (Time) | 30/47 Sunny (Weather) | 42.175 N (Latitude) | -70.887 W (Longitude:)

1. Land Use: Single-Family (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: Near Garage Building

2. Soil Parent Material: Glacial Stratified Deposits | Delta (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >20 feet | Wetlands >100 feet
Property Line >10 feet | Drinking Water Well _____ feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 91-inch Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	Fill										
16-114	C	Sand	10YR5/4	77	7.5yr5/8 2.5y4/3	20%	25%	10%	Massive	Friable	

Additional Notes:
Weeping at 91-inches.

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 (Hole #) | 03/06/2020 (Date) | 11:00 am (Time) | 30/47 Sunny (Weather) | 42.175 N (Latitude) | -70.887 W (Longitude:)

1. Land Use: Single-Family (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Stratified Deposits | Kame Terrace (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >20 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >200 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 91 Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-57	Fill										Fill depth reduces to 36" deep away from the road
57-108	C	Loamy Sand	10YR5/4	67	7.5yr5/8 2.5y4/3	60%			Massive	Friable	

Additional Notes:
Weeping at 91 inches

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 (Hole #) | 03/06/2020 (Date) | 11:50 am (Time) | 30/47 Sunny (Weather) | 42.175 N (Latitude) | -70.887 W (Longitude:)

1. Land Use: Single-Family (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Stratified Deposits | Kame Terrace (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >20 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >200 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Fill										
10-83	C1	Sand	10YR5/4				25%	10%	Single Grain	Loose	
83-108	C2	Sandy Loam	10YR5/6	83	7.5yr5/8 2.5y4/3	20%	5%		Massive	Friable	

Additional Notes:
Caving Soil.

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-5 (Hole #) | 03/06/2020 (Date) | 10:30 am (Time) | 30/47 Sunny (Weather) | 42.175 N (Latitude) | -70.887 W (Longitude:)

1. Land Use: Single-Family (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Stratified Deposits | Kame Terrace (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >20 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >200 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 53 Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-26	Fill										
26-38	A	Sandy Loam	10YR3/2						Massive	Friable	
38-84	C	Sandy Loam	2.5Y6/2	38	7.5yr5/8 2.5y4/3	25%		15%	Massive	Friable	Gleyed Wetland Soils not suitable for infiltiration

Additional Notes:
Weeping at 53 inches. Caving Soil.

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-6 (Hole #) | 03/06/2020 (Date) | 10:30 am (Time) | 30/47 Sunny (Weather) | 42.175 N (Latitude) | -70.887 W (Longitude:)

1. Land Use: Single-Family (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Stratified Deposits | Kame Terrace (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >20 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >200 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Fill										
10-120	C	Loamy Sand	10YR5/4	60	7.5yr5/8 2.5y4/3	many			Massive	Friable	

Additional Notes:
Caving Solis.

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #	Obs. Hole #
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☒ Depth to soil redoximorphic features (mottles)	___ inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater:

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Hingham

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.

Signature of Soil Evaluator

03/20/2020
Date

Hazem Dani/ #13902
Typed or Printed Name of Soil Evaluator / License #

6/30/2022
Expiration Date of License

Chessia Consulting Services, LLC
Name of Approving Authority Witness

Hingham Board of Health
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.

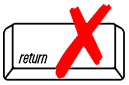
Field Diagrams: Use this area for field diagrams:

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Commonwealth of Massachusetts
City/Town of Hingham
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Merhej And Sons Realty LLC
Owner Name

87 Derby Street
Street Address or Lot #

Hingham | MA | 02043
City/Town | State | Zip Code

Contact Person (if different from Owner) | Telephone Number

B. Test Results

	03/06/2020 (Date)	9:12 am (Time)	03/06/2020 (Date)	9:52 am (Time)
Observation Hole #	TP-1		TP-2	
Depth of Perc	24"-42"		26"-44"	
Start Pre-Soak	9:12 am		9:52 am	
End Pre-Soak	9:27 am		10:07 am	
Time at 12”	9:27 am		24 Gallon in less than 15 minutes	
Time at 9”	9:30 am			
Time at 6”	9:35			
Time (9”-6”)	5 minutes			
Rate (Min./Inch)	< 2 minutes/ inch		< 2 minutes/ inch	
	Test Passed: ☒ Test Failed: ☐		Test Passed: ☒ Test Failed: ☐	

Hazem Dani
Test Performed By:

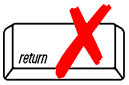
John Chessia
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Hingham
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Merhej And Sons Realty LLC
Owner Name

87 Derby Street
Street Address or Lot #

Hingham	MA	02043
City/Town	State	Zip Code

Contact Person (if different from Owner) | Telephone Number

B. Test Results

	03/06/2020 Date	9:12 am Time	03/06/2020 Date	12:53 am Time
Observation Hole #	TP-3		TP-4	
Depth of Perc	36"-54"		21"-39"	
Start Pre-Soak	11:15 am		12:42 am	
End Pre-Soak	11:30 am		12:51 am	
Time at 12”	11:30 am		24 Gallon in less than 15 minutes	
Time at 9”	11:36 am			
Time at 6”	11:42			
Time (9”-6”)	6 minutes			
Rate (Min./Inch)	2 minutes/ inch		< 2 minutes/ inch	
	Test Passed: ☒ Test Failed: ☐		Test Passed: ☒ Test Failed: ☐	

Hazem Dani
Test Performed By:

John Chessia
Board of Health Witness

Comments:

M 658730

THIS DOCUMENT HAS A VOID PANTOGRAPH, HIGH RESOLUTION BORDER, CHEMICALLY REACTIVE PAPER, FLUORESCENT FIBERS AND A WATERMARK. ABSENCE OF THESE FEATURES WILL INDICATE A COPY.

ROCKLAND TRUST Branch: 958

www.rocklandtrust.com

TREASURER'S CHECK

2141178

53-447

113

IF THIS CHECK IS LOST OR STOLEN, AN INDEMNITY BOND WILL BE REQUIRED FOR REPLACEMENT.

DATE April 28, 2020

REMITTER MERHEJ AND SONS REALTY LLC

$*******1,000.00

PAY ONE THOUSAND AND 00/100

TO THE ORDER OF TOWN OF HINGHAM

$500 SPR
$500 SPA3

PURPOSE #27 Whiting St. Hingham

AUTHORIZED SIGNATURE

PRINTED NAME

⑈02141178⑈ ⑆011304478⑆ ⑈1111111⑈