JFK PLACE

BROOKLINE, MA

Comprehensive Permit Application
Under M.G.L. Chapter 40B, Sections 20-23

Submitted by:
445 Harvard LLC
July, 2018

EXHIBIT C

TOWN OF BROOKLINE BOARD OF APPEALS
APPLICATION FOR COMPREHENSIVE PERMIT

(Under M.G.L. c. 40B §21 and BOA Rules and Regulations)

Date: 07 / 31 / 2018

Applicant(s): 445 Harvard LLC **Address:** 28 Lyon Road, Brookline, MA 02467

Owner(s) of Record: 445 Harvard LLC **Address:** 28 Lyon Road, Brookline, MA 02467

Address of Premises: 445 Harvard Street **Brookline, MA**

Deed recorded in Registry of Deeds, Book 15748 **Page** 321

or registered in the Land Registration Office under Certificate No._____

Tax Assessor's Property ID No.: **Map:** 067 **Block:** 09 **Lot:** 00

This application shall be submitted in accordance with Part H (Rules and Regulations for M.G.L. c. 40B § 21) of the Brookline Board of Appeals Rules and Regulations. ***All applications must include material required in Part H Sections 3(a) and (b) - Filing, Time Limits and Notice.***

1. Filing fee and peer review deposit included? Yes ☐ No ☒

2. Fee for retention of financial expert and/or engineers or consultants included?

   Yes ☐ No ☒

3. Thirty (30) complete copies of application including an 11" x 17" or smaller sized copy of the plans.

   Yes ☒ No ☐

Certification and Required Signatures

(Signatures of Appellant(s) and Owner(s) of Record (if different than appellant) are required)

The original Application with thirty (30) complete copies of the application and supporting documentation to include: ***Application materials required pursuant to M.G.L. c.40B §21, Elements of Submission consistent with 760 CMR Section 56.05(2), Filing Fee, all materials required in the Board's Rules and Regulations Part H Sections 3(a)& (b) and a copy of any previous relief granted by the Board of Appeals for the subject premises. Once the submission is reviewed and the appropriate fee is paid, the Zoning Coordinator will transmit to and file with the Office of the Town Clerk four (4) copies of said application. One extra copy of the plan(s) reduced to 11" x 17" must be submitted with the application.*** ***Note:*** *You are encouraged to discuss your application with Building and Planning Department Staff and thoroughly familiarize yourself with the Board of Appeals Rules and Regulations before submittal to insure the thoroughness of your application. Copies of the Rules and Regulations are available at the Office of the Town Clerk and also on-line at both the Town Clerk and Board of Appeals links on the town website.* ***Contact the Planning and Community Development Department (617-730-2130) with any questions about the approval process and/or meeting schedules. Also see meeting calendar on Town website at: www.brooklinema.gov .***

I (We) hereby certify that I (we) have read the Board of Appeals Rules and Regulations and that the statements within my (our) Comprehensive Permit Application and attachments are true and accurate to the best of my (our) knowledge and belief.

7/24/2018	617-838-5136
Signature(s) of Appellant — Date	Daytime Telephone Number and/or Cell
	shmcon@comcast.net
Fax Number	E-Mail Address
7/24/2018	617-838-5136
Signature(s) of Owner of Record — Date	Daytime Telephone Number and/or Cell
	shmcon@comcast.net
Fax Number	E-Mail Address

If Applicable:

Name of Attorney for Appellant	Address of Attorney
Phone Number of Attorney	E-Mail Address and Fax # of Attorney

SUBMIT THIS FORM (original) WITH THIRTY (30) COPIES OF THE APPLICATION, FILING FEE, SUPPORTING DOCUMENTATION TO THE ZONING COORDINATOR

EXHIBIT D

TOWN OF BROOKLINE BOARD OF APPEALS
APPLICATION FILING FEE SCHEDULE

(See BOA Rules and Regulations Part D §7 and Part H §4)

1. Application for Residential, Commercial or Institutional project:
    a. Special Permit "A" $350.00, plus $50.00 per 1,000 s.f. of additional gfa*****
    b. Variance "A" $350.00, plus $50.00 per 1,000 s.f. of additional gfa*****
2. Application for Comprehensive Permit:
    Comprehensive Permit "C" $350.00, plus $50.00 per 1,000 s.f. of additional gfa*****
3. Application for Wireless Telecommunication, or modification:
    $1,500.00, plus additional $1,500.00 inventory fee at time of bldg. permit issuance
4. Application for Time Extension/Minor Modification: $500.00
5. Application for Appeal of Administrative Decision "B": $500.00
6. Other, anything not covered above (e.g. sign, parking,): $500.00
7. Consultant fees may be required in accordance with Section 4 of H. Rules and Regulations for M.G.L. c. 40B § 21 Comprehensive Permits of the Board of Appeals Rules and Regulations.
8. Additional fees may be required in accordance with Section 4 of H. Rules and Regulations for M.G.L. c. 40B § 21 Comprehensive Permits of the Board of Appeals Rules and Regulations.
9. Plan Review Filing Fees for Board of Appeals Cases – see Building Department Fee Schedule.
10. **A separate fee of $21.00 payable to the Brookline TAB** for publication of notice shall be included with application for relief.

All filing fee checks must be payable to the "Town of Brookline" Applications without the appropriate filing fee will not be accepted.

At the discretion of the Board of Appeals, applicants may be asked to provide a stenographic copy of Public Hearing(s). Cost of this service shall be borne by the applicant including a copy for each member of the Board of Appeals.

*****Gross Floor Area (gfa) as defined in Article II section 2.07 of the Brookline Zoning By-Law (rounded to the nearest 1,000 s.f.)

TABLE OF CONTENTS

Section 1: Introduction
Request for findings of fact

Section 2: Project Data Summary
Summary description of the Applicant, the proposed development, the development area and the need for regional and community housing

Section 3: Applicant Status
Identification of applicant's status as a qualifying limited dividend organization.

Section 4: Project Eligibility Letter
Site approval letter from Massachusetts Housing Partnership

Section 5: Development Team
Identification of development team members

Section 6: Site Control
Recorded Deed indicating site control of the subject parcel by the Applicant

Section 7: Department of Housing & Community Development Subsidized Housing Inventory
Most recently issued SHI inventory relative to the Town of Brookline

Section 8: Sample Regulatory Agreement
A copy of the legal document that will govern the terms of affordability (executed post permitting).

Section 9: List of Exceptions / Waiver Requests
A list of exceptions being requested to the Town's local zoning ordinance as well as any other local permits and approvals pertinent to this application.

Section 10: Traffic Impact Assessment
Prepared by Vanasse & Associates

Section 11: Engineering Plans
Engineering plans prepared by McKenzie Engineering Group

Section 12: Existing Conditions Summary
Project narrative Prepared by EMBARC Studio, and existing conditions plan prepared by Greater Boston Surveying and Engineering

Section 13: Architectural and Landscaping Plans
Includes a full set of schematic architectural plans prepared by EMBARC Studio, and schematic landscape plan prepared by Verdant Landscape Architect

Section 14: Aerial Photos, Locus Map & Context Photos

Section 15 Shadow Study
Prepared by EMBARC Studio

Section 16 Stormwater Management Summary
Prepared by McKenzie Engineering Group

SECTION 1

REQUEST FOR FINDINGS OF FACT

Town of Brookline, Massachusetts
ZONING BOARD OF APPEALS

Premises affected: An 10,068± square foot parcel of land, on 445 Harvard Street

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APPLICATION FOR A COMPREHENSIVE PERMIT
UNDER GENERAL LAW CHAPTER 40B, SECTIONS 20-23

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445 Harvard LLC, (hereinafter the "Applicant") hereby applies to the Board of Appeals of the Town of Brookline, Massachusetts, pursuant to General Laws, Chapter 40B, Section 20 through 23, as amended, for the issuance of a Comprehensive Permit authorizing the applicant to construct 25 rental units (20 market rate and 5 affordable units) and approximately 4,380 square foot of commercial space on land located at 445 Harvard Street in Coolidge Corner. The applicant and the development are more particularly described in the exhibits hereto annexed and submitted simultaneously herewith, all of which are incorporated herein by reference and constitute the documents required to be submitted by Sections 30.00 and 31.00 of the Rules and Regulations of the Housing Appeals Committee of the Department of Communities and Development.

REQUEST FOR FINDINGS OF FACT

The applicant requests that the Board of Appeals make the following findings of fact in connection with the action of the Board on this application:

1. 445 Harvard LLC, a limited dividend organization within the meaning of General Laws, Chapter 40B, is eligible to receive a subsidy under a state or federal affordable housing program after a Comprehensive Permit has been granted.

2. The applicant has shown evidence of its legal interest in the proposed site sufficient to qualify it as a recipient of a Comprehensive Permit for this site.

to qualify it as a recipient of a Comprehensive Permit for this site.

3. Massachusetts Housing Partnership ("MHP"), will be the subsidizing agency within the meaning of the procedural regulations of the Housing Appeals Committee (760 CMR:30.01(C).

4. The number of low or moderate income housing units in the Town of Brookline constitutes less than ten percent (10%) as reported in the latest decennial census of the town and reported by the Department of Housing & Community Development as of September 14, 2017. 9.4% is the reported percentage.

5. The development as proposed in the application is consistent with local needs within the meaning of General Laws, Chapter 40B, Section 20.

The applicant respectfully requests the Board of Appeals after complying with the procedural requirements as provided by law, to issue to the applicant a Comprehensive Permit for the development.

445 Harvard LLC

By: _____
Shimon Cohen, Manager

SECTION 10

TRAFFIC IMPACT ASSESSMENT

MEMORANDUM

TO: Mr. Victor L.H. Sheen
Aura Properties
49 Coolidge Street
Brookline, MA 0244

FROM: Mr. Jeffrey S. Dirk, P.E., PTOE, FITE
Principal
Vanasse & Associates, Inc.
35 New England Business Center Drive
Suite 140
Andover, MA 01810-1066
(978) 269-6830
jdirk@rdva.com

DATE: July 23, 2018

RE: 7971

SUBJECT: Proposed Mixed-Use Development
445 Harvard Street
Brookline, Massachusetts

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in support of the proposed mixed-use development to be located at 445 Harvard Street in Brookline, Massachusetts (hereafter referred to as the "Project"). This assessment provides an existing conditions context for the Project with regard to its interface with the transportation infrastructure and includes: i) traffic volume projections for the Project; ii) an assessment of potential impacts; iii) a review of lines of sight at the proposed driveway; and iv) recommendations with regard to the design and operation of the driveway that will serve the Project.

Based on this evaluation, we have determined that the Project will represent an overall reduction in traffic over the current use that occupies the Project site (gasoline/service station) and, as such, the Project would not result in a material impact (increase) on motorist delays or vehicle queuing over existing conditions. Further, lines of sight to and from the Project site driveway intersection with Thorndike Street exceed or can be made to exceed the recommended minimum distances for safe operation based on the appropriate speed of traffic approaching the driveway and with consideration of the urban environment in which the Project is located. Accordingly, we have concluded that the transportation infrastructure affords sufficient capacity to accommodate the Project in a safe manner.

The following details our assessment of the Project.

PROJECT DESCRIPTION AND EXISTING CONDITIONS CONTEXT

Project Description

The Project will entail the construction of a five-story, 25-unit, multi-family residential community with 4,380± square foot (sf) of ground-floor commercial space to be located at 445 Harvard Street in Brookline, Massachusetts. The Project site encompasses approximately 0.23 ± acres of land that is situated on the southeast corner of the intersection of Harvard Street at Thorndike Street and is currently occupied by a gasoline/service station with associated appurtenances that will be removed to accommodate the Project. Access to the Project site will be provided by way of a new driveway that will

intersect the south side of Thorndike Street approximately 90 feet east of Harvard Street. The existing driveways that serve the Project site on both Harvard Street and Thorndike Street that are proximate to the Harvard Street/Thorndike Street intersection will be closed in conjunction with the Project thereby improving both traffic operations and safety. On-site parking will be provided for 20 vehicles in a below-grade parking garage, with one (1) short-term parking space to be provided adjacent to the car elevator.

Existing Conditions Context

The following provides an existing conditions context for Harvard Street and Thorndike Street in the vicinity of the Project site:

Harvard Street:

- Two-lane, urban principal arterial roadway that is under Town jurisdiction
- Provides two 12-foot wide travel lanes per direction that are separated by a double-yellow centerline with marked bicycle lanes and metered, on-street parking provided where not otherwise prohibited
- Additional travel lanes are provided at major intersections
- Sidewalks are provided along both sides of the roadway
- A posted speed limit is not provided; statutory speed limit is 25 miles per hour (mph)[1] excepting within the school zone for the Kehillath Israel Nursery School where the speed limit is 20 mph when school is in session

Thorndike Street:

- Two-lane urban collector roadway that is under Town jurisdiction
- Provides a 24-foot wide traveled-way that accommodates two-way travel with no marked centerline and 2-hour on-street parking along the south side except where otherwise prohibited
- Sidewalks are provided along both sides of the roadway
- While the roadway width is not sufficient width to support bicycle travel in a shared traveled-way configuration,[2] the roadway can function as a shared-use facility given the relatively low traffic volumes
- A posted speed limit is not provided; statutory speed limit is 25 mph
- Forms a four-legged intersection with Harvard Street that is under STOP-sign control with marked crosswalks for crossing all legs of the intersection

Motor Vehicle Crash Data

A review of motor vehicle crash data provided by the Massachusetts Department of Transportation (MassDOT) Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2011 through 2015, inclusive) indicated that a total of six (6) motor vehicle crashes were

[1] In April 2018, the Town of Brookline adopted a town-wide statutory speed limit of 25 mph pursuant to MGL c. 90 § 17C on roadways in a thickly settled or business district without a speed regulation established pursuant to MGL c. 90 § 18.

[2] A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.

reported to have occurred at or in the vicinity of the Harvard Street/Thorndike Street intersection over the five-year review period, or an average of approximately one (1) crash per year. Of the six (6) crashes, four (4) involved pedestrians and two (2) involved bicyclists, and the crashes were evenly divided between property damage and personal injury. Improvements are planned for the Harvard Street/Thorndike Street intersection in conjunction with the redevelopment project at 455 Harvard Street that include: i) the installation of curbline extensions (bump-outs) on the corners of the intersection to reduce pedestrian crossing distances and improve sight lines to/from pedestrians waiting to cross the intersection; and ii) enhanced signs and pavement markings at and approaching the intersection.

Public Transportation Services

Public transportation services are provided along Harvard Street by the Massachusetts Bay Transportation Authority (MBTA) by way of Route 66, *Harvard Square – Dudley Station*, which provides service between Harvard Square and Dudley Square, with connections to the Red Line (Harvard Station), the Green Line ("B", "C", "D" and "E" branches at Harvard Avenue, Coolidge Corner, Brookline Village and Brigham Circle, respectively), the Silver Line (Dudley Square Station) and other MBTA bus routes. The closest bus stop to the Project site for the Route 66 bus is located at the Harvard Street/Coolidge Street intersection, which is within a 1-minute walking distance.

PROJECT-GENERATED TRAFFIC

In order to determine the traffic characteristics of the Project, trip-generation methodologies established by the Institute of Transportation Engineers (ITE)[3] were used. The ITE provides trip-generation information for various types of land uses developed as a result of scientific studies that have been conducted over the past 50 plus years, the most recent update of which was published in September 2017. As proposed, the Project will entail the removal of an existing gasoline/service station and the construction of a five-story, 25-unit, multi-family residential community with 4,380± sf of ground-floor commercial space. Based on the defined characteristics of the Project and a review of the ITE trip-generation database, ITE Land Use Codes (LUC) 221, *Multifamily Housing (Mid-Rise)*, and 820, *Shopping Center*, were determined to be the most appropriate land use to develop the traffic characteristics of the Project.

Table 1 summarizes the trip-generation calculations for the Project using the above methodology and compares the traffic volumes to those of the existing gasoline/service station that occupies the Project site.

[3] *Trip Generation*, 10th Edition; Institute of Transportation Engineers; Washington, DC; 2017.

Table 1
TRIP GENERATION SUMMARY AND COMPARISON
PROPOSED MIXED-USE DEVELOPMENT

Time Period/Direction	Vehicle Trips (A) Proposed Mixed-Use Development[a]	(B) Existing Gasoline/ Service Station[b]	(A – B) Difference
Average Weekday Daily:			
Entering	151	344	
Exiting	151	344	
Total	302	688	-386
Weekday Morning Peak Hour:			
Entering	4	21	
Exiting	9	21	
Total	13	42	-29
Weekday Evening Peak Hour:			
Entering	15	28	
Exiting	14	28	
Total	29	56	-27

[a]Based on ITE LUCs 221, *Multifamily Housing (Mid-Rise) (25 units)*, and 820, *Shopping Center* (4,380± sf and using the average trip rate).
[b]Based on ITE LUC 944, *Gasoline/Service Station* (4 vehicle fueling positions).

Project-Generated Traffic Summary

As can be seen in Table 1, without adjustment to account for the use of public transportation and pedestrian/bicycle trips, the Project is expected to generate approximately 302 vehicle trips on an average weekday (two-way, 24-hour volume, or 151 vehicles entering and 151 exiting), with 13 vehicle trips (4 vehicles entering and 9 exiting) expected during the weekday morning peak-hour and 29 vehicle trips (15 vehicles entering and 14 exiting) expected during the weekday evening peak-hour.

In comparison to the existing gasoline/service station that occupies the Project site, the Project is expected to result in 386 fewer vehicle trips on an average weekday (an approximate 56 percent reduction), with 29 fewer vehicle trips expected during the weekday morning peak-hour (an approximate 69 percent reduction) and 27 fewer vehicle trips expected during the weekday evening peak-hour (an approximate 48 percent reduction). Accordingly and with consideration of the use of public transportation and pedestrian/bicycle trips, it can be concluded that ***the Project represents a significant reduction in traffic over the current use of the property and, as such, would not result in a material impact (increase) in motorist delays or vehicle queuing over existing conditions.***

SIGHT DISTANCE ASSESSMENT

Sight distance measurements were performed at the Project site driveway intersection with Thorndike Street in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[4] requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 2 presents the measured SSD and ISD at the subject intersection.

Table 2
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Thorndike Street at the Project Site Driveway			
Stopping Sight Distance:			
Thorndike Street approaching from the east	155	--	392
Thorndike Street approaching from the west	80	--	90+[c]
Intersection Sight Distance:			
Looking to the east from the Project Site Driveway	155	240/280	36/175[d]
Looking to the west from the Project Site Driveway	80	145/170	29/90[d]

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2011; and based on a 25 mph speed on Thorndike Street approaching from the east (westbound) and 15 mph approaching from the west (eastbound).
[b]Values shown are the intersection sight distance for a vehicle turning right/left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.
[c]Clear line of sight is provided to/from Harvard Street.
[d]With the removal of on-street parking adjacent to the driveway.

As can be seen in Table 2, the available lines of sight at the Project site driveway intersection with Thorndike Street were found to exceed or could be made to exceed the recommended minimum sight distances to function in a safe manner (SSD) based on the appropriate approach speed along Thorndike Street with consideration of the reduce travel speed of vehicles transitioning from Harvard Street to Thorndike Street and the urban environment in which the Project site is located. Specifically, motorists exiting the Project site driveway will: i) look for pedestrians that may be crossing the driveway within the sidewalk area; ii) proceed to enter the sidewalk area when clear of pedestrians; and iii) look for an approaching vehicle on Thorndike Street; before entering the traveled-way.

[4]*A Policy on Geometric Design of Highway and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2011.

SUMMARY

VAI has prepared a TIA in support of the proposed mixed-use development to be located at 445 Harvard Street in Brookline, Massachusetts. This assessment has provided an existing conditions context for the Project with regard to its interface with the transportation infrastructure and included: i) traffic volume projections for the Project; ii) an assessment of potential impacts; iii) a review of lines of sight at the proposed driveway; and iv) recommendations with regard to the design and operation of the driveway that will serve the Project, a discussion of which follows.

Based on this evaluation, we have determined that the Project will represent an overall reduction in traffic over the current use that occupies the Project site (gasoline/service station) and, as such, the Project would not result in a material impact (increase) on motorist delays or vehicle queuing over existing conditions. Further, lines of sight to and from the Project site driveway intersection with Thorndike Street exceed or can be made to exceed the recommended minimum distances for safe operation based on the appropriate speed of traffic approaching the driveway and with consideration of the urban environment in which the Project is located. Accordingly, we have concluded that the transportation infrastructure affords sufficient capacity to accommodate the Project in a safe manner. This conclusion is predicated on implementation of the following specific recommendations that should be advanced as a part of the Project:

1. The Project site driveway should be a minimum of 20-feet in width or as required to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle as defined by the Brookline Fire Department to the extent that emergency vehicles will be entering the driveway.

2. Vehicles exiting the Project site should be placed under STOP-sign control with marked STOP-lines provided.

3. All signs and pavement markings to be installed within the Project site shall conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[5]

4. On-street parking adjacent to the Project site driveway should be prohibited within 20-feet of the driveway.

5. Consideration should be given to designating a portion of the curbside area along the Project site frontage on Thorndike Street as a short-term loading zone for deliveries, tenant moves and resident drop-off/pick-up.

6. The existing stockade fence along the east property line should be removed or modified as it approaches Thorndike Street (approximately 4-feet of the last section of fencing) to improve lines of sight exiting the driveway.

7. Signs and landscape features to be installed within the site triangle areas of the Project site driveway shall be designed and maintained so as not to restrict lines of sight.

8. Snow windrows along the Project site frontage within the sight triangle areas of the Project site driveway shall be promptly removed where such accumulations would inhibit sight lines.

[5] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

In addition, a comprehensive Transportation Demand Management (TDM) program should be an integral part of the Project that would include the following measures to encourage the use of alternative modes of transportation to single-occupant vehicles:

- The owner or property manager should contact MassRIDES to obtain information on facilitating and encouraging healthy transportation options for residents and employees of the Project, and should become a MassRIDES employer partner;

- Information regarding public transportation services, maps, schedules and fare information should be posted in a central location and/or otherwise made available to residents and employees of the Project;

- A "welcome packet" should be provided to new residents and employees detailing available public transportation services, bicycle and walking alternatives, and commuter options available through MassRIDES' and their NuRide program which rewards individuals that choose to walk, bicycle, carpool, vanpool or that use public transportation to travel to and from work;

- Residents and employees should be made aware of the Emergency Ride Home (ERH) program available through MassRIDES, which reimburses employees of a participating MassRIDES employer partner worksite that is registered for ERH and that carpool, take transit, bicycle, walk or vanpool to work;

- Pedestrian accommodations should be incorporated within the Project site consisting of connections between the proposed building and the sidewalks along both Harvard Street and Thorndike Street;

- The Project site driveway should be constructed as a "pan-type" driveway such that the sidewalk continues across driveway at the same elevation (i.e., wheelchair ramps are not required to cross the driveway);

- A mail drop should be provided in a central location; and

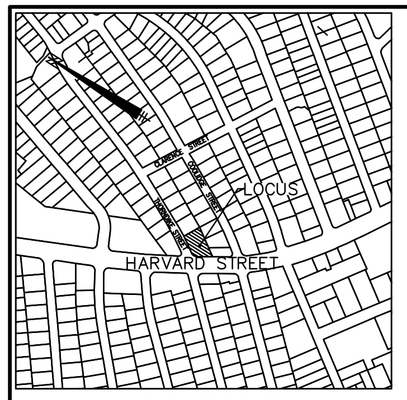
- Secure bicycle parking should be provided consisting of weather protected bicycle parking located in a secure area within the building and an exterior bicycle rack conveniently located for patrons and visitors.

With implementation of the above recommendations, safe and efficient vehicular, pedestrian and bicycle access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

cc: File

SECTION 11

SITE ENGINEERING PLANS



LOCUS MAP
Not to Scale

ABBREVIATIONS

FFE	FIRST FLOOR ELEVATION
BIT CONC.	BITUMINOUS CONCRETE PAVEMENT
CCB	CAPE COD BERM
EP	EDGE OF PAVEMENT
BC	BITUMINOUS CONCRETE CURB
(AM)	AS MEASURED
RET WALL	RETAINING WALL
CONC.	CONCRETE
RCP	REINFORCED CONCRETE PIPE
VGC	VERTICAL GRANITE CURB
ETW	EDGE OF TRAVEL WAY
MTL	METAL BERM
VCC	VERTICAL CONCRETE CURB
CMP	CORRUGATED METAL PIPE

LEGEND

SURVEY SYMBOLS

- REBAR
- ANGLE IRON
- CB/DH — CONCRETE BOUND WITH DRILL HOLE
- SB — STONE BOUND
- SB/DH — STONE BOUND

UTILITY SYMBOLS

- CHIMNEY
- ELECTRIC HAND HOLE
- GUY POLE
- GW — GUY WIRE
- HVAC UNIT
- BUILDING LIGHT W/MAST
- BUILDING LIGHT
- TRANSFORMER
- WATER GATE
- EXH — EXHAUST VENT
- AIR VENT
- DRAINAGE SUMP
- EMH — ELECTRIC MANHOLE
- SMH — SEWER MANHOLE
- DMH — DRAIN MANHOLE
- TMH — TELEPHONE MANHOLE
- CBN — DRAINAGE CATCH BASIN
- DOOR WAY THRESHOLD
- HYDRANT
- POST INDICATER VALVE
- UTILITY POLE
- YARD LIGHT
- RIP RAP
- B — BOLLARD
- SIGN
- FA — FIRE ALARM
- DECIDUOUS TREE
- CONIFEROUS TREE

LINE DESIGNATORS

- W — WATER MAIN
- HANDRAIL
- JERSEY BARRIER
- GUARD RAIL
- RAILROAD TRACKS
- OHW — OVERHEAD WIRES
- GAS LINE
- WS — WATER SERVICE
- UNDERGROUND ELECTRIC
- D — STORM DRAIN LINE
- S — SANITARY SEWER LINE
- DRAINAGE SWALE
- X — CHAIN LINK FENCE

SURVEY NOTES:

1. OWNER: 445 HARVARD STREET CORP
   445 HARVARD ST.
   BROOKLINE, MA 02446
2. LOCUS IS SHOWN AS APN 67-09-00 ON THE TOWN OF BROOKLINE ASSESSORS MAPS.
3. DEED TO LOCUS IS RECORDED IN THE NORFOLK COUNTY REGISTRY OF DEEDS AT BOOK 15748, PAGE 321.
4. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
5. LOCUS IS ZONED L-1.0 AND IS LOCATED WITHIN THE COOLIDGE CORNER DESIGN OVERLAY DISTRICT.

   ZONING RESTRICTIONS:
   FRONT YARD: 10'
   SIDE YARD: NONE
   REAR YARD 10 + L/10 (SEE REG.)
6. LOCUS IS SITUATED IN ZONE X AS SHOWN ON F.I.R.M. No. 25021C0032E. (NOT PRINTED).
6. THE PROPERTY SHOWN HEREON IS/IS NOT LOCATED IN A DEP ZONE 2 AND TOWN OF BROOKLINE AQUIFER PROTECTION DISTRICT ZONE.
7. UTILITY INFORMATION FROM ABOVE GROUND OBSERVED EVIDENCE IN CONJUNCTION WITH DIG SAFE MARKINGS AND RECORD PLANS. THE LAND SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE LAND SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. BEFORE CONSTRUCTION CALL DIG SAFE SYSTEMS, INC. AT 1-888-344-7233.

I HEREBY CERTIFY THAT THIS PLANCONFORMS TO THE RULES AND REGULATIONS OF THE REGISTER OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

RICHARD J. HOOD, PLS DATE

© MCKENZIE ENGINEERING GROUP, INC.

REV	DATE	DESCRIPTION	BY	APP
I	I	I	I	I

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL SURVEYOR:

OWNERS/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

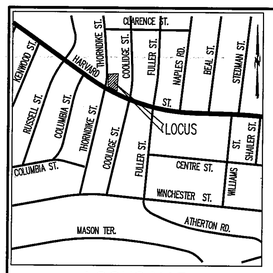
BROOKLINE, MA 02446

DRAWN BY:	--
DESIGNED BY:	--
CHECKED BY:	--
APPROVED BY:	--
DATE:	JULY 20, 2018
SCALE:	1"=20'
PROJECT NO.:	218-106

DWG. TITLE:
EXISTING CONDITIONS PLAN

DWG. NO:
EX-1

M:\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL – 445 HARVARD\DWGS\218-106 EC 26JUN18.DWG



LOCUS MAP
Not to Scale

SURVEY NOTES:

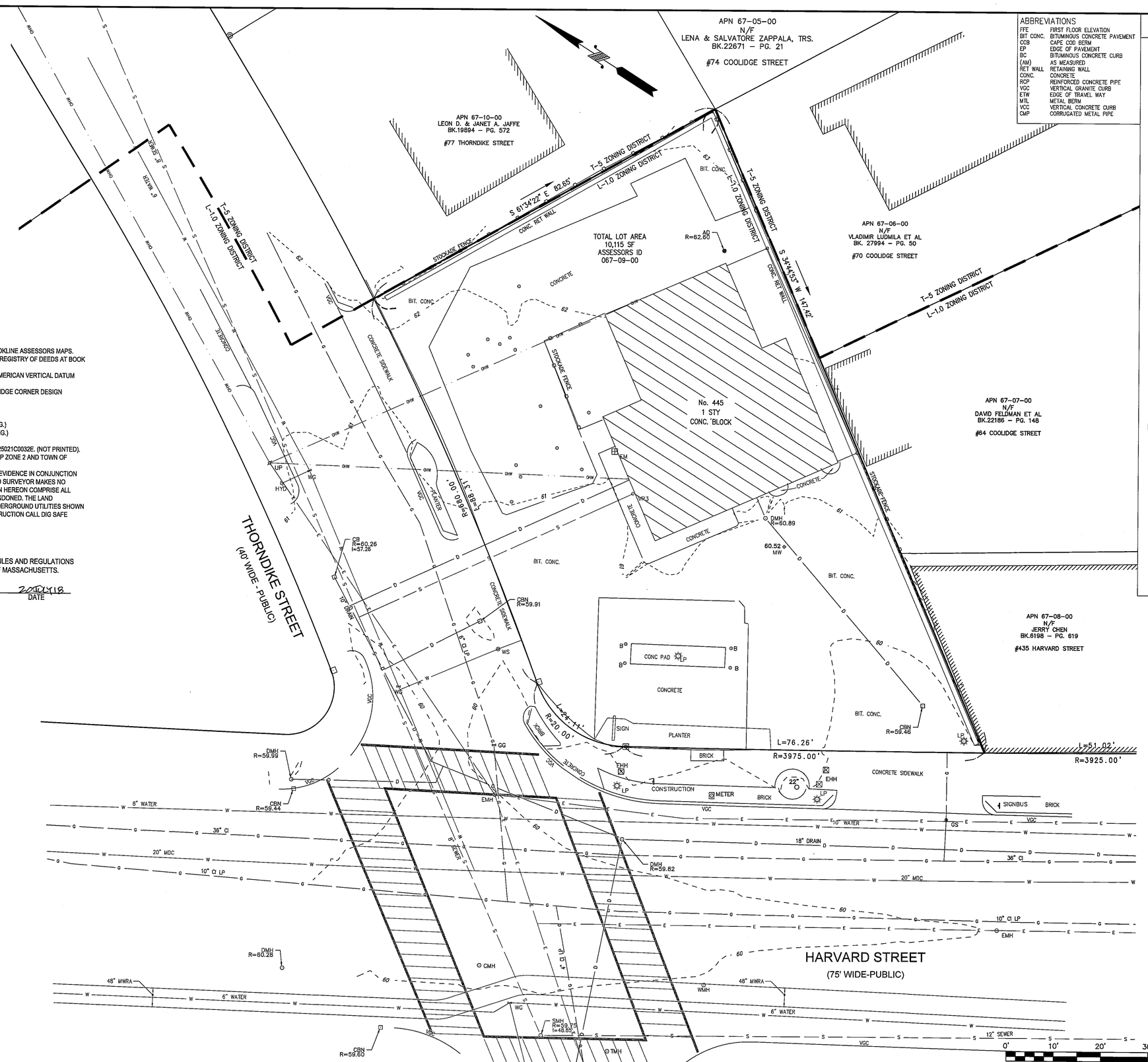
1. OWNER: 445 HARVARD STREET CORP
445 HARVARD ST.
BROOKLINE, MA 02446
2. LOCUS IS SHOWN AS APN 67-09-00 ON THE TOWN OF BROOKLINE ASSESSORS MAPS.
3. DEED TO LOCUS IS RECORDED IN THE NORFOLK COUNTY REGISTRY OF DEEDS AT BOOK 15748, PAGE 321.
4. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
5. LOCUS IS ZONED L-1.0 AND IS LOCATED WITHIN THE COOLIDGE CORNER DESIGN OVERLAY DISTRICT.

ZONING RESTRICTIONS:
FRONT YARD: 10'
SIDE YARD: 10' (SEE REG.)
REAR YARD 30' (SEE REG.)

6. LOCUS IS SITUATED IN ZONE X AS SHOWN ON F.I.R.M. No. 25021C0032E. (NOT PRINTED).
7. THE PROPERTY SHOWN HEREON IS NOT LOCATED IN A DEP ZONE 2 AND TOWN OF BROOKLINE AQUIFER PROTECTION DISTRICT ZONE.
8. UTILITY INFORMATION FROM ABOVE GROUND OBSERVED EVIDENCE IN CONJUNCTION WITH DIG SAFE MARKINGS AND RECORD PLANS. THE LAND SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE LAND SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. BEFORE CONSTRUCTION CALL DIG SAFE SYSTEMS, INC. AT 1-888-344-7233.

I HEREBY CERTIFY THAT THIS PLAN CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTER OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

RICHARD J. HOOD, PLS — DATE 20JUL18



ABBREVIATIONS

FFE	FIRST FLOOR ELEVATION
BIT CONC.	BITUMINOUS CONCRETE PAVEMENT
CCB	CAPE COD BERM
EP	EDGE OF PAVEMENT
BC	BITUMINOUS CONCRETE CURB
(AM)	AS MEASURED
RET WALL	RETAINING WALL
CONC.	CONCRETE
RCP	REINFORCED CONCRETE PIPE
VGC	VERTICAL GRANITE CURB
ETW	EDGE OF TRAVEL WAY
MTL	METAL BERM
VCC	VERTICAL CONCRETE CURB
CMP	CORRUGATED METAL PIPE

LEGEND

SURVEY SYMBOLS
- REBAR
- ANGLE IRON
- CB/DH — CONCRETE BOUND WITH DRILL HOLE
- SB — STONE BOUND
- SB/DH — STONE BOUND

UTILITY SYMBOLS
- CHIMNEY
- ELECTRIC HAND HOLE
- GUY POLE
- GUY WIRE
- HVAC UNIT
- BUILDING LIGHT W/MAST
- BUILDING LIGHT
- TRANSFORMER
- WATER GATE
- EXH — EXHAUST VENT
- AIR VENT
- DRAINAGE SUMP
- EMH — ELECTRIC MANHOLE
- SMH — SEWER MANHOLE
- DMH — DRAIN MANHOLE
- TMH — TELEPHONE MANHOLE
- CBN — DRAINAGE CATCH BASIN
- DOOR WAY THRESHOLD
- HYDRANT
- POST INDICATER VALVE
- UTILITY POLE
- YARD LIGHT
- RIP RAP
- B — BOLLARD
- SIGN
- FA — FIRE ALARM
- DECIDUOUS TREE
- CONIFEROUS TREE

LINE DESIGNATORS
- W — WATER MAIN
- HANDRAIL
- JERSEY BARRIER
- GUARD RAIL
- RAILROAD TRACKS
- OHW — OVERHEAD WIRES
- G — GAS LINE
- WS — WATER SERVICE
- E — UNDERGROUND ELECTRIC
- D — STORM DRAIN LINE
- S — SANITARY SEWER LINE
- DRAINAGE SWALE
- X — CHAIN LINK FENCE

REV	DATE	DESCRIPTION	BY	APP
-	-	-	-	-

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL SURVEYOR:
COMMONWEALTH OF MASSACHUSETTS — RICHARD J. HOOD No.35031 — PROFESSIONAL LAND SURVEYOR

OWNERS/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

BROOKLINE SITE PLAN# 2018-XX

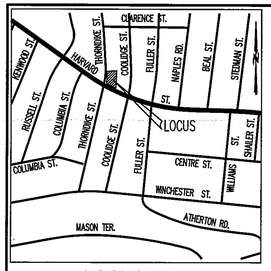
DRAWN BY:	--
DESIGNED BY:	--
CHECKED BY:	--
APPROVED BY:	--
DATE:	JULY 20, 2018
SCALE:	1"=10'
PROJECT NO.:	218-106

DWG. TITLE:
EXISTING CONDITIONS PLAN

DWG. NO:
EX-1

© MCKENZIE ENGINEERING GROUP, INC.

M:\MEG\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL – 445 HARVARD\DWGS\218-106 EC 26JUN18.DWG



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ZONING SUMMARY - LOCAL BUSINESS (L-1.0)
COOLIDGE CORNER OVERLAY DISTRICT

ZONING REQUIREMENT	REQUIRED	PROVIDED
LOT SIZE MINIMUM	NONE	10,115 S.F.
FLOOR AREA RATIO MAXIMUM	1.0	3.44
LOT FRONTAGE (§ 5.14)	20 FT.	188.76 FT.
HEIGHT MAXIMUM (§ 5.30)	40 FT.	58 FT.
FRONT YARD SETBACK MINIMUM (1)	10 FT. GARAGE ENTRANCE 20 FT.	1.5 FT. GARAGE ENTRANCE 3.9 FT.
SIDE YARD SETBACK MINIMUM (7)	10 FT.	5.0 FT.
REAR YARD SETBACK MINIMUM (8)*	30FT.	5.0 FT.
MINIMUM OPEN SPACE - LANDSCAPE	10%	14.5%
MINIMUM OPEN SPACE - USABLE (5,13)	NONE	0%

(1) IF THE ENTRANCE TO A GARAGE OR COVERED VEHICULAR PASSAGEWAY FACES TOWARD THE STREET TO WHICH ITS DRIVEWAY HAS ACCESS, SAID ENTRANCE SHALL BE AT LEAST 20 FEET FROM THE STREET LOT LINE.

(5) § 5.07 DWELLING IN BUSINESS AND INDUSTRIAL DISTRICTS: "DWELLINGS IN BUSINESS AND INDUSTRIAL DISTRICTS SHALL CONFORM TO THE MINIMUM USABLE OPEN SPACE MINIMUM SIDE AND REAR YARD REQUIREMENTS OF THE M DISTRICT WITH THE SAME MAXIMUM PERMITTED FLOOR AREA RATIO AS THE BUSINESS OR INDUSTRIAL DISTRICT IN WHICH THE DWELLING IS LOCATED OR OF THE M-2.0 DISTRICT FOR DWELLINGS IN G-1.75 DISTRICTS. HOWEVER, IF THE BOARD OF APPEALS FINDS THAT A WAIVER OF SUCH DIMENSIONAL REQUIREMENTS WOULD PROMOTE REASONABLE DEVELOPMENT OF THE SITE COMPATIBLE WITH ADJACENT BUILDINGS AND THE SURROUNDING AREA, THE BOARD MAY WAIVE SUCH REQUIREMENT BY SPECIAL PERMIT".

(7) § 5.64 SIDE YARDS FOR NON-DWELLING USES: "NO SIDE YARDS ARE REQUIRED FOR PERMITTED USES, OTHER THAN DWELLINGS, IN L,G,O-2 OR I DISTRICTS EXCEPT WHERE A SIDE LOT LINE ABUTS AN S,SC,T,F OR M DISTRICT, IN WHICH CASE THE SIDE YARD REQUIREMENTS OF S, SC, T, F OR M DISTRICT SHALL APPLY. SITE ABUTS T-5; THEREFORE DISTRICT REQUIRED SIDE YARD 10 FT. (#77 THORNDIKE IS A 2-FAMILY RESIDENTIAL USE).

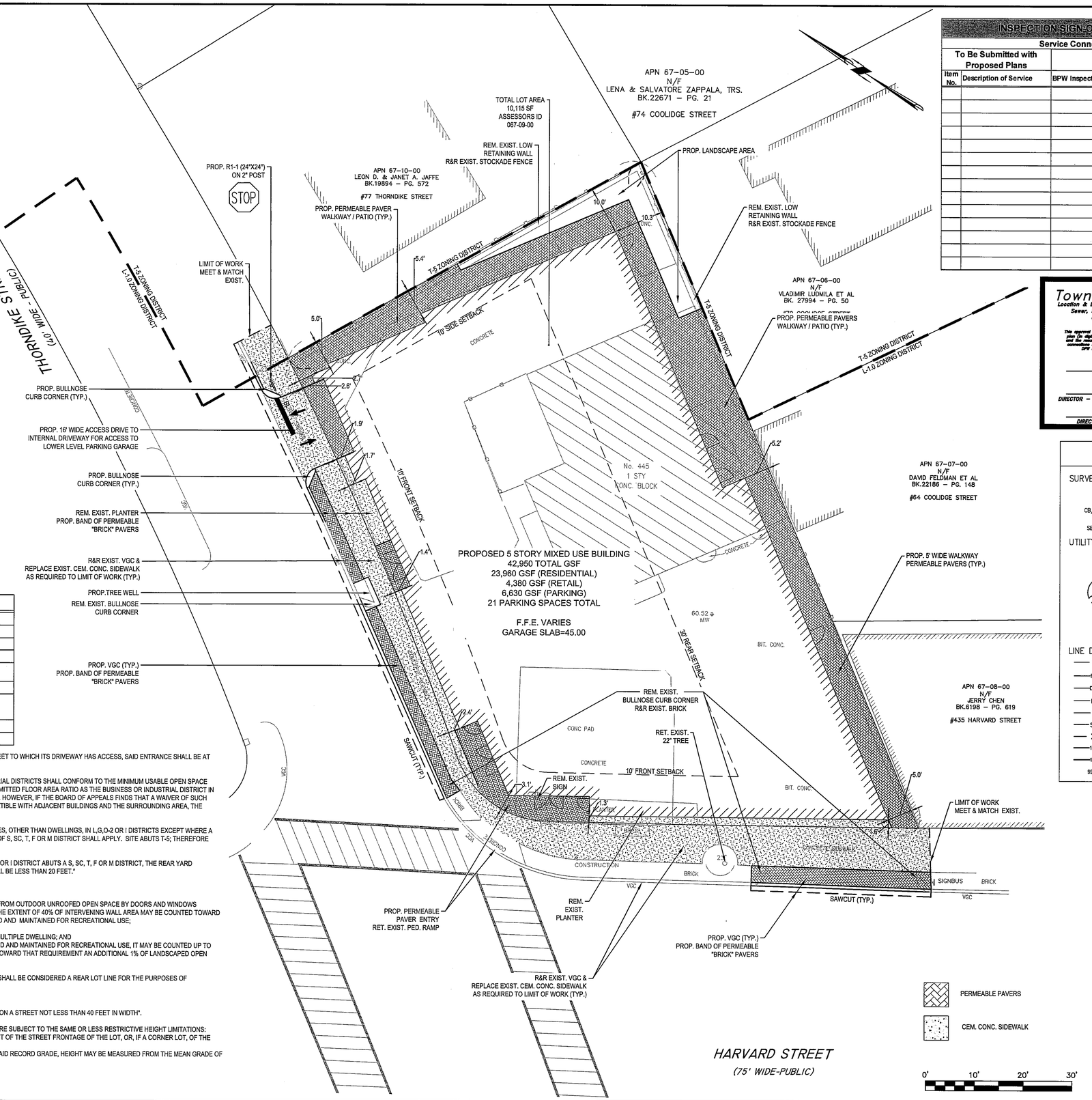
(8) § 5.73 REAR YARDS IN BUSINESS OR INDUSTRIAL DISTRICTS: "WHERE A REAR LOT LINE IN AN L, G, O OR I DISTRICT ABUTS A S, SC, T, F OR M DISTRICT, THE REAR YARD REQUIREMENTS AS SPECIFIED IN TABLE 5.01 SHALL BE APPLIED, EXCEPT THAT NO REAR YARD SHALL BE LESS THAN 20 FEET."

(13) § 5.91 OPEN SPACE SHALL BE DEEMED USABLE ONLY IF:
A. AT LEAST 75% OF THE AREA HAS A GRADE OF LESS THAN 8%;
B. AT LEAST 75% OF THE AREA IS OPEN TO THE SKY, EXCEPT THAT ROOFED SPACE SEPARATED FROM OUTDOOR UNROOFED OPEN SPACE BY DOORS AND WINDOWS CONSTRUCTED OF TRANSPARENT MATERIAL WHICH CAN BE OPENED IN GOOD WEATHER TO THE EXTENT OF 40% OF INTERVENING WALL AREA MAY BE COUNTED TOWARD THE 25% OF USABLE OPEN SPACE NOT OPEN TO THE SKY PROVIDED SUCH SPACE IS DESIGNED AND MAINTAINED FOR RECREATIONAL USE;
C. EACH DIMENSION OF SUCH SPACE IS AT LEAST 15 FEET;
D. SUCH SPACE IS AT LEAST 10 FEET FROM THE FRONT LOT LINE IF IT IS REQUIRED TO SERVE A MULTIPLE DWELLING; AND
E. IF SUCH SPACE IS ABOVE GROUND LEVEL ON A ROOF, TERRACE, OR THE LIKE, AND IS DESIGNED AND MAINTAINED FOR RECREATIONAL USE, IT MAY BE COUNTED UP TO 50% OF THE USABLE OPEN SPACE REQUIREMENT, PROVIDED THAT FOR EVERY 2% COUNTED TOWARD THAT REQUIREMENT AN ADDITIONAL 1% OF LANDSCAPED OPEN SPACE, BEYOND THAT REQUIRED BY TABLE 5.01, SHALL BE PROVIDED AT GROUND LEVEL.

* CORNER LOTS WHERE THE INTERIOR LOT LINE ABUTS A REAR LOT LINE OF AN ADJOINING PARCEL, SHALL BE CONSIDERED A REAR LOT LINE FOR THE PURPOSES OF DETERMINING THE LOCATION OF THE REAR YARD OF THE CORNER LOT.

§ 5.14 LOT FRONTAGE: "EVERY LOT SHALL HAVE A MINIMUM FRONTAGE OF NOT LESS THAN 20 FEET, UPON A STREET NOT LESS THAN 40 FEET IN WIDTH".

§ 5.30 MAXIMUM HEIGHT OF BUILDINGS: "1. WHERE THE LOT ABUTS OTHER LOTS TO THE REAR WHICH ARE SUBJECT TO THE SAME OR LESS RESTRICTIVE HEIGHT LIMITATIONS:
a. HEIGHT SHALL BE MEASURED FROM THE RECORD GRADE OF THE STREET OPPOSITE THE MIDPOINT OF THE STREET FRONTAGE OF THE LOT, OR, IF A CORNER LOT, OF THE STREET FRONTAGE HAVING THE LOWER RECORD GRADE.
b. WHERE THE GRADE OF THE NATURAL GROUND CONTIGUOUS TO THE BUILDING IS HIGHER THAN SAID RECORD GRADE, HEIGHT MAY BE MEASURED FROM THE MEAN GRADE OF SAID NATURAL GRADE".



INSPECTION SIGN-OFF SCHEDULE

Service Connections

To Be Submitted with Proposed Plans		To Be Submitted with As-Built Plans		
Item No.	Description of Service	BPW Inspector	Date	Comments

Town of Brookline
Location & Elevation of Domestic Water, Sanitary Sewer, Storm Drin and/or Storm Water Management – Approved

This approval is given on the condition that an "as-built" site plan (in digital AutoCad DWG or DXF format and hard copy) and the results of a dyed water test of the sewer and drain connections be provided to the engineering division prior to DPW sign off on the Certificate of Occupancy

DATE

DIRECTOR – ENGINEERING/TRANSPORTATION DIRECTOR

DIRECTOR – WATER & SEWER DIVISION

LEGEND

SURVEY SYMBOLS
REBAR
ANGLE IRON
CB/DH CONCRETE BOUND WITH DRILL HOLE
SB STONE BOUND
SB/DH STONE BOUND

UTILITY SYMBOLS
CBN DRAINAGE CATCH BASIN
SIGN
DECIDUOUS TREE
PROPOSED BUILDING ENTRANCE
O RD ROOF DRAIN

LINE DESIGNATORS
G GAS LINE
FP DOMESTIC WATER SERVICE
DW DOMESTIC WATER SERVICE
E UNDERGROUND ELECTRIC
D STORM DRAIN LINE
SS SANITARY SEWER LINE
X CHAIN LINK FENCE
100 MAJOR CONTOUR
101 MINOR CONTOUR
99.55 SPOT GRADE

ABBREVIATIONS

AC	AIR CONDITIONING UNIT
APPROX.	APPROXIMATE
ASPH.	ASPHALT
BCC	BITUMINOUS CONCRETE CURBING
BOL	BOLLARD
CB	CATCH BASIN
CEM	CEMENT
CLF	CHAIN LINK FENCE
CO	CLEANOUT
CONC.	CONCRETE
CRW	CONCRETE RETAINING WALL
DUMP	DUMPSTER
(E)	EXISTING ELEVATION
EL.	ELEVATION
EOP	EDGE OF PAVEMENT
EPLP	ENGINEERING PIN/LEAD PLUG
F.F.E.	FIRST FLOOR
FND	FOUND
GUY	GUY WIRE
HH	HANDHOLE
HR	HANDRAIL
I.F.	IRON PIPE
LP	LIGHT POLE
(M)	MARKED
MHB	MASSACHUSETTS HIGHWAY BOUND
N/F	NOW OR FORMERLY
No.	NUMBER
O/H	OVERHANG
OHW	OVERHEAD WIRES
PED	PEDESTRIAN
R	RIM
R&R	REMOVE & RESET
REM	REMOVE
RET	RETAIN
RD	ROOF DRAIN
RRT	RAILROAD TIE
SMH	SEWER MANHOLE
T.O.A.	TOP OF FOUNDATION
TYP	TYPICAL
UEM	UTILITY ELECTRIC METER
UP	UTILITY POLE
VGC	VERTICAL GRANITE CURB
WP	WOODEN POST
WSF	WOODEN STOCKADE FENCE

REV	DATE	DESCRIPTION	BY	APP
-	-	-	-	

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
781.792.3900
www.mckeng.com

445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL ENGINEER:
COMMONWEALTH OF MASSACHUSETTS
BRADLEY C. McKENZIE
CIVIL
No. 36917
REGISTERED PROFESSIONAL ENGINEER

BROOKLINE SITE PLAN# 2018-XX

OWNERS/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20, 2018
SCALE:	1"=10'
PROJECT NO.:	218-106

DWG. TITLE:
SITE LAYOUT PLAN

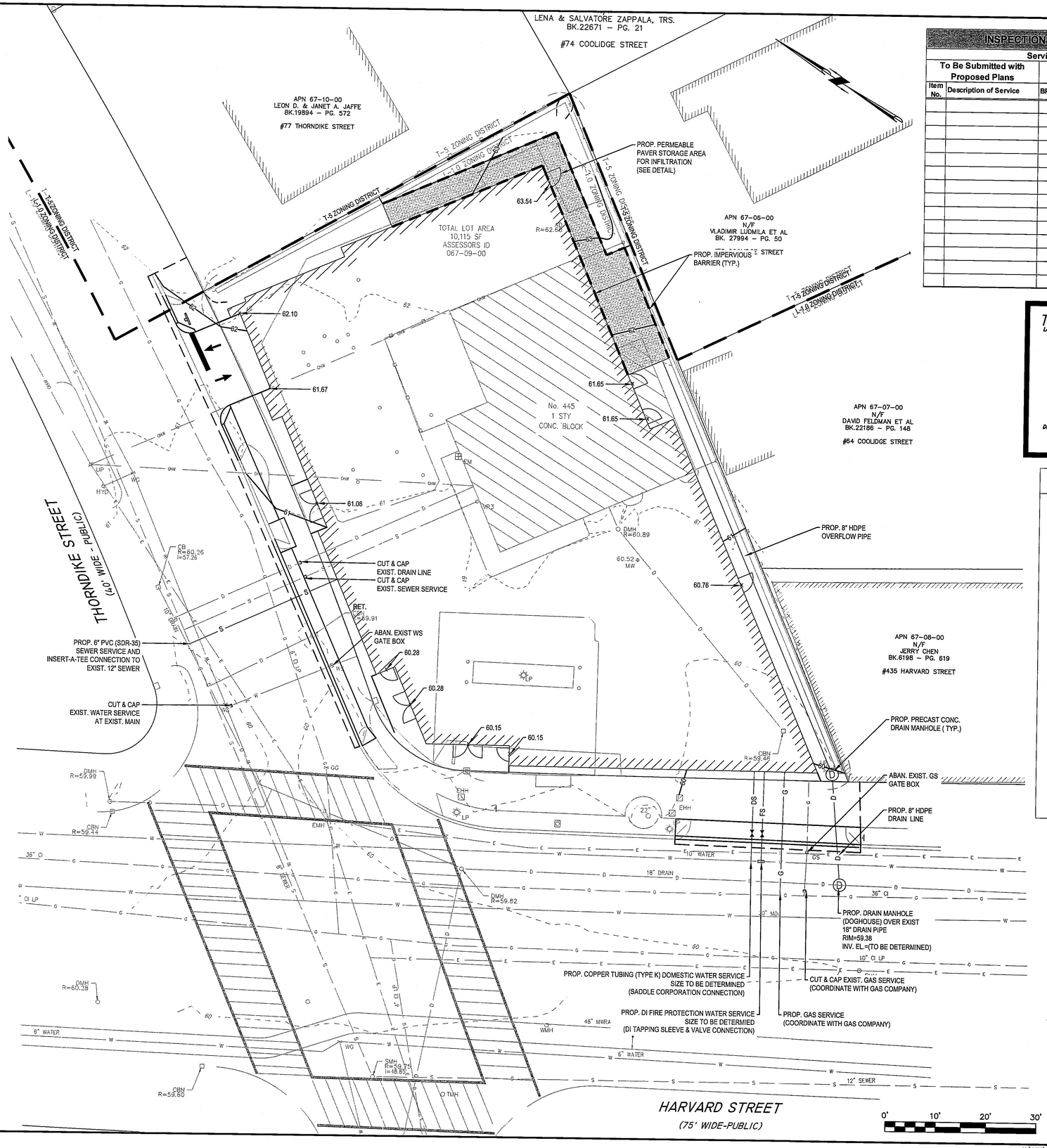
DWG. NO:
C-1

M:\MEG\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL – 445 HARVARD\DWGS\SUBMISSIONS\1\218-106 C-1.DWG

GENERAL UTILITY NOTES:

1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES, TOWN OF BROOKLINE ENGINEERING, AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIGSAFE" AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION SHALL BE TAKEN BEFORE PROCEEDING WITH THE WORK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLAN.
2. MASSACHUSETTS STATE LAW REQUIRES UTILITY NOTIFICATION AT LEAST THREE BUSINESS DAYS PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL CALL DIG-SAFE AT 1-888-344-7233 IN ORDER TO COMPLY WITH STATE LAW.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING ALL CONTROL POINTS AND BENCHMARKS NECESSARY FOR THE WORK.
4. THE CONTRACTOR SHALL EXCAVATE THE UTILITY TRENCHES IN THE LOCATIONS SHOWN ON THE PLAN PRIOR TO COMMENCING WORK TO VERIFY THE ELEVATIONS AND LOCATIONS OF EXISTING UTILITIES.
5. THE CONTRACTOR SHALL PROVIDE THE OWNER AND ENGINEER WITH THE RESULTS PRIOR TO COMMENCING ANY WORK.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE DESIGN ENGINEER FOR INSPECTION OR AS-BUILT LOCATIONS, AS REQUIRED BY THE TOWN OF BROOKLINE.
7. ALL WORK SHALL BE SUBJECT TO THE INSPECTION BY AND APPROVAL OF THE TOWN ENGINEER.
8. IF ANY PART OF THIS DESIGN IS TO BE ALTERED IN ANY WAY, THE DESIGN ENGINEER, AS WELL AS THE APPROVING AUTHORITIES, SHALL BE NOTIFIED IN WRITING BEFORE CONSTRUCTION.
9. ALL UTILITY CONSTRUCTION SHALL CONFORM TO THE TOWN OF BROOKLINE REGULATIONS FOR THE CONSTRUCTION OF SANITARY SEWER AND SURFACE WATER DRAIN CONNECTIONS, LATEST EDITION.
10. ALL WATER AND FIRE SERVICES SHALL BE INSTALLED WITH 5' OF COVER EXCEPT AS NOTED OR DETAILED OTHERWISE.
11. THE DOMESTIC WATER SERVICE AND FIRE SERVICE SHALL BE CEMENT LINED DUCTILE IRON PIPE (C.L.D.I.) AND SHALL BE INSTALLED WITH APPROPRIATELY SIZED APPURTENANCES.
12. ALL WATER AND FIRE SERVICE APPURTENANCES, MATERIALS, METHODS OF INSTALLATION SHALL MEET OR EXCEED ALL LOCAL MUNICIPAL REQUIREMENTS.
13. THE FIRE SERVICE AND DOMESTIC WATER SERVICE SHALL BE ADEQUATELY PROTECTED AGAINST BACKFLOW (BACKFLOW PREVENTION) AT THE BUILDING.
14. AFTER PRESSURE TESTING AND CHLORINATION IS COMPLETED, SAMPLES SHALL BE TAKEN FROM THE FIRE SERVICE AND DOMESTIC WATER SERVICE AND SHALL BE TESTED AT 200 PSI FOR A MINIMUM OF 2 HOURS. THE CONTRACTOR IS REQUIRED TO NOTIFY THE BROOKLINE DEPARTMENT OF PUBLIC WORKS AT LEAST 24 HOURS PRIOR TO THE TESTING.
15. THE FIRE SERVICE AND DOMESTIC WATER SERVICE SHALL BE TESTED IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENTAL PROTECTION REGULATIONS. A MINIMUM OF 2 SEPARATE WATER SAMPLES SHALL BE TESTED AT A STATE CERTIFIED LABORATORY.
16. A MINIMUM OF 10 FEET CLEAR HORIZONTALLY SHALL BE MAINTAINED BETWEEN SANITARY SEWER SERVICES AND WATER SERVICES. WHENEVER CONDITIONS PREVENT A LATERAL SEPARATION OF 10 FEET TO A WATER SERVICE THE ELEVATION OF THE CROWN OF THE SEWER SHALL BE AT LEAST 18 INCHES BELOW THE INVERT OF THE WATER SERVICE.
17. ALL GRAVITY SEWER PIPE SHALL BE POLYVINYL CHLORIDE (PVC) SDR-35 UNLESS OTHERWISE NOTED.
18. WHERE SANITARY SEWERS CROSS WATER MAINS, THE SEWER SHALL BE LAID AT SUCH AN ELEVATION THAT THE CROWN OF THE SEWER IS AT LEAST 18 INCHES BELOW THE INVERT OF THE WATER MAIN. IF THE ELEVATION OF THE SEWER CANNOT BE VARIED TO MEET THIS REQUIREMENT, THE WATER MAIN SHALL BE RELOCATED TO PROVIDE THIS SEPARATION OR CONSTRUCTED WITH MECHANICAL-JOINT PIPE FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE SEWER. ONE FULL LENGTH OF WATER MAIN SHALL BE CENTERED OVER THE SEWER SO THAT BOTH JOINTS WILL BE AS FAR FROM THE SEWER AS POSSIBLE. WHENEVER IT IS IMPOSSIBLE TO OBTAIN VERTICAL SEPARATION AS STIPULATED ABOVE, BOTH THE WATER MAIN AND THE SEWER MAIN SHALL BE ENCASED IN CONCRETE FOR A MINIMUM DISTANCE OF 10 FEET FROM THE CROSSING POINT OF THE OTHER PIPE AS MEASURED NORMALLY FROM ALL POINTS ALONG THE PIPE.
19. ALL SEWER AND STORM DRAINAGE WORK (EXCEPT PLUMBING) SHALL BE PERFORMED BY LICENSED DRAIN LAYER (LICENSED BY TOWN OF BROOKLINE WATER AND SEWER DIVISION) AND THE DRAIN LAYER SHALL PULL A PERMIT FOR THE SITE FROM THE WATER AND SEWER DIVISION PRIOR TO BEGINNING WORK. ALL WORK (EXCEPT PLUMBING) SHALL BE INSPECTED BY THE TOWN OF BROOKLINE ENGINEERING DIVISION. APPOINTMENTS ARE SCHEDULED THROUGH BROOKLINE WATER AND SEWER DIVISION AT 1-617-730-2170 AND REQUIRE 48 HOURS NOTICE.
20. ALL NEW SEWER AND DRAIN CONNECTIONS MUST BE CORED AND ATTACHED WITH AN INSERTA TEE OR APPROVED EQUAL IF FACTORY WYE IS NOT AVAILABLE OR DAMAGED.
21. THE LOCATIONS OF PROPOSED ELECTRIC SERVICES ARE APPROXIMATE. THE PROJECT ELECTRICAL ENGINEER SHALL VERIFY THESE LOCATIONS PRIOR TO THE START OF CONSTRUCTION. COORDINATE ALL ELECTRICAL WORK WITH THE APPROPRIATE UTILITY COMPANIES.
22. THE PROPOSED GAS SERVICE LOCATION IS APPROXIMATE ONLY. THE CONTRACTOR SHALL COORDINATE THE GAS SERVICE INSTALLATION WITH THE LOCAL GAS COMPANY. THE CONTRACTOR SHALL GIVE ADVANCE NOTICE OF WHEN THE GAS LINE CAN BE INSTALLED.
23. ALL CONSTRUCTION WORK SHALL BE PERFORMED IN ACCORDANCE WITH BROOKLINE DEPARTMENT OF PUBLIC WORKS SPECIFICATIONS.
24. PRIOR TO OCCUPANCY PERMIT BEING ISSUED, AS CERTIFIED AS-BUILT PLAN SHOULD BE SUBMITTED THE THE ENGINEERING DIVISION IN BOTH DIGITAL FORMAT AND HARD COPY AND SEWER DYE TEST IS REQUIRED.
25. THE DESIGN ENGINEER MUST OVERSEE AND APPROVE THE INSTALLATION OF THE STORMWATER SYSTEM AND SHALL PROVIDE CERTIFICATION TO THE TOWN OF BROOKLINE. THE CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION OF THE SYSTEM IN ACCORDANCE WITH THE APPROVED DESIGN PLAN AND MANUFACTURER SPECIFICATIONS.

DIG SAFE
MA – RI – ME – NH – VT
CALL TOLL FREE
1-888-344-7233
UTILITIES UNDERGROUND PLANT DAMAGE PREVENTION SYSTEM



INSPECTION SIGN-OFF SCHEDULE

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Item No.	Description of Service	BPW Inspector	Date	Comments

Town of Brookline

Location & Elevation of Domestic Water, Sanitary Sewer, Storm Drin and/or Storm Water Management – Approved

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DIRECTOR – WATER & SEWER DIVISION

LEGEND

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- CB/DH — CONCRETE BOUND WITH DRILL HOLE
- SB — STONE BOUND
- SB/DH — STONE BOUND

UTILITY SYMBOLS

- CBN — DRAINAGE CATCH BASIN
- SIGN
- DECIDUOUS TREE
- PROPOSED BUILDING ENTRANCE
- RD — ROOF DRAIN

LINE DESIGNATORS

- G — GAS LINE
- FP — DOMESTIC WATER SERVICE
- DW — DOMESTIC WATER SERVICE
- E — UNDERGROUND ELECTRIC
- D — STORM DRAIN LINE
- SS — SANITARY SEWER LINE
- X — CHAIN LINK FENCE
- 100 — MAJOR CONTOUR
- 101 — MINOR CONTOUR
- x99.55 — SPOT GRADE

ABBREVIATIONS

AC	AIR CONDITIONING UNIT
APPROX.	APPROXIMATE
ASPH.	ASPHALT
BCC	BITUMINOUS CONCRETE CURBING
BOL	BOLLARD
CB	CATCH BASIN
CEM	CEMENT
CLF	CHAIN LINK FENCE
CO	CLEANOUT
CONC.	CONCRETE
CRW	CONCRETE RETAINING WALL
DMH	DRAINAGE MANHOLE
(E)	EXISTING ELEVATION
EL.	ELEVATION
EOP	EDGE OF PAVEMENT
EPLP	ENGINEERING PIN/LEAD PLUG
F.F.E.	FIRST FLOOR
FND	FOUND
GUY	GUY WIRE
HH	HANDHOLE
I.G.	IRON PIPE
INV.	INVERT
LP	LIGHT POLE
(M)	MARKED
MHB	MASSACHUSETTS HIGHWAY BOUND
N/F	NOW OR FORMERLY
No.	NUMBER
O/H	OVERHANG
OHW	OVERHEAD WIRES
PED	PEDESTRIAN
R	RIM
R&R	REMOVE & RESET
REM	REMOVE
RET	RETAIN
RD	ROOF DRAIN
S	SLOPE
SMH	SEWER MANHOLE
T.O.F.	TOP OF FOUNDATION
TYP	TYPICAL
UEM	UTILITY ELECTRIC METER
UP	UTILITY POLE
VCC	VERTICAL GRANITE CURB
WP	WOODEN POST
WSF	WOODEN STOCKADE FENCE

REV	DATE	DESCRIPTION	BY	APP
-	-	-	-	

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445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL ENGINEER:
COMMONWEALTH OF MASSACHUSETTS
BRADLEY C McKENZIE
CIVIL
No. 36917
REGISTERED PROFESSIONAL ENGINEER

OWNERS/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

BROOKLINE SITE PLAN# 2018-XX

DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20, 2018
SCALE:	1"=10'
PROJECT NO.:	218–106

DWG. TITLE:

GRADING PLAN & UTILITY PLAN

DWG. NO: C-2

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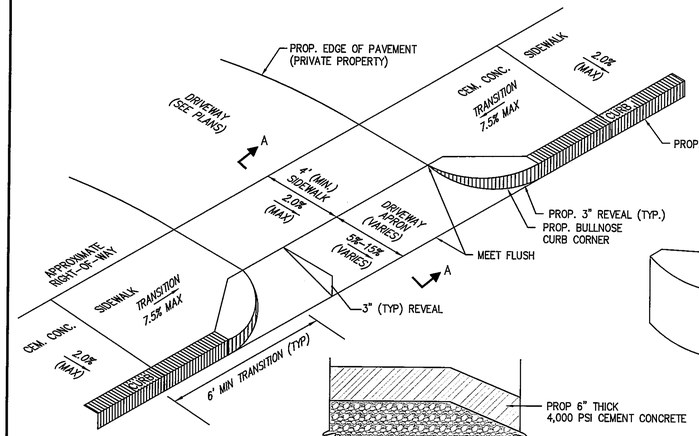
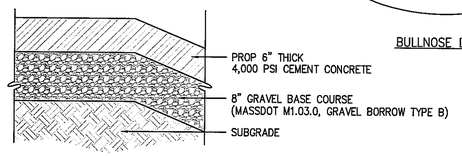
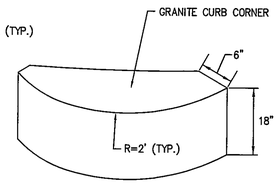




SECTION A–A

NOTES
1. ALL WORK SHALL COMPLY WITH TOWN OF BROOKLINE SPECIFICATION FOR PORTLAND CEMENT CONCRETE SIDEWALKS. LATEST REVISION.
2. SUBGRADE SHALL CONSIST OF NATIVE SOIL OR IMPORTED SOIL CONFORMING TO MASSDOT SPECIFICATION FOR ORDINARY BORROW AND SHALL BE FREE OF ANY UNSUITABLE MATERIALS.

DRIVEWAY APRON DETAIL
SCALE: N.T.S.

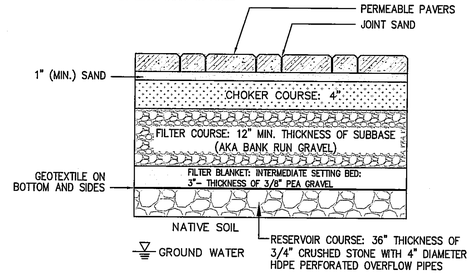


BULLNOSE DETAIL

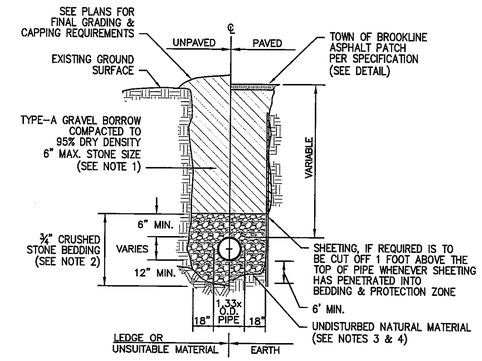
GRADATIONS OF SAND, CHOKER, FILTER AND RESERVOIR COURSE MATERIALS

US STANDARD SIEVE SIZE INCHES	PERCENT PASSING (%)				
	SAND	CHOKER COURSE (AASHTO NO. 57)	FILTER COURSE (BANK RUN GRAVEL)	3/8" PEA GRAVEL	RESERVOIR COURSE (AASHTO NO. 3)
6		–	100		–
2 1/2		–			100
2		–			90–100
1 1/2		100			35–70
1		95–100			0–15
3/4		–			–
1/2	100	25–60		100	0–5
3/8	85–100	–		85–100	–
#4	60–100	0–10	70–100	20–50	–
#8		0–5		0–15	–
#16	35–80			0–5	
#50	10–55				
#100	2–10				
#200			0–6**		
% COMPACTION	95	95	95	95	95

** PREFERABLY LESS THAN 4% FINES

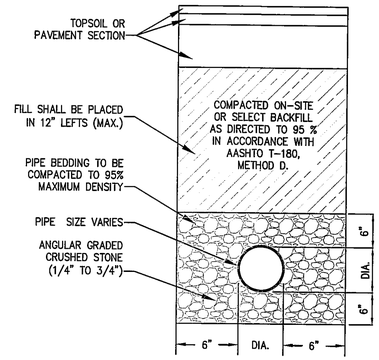


PERMEABLE PAVERS WITH FULL EXFILTRATION TO SOIL SUBGRADE DETAIL
SCALE: N.T.S.



NOTES
1. GRAVEL BORROW SHALL CONFORM TO MASSDOT SPECIFICATION M1.03.0.
2. CRUSHED STONE BEDDING SHALL CONFORM TO MASSDOT SPECIFICATION M2.01.1.
3. SUBGRADE SHALL CONSIST OF NATIVE SOIL OR IMPORTED SOIL CONFORMING TO THE MASSDOT SPECIFICATION FOR ORDINARY BORROW AND SHALL BE FREE OF ANY UNSUITABLE SOILS OR MATERIAL.
4. UNSUITABLE SOIL OR MATERIAL SHALL INCLUDE BUT NOT BE LIMITED TO PEAT, MUCK, BROKEN PAVEMENT, STUMPS, LOGS, CONSTRUCTION DEBRIS OR ANY OTHER DELETERIOUS MATERIAL.

GRAVITY SEWER TRENCH DETAIL
N.T.S.



DRAIN TRENCH DETAIL
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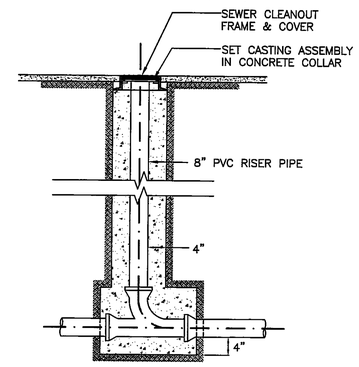
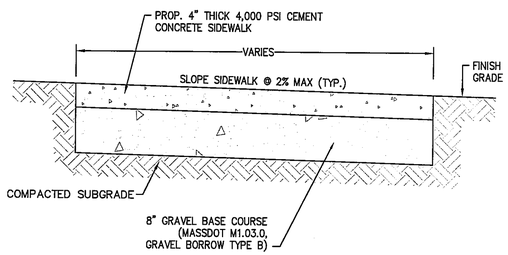


NOTES:
1. CLEANOUT TOP SHALL BE ENCLOSED IN CASTING AND/OR FABRICATED COVER ASSEMBLY.

IN LINE SEWER CLEANOUT DETAIL
SCALE: N.T.S.



NOTES
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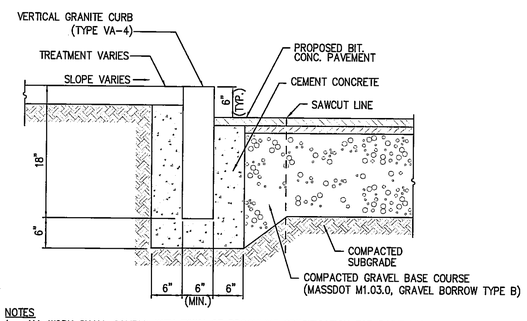
CEMENT CONCRETE SIDEWALK DETAIL
SCALE: N.T.S



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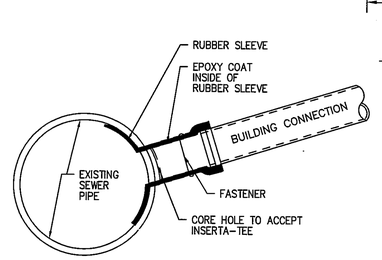
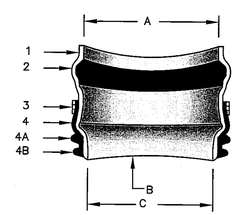
VERTICAL GRANITE CURB (VGC) DETAIL
SCALE: N.T.S.



A. BELL END ACCEPTS PIPE WITH SDR 26, SDR 35 AND ASTM D3034 OR EQUIVALENT O.D. SPECIFICATION IN 4" AND 6" SIZES.
B. CURVATURE VARIES WITH MAINLINE DIAMETERS.
C. SPIGOT END SDR 26, PVC SDR 35, ASTM D3034 DIAMETERS: 4" AND 6"

PART	PART NAME
1	HUB ADAPTOR
2	RUBBER GASKET
3	SECURING CLAMP*
4	RUBBER SLEEVE
4A	UPPER SEGMENT**
4B	LOWER SEGMENT***

* OPTIONAL: #316 STAINLESS STEEL BAND, SCREW AND HOUSING
** DISTANCE BETWEEN 4A AND 4B WILL VARY BY PRODUCT TYPE
*** WILL NOT APPEAR ON RUBBER SLEEVES FOR CONCRETE OR CLAY PIPE

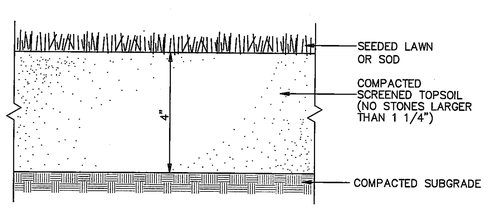


INSERTA TEE SIZE	HOLE DIAMETER
4" (100 mm)	4 ½" (114 mm)
6" (150 mm)	6 ½" (165 mm)

MATERIALS
PVC SDR 26 ASTM D3034
ASTM F477
BAND SS #301
SCREW SS #305
HOUSING SS #301
ASTM F477

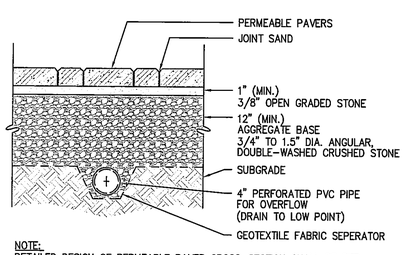
NOTES:
1. DETAILS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. PRODUCT SPECIFICATIONS AND INSTALLATION SHALL COME FROM MANUFACTURER.
2. RECOMMENDED METHOD OF CUTTING HOLE IS WITH HOLE SAW FOR PVC AND OTHER PLASTICS, AND DIAMOND BIT FOR CONCRETES, CLAY, FRP, AND D.I. (SEE INSTALLATION INSTRUCTIONS.)

INSERTA–TEE SEWER CONNECTION TO EXISTING SEWER
SCALE: N.T.S.



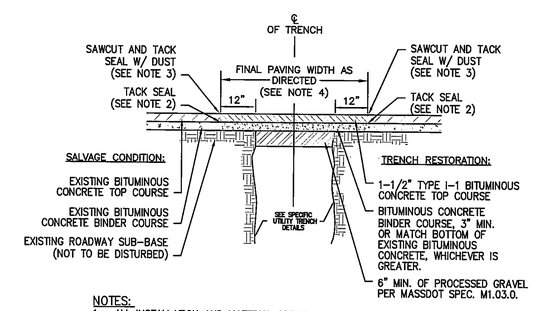
NOTE:
LOAM & SEED MATERIAL SHALL CONFORM TO MASSDOT MATERIAL SPECIFICATIONS M1.05.0, M1.07.0, M1.08.1, AND CONSTRUCTION METHODS 751.80 TO 751.83

SEEDED OR SODDED LAWN DETAIL
SCALE: N.T.S.



NOTE:
DETAILED DESIGN OF PERMEABLE PAVER CROSS–SECTION SHALL BE PER MANUFACTURER SPECIFICATIONS. DESIGN ENGINEER SHALL REVIEW AND APPROVE SHOP DRAWINGS AND DETAILS PRIOR TO PAVER INSTALLATION.

PERMEABLE PAVER (NO EXFILTRATION) DETAIL
SCALE: N.T.S.



NOTES:
1. ALL INSTALLATION AND MATERIAL SPECIFICATIONS PER MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGES, 1988 AS AMENDED.
2. ALL EXPOSED BITUMINOUS CONCRETE IS TO BE TACKED PER MASSDOT PRIOR TO NEW BITUMINOUS CONCRETE INSTALLATION.
3. ALL EXPOSED JOINTS ARE TO BE SEALED WITH TACK AND STONE DUST.
4. ANY TOP COURSE APPLIED AT A WIDTH OF 6' WIDE OR GREATER IS TO BE PLACED BY MACHINE OR BOX SPREADER WHEN & AS DIRECTED BY THE TOWN OF BROOKLINE.

TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL
SCALE: N.T.S.

REV	DATE	DESCRIPTION	BY	APP
–	–	–	–	–

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BRADLEY C. McKENZIE
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No. 36917
REGISTERED PROFESSIONAL ENGINEER

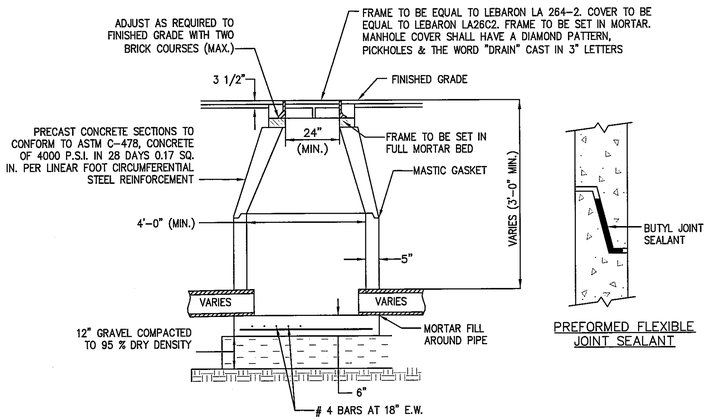
OWNERS/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

BROOKLINE SITE PLAN# 2018-XX

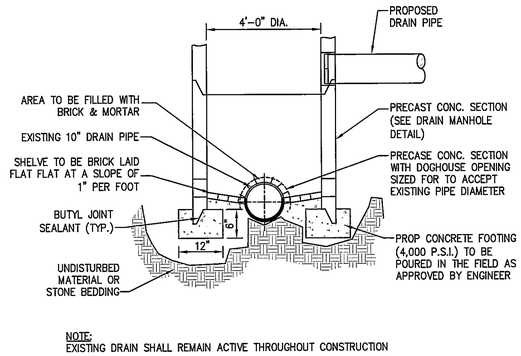
DRAWN BY:	SBS
DESIGNED BY:	
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20, 2018
SCALE:	AS NOTED
PROJECT NO.:	218–106

DWG. TITLE:
CONSTRUCTION DETAILS

DWG. NO:
CD-1

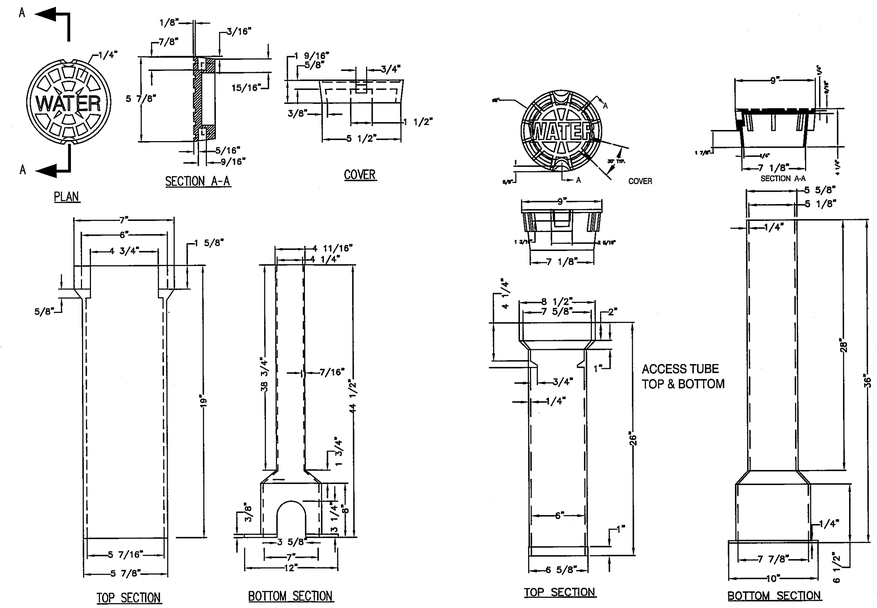


PREFORMED FLEXIBLE JOINT SEALANT



NOTE:
EXISTING DRAIN SHALL REMAIN ACTIVE THROUGHOUT CONSTRUCTION

TYPICAL DOGHOUSE DRAIN MANHOLE
SCALE: N.T.S.



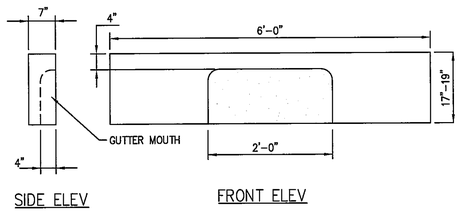
4 1/2" WATER SERVICE ROADWAY BOX FOR 2" WATER SERVICE (BROOKLINE DETAIL W-6)
SCALE: N.T.S.

CAST IRON 6" WATER GATE BOX FOR 4" – 12" GATE VALVES (BROOKLINE DETAIL W-7)
SCALE: N.T.S.

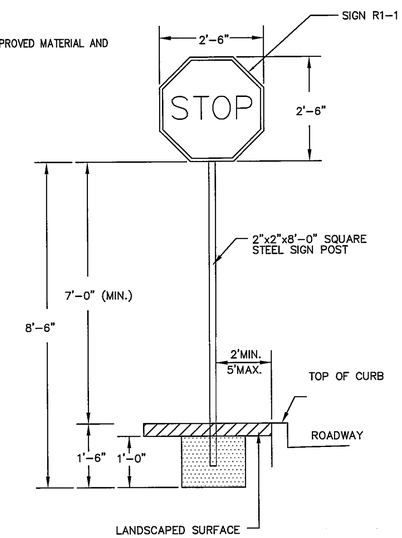
STORM DRAIN NOTES:

1. REINFORCED CONCRETE DRAIN PIPE SHALL BE CLASS IV UNLESS OTHERWISE NOTED.
2. DRAIN PIPES WITH LESS THAN 3' OF COVER SHALL BE CLASS V RCP.
3. BACKFILL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY BY AASHTO T-180D METHOD.
4. SHEETING, IF USED, SHALL BE CUT OFF NO MORE THAN 12" ABOVE TOP OF PIPE.
5. UNSUITABLE SOIL BELOW THE INVERT SHALL BE REMOVED AND REPLACED WITH APPROVED MATERIAL AND SHALL NOT BE USED AS BACKFILL.

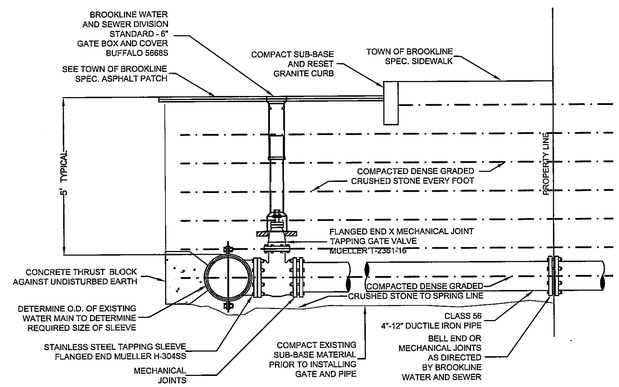
TYPICAL PRECAST DRAIN MANHOLE
SCALE: N.T.S.



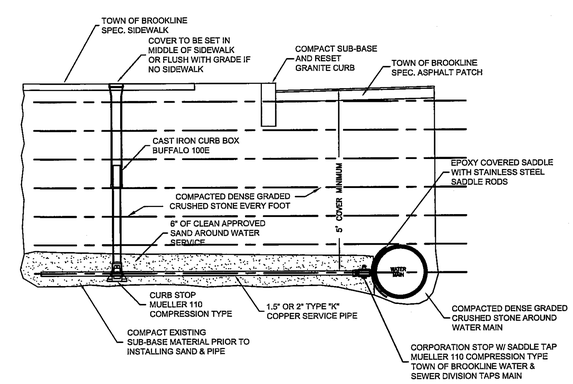
GRANITE CURB INLET
SCALE: N.T.S.



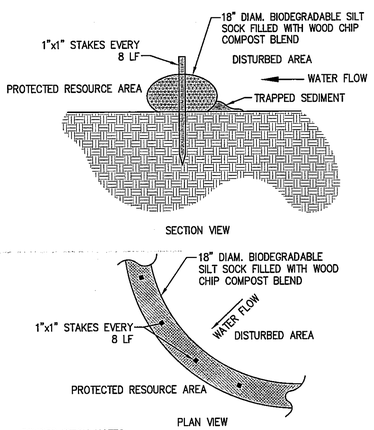
SIGN DETAIL
SCALE: N.T.S.



TAPPING SLEEVE AND GATE VALVE WATER PIPE CONNECTION (BROOKLINE DETAIL W-1)
SCALE: N.T.S.



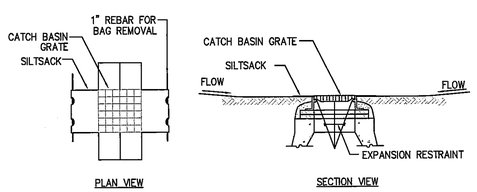
TYPE "K" 1-1/2" & 2" WATER SERVICE CONNECTION (BROOKLINE DETAIL W-4)
SCALE: N.T.S.



CONSTRUCTION NOTES:

1) SILT SOCKS SHALL BE PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING OR LAPPING THE ADJACENT SECTIONS.
2) SILT SOCKS SHALL BE SECURELY ANCHORED IN PLACE BY STAKES OR RE-BARS DRIVEN EVERY 8 LF.
3) INSPECTION SHALL BE FREQUENT, AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS REQUIRED.
4) SILT SOCKS SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS, SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.

SILTSOCK EROSION CONTROL BARRIER DETAIL
SCALE: N.T.S.



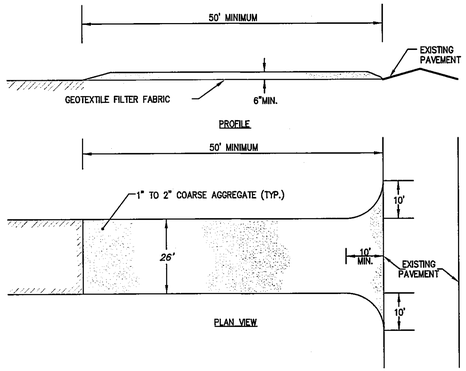
SILT SACK SEDIMENT TRAP CONTRUCTION NOTES:

1. INSTALL SILTSACK IN ALL CATCH BASINS WHERE INDICATED ON THE PLAN BEFORE COMMENCING WORK OR IN PAVED AREAS AFTER BINDER COURSE IS PLACED AND HAY BALES HAVE BEEN REMOVED.
2. GRATE TO BE PLACED OVER SILTSACK.
3. SILTSACK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS AND CLEANING OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED. MAINTAIN UNTIL UPSTREAM AREAS HAVE BEEN PERMANENTLY STABILIZED

SILTSACK SEDIMENT TRAP
SCALE: N.T.S.

CONSTRUCTION SPECIFICATIONS:

1. STONE FOR A STABILIZATION CONSTRUCTION ENTRANCE SHALL BE 1 TO 2 INCH STONE, RECLAIMED STONE.
2. THE LENGTH OF THE STABILIZED ENTRANCE SHALL NOT BE LESS THAN 50 FEET, EXCEPT FOR A SINGLE RESIDENTIAL LOT A 30 FOOT MINIMUM LENGTH WOULD APPLY.
3. THE THICKNESS OF THE STONE FOR THE STABILIZED ENTRANCE SHALL NOT BE LESS THAN 6 INCHES.
4. GEOTEXTILE FILTER CLOTH SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING THE STONE.
5. ALL SURFACE WATER THAT IS FLOWING TO OR DEVERTED TOWARDS THE CONSTRUCTION ENTRANCE SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A BERM WITH 5:1 SLOPES THAT CAN BE CROSSED BY VEHICLES MAY BE SUBSTITUTED FOR THE PIPE.
6. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOPDRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, WASHED, OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED PROMPTLY.



STABILIZED CONSTRUCTION ENTRANCE DETAIL
SCALE: N.T.S.

REV	DATE	DESCRIPTION	BY	APP
1	1	1	1	1

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28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

BROOKLINE SITE PLAN# 2018-XX

DRAWN BY:	SBS
DESIGNED BY:	
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20, 2018
SCALE:	AS NOTED
PROJECT NO.:	218-106

DWG. TITLE:

CONSTRUCTION DETAILS

DWG. NO:

CD-2

M:\MEG\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL – 445 HARVARD\DWGS\SUBMISSIONS\1\218-106 DETAILS.DWG

PRELIMINARY DRAINAGE CALCULATIONS AND STORMWATER MANAGEMENT PLAN

For:

445 HARVARD STREET

Located:

445 HARVARD STREET
(ASSESSOR'S ID 067-09-00)
BROOKLINE, MASSACHUSETTS 02467

Submitted to:

TOWN OF BROOKLINE

Prepared For:

445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

JULY 20, 2018

COMMONWEALTH OF MASSACHUSETTS
BRADLEY C McKENZIE
CIVIL
No. 36917
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TABLE OF CONTENTS

1. NARRATIVE	Page
▪ Project Summary	1
▪ Pre-Development Condition	1
▪ Post-Development Condition	2
▪ Stormwater Best Management Practices (BMP's)	3
▪ Erosion and Sedimentation Control	3
▪ Compliance with Stormwater Management Standards	3
▪ Figure 1 (USGS Locus Map)	7
▪ Figure 2 (FEMA Flood Map)	8
▪ Figure 3 (NRCS Soils Map)	9
▪ Figure 4 (NHESP Map)	10

2. APPENDICES

- APPENDIX A: Pre-Development Condition
- APPENDIX B: Post Development Condition
- APPENDIX C: Checklist for Stormwater Report
- APPENDIX D: Illicit Discharge Compliance Statement
  Supplemental BMP Calculations
- APPENDIX E: Best Management Practices Operation & Maintenance Plans

Preliminary Hydrologic Analysis
Comprehensive Permit Development
445 Harvard Street
Brookline, Massachusetts

Project Summary

The project proponent, 445 Harvard Street Corp proposes to redevelop a 10,115 square foot parcel of land located at 445 Harvard Street in Brookline, Massachusetts. The proposed redevelopment is being permitted under MGL Ch. 40B Comprehensive Permit and will consist of 21 multi-family residential units with 4,370 square feet of retail space available on the first floor. The proposed development will involve the construction of a five (5) story plus one (1) basement level parking building, sidewalks, access drive, utilities, stormwater management structures and other related infrastructure.

The site has frontage on Harvard Street to the southwest and Thorndike Street to the northwest and is shown on the Brookline Assessor's Map as Parcel 067-09-00. The site is otherwise surrounded by developed residential/commercial property as shown on Figure 1 - USGS Locus Map.

The project will access the existing utility infrastructure located on Thorndike Street and Harvard Street, including sanitary sewer, water, gas, electric, telephone, and cable television. Parking areas will be contained within the building and will drain to oil/sediment traps prior to discharge into the municipal sewer system, as required. The stormwater management system will be designed to comply with the Department of Environment Protection's Stormwater Management Regulations to the extent practicable as required under Standards 6 and 7 and will utilize an existing closed drainage system on Thorndike Street and Harvard Street as an overflow connection.

The existing and proposed site conditions are illustrated on the project *site plans* entitled "445 Harvard Street", prepared by McKenzie Engineering Group, Inc. dated July 20, 2018.

This report contains stormwater runoff calculations for the pre-development and post-development conditions and includes the sizing of the proposed low impact drainage system and stormwater best management practices (BMPs). All stormwater management facilities will be designed to mitigate peak rates of runoff, provide renovation of stormwater and meet the requirements of the DEP's Stormwater Management Regulations.

Pre-Development Condition

The property is located within L-1.0 Zoning District. The parcel comprises approximately 10,115 square feet and contains no wetlands and is currently fully developed and is occupied by an existing building and bituminous concrete pavement parking area and is comprised of approximately 97% impervious surfaces.

The existing topography generally ranges in elevation from approximately 63 ft. (in the northeast portion of the site to an elevation of approximately 60 in the southeast portion of the site. The parcel slopes in a westerly direction from its northern boundary towards Thorndike Street and a southerly direction towards Harvard Street.

Review of available environmental databases such as MassGIS reveals that the site is not located within a mapped Natural Heritage Area, a Zone II Groundwater Recharge Area, the Town of Brookline Aquifer Protection District Zone, an Interim Wellhead Protection Area (IWPA), or a Contributing Watershed to Outstanding Resource Water (ORW).

The site is located within Zone X, Area of Minimal Flooding as shown on FEMA Flood Insurance Rate Map Panel No. 25021C0032E (not printed). Refer to Figure 2 – FEMA Flood Map.

The Natural Resources Conservation Service (NRCS) has identified the soil on the site as 628C, Canton – Urban Land Complex, 3 to15% slopes with hydrologic soil group (HSG) B. Refer to Figure 3 - NRCS Soils Map.

The existing watershed analyzed in this report is comprised of approximately 10,113 square feet which includes the subject parcel. The watershed consists of two sub-catchment areas and two (2) Design Points (DP-1) Thorndike Street and (DP-2) Harvard Street. Refer to the Pre-Development Watershed Plan WS-1 in Appendix A for a delineation of drainage subcatchments for the pre-development design condition.

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method-based program "HydroCAD" was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas.

Post-Development Condition

445 Harvard Street is proposed as a 21-unit redevelopment to be permitted in accordance with Massachusetts General Laws 40B § 20-23. The project consists of the construction of a five (5) story plus one (1) basement level parking building, sidewalks, access drive, utilities, stormwater management structures and other related infrastructure. The impervious surfaces have been reduced from 97% to 81%.

The project will access the existing utility infrastructure located on Thorndike Street and Harvard Street, including sanitary sewer, water, gas, electric, telephone, and cable television. Parking areas will be contained within the building and will drain to oil/sediment traps prior to discharge into the municipal sewer system, as required. The stormwater management system will be designed to comply with the Department of Environment Protection's Stormwater Management Regulations to the extent practicable as required under Standards 6 and 7 and will utilize an existing closed drainage system on Thorndike Street and Harvard Street as an overflow connection.

Prior to the development of final engineered site plans, MEG will observe test pits on-site to evaluate the permeability of the soil and to establish seasonal high groundwater elevation. The resultant data will be utilized in the design of the subsurface infiltration system beneath the permeable pavers to which some of the roof runoff will be directed.

Watershed areas were analyzed in the post-development condition to design low impact stormwater management facilities to mitigate impacts resulting from redeveloping the property. The objective in designing the proposed drainage facilities for the project was to maintain existing drainage patterns to the extent practicable and to ensure that the post-development rates of runoff are less than pre-development rates at the design point. Refer to the Post-Development Watershed Plan WS-2 in Appendix B for a delineation of post-development drainage subareas. The design point for the post-development design conditions correspond to those analyzed for the pre-development design condition.

Refer to site plans for the drainage system design. All BMPs shall be supported by a comprehensive Construction Phase Pollution Prevention and Erosion Control Plan and Post-Development BMP Operation and Maintenance Plan.

Low Impact Design Elements

Permeable pavers walkways are being proposed to provide groundwater recharge and to reduce stormwater runoff volume. The storage reservoir will be sized to hold the Required Water Quality or Required Recharge Volume, whichever is larger, using the Static Method, and will be designed to dewater within 72 hours. Refer to the Supplemental Calculations in Appendix D.

Stormwater Best Management Practices (BMP's)

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. The proposed stormwater management system will provide 80% Total Suspended Solids (TSS) removal through the use of permeable pavers. Refer to the TSS Removal Worksheets in Appendix D for TSS removal rates.

Erosion and Sedimentation Controls

Silt sock erosion control barriers will be placed at the limit of work prior to the commencement of any construction activity. The integrity of the silt sock will be maintained by periodic inspection and replacement as necessary. The silt sock will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Riprap outlet protection for the rain garden is proposed to ensure that minimal velocities will be realized before flows are discharged into wetland areas. Refer to the Erosion Control details on the Site Development Plans and BMP Operation and Maintenance Plan for proposed erosion control measures to be employed for the project.

Compliance with Stormwater Management Standards

Standard 1 – No New Untreated Discharges

The proposed redevelopment will not introduce any new untreated discharges to a wetland area or waters of the Commonwealth of Massachusetts.

Standard 2 – Peak Rate Attenuation

In the pre-development and post-development stormwater analysis, the watershed area analyzed was approximately 10,115 SF consisting of the subject parcel to be redeveloped. Refer to Existing Watershed Delineation Plan WS-1 for a delineation of drainage subareas for the pre-development design condition and refer to Post-Development Watershed Delineation Plan WS-2 for a delineation of drainage subareas for the post-development design condition.

Drainage calculations were performed by employing SCS TR-20 methods for the 2, 10, 25, and 100-year Type III storm events. Refer to Appendix A and B for computer results. All drainage structures will be designed employing the Rational Method and the Mass. DPW Design Manual to accommodate peak flows generated by a minimum of a 25-year storm event or a 100-year storm event where applicable. The stormwater management systems were designed to accommodate peak flows generated by a 100-year storm event.

The peak rates of runoff and elevations are as follows:

Table 1 – Pre-Development Results								
	Design Storm							
	2-Year Storm 3.35" of Rainfall		10-Year Storm 4.96" of Rainfall		25-Year Storm 6.20" of Rainfall		100-Year Storm 8.72" of Rainfall	
Design Point	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)
DP-1	1,205	0.35	1,826	0.52	2,304	0.65	3,278	0.91
DP-2	1,370	0.40	2,100	0.60	2,663	0.76	3,810	1.07

Table 2 – Post-Development Results								
	Design Storm							
	2-Year Storm 3.35" of Rainfall		10-Year Storm 4.96" of Rainfall		25-Year Storm 6.20" of Rainfall		100-Year Storm 8.72" of Rainfall	
Design Point	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)
DP-1	519	0.15	809	0.23	1,036	0.30	1,505	0.43
DP-2	1,270	0.37	1,967	0.56	2,513	0.71	3,930	1.03

A comparison of the pre-development and post-development peak rates of runoff indicates that the peak rates and volumes of runoff for the post-development condition will be reduced in comparison to the pre-development condition for all storm events.

Standard 3 – Groundwater Recharge

Runoff will be infiltrated by permeable pavers, which will the meet the Stormwater Guidelines for infiltration:

- Infiltration structures will be a minimum of two (2) feet above seasonal high groundwater.
- Utilize the "Simple Dynamic" method for sizing the storage volume, which takes into account the fact that stormwater is exfiltrating from the infiltration basin at the same time that the basin is filling.
- Hydraulic conductivity are based on soil data from the Geotechnical Report and values developed from Rawls, Brakensiek and Saxton, 1982, Estimation of Soil Water Properties, *Transactions of the American Society of Agricultural Engineers*, vol.25, no. 5.
- Refer to Appendix D for infiltration and drawdown calculations

Groundwater Recharge Volume

	Soil Type	Target Depth Factor (F) (in)	Total Impervious Area (sf)	Required Recharge Volume (cf)[1]	Provided Recharge Volume (cf)[2]
Permeable Pavers	B	0.35	8,241	240	552

1. Required Recharge Volume = Target Depth Factor x Impervious Area / (d+Kt) [Simple dynamic method]

(Refer to supplemental calculations in Appendix D)

2. Provided Recharge Volume = Volume Provided from Bottom of System to invert.

The permeable pavers storage layer has been designed to store and infiltrate 383 cubic feet of runoff and completely drain within 72 hours. The drawdown analysis is based on the required recharge volume exfiltrating at the Rawls Rates based on the soil textural analysis at the proposed exfiltration location. Refer to Appendix D for calculations.

Standard 4 – Water Quality

The total required water quality treatment volume was calculated to be 343 cubic feet. The half-inch rule has been applied to the water quality volume calculations. The water quality treatment volume will be provided within the permeable paver storage layer.

Water Quality Volume Required vs. Volume Provided

Permeable Pavers	Impervious Contributing Area (ft^2)	Required Water Quality Volume[1] (ft^3)	Provided Water Quality Volume (ft^3)
PP-1	8,241	343	552

1. Required Water Quality Volume = Impervious Area (sq.ft) x (0.5”/1 acre) x (1ft/12”)

The permeable paver storage layer will provide both water quality treatment and recharge. Per Standard 4, Water Quality, the BMP must be sized to treat or hold the Target Volume, the larger of the Required Water Quality Volume and the Required Recharge Volume. The Required Water Quality Volume is based on the half-inch of runoff and the Required Recharge Volume is based on 0.34-inches (Soil Type B); 0.50 inches if greater than 0.35 inches, therefore the Target Volume is the Required Recharge Volume of 343 cubic feet. Refer to Appendix D supplemental calculations.

The majority of the runoff generated at the site will be in the form of roof water runoff which does not require treatment for TSS. The use of permeable pavers for the walkways will provide 80% Total Suspended Solids (TSS). Refer to Appendix D for TSS Removal Calculation Worksheets.

The Long-Term Pollution Prevention Plan has been incorporated into the Post-Development Operation and Maintenance Plan. Refer to Appendix E for BMP Operation and Maintenance Plans.

Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPL)

The proposed project does not include land uses with higher potential pollutant loads. Not Applicable.

Standard 6 – Critical Areas

The proposed project does not discharge to any critical areas. Not Applicable.

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

The proposed project is a redevelopment project. The site will be designed to comply with the Stormwater Management Regulations to the extent practicable as required for a redevelopment project.

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

The project will require a NPDES Construction General Permit but the Stormwater Pollution Prevention Plan (SWPPP) has not been submitted. The SWPPP will be submitted prior to any proposed construction. A Construction Phase BMP Operation and Maintenance Plan will be provided as a basis for the SWPPP during final design.

Standard 9 – Operation and Maintenance Plan

The Post Construction Operation and Maintenance Plan has been developed for the Stormwater Management System. Refer to Appendix E.

Standard 10 – Prohibition of Illicit Discharges

No illicit discharges are anticipated on site. An Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction best management practices. Measures to prevent illicit discharges will be included in the Long-Term Pollution Prevention Plan.

FIGURE - 1

0 500' 1000' 1250'

U.S. GEOLOGICAL SURVEY
7.5 ▯ ▯5 MINUTE SERIES

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Norwell, MA 02061
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USGS LOCUS MAP

445 HARVARD STREET
PARCEL ID ▯067-0▯-00
BROOKLINE, MASSACHUSETTS

FIGURE - 2

0 1000' 2000' 2500'

COMMUNITY PANEL NO: 2502□C020□E

E□□ECTIVE DATE: □ULY □7, 20□2

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FEMA FLOOD MAP

445 HARVARD STREET
PARCEL ID □067-0□-00
BROOKLINE, MASSACHUSETTS

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
628C	CANTON–URBAN LAND COMPLEX, 3% TO 15% SLOPES	B

FIGURE - 3

0 250' 500' 625'

NRCS SOIL SURVEY
NOR□OLK □ SU□□OLK COUNTY

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NRCS SOILS MAP

445 HARVARD STREET
PARCEL ID □067-0□-00
BROOKLINE, MASSACHUSETTS

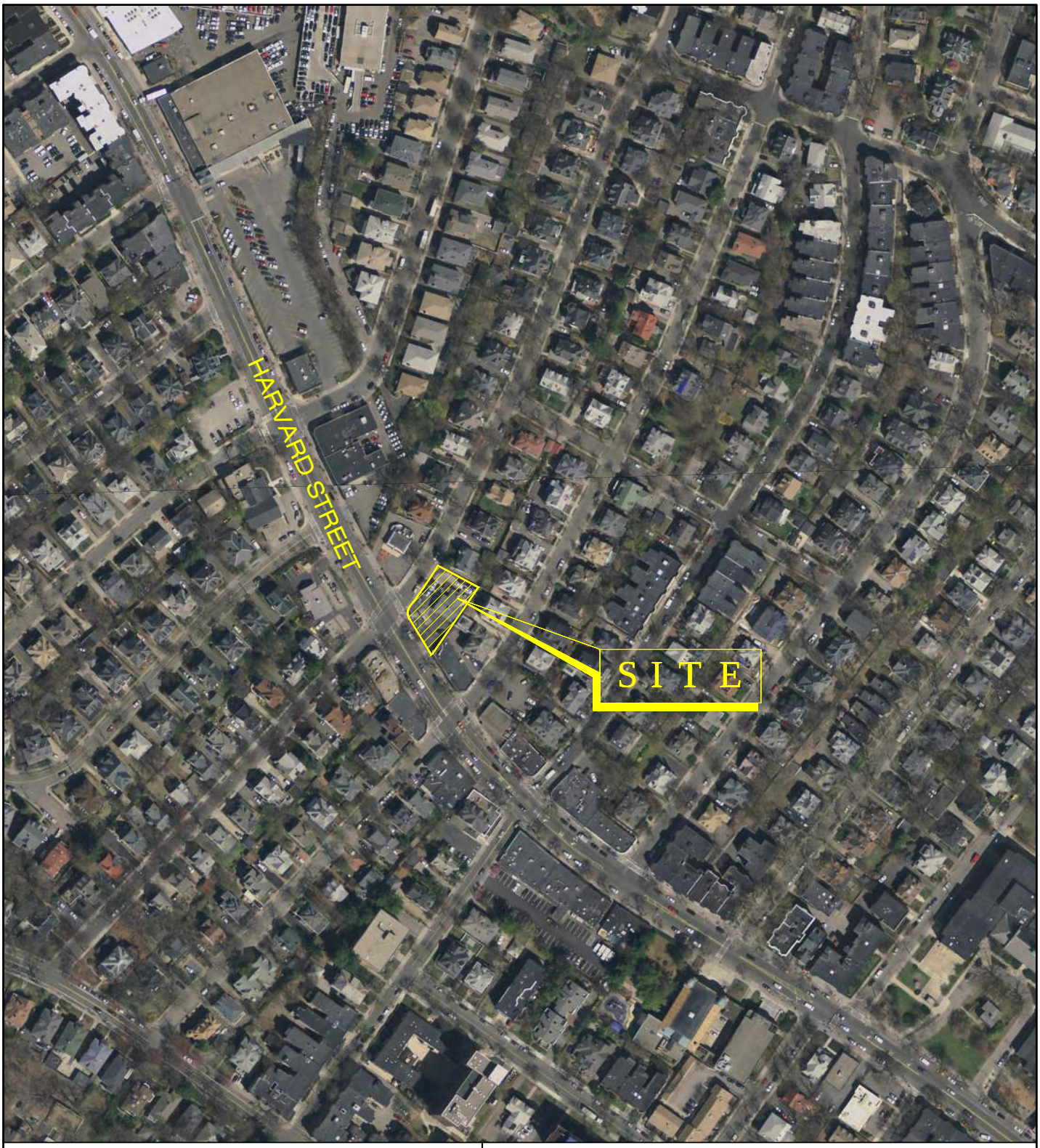

FIGURE - 4

0 250' 500' 625'

□4TH EDITION MASSACHUSETTS
NATURAL HERITAGE ATLAS

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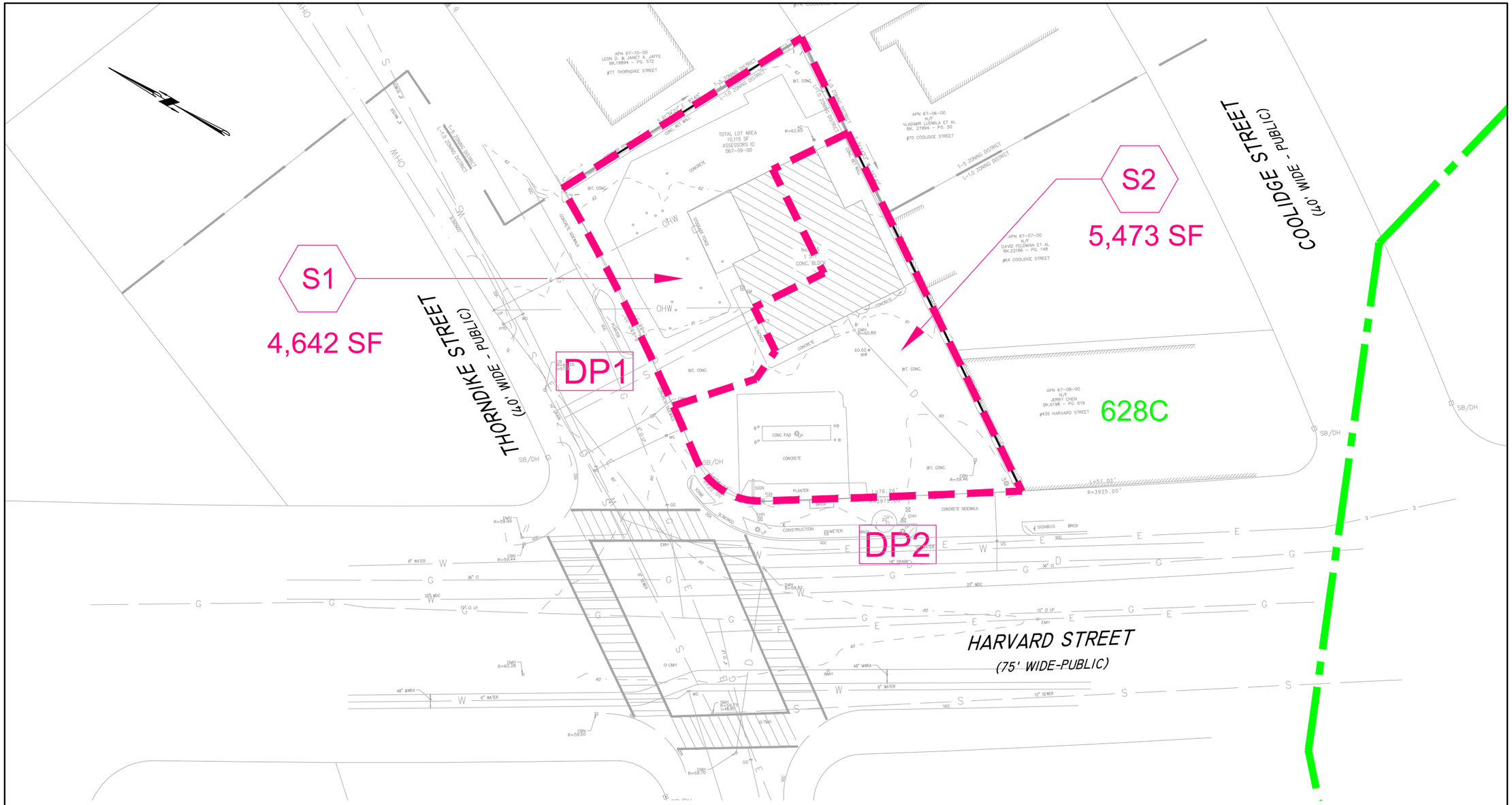
NATURAL HERITAGE & ENDANGERED SPECIES MAP

445 HARVARD STREET
PARCEL ID □067-0□-00
BROOKLINE, MASSACHUSETTS

A P P E N D I X A

Pre-Development Condition



LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
628C	CANTON-URBAN LAND COMPLEX, 3 TO 15% SLOPES	B

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REV	DATE	DESCRIPTION	BY	APP

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www.mckeng.com

445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL ENGINEER:

OWNER/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

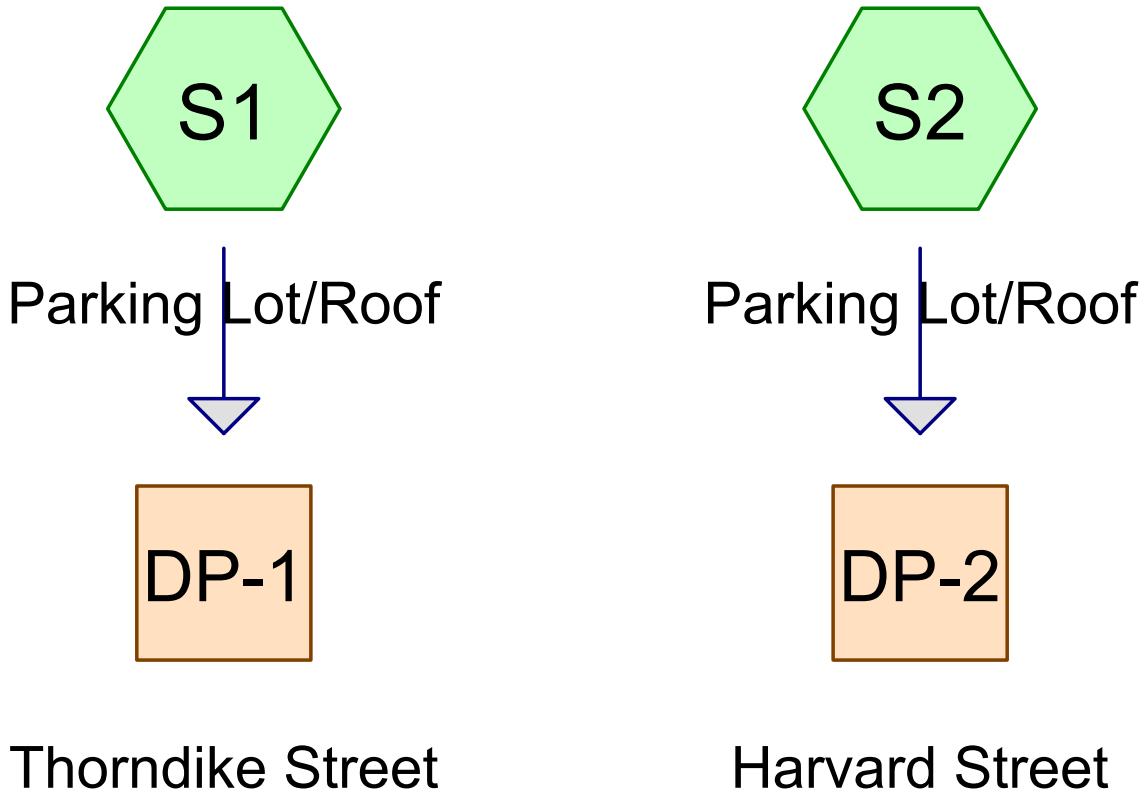
PERMIT PLAN SET

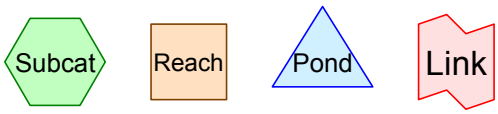
DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20 2018
SCALE:	1"=30'
PROJECT NO.:	218-106

DWG. TITLE:
Pre-Dev. Watershed Plan

DWG. No:
WS-1

M:\MES\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL - 445 HARVARD\DWGS\SUBMISSIONS\1\218-106 WS-1.DWG





Routing Diagram for 218-106 Existing
Prepared by McKenzie Engineering Group, Inc.
HydroCAD® 10.00-21 s/n 00452 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
276	61	>75% Grass cover, Good, HSG B (S1, S2)
7,581	98	Paved parking, HSG B (S1, S2)
218	98	Retaining wall, HSG B (S1, S2)
2,040	98	Roofs, HSG B (S1, S2)
10,115	**97**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,115	HSG B	S1, S2
0	HSG C	
0	HSG D	
0	Other	
10,115		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	276	0	0	0	276	>75% Grass cover, Good	
0	7,581	0	0	0	7,581	Paved parking	
0	218	0	0	0	218	Retaining wall	
0	2,040	0	0	0	2,040	Roofs	
0	**10,115**	**0**	**0**	**0**	**10,115**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,642 sf 98.79% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=98 Runoff=0.35 cfs 1,205 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=97 Runoff=0.40 cfs 1,370 cf

Reach DP-1: Thorndike Street Inflow=0.35 cfs 1,205 cf
Outflow=0.35 cfs 1,205 cf

Reach DP-2: Harvard Street Inflow=0.40 cfs 1,370 cf
Outflow=0.40 cfs 1,370 cf

Total Runoff Area = 10,115 sf Runoff Volume = 2,574 cf Average Runoff Depth = 3.05"
2.73% Pervious = 276 sf 97.27% Impervious = 9,839 sf

Summary for Subcatchment S1: Parking Lot/Roof

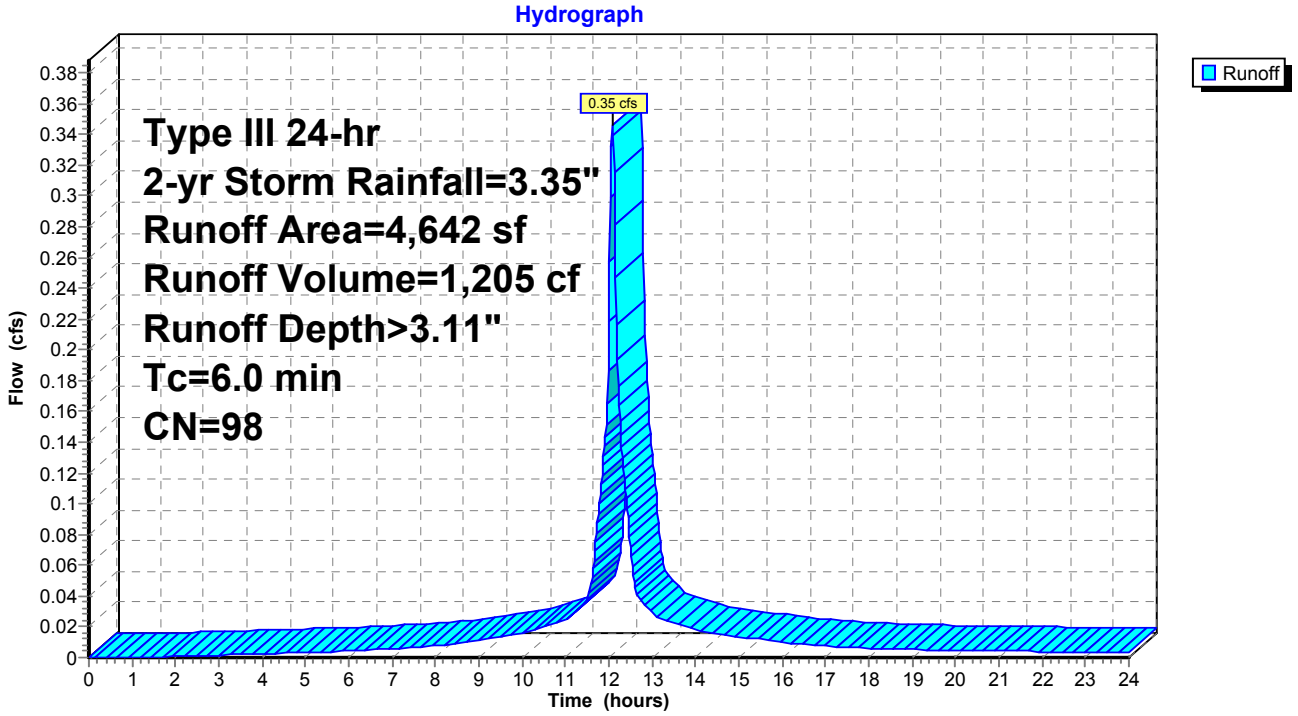
Runoff = 0.35 cfs @ 12.08 hrs, Volume= 1,205 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,884	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,642	98	Weighted Average
	56		1.21% Pervious Area
	4,586		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

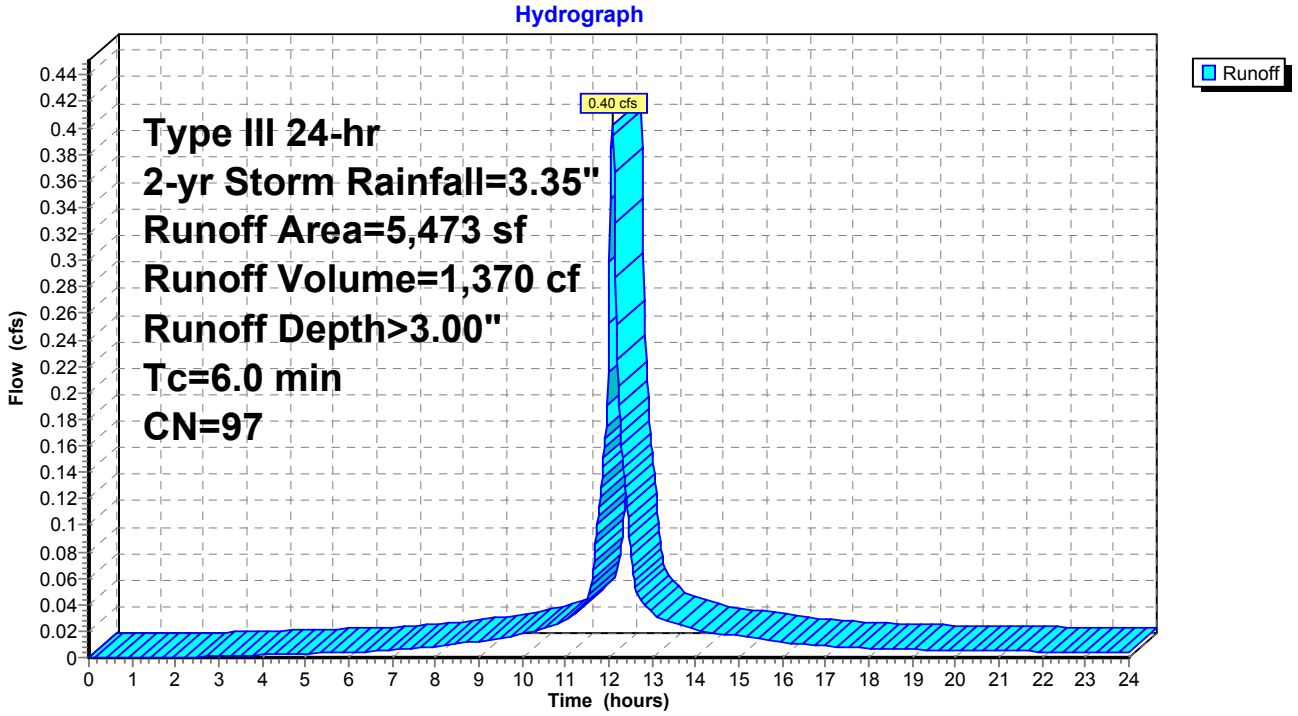
Runoff = 0.40 cfs @ 12.08 hrs, Volume= 1,370 cf, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof



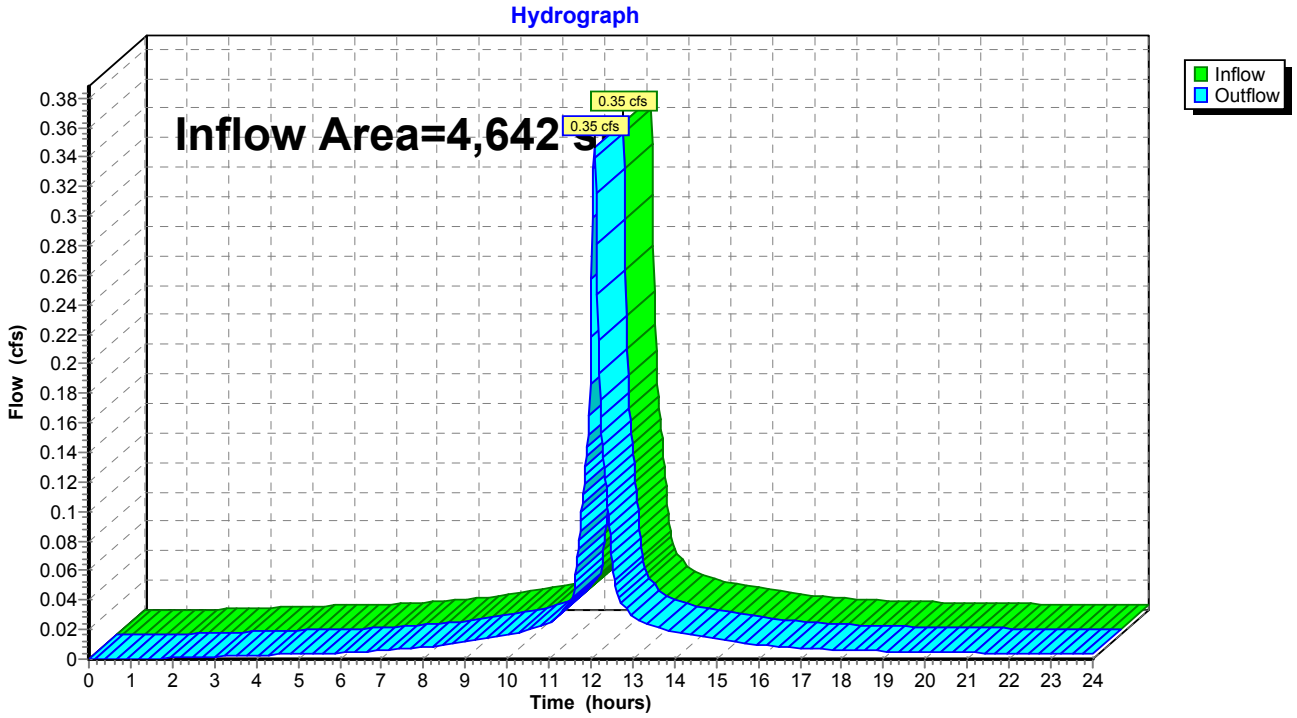
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 4,642 sf, 98.79% Impervious, Inflow Depth > 3.11" for 2-yr Storm event
Inflow = 0.35 cfs @ 12.08 hrs, Volume= 1,205 cf
Outflow = 0.35 cfs @ 12.08 hrs, Volume= 1,205 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



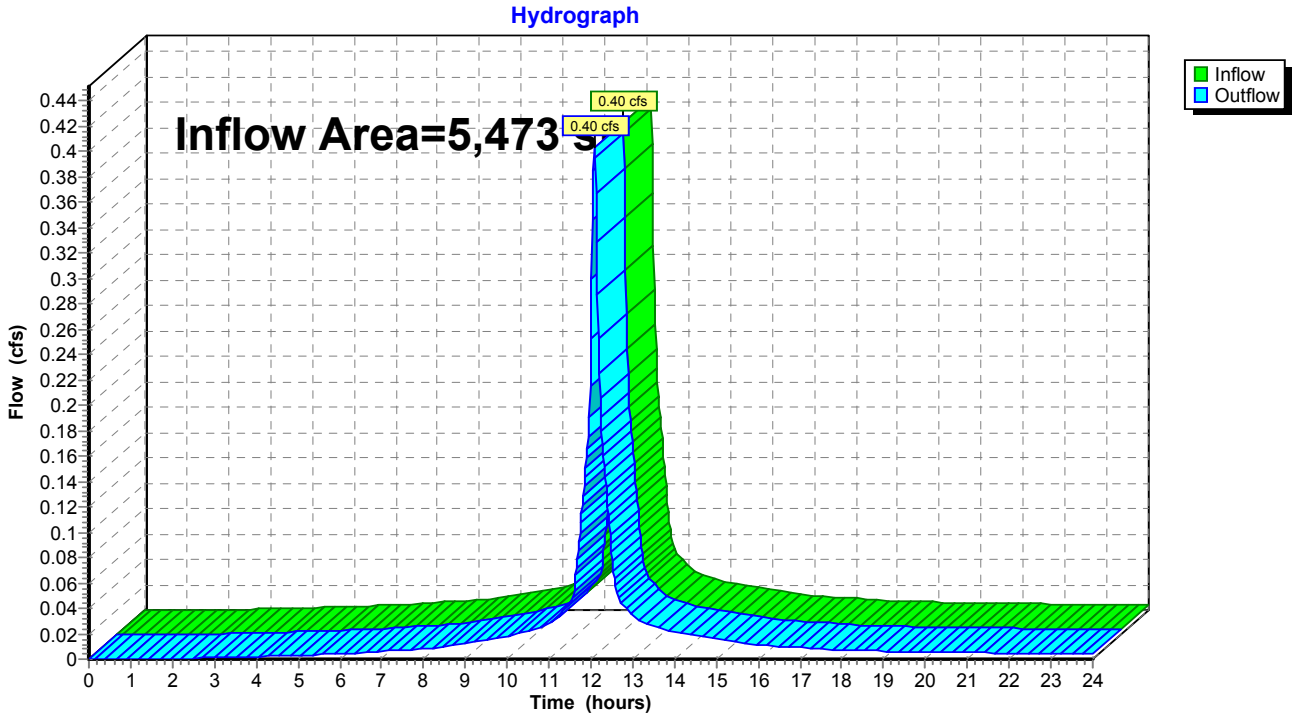
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 3.00" for 2-yr Storm event
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 1,370 cf
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 1,370 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,642 sf 98.79% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=98 Runoff=0.52 cfs 1,826 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>4.60"
Tc=6.0 min CN=97 Runoff=0.60 cfs 2,100 cf

Reach DP-1: Thorndike Street Inflow=0.52 cfs 1,826 cf
Outflow=0.52 cfs 1,826 cf

Reach DP-2: Harvard Street Inflow=0.60 cfs 2,100 cf
Outflow=0.60 cfs 2,100 cf

Total Runoff Area = 10,115 sf Runoff Volume = 3,925 cf Average Runoff Depth = 4.66"
2.73% Pervious = 276 sf 97.27% Impervious = 9,839 sf

Summary for Subcatchment S1: Parking Lot/Roof

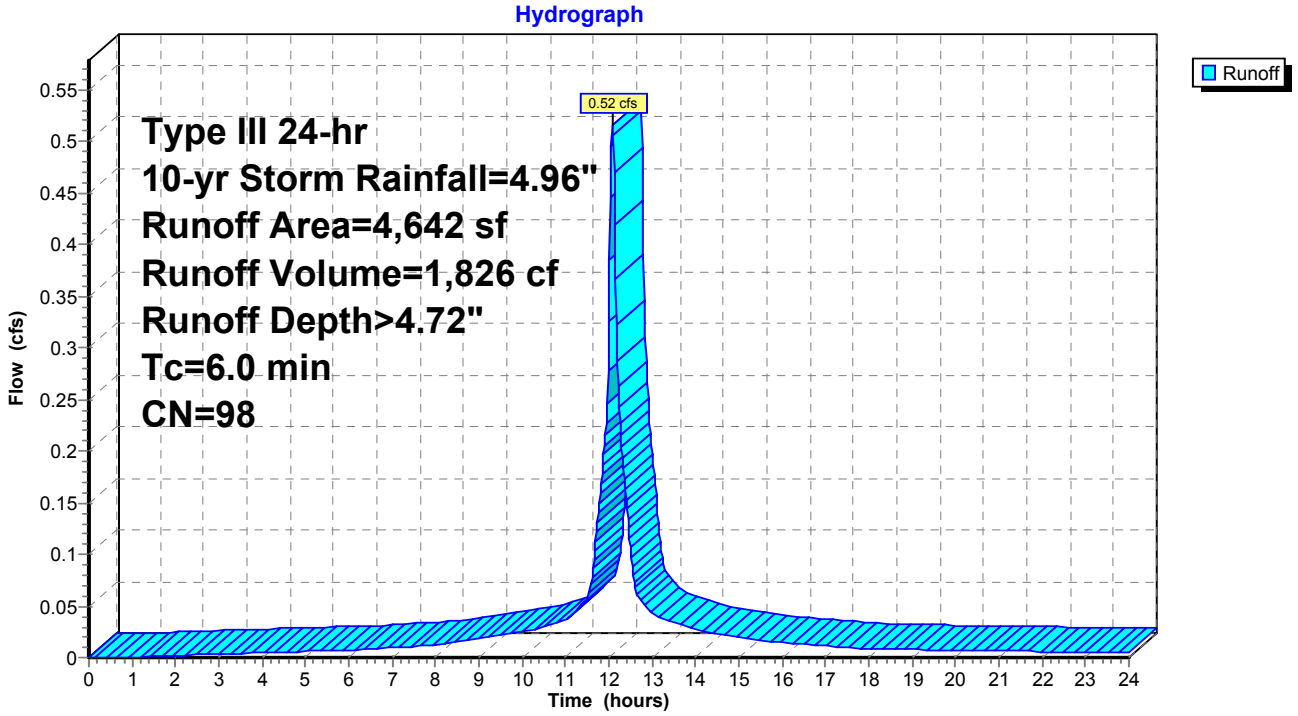
Runoff = 0.52 cfs @ 12.08 hrs, Volume= 1,826 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,884	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,642	98	Weighted Average
	56		1.21% Pervious Area
	4,586		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

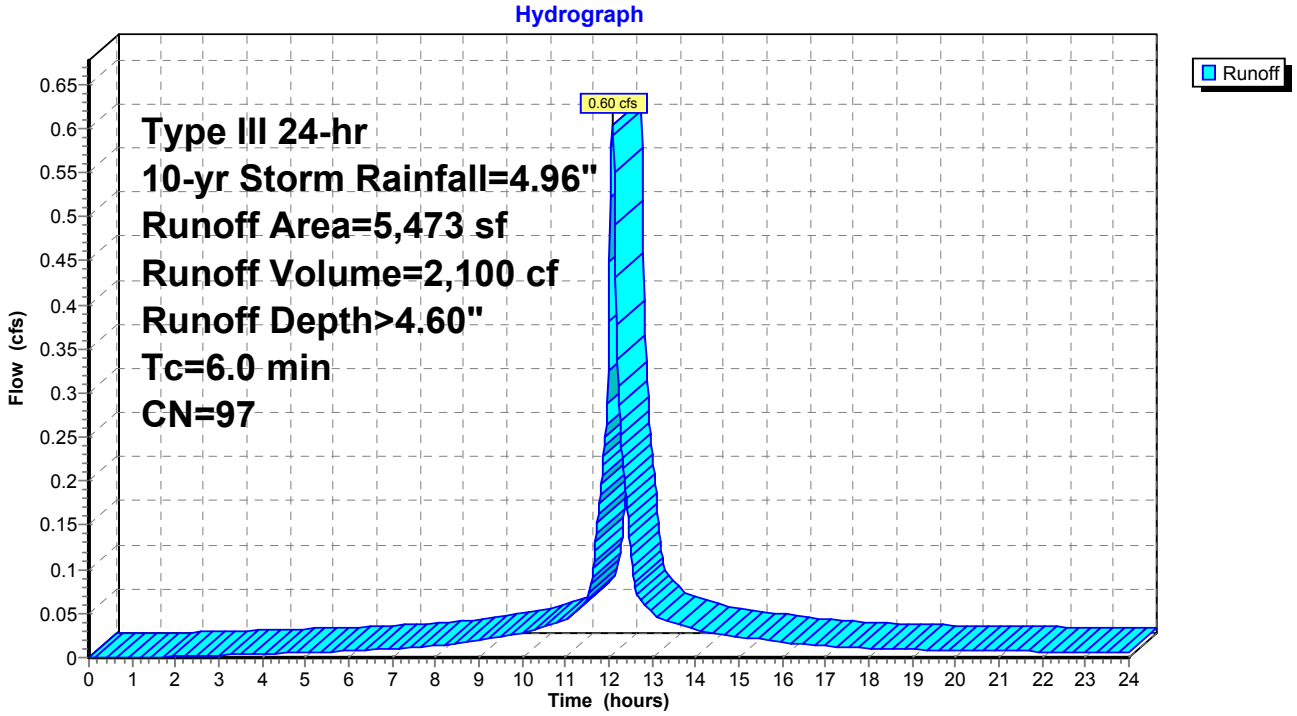
Runoff = 0.60 cfs @ 12.08 hrs, Volume= 2,100 cf, Depth> 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof



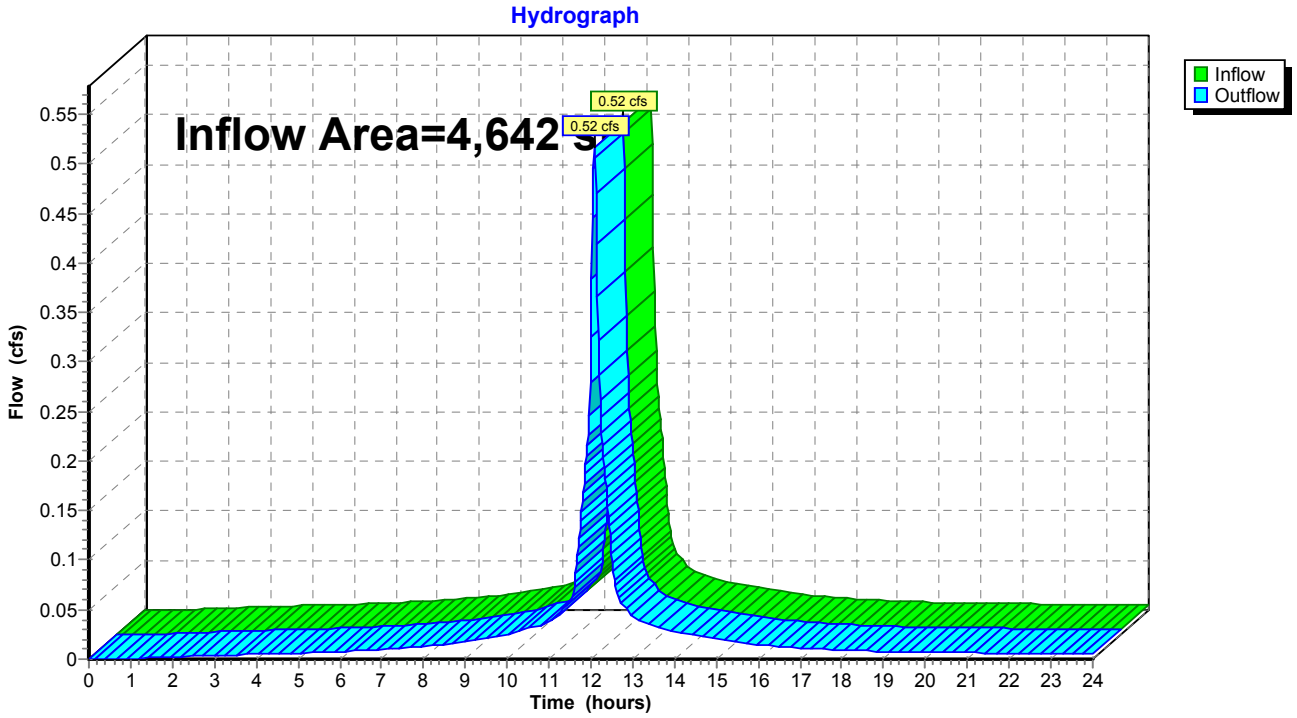
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 4,642 sf, 98.79% Impervious, Inflow Depth > 4.72" for 10-yr Storm event
Inflow = 0.52 cfs @ 12.08 hrs, Volume= 1,826 cf
Outflow = 0.52 cfs @ 12.08 hrs, Volume= 1,826 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



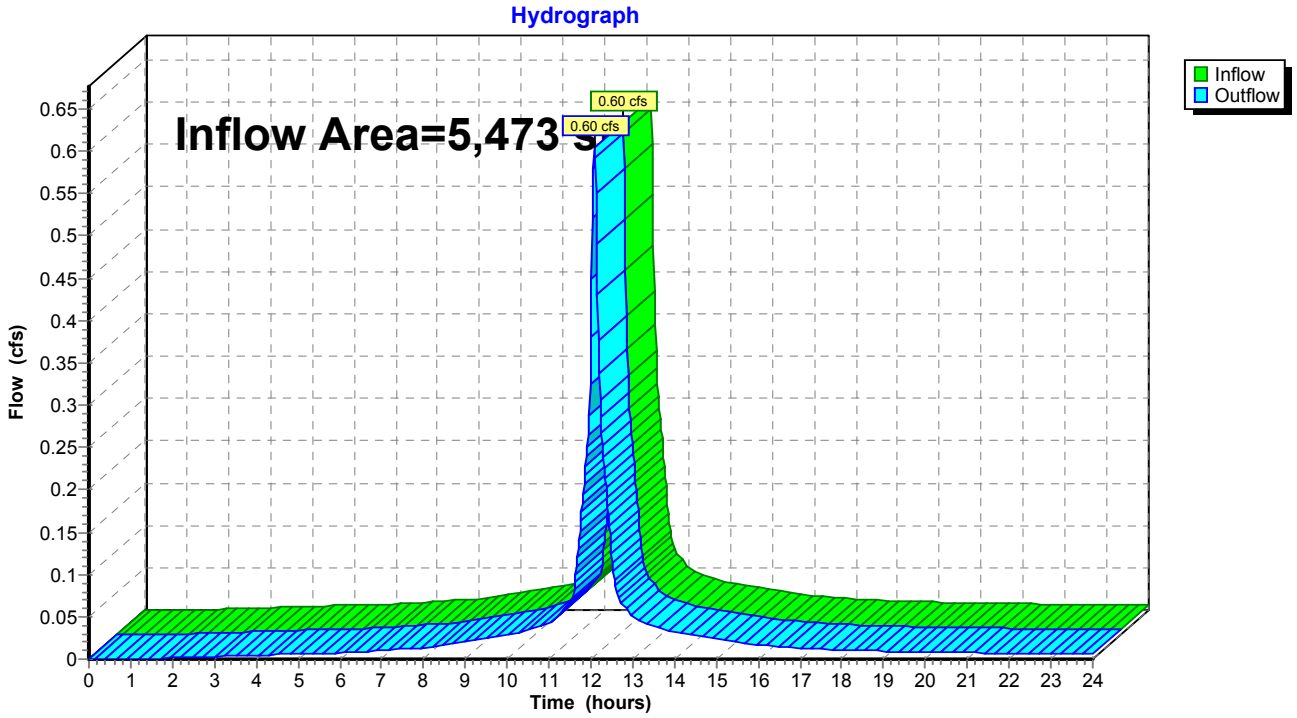
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 4.60" for 10-yr Storm event
Inflow = 0.60 cfs @ 12.08 hrs, Volume= 2,100 cf
Outflow = 0.60 cfs @ 12.08 hrs, Volume= 2,100 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,642 sf 98.79% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=98 Runoff=0.65 cfs 2,304 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>5.84"
Tc=6.0 min CN=97 Runoff=0.76 cfs 2,663 cf

Reach DP-1: Thorndike Street Inflow=0.65 cfs 2,304 cf
Outflow=0.65 cfs 2,304 cf

Reach DP-2: Harvard Street Inflow=0.76 cfs 2,663 cf
Outflow=0.76 cfs 2,663 cf

Total Runoff Area = 10,115 sf Runoff Volume = 4,968 cf Average Runoff Depth = 5.89"
2.73% Pervious = 276 sf 97.27% Impervious = 9,839 sf

Summary for Subcatchment S1: Parking Lot/Roof

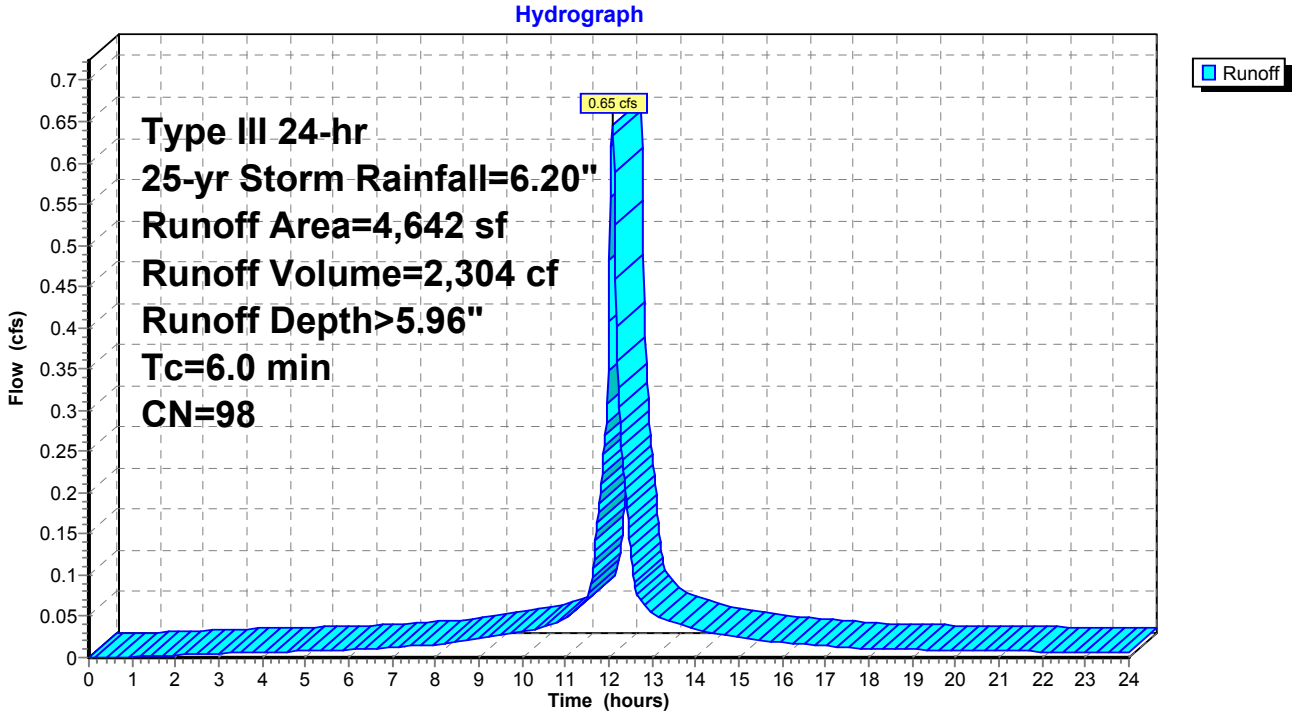
Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,304 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,884	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,642	98	Weighted Average
	56		1.21% Pervious Area
	4,586		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

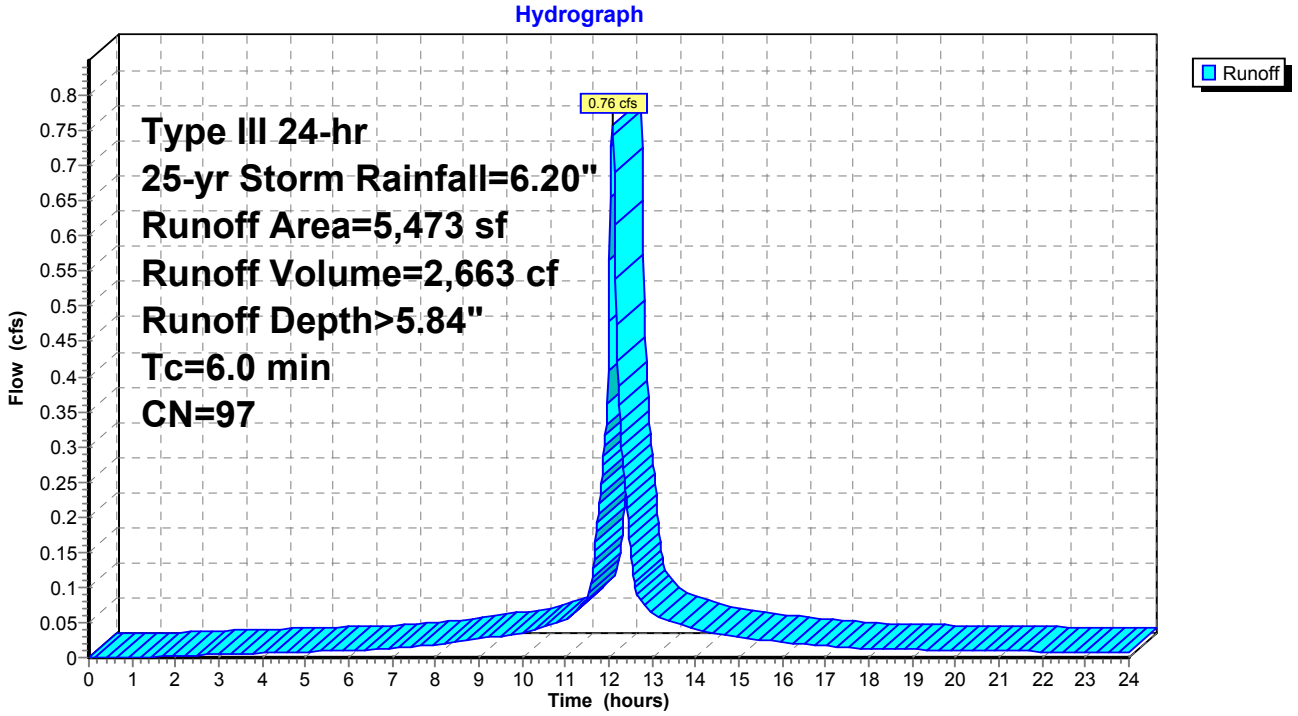
Runoff = 0.76 cfs @ 12.08 hrs, Volume= 2,663 cf, Depth> 5.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof



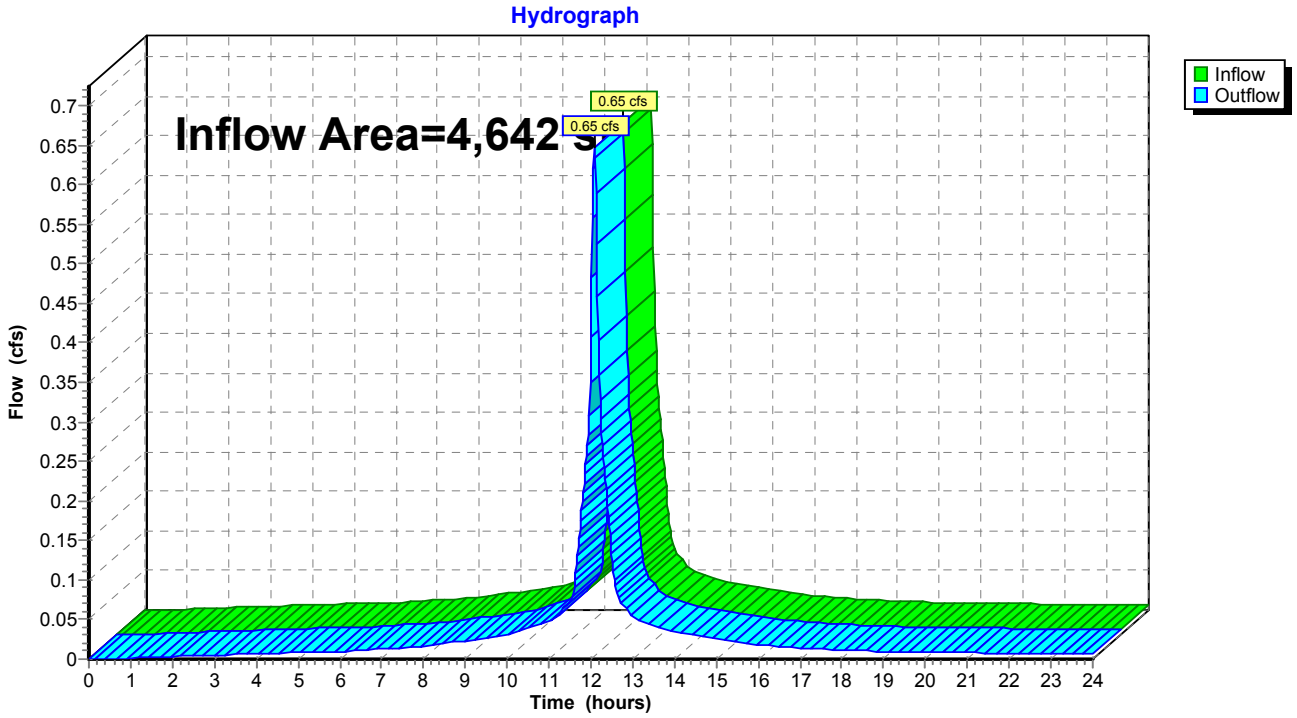
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 4,642 sf, 98.79% Impervious, Inflow Depth > 5.96" for 25-yr Storm event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 2,304 cf
Outflow = 0.65 cfs @ 12.08 hrs, Volume= 2,304 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



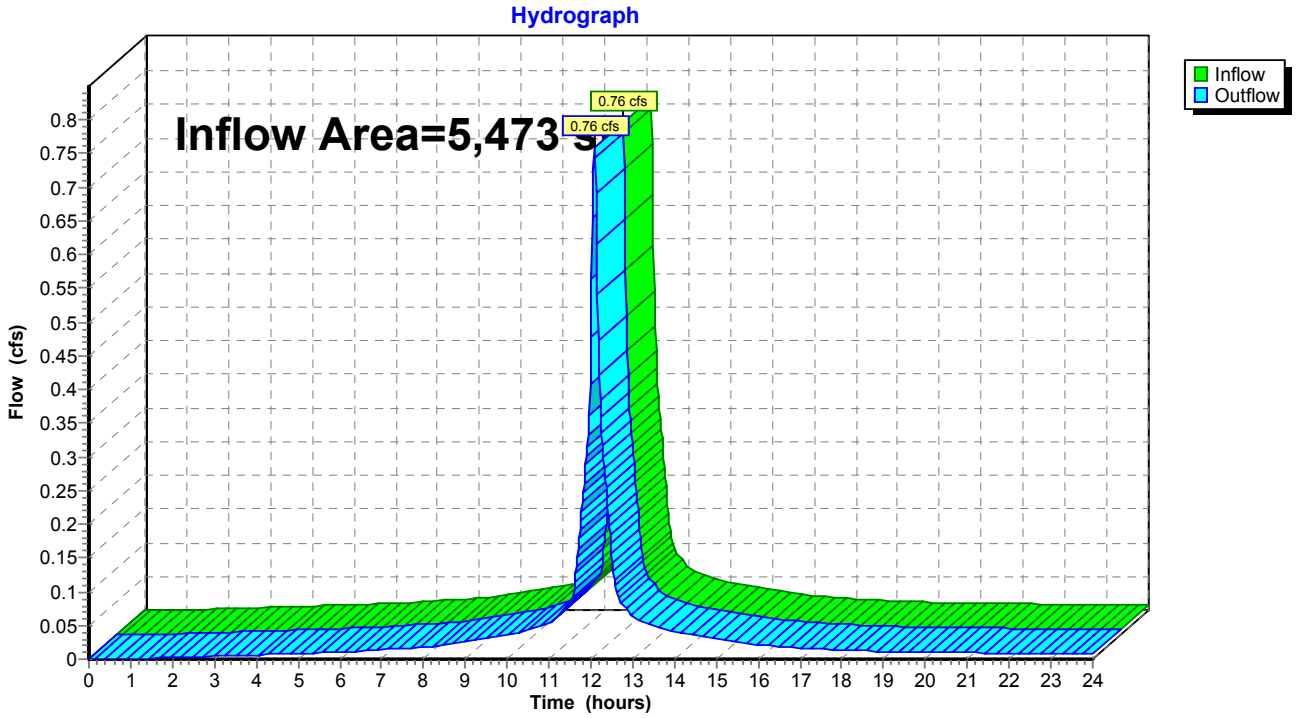
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 5.84" for 25-yr Storm event
Inflow = 0.76 cfs @ 12.08 hrs, Volume= 2,663 cf
Outflow = 0.76 cfs @ 12.08 hrs, Volume= 2,663 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,642 sf 98.79% Impervious Runoff Depth>8.47"
Tc=6.0 min CN=98 Runoff=0.91 cfs 3,278 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>8.35"
Tc=6.0 min CN=97 Runoff=1.07 cfs 3,810 cf

Reach DP-1: Thorndike Street Inflow=0.91 cfs 3,278 cf
Outflow=0.91 cfs 3,278 cf

Reach DP-2: Harvard Street Inflow=1.07 cfs 3,810 cf
Outflow=1.07 cfs 3,810 cf

Total Runoff Area = 10,115 sf Runoff Volume = 7,088 cf Average Runoff Depth = 8.41"
2.73% Pervious = 276 sf 97.27% Impervious = 9,839 sf

Summary for Subcatchment S1: Parking Lot/Roof

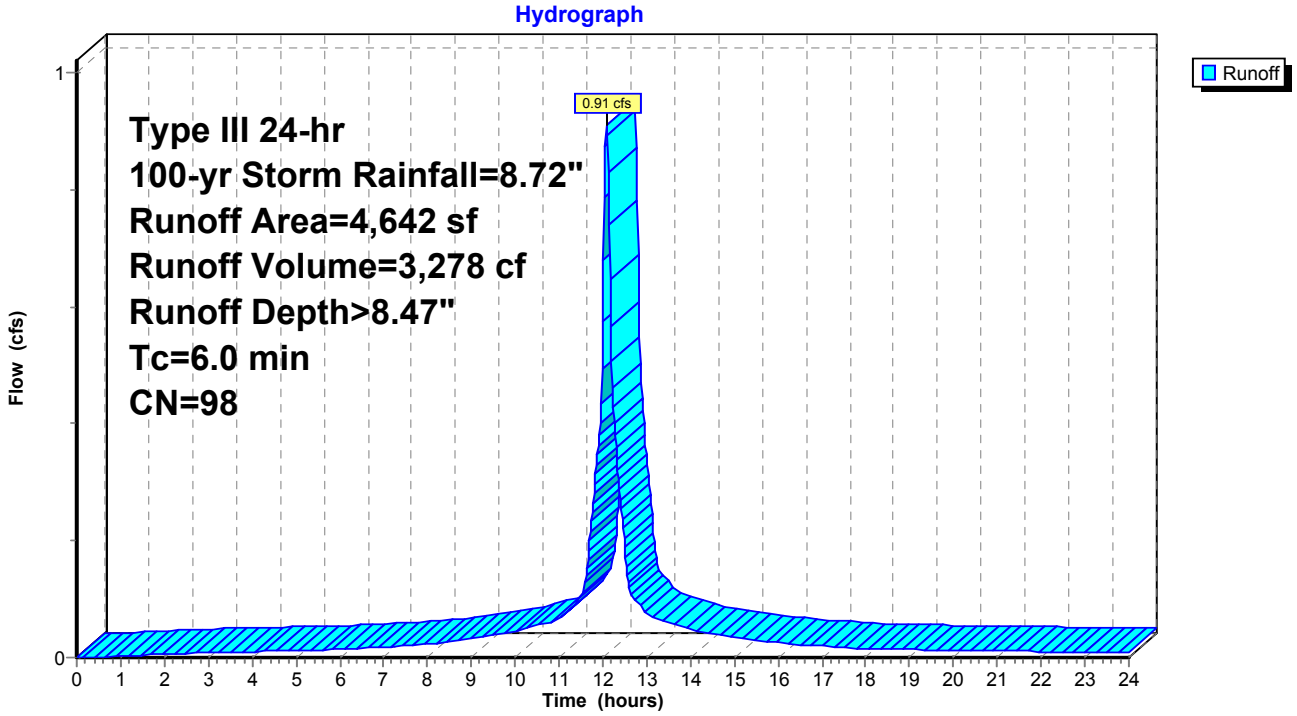
Runoff = 0.91 cfs @ 12.08 hrs, Volume= 3,278 cf, Depth> 8.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,884	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,642	98	Weighted Average
	56		1.21% Pervious Area
	4,586		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

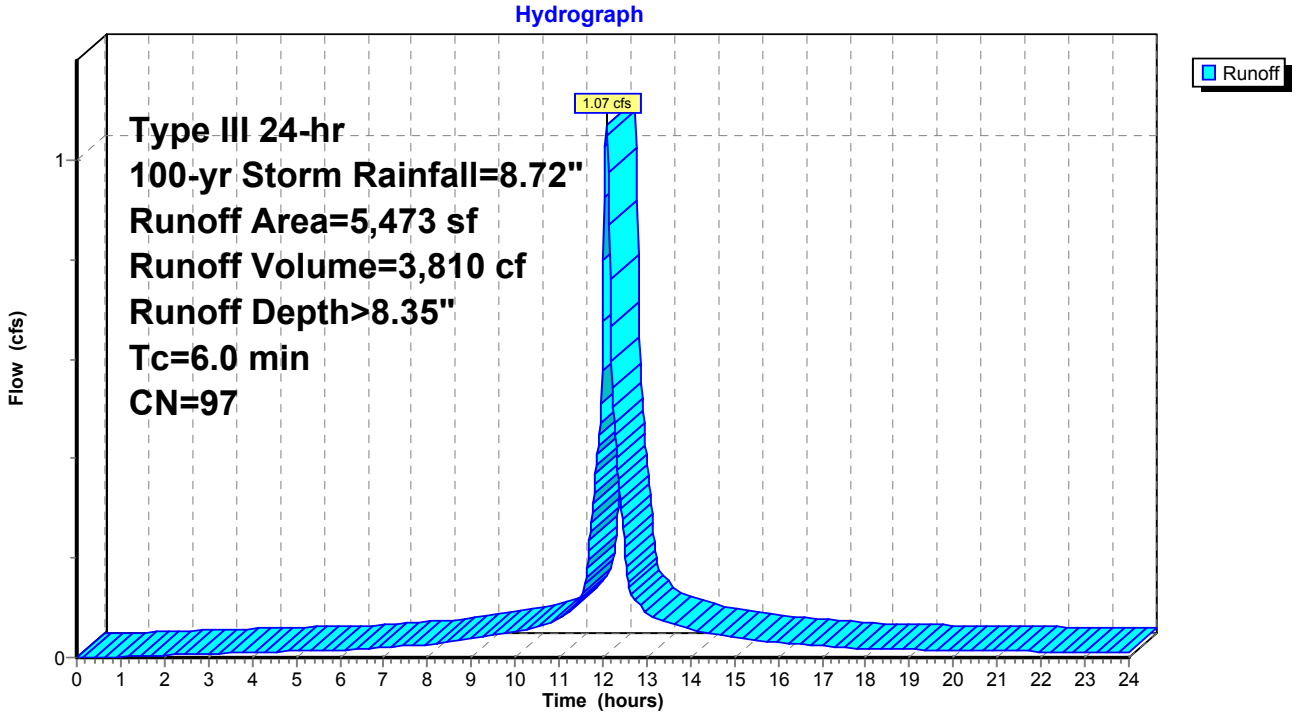
Runoff = 1.07 cfs @ 12.08 hrs, Volume= 3,810 cf, Depth> 8.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof



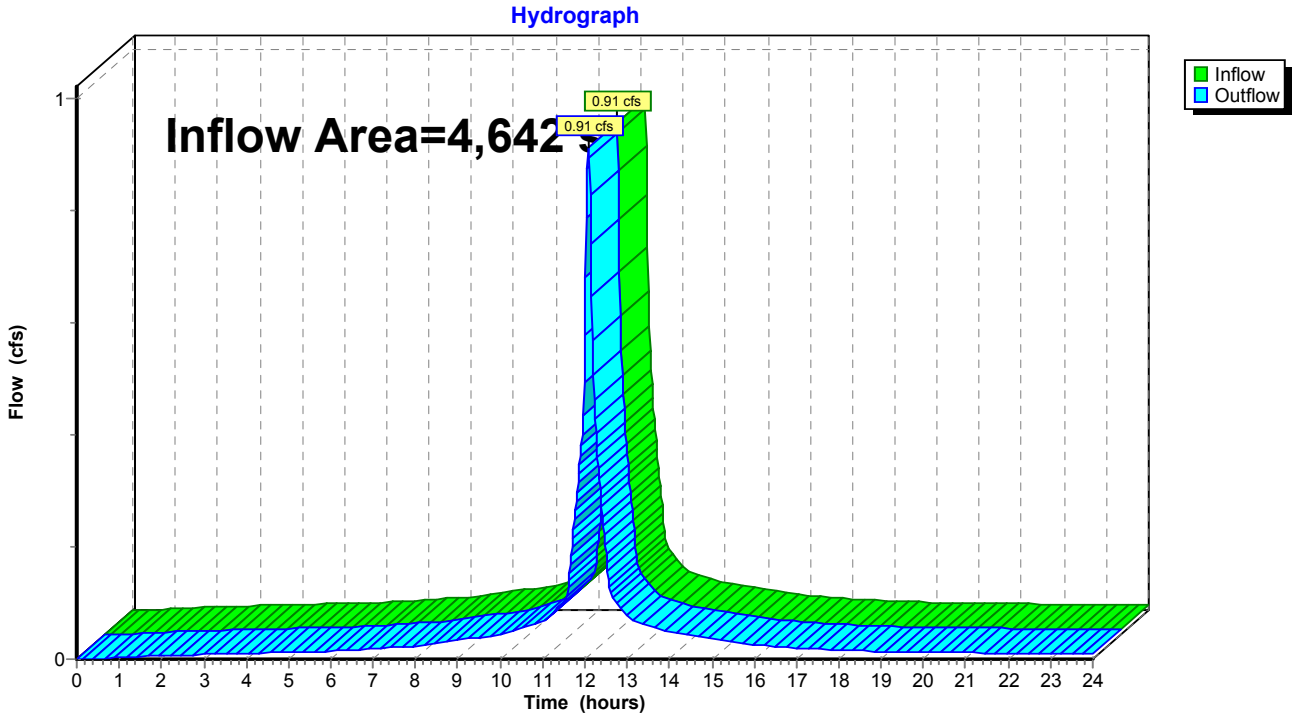
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 4,642 sf, 98.79% Impervious, Inflow Depth > 8.47" for 100-yr Storm event
Inflow = 0.91 cfs @ 12.08 hrs, Volume= 3,278 cf
Outflow = 0.91 cfs @ 12.08 hrs, Volume= 3,278 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



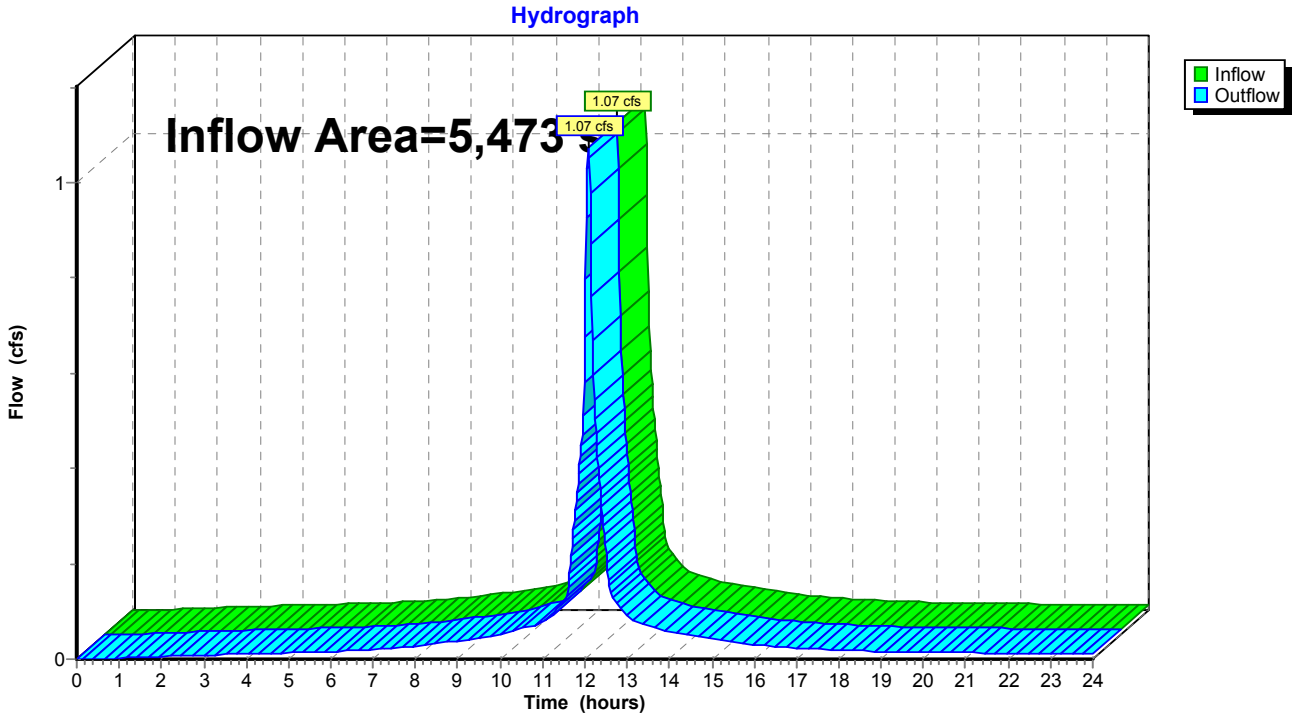
Summary for Reach DP-2: Harvard Street

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

Inflow Area =	5,473 sf,	95.98% Impervious,	Inflow Depth >	8.35"	for 100-yr Storm event
Inflow =	1.07 cfs @	12.08 hrs,	Volume=	3,810 cf	
Outflow =	1.07 cfs @	12.08 hrs,	Volume=	3,810 cf,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



A P P E N D I X B

Post-Development Condition

S1-R
1,866 SF

S1
431 SF

S3
2,342 SF

S2
824 SF

S2-R
4,652 SF
628C

DP1

DP2

THORNDIKE STREET
(40' WIDE - PUBLIC)

COOLIDGE STREET
(40' WIDE - PUBLIC)

HARVARD STREET
(75' WIDE-PUBLIC)

0' 30' 60' 90'

LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
628C	CANTON-URBAN LAND COMPLEX, 3 TO 15% SLOPES	B

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REV	DATE	DESCRIPTION	BY	APP

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
Ph: 781-792-3900
www.mckeng.com

445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL ENGINEER:

PERMIT PLAN SET

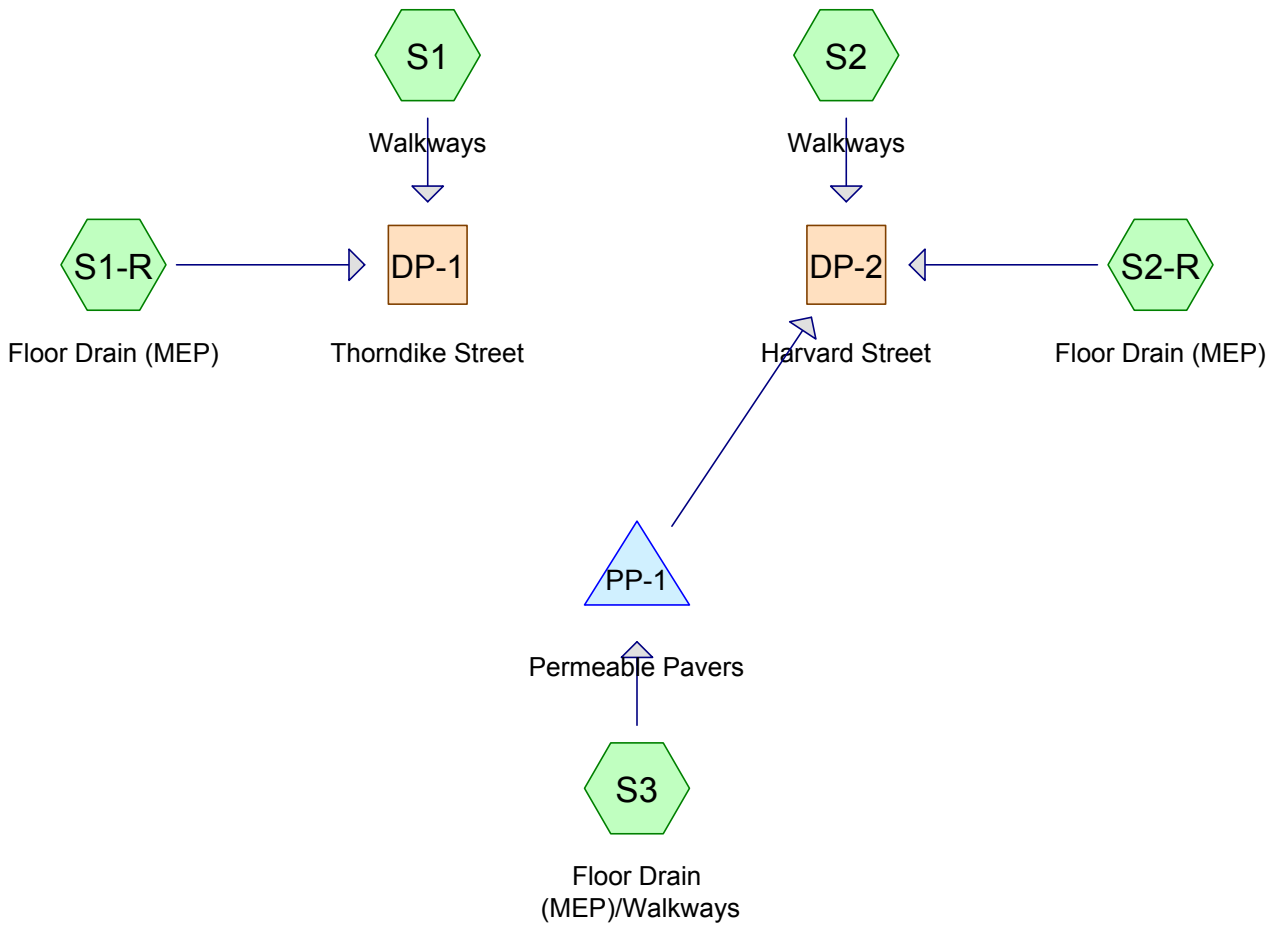
OWNER/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

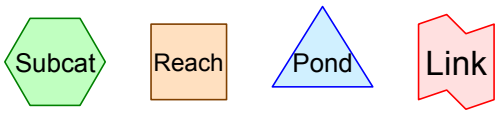
DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20, 2018
SCALE:	1"=30'
PROJECT NO.:	218-106

DWG. TITLE:
Post-Dev. Watershed Plan

DWG. No: WS-2

M:\MEG\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL - 445 HARVARD\DWGS\SUBMISSIONS\1\218-106 WS-2.DWG





Routing Diagram for 218-106 Proposed-2
Prepared by McKenzie Engineering Group, Inc.
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
338	61	>75% Grass cover, Good, HSG B (S3)
225	98	Conc walks, HSG B (S1, S2)
1,534	64	Permeable pavers, HSG B (S1, S2, S3)
8,018	98	Roofs, HSG B (S1-R, S2-R, S3)
10,115	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,115	HSG B	S1, S1-R, S2, S2-R, S3
0	HSG C	
0	HSG D	
0	Other	
10,115		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	338	0	0	0	338	>75% Grass cover, Good	
0	225	0	0	0	225	Conc walks	
0	1,534	0	0	0	1,534	Permeable pavers	
0	8,018	0	0	0	8,018	Roofs	
0	**10,115**	**0**	**0**	**0**	**10,115**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	PP-1	60.50	56.30	88.5	0.0475	0.013	4.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=431 sf 21.11% Impervious Runoff Depth>0.97"
Tc=6.0 min CN=71 Runoff=0.01 cfs 35 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=98 Runoff=0.14 cfs 484 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>0.92"
Tc=6.0 min CN=70 Runoff=0.02 cfs 63 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=98 Runoff=0.35 cfs 1,207 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>1.88"
Tc=6.0 min CN=85 Runoff=0.12 cfs 368 cf

Reach DP-1: Thorndike Street Inflow=0.15 cfs 519 cf
Outflow=0.15 cfs 519 cf

Reach DP-2: Harvard Street Inflow=0.37 cfs 1,270 cf
Outflow=0.37 cfs 1,270 cf

Pond PP-1: Permeable Pavers Peak Elev=58.67' Storage=136 cf Inflow=0.12 cfs 368 cf
Discarded=0.01 cfs 368 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 368 cf

Total Runoff Area = 10,115 sf Runoff Volume = 2,157 cf Average Runoff Depth = 2.56"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,243 sf

Summary for Subcatchment S1: Walkways

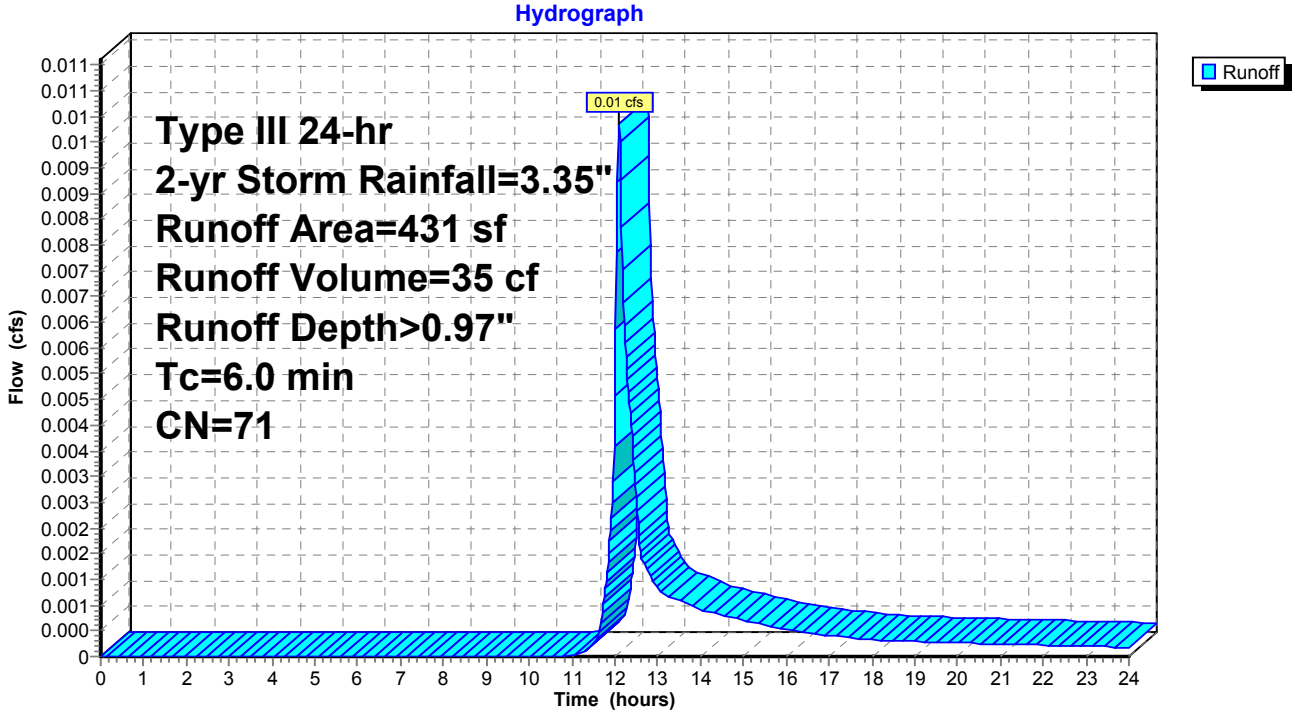
Runoff = 0.01 cfs @ 12.10 hrs, Volume= 35 cf, Depth> 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	91	98	Conc walks, HSG B
	431	71	Weighted Average
	340		78.89% Pervious Area
	91		21.11% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

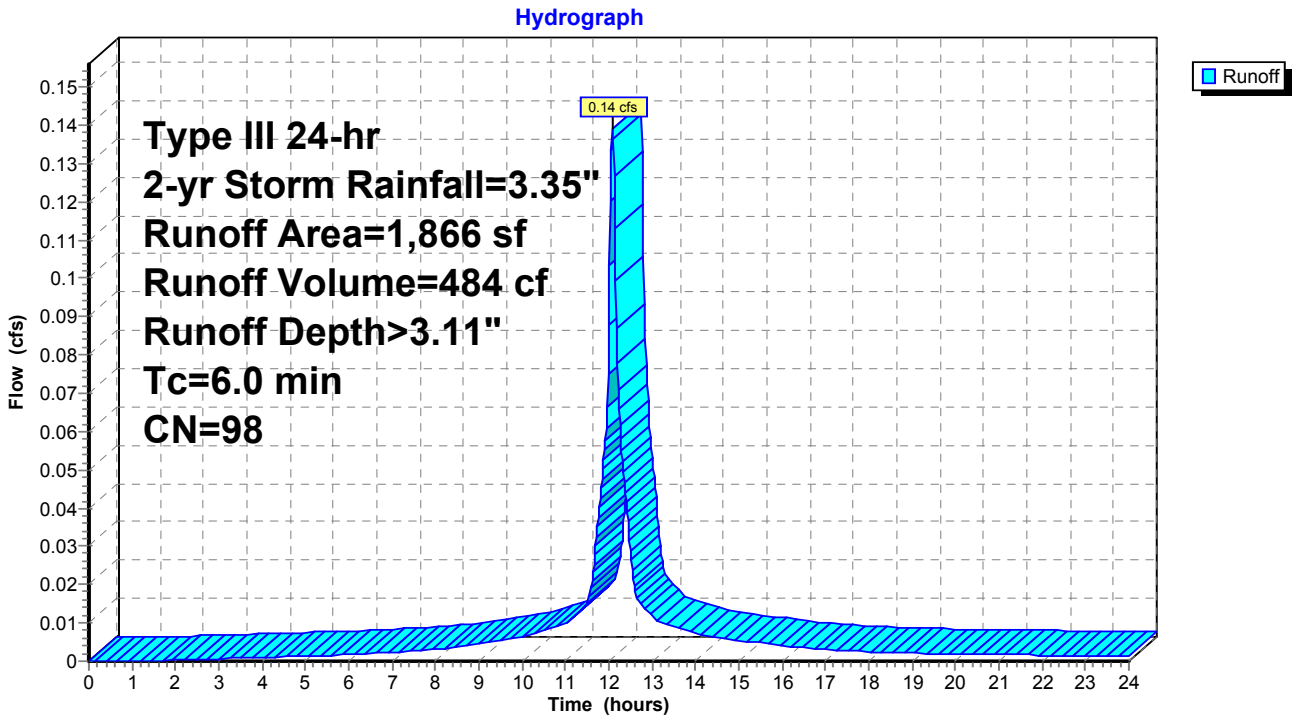
Runoff = 0.14 cfs @ 12.08 hrs, Volume= 484 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

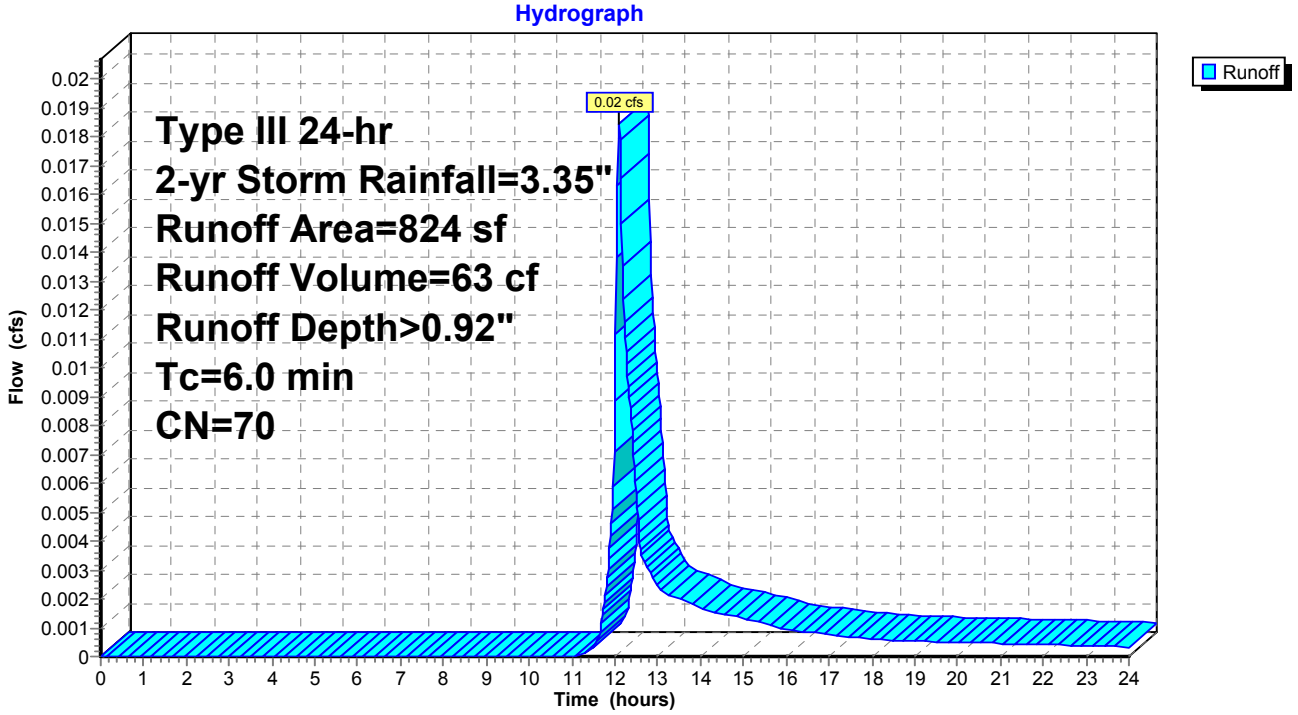
Runoff = 0.02 cfs @ 12.10 hrs, Volume= 63 cf, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

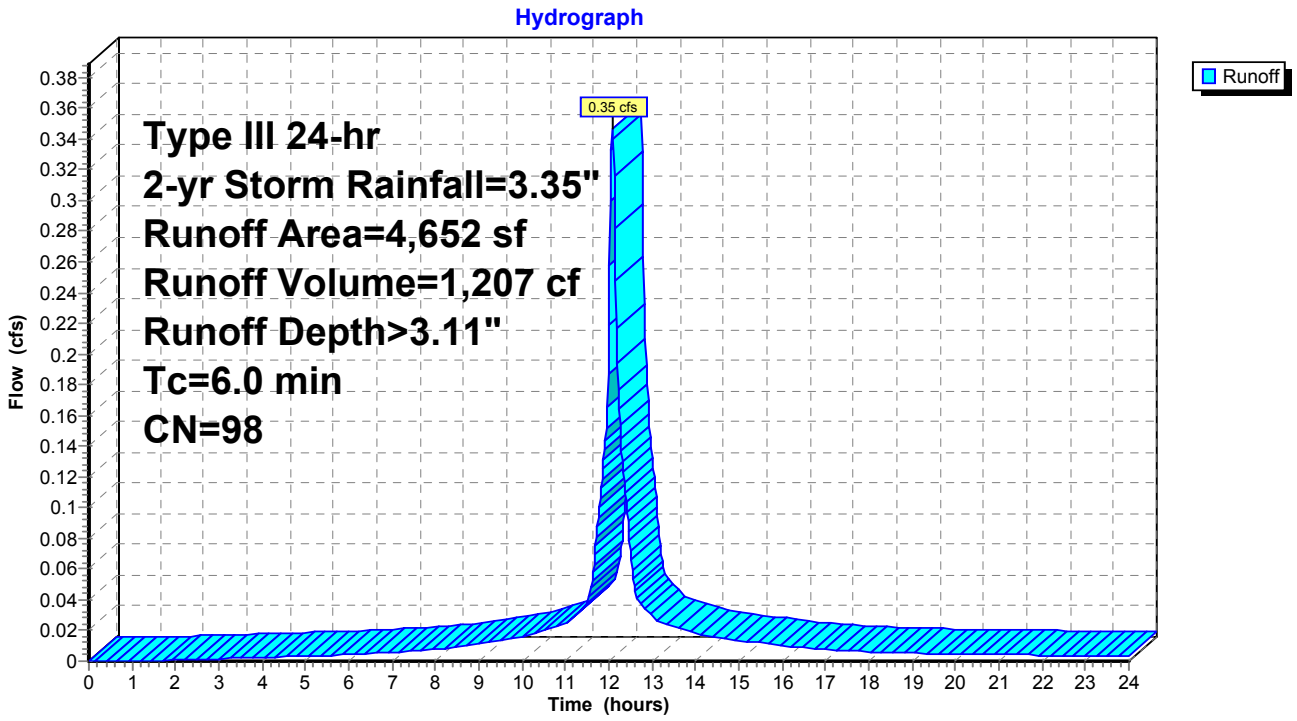
Runoff = 0.35 cfs @ 12.08 hrs, Volume= 1,207 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

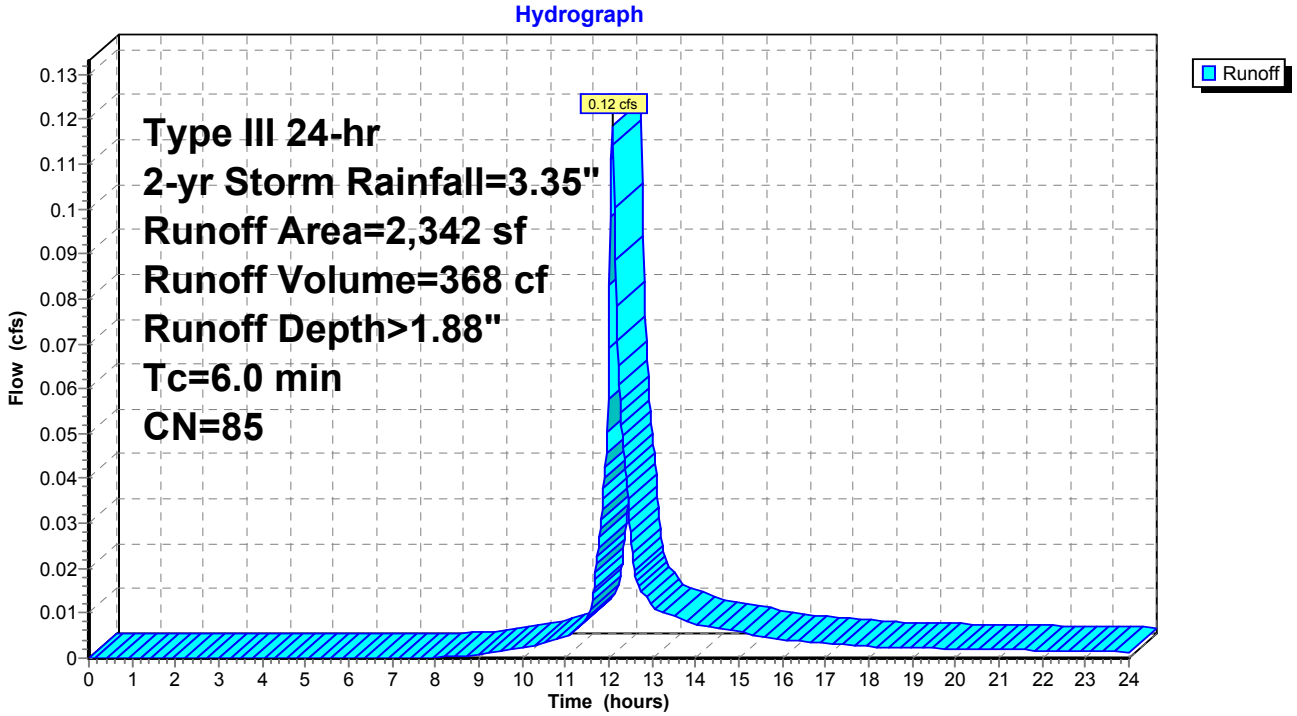
Runoff = 0.12 cfs @ 12.09 hrs, Volume= 368 cf, Depth> 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways



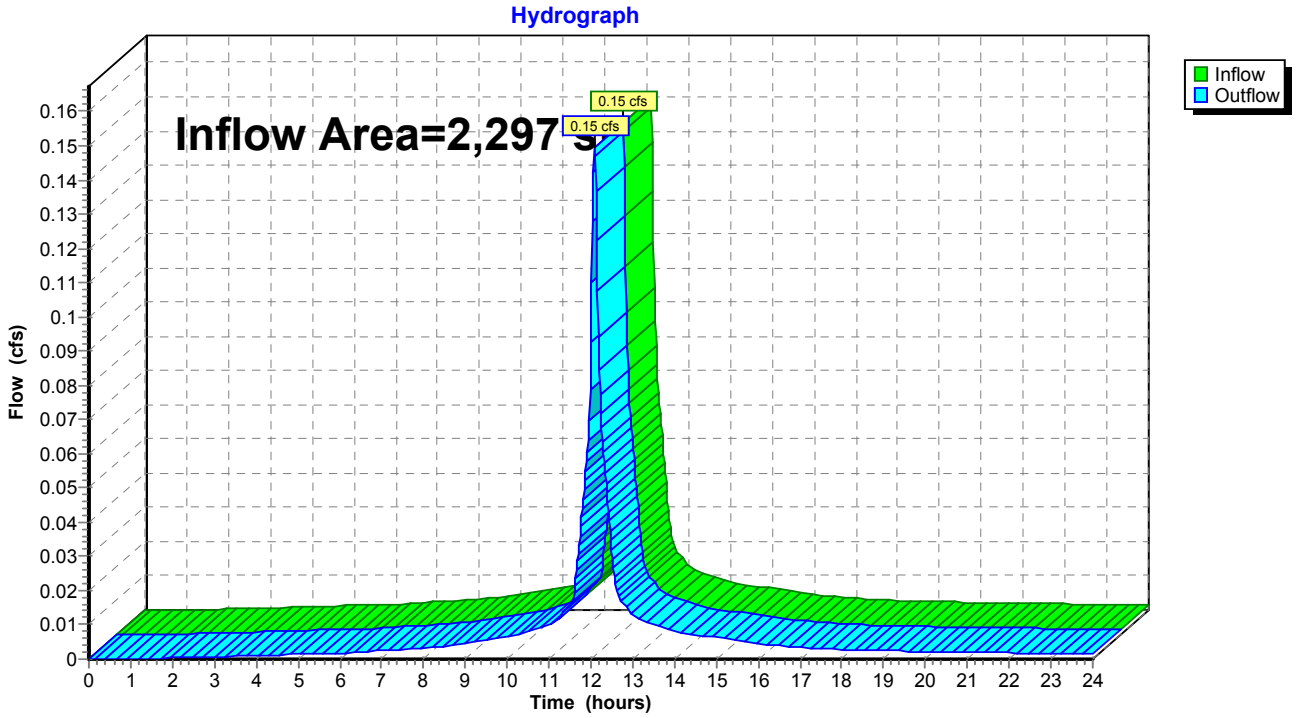
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 2,297 sf, 85.20% Impervious, Inflow Depth > 2.71" for 2-yr Storm event
Inflow = 0.15 cfs @ 12.08 hrs, Volume= 519 cf
Outflow = 0.15 cfs @ 12.08 hrs, Volume= 519 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



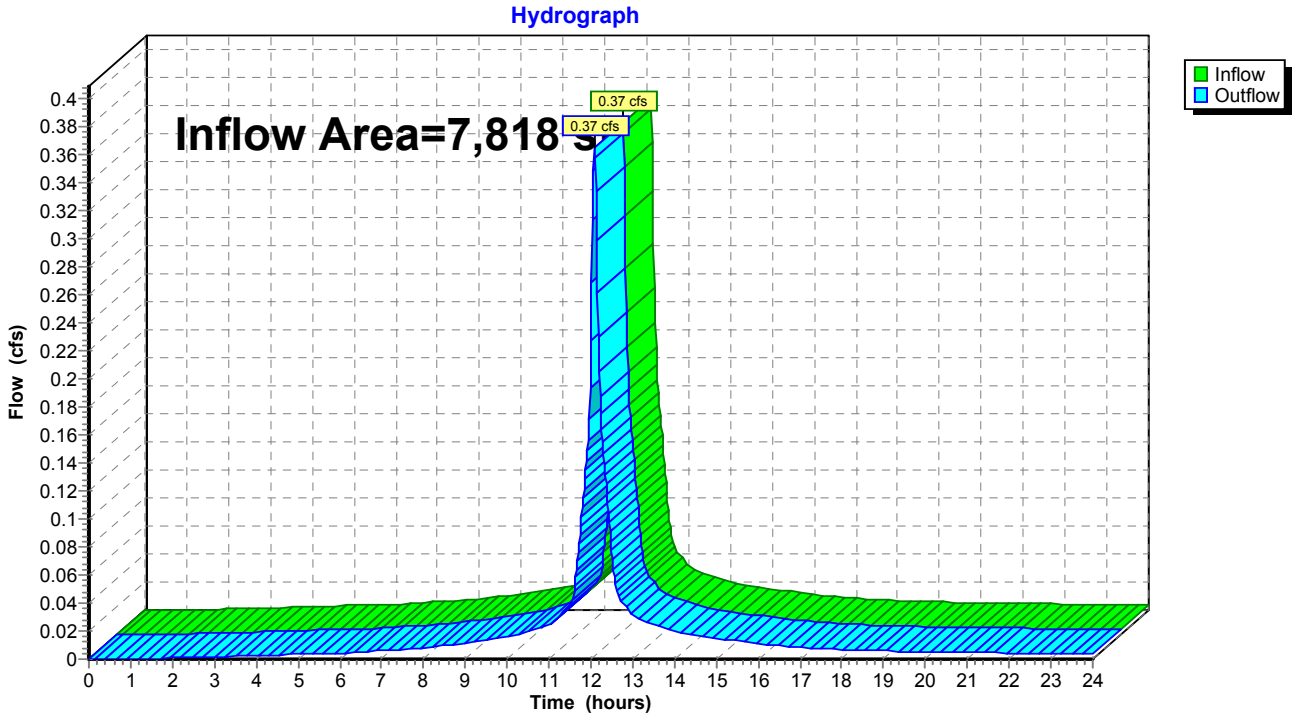
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 7,818 sf, 80.40% Impervious, Inflow Depth > 1.95" for 2-yr Storm event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 1,270 cf
Outflow = 0.37 cfs @ 12.08 hrs, Volume= 1,270 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area =	2,342 sf, 64.05% Impervious, Inflow Depth > 1.88" for 2-yr Storm event				
Inflow =	0.12 cfs @	12.09 hrs,	Volume=	368 cf	
Outflow =	0.01 cfs @	11.78 hrs,	Volume=	368 cf,	Atten= 90%, Lag= 0.0 min
Discarded =	0.01 cfs @	11.78 hrs,	Volume=	368 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 58.67' @ 12.99 hrs Surf.Area= 504 sf Storage= 136 cf

Plug-Flow detention time= 94.2 min calculated for 367 cf (100% of inflow)
Center-of-Mass det. time= 93.8 min (917.2 - 823.4)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

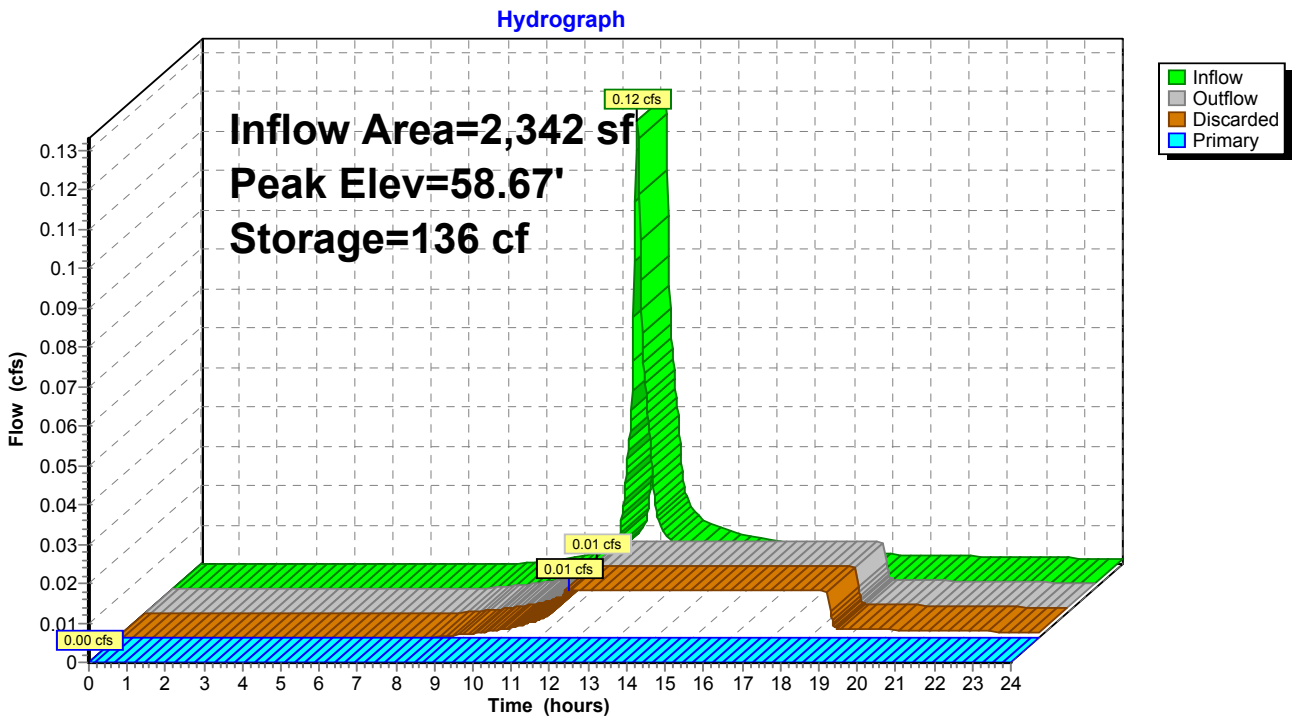
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	60.50'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.50' / 56.30' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 11.78 hrs HW=58.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond PP-1: Permeable Pavers



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=431 sf 21.11% Impervious Runoff Depth>2.08"
Tc=6.0 min CN=71 Runoff=0.02 cfs 75 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=98 Runoff=0.21 cfs 734 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>2.00"
Tc=6.0 min CN=70 Runoff=0.04 cfs 138 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=98 Runoff=0.52 cfs 1,830 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=85 Runoff=0.21 cfs 649 cf

Reach DP-1: Thorndike Street Inflow=0.23 cfs 809 cf
Outflow=0.23 cfs 809 cf

Reach DP-2: Harvard Street Inflow=0.56 cfs 1,967 cf
Outflow=0.56 cfs 1,967 cf

Pond PP-1: Permeable Pavers Peak Elev=59.48' Storage=299 cf Inflow=0.21 cfs 649 cf
Discarded=0.01 cfs 609 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 609 cf

Total Runoff Area = 10,115 sf Runoff Volume = 3,426 cf Average Runoff Depth = 4.06"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,243 sf

Summary for Subcatchment S1: Walkways

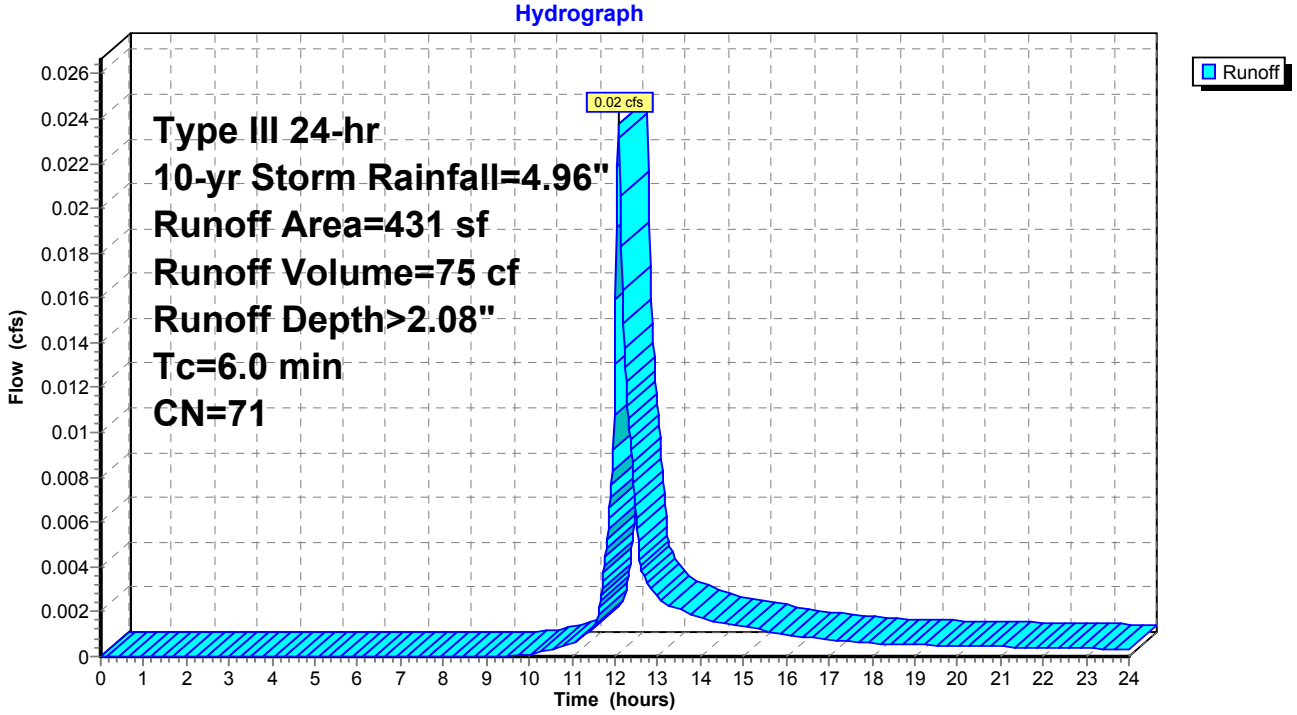
Runoff = 0.02 cfs @ 12.09 hrs, Volume= 75 cf, Depth> 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	91	98	Conc walks, HSG B
	431	71	Weighted Average
	340		78.89% Pervious Area
	91		21.11% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

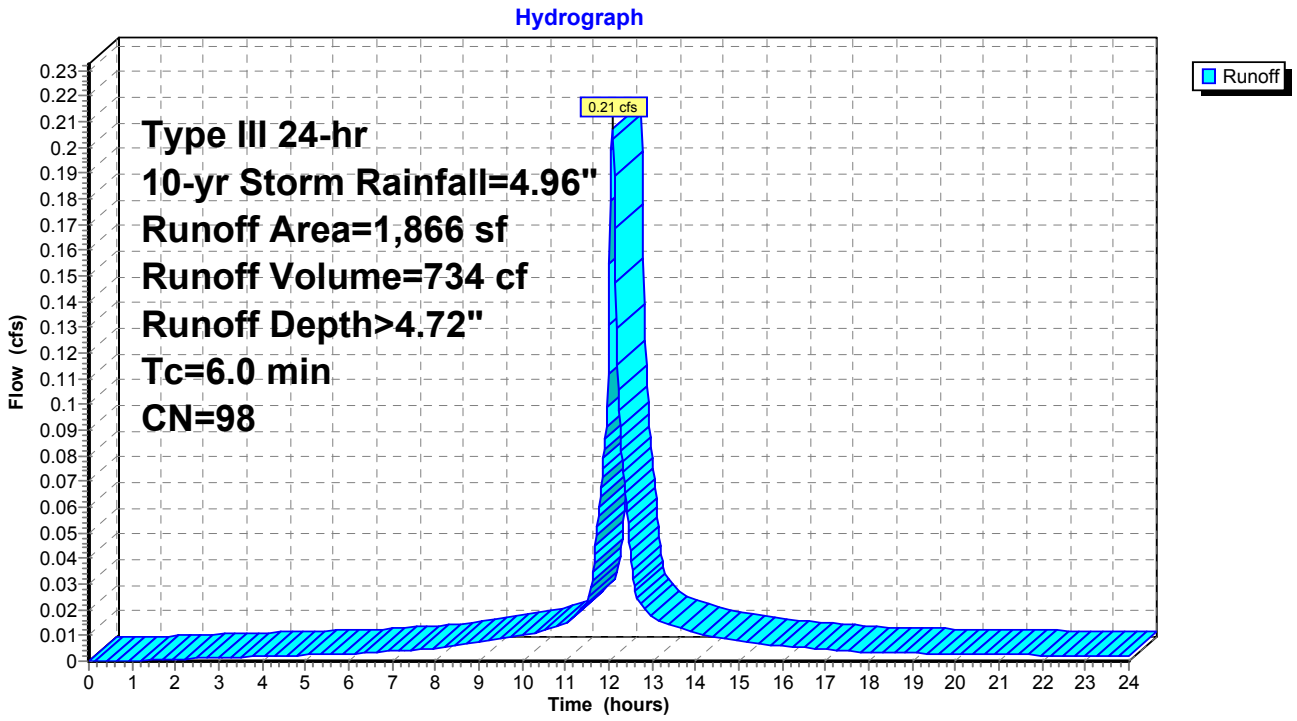
Runoff = 0.21 cfs @ 12.08 hrs, Volume= 734 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

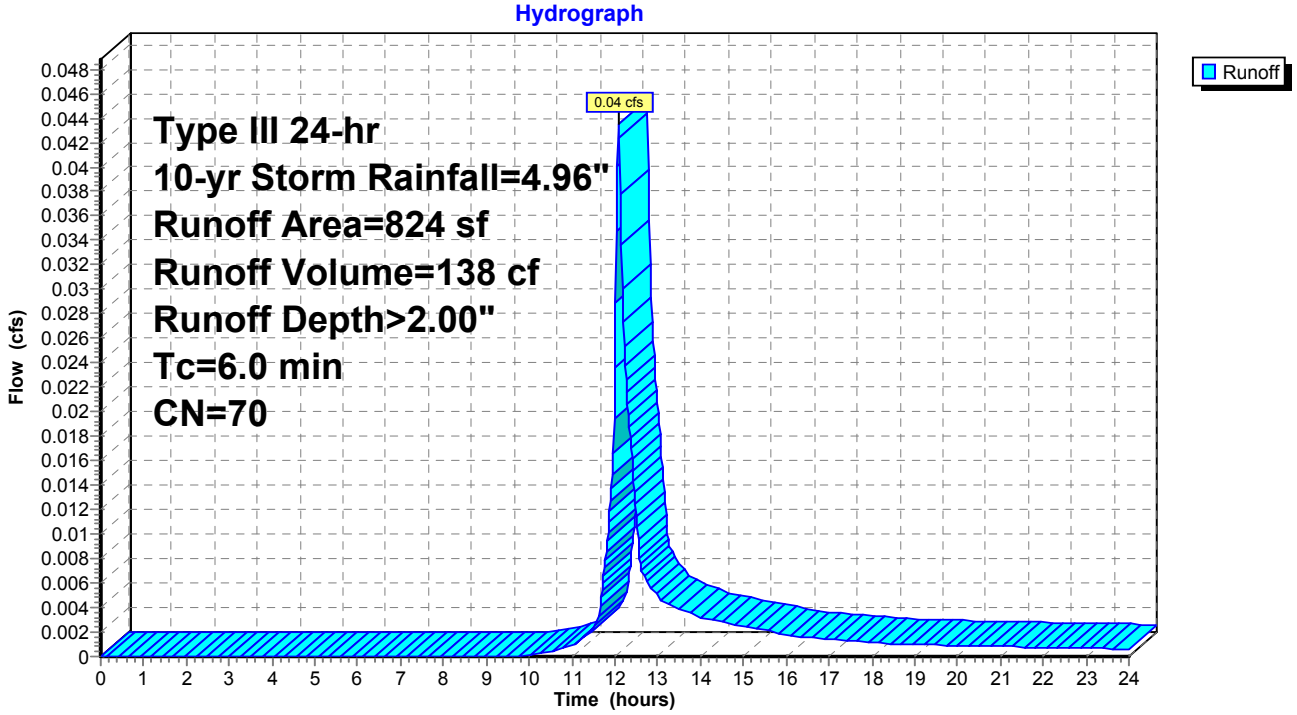
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 138 cf, Depth> 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

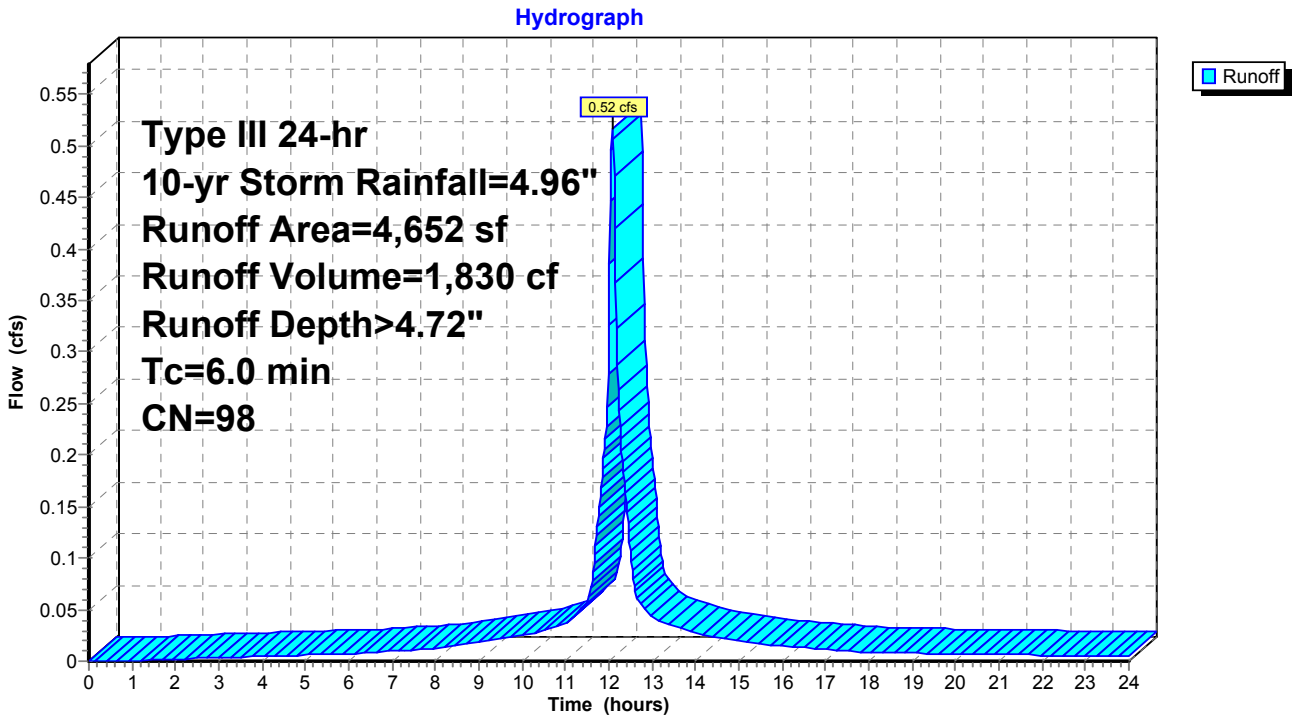
Runoff = 0.52 cfs @ 12.08 hrs, Volume= 1,830 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

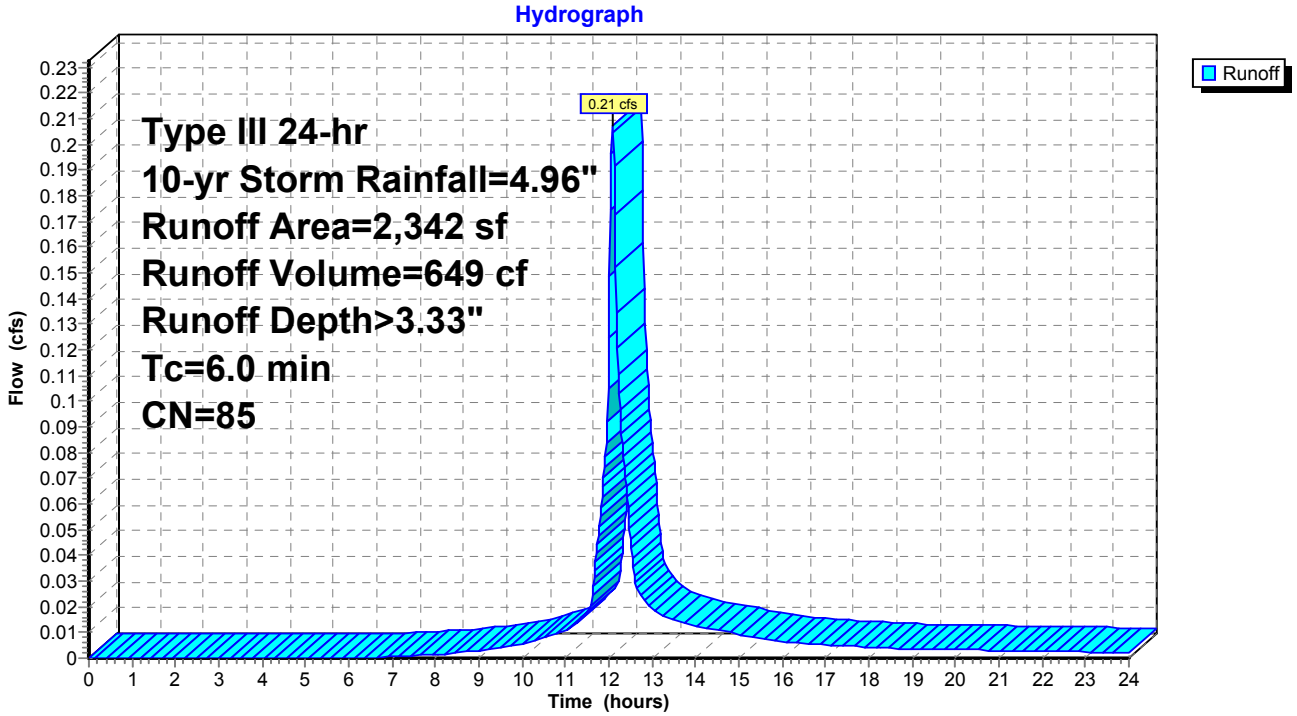
Runoff = 0.21 cfs @ 12.09 hrs, Volume= 649 cf, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways



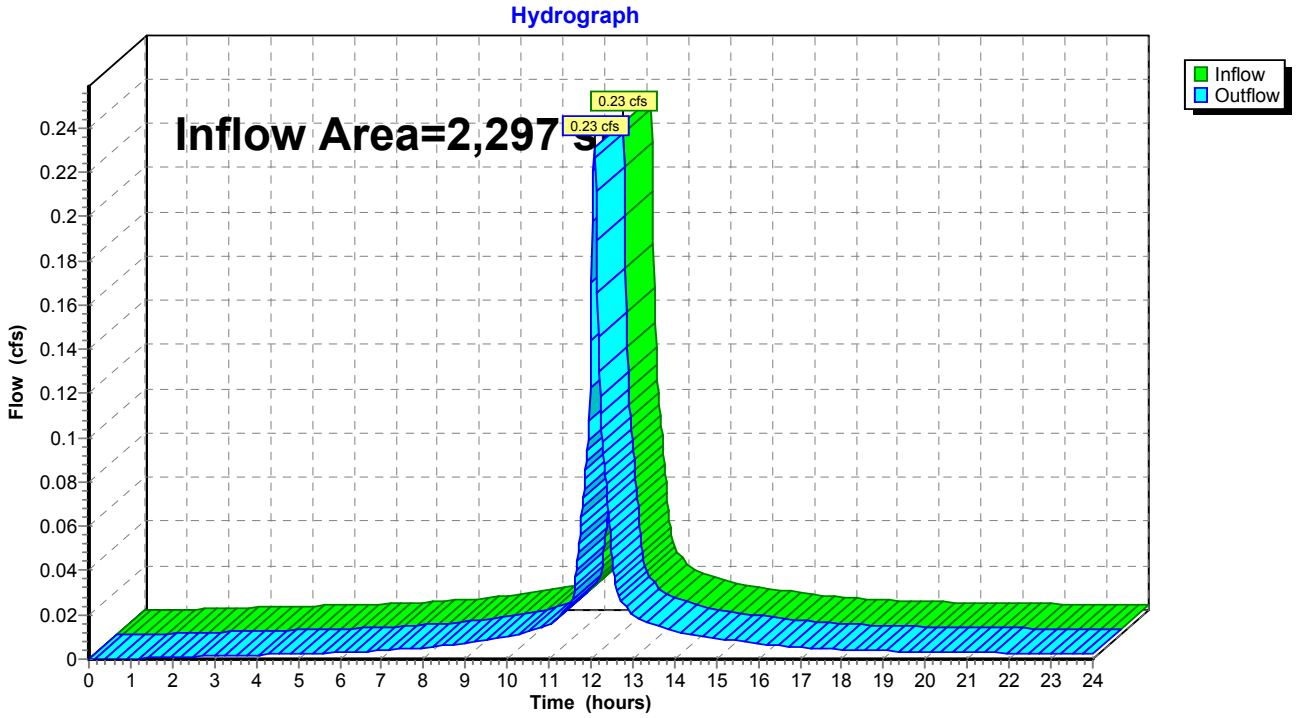
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 2,297 sf, 85.20% Impervious, Inflow Depth > 4.23" for 10-yr Storm event
Inflow = 0.23 cfs @ 12.08 hrs, Volume= 809 cf
Outflow = 0.23 cfs @ 12.08 hrs, Volume= 809 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



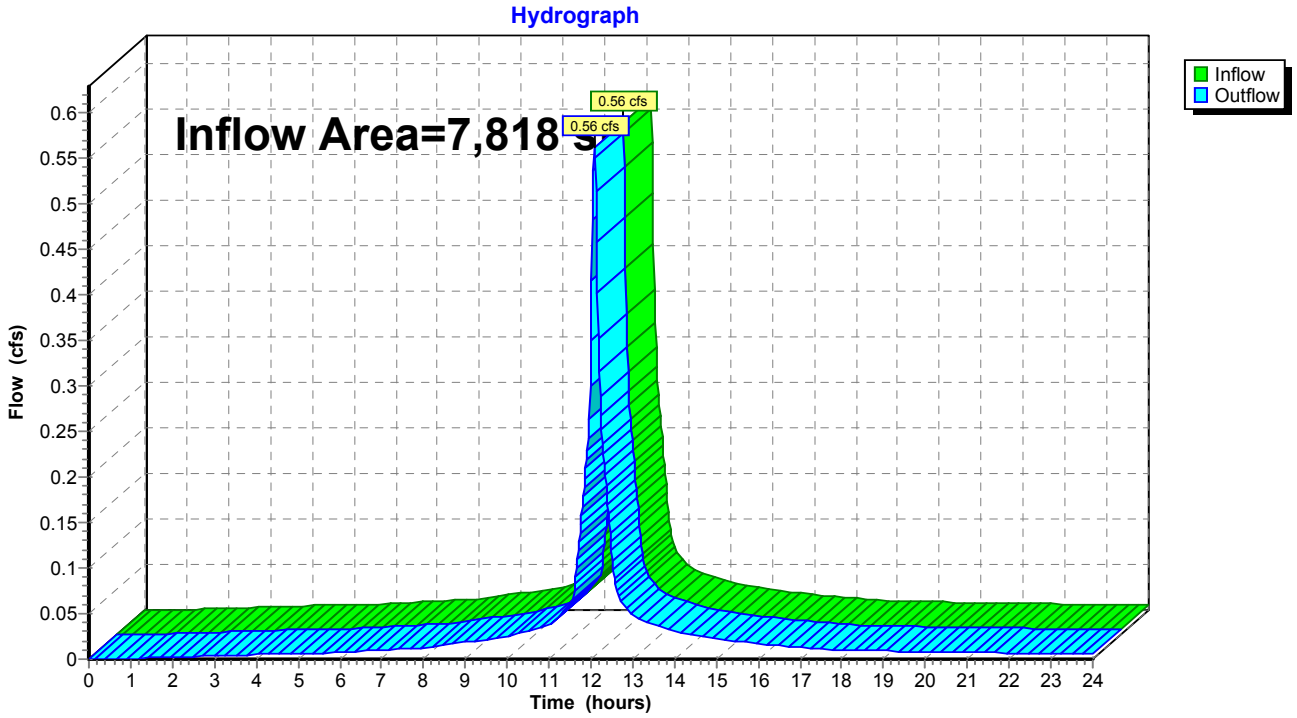
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 7,818 sf, 80.40% Impervious, Inflow Depth > 3.02" for 10-yr Storm event
Inflow = 0.56 cfs @ 12.08 hrs, Volume= 1,967 cf
Outflow = 0.56 cfs @ 12.08 hrs, Volume= 1,967 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area = 2,342 sf, 64.05% Impervious, Inflow Depth > 3.33" for 10-yr Storm event
Inflow = 0.21 cfs @ 12.09 hrs, Volume= 649 cf
Outflow = 0.01 cfs @ 11.52 hrs, Volume= 609 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.52 hrs, Volume= 609 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 59.48' @ 14.08 hrs Surf.Area= 504 sf Storage= 299 cf

Plug-Flow detention time= 236.5 min calculated for 609 cf (94% of inflow)
Center-of-Mass det. time= 203.5 min (1,010.7 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

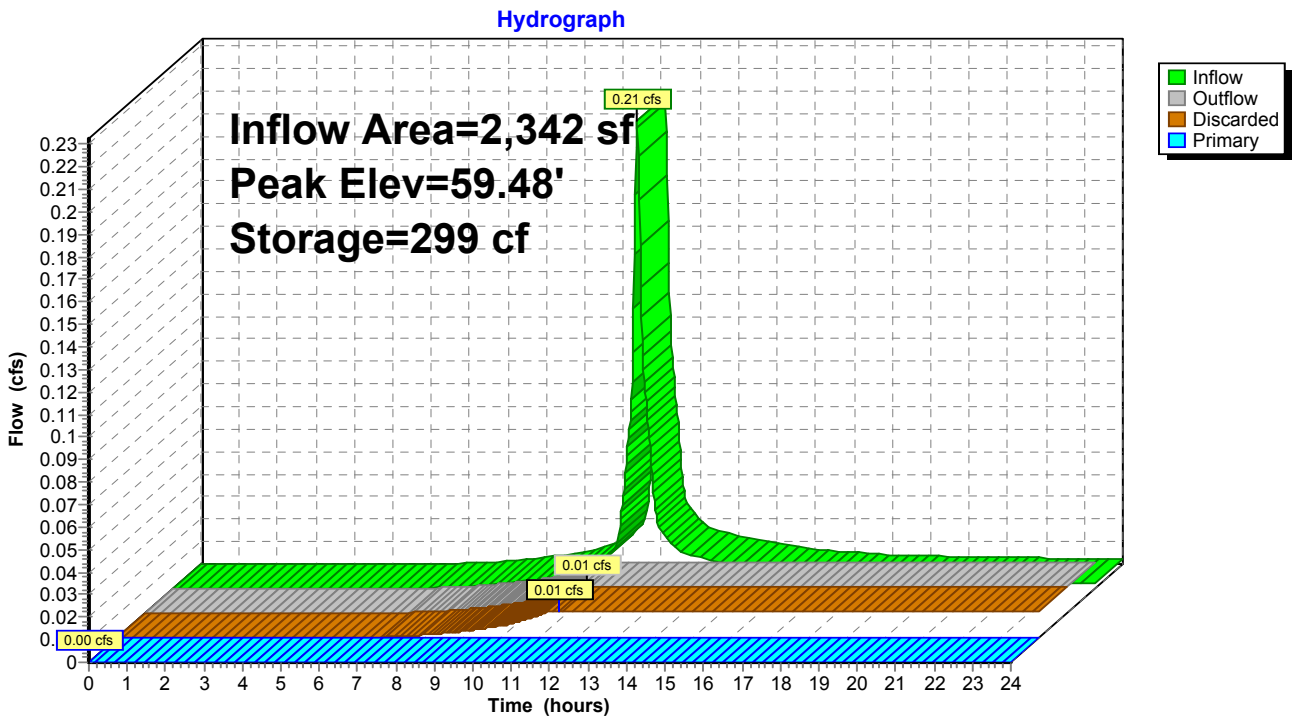
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	60.50'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.50' / 56.30' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 11.52 hrs HW=58.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond PP-1: Permeable Pavers



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=431 sf 21.11% Impervious Runoff Depth>3.06"
Tc=6.0 min CN=71 Runoff=0.04 cfs 110 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=98 Runoff=0.26 cfs 926 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>2.96"
Tc=6.0 min CN=70 Runoff=0.07 cfs 203 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=98 Runoff=0.65 cfs 2,309 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>4.49"
Tc=6.0 min CN=85 Runoff=0.28 cfs 876 cf

Reach DP-1: Thorndike Street Inflow=0.30 cfs 1,036 cf
Outflow=0.30 cfs 1,036 cf

Reach DP-2: Harvard Street Inflow=0.71 cfs 2,513 cf
Outflow=0.71 cfs 2,513 cf

Pond PP-1: Permeable Pavers Peak Elev=60.24' Storage=451 cf Inflow=0.28 cfs 876 cf
Discarded=0.01 cfs 642 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 642 cf

Total Runoff Area = 10,115 sf Runoff Volume = 4,425 cf Average Runoff Depth = 5.25"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,243 sf

Summary for Subcatchment S1: Walkways

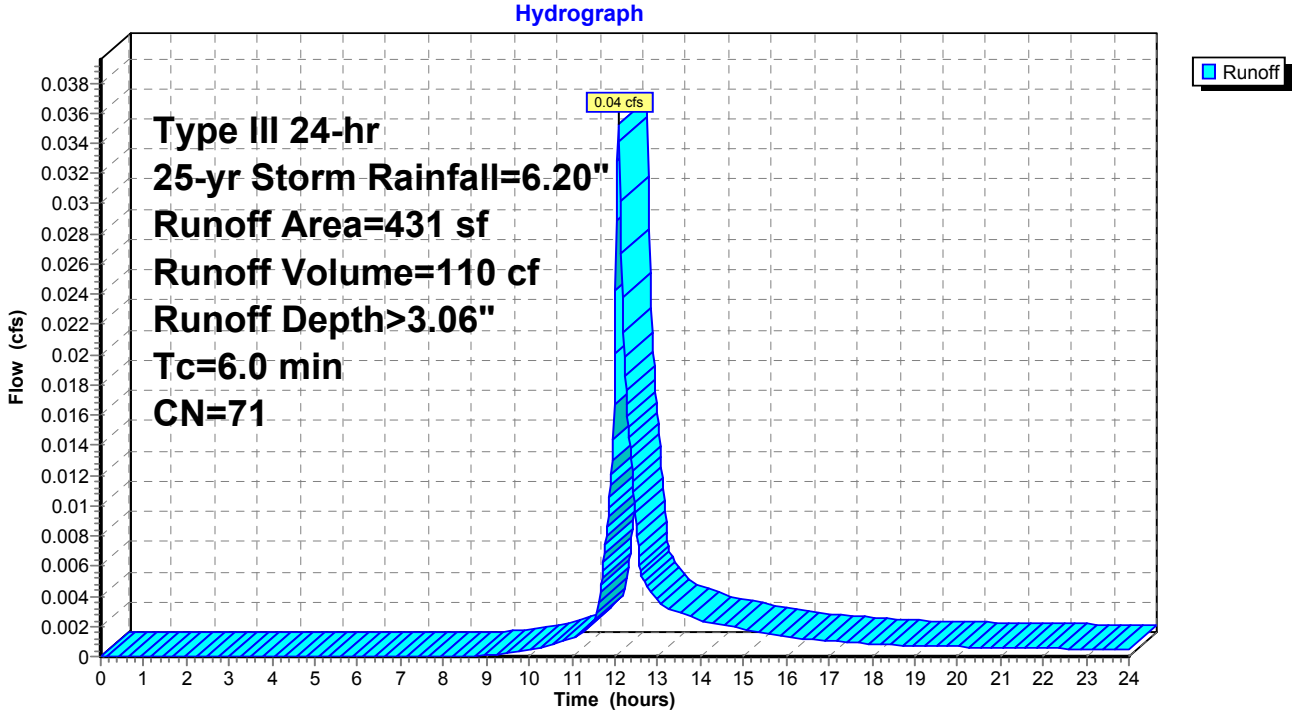
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 110 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	91	98	Conc walks, HSG B
	431	71	Weighted Average
	340		78.89% Pervious Area
	91		21.11% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

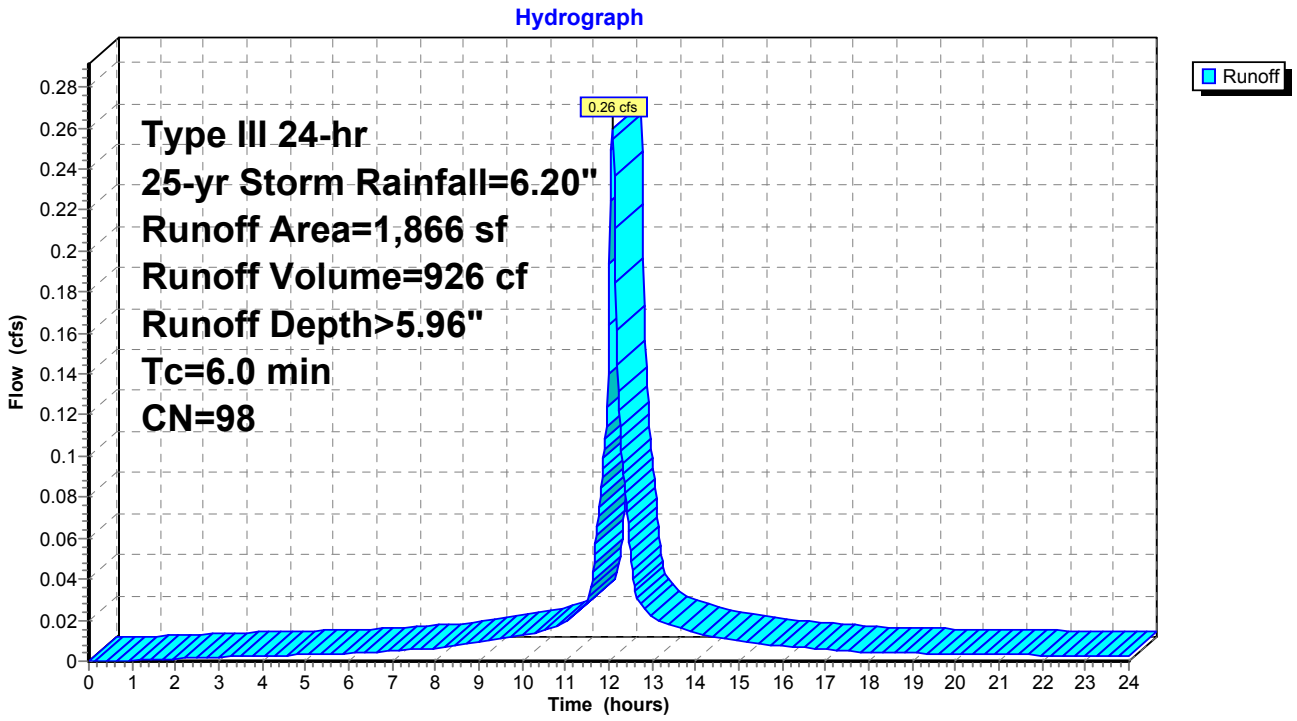
Runoff = 0.26 cfs @ 12.08 hrs, Volume= 926 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

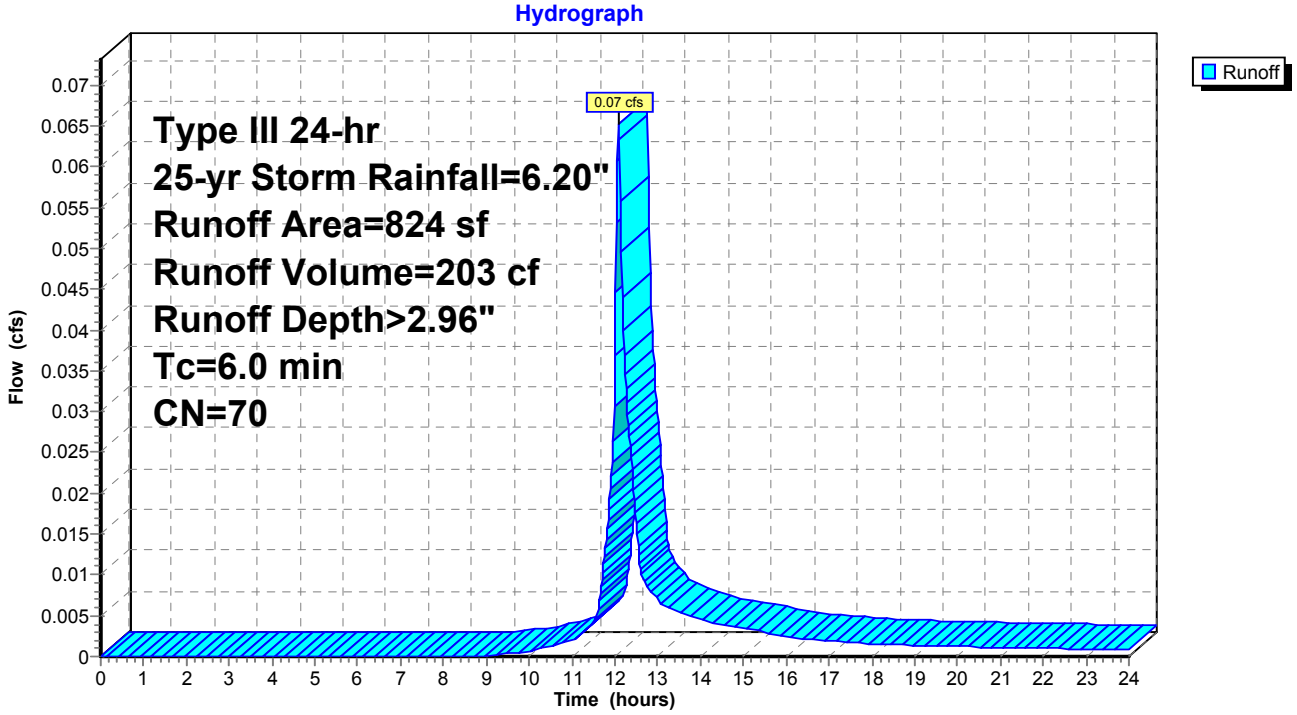
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 203 cf, Depth> 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

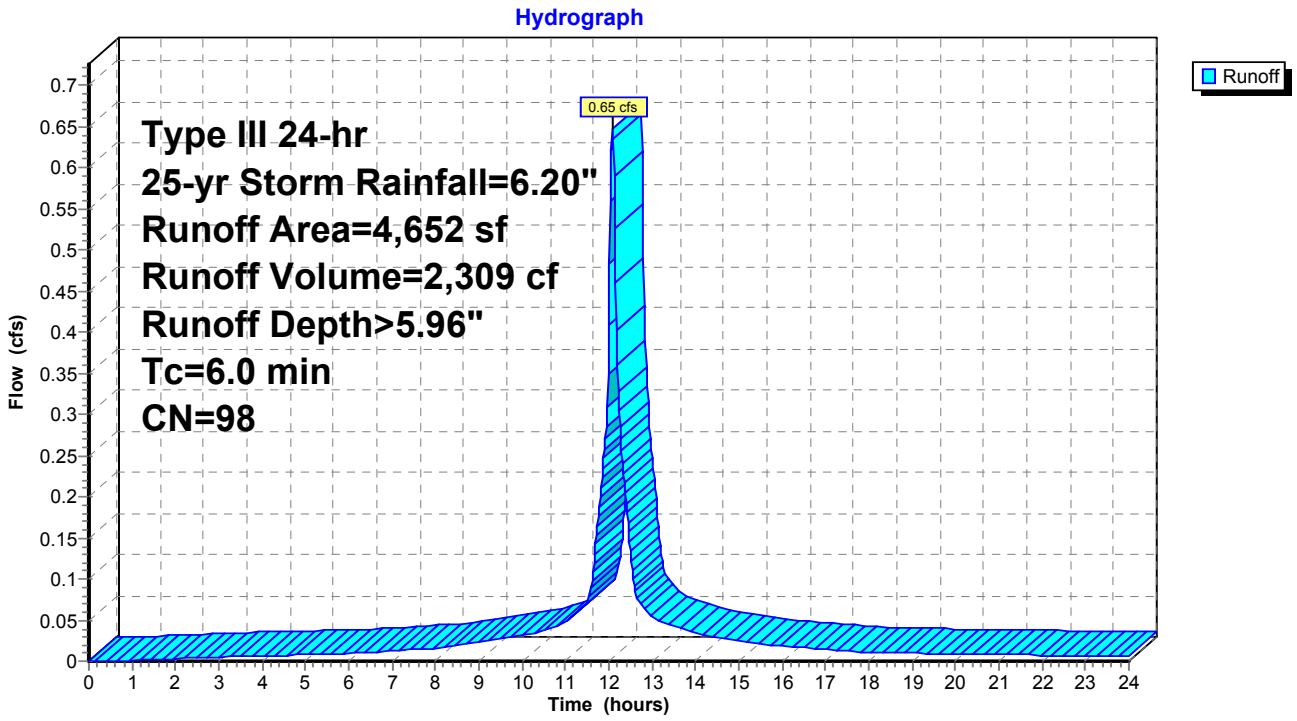
Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,309 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

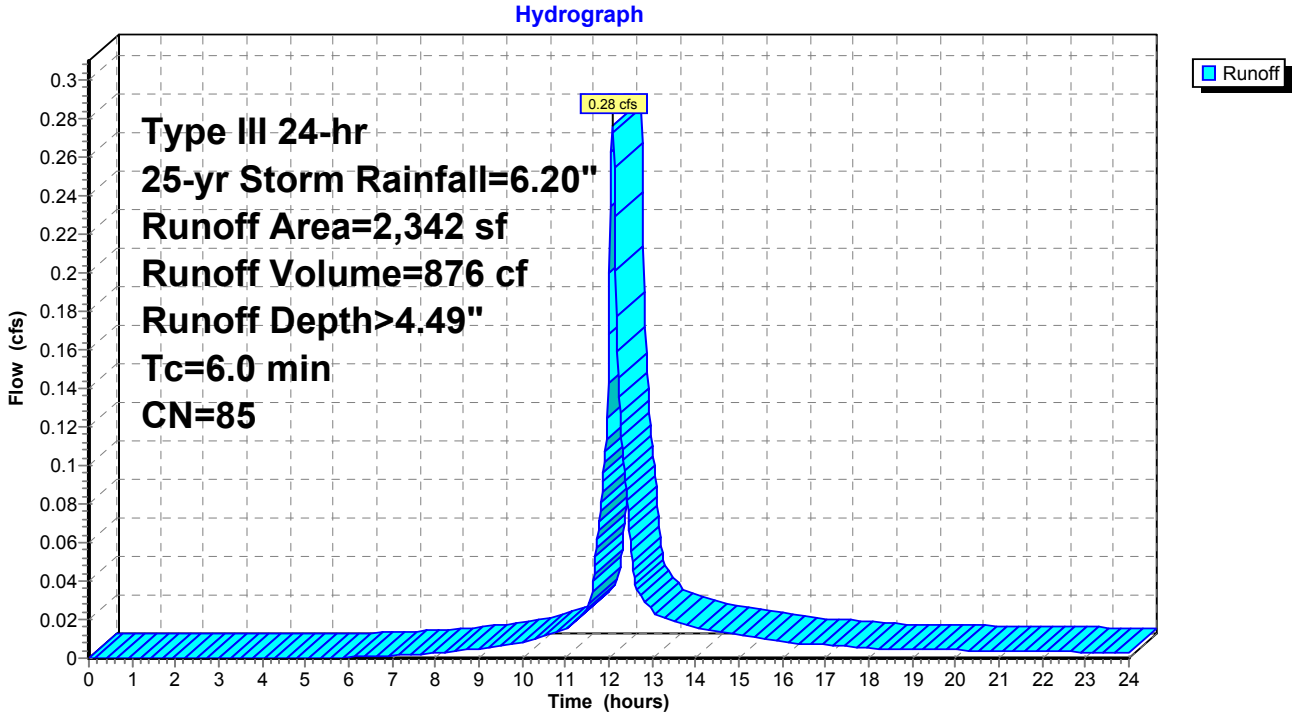
Runoff = 0.28 cfs @ 12.09 hrs, Volume= 876 cf, Depth> 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways



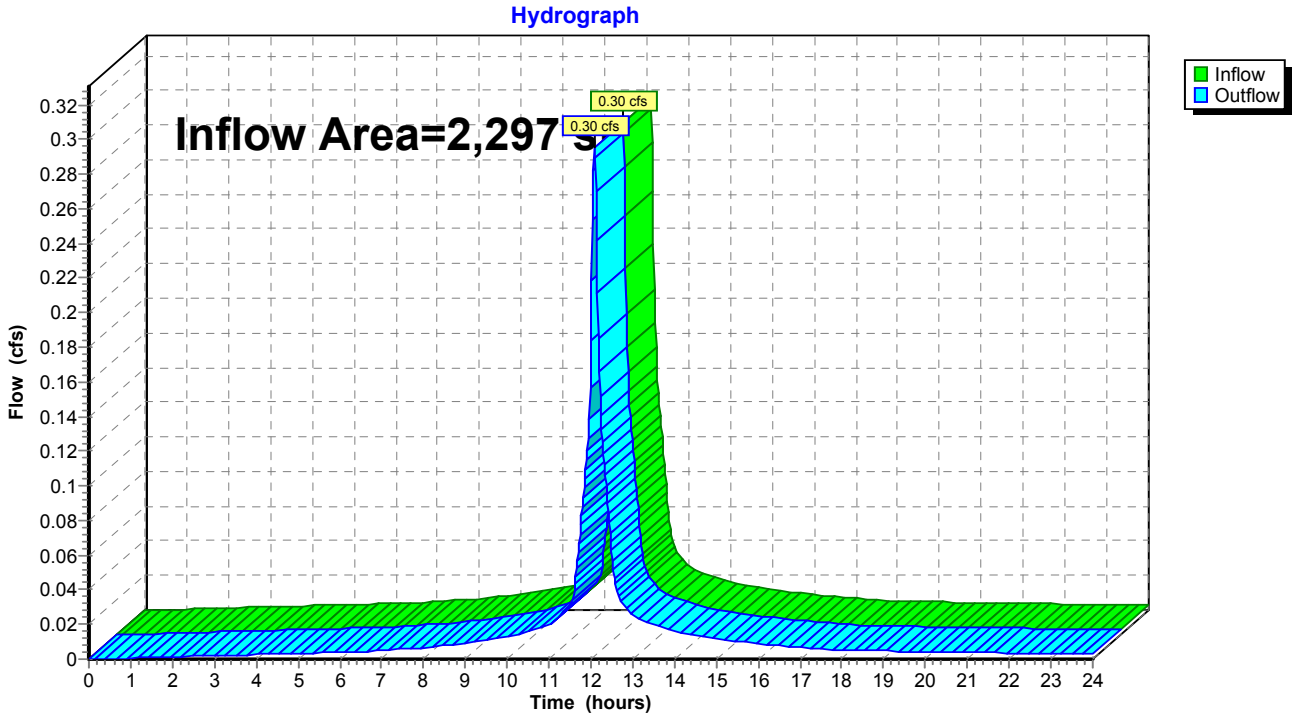
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 2,297 sf, 85.20% Impervious, Inflow Depth > 5.41" for 25-yr Storm event
Inflow = 0.30 cfs @ 12.08 hrs, Volume= 1,036 cf
Outflow = 0.30 cfs @ 12.08 hrs, Volume= 1,036 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



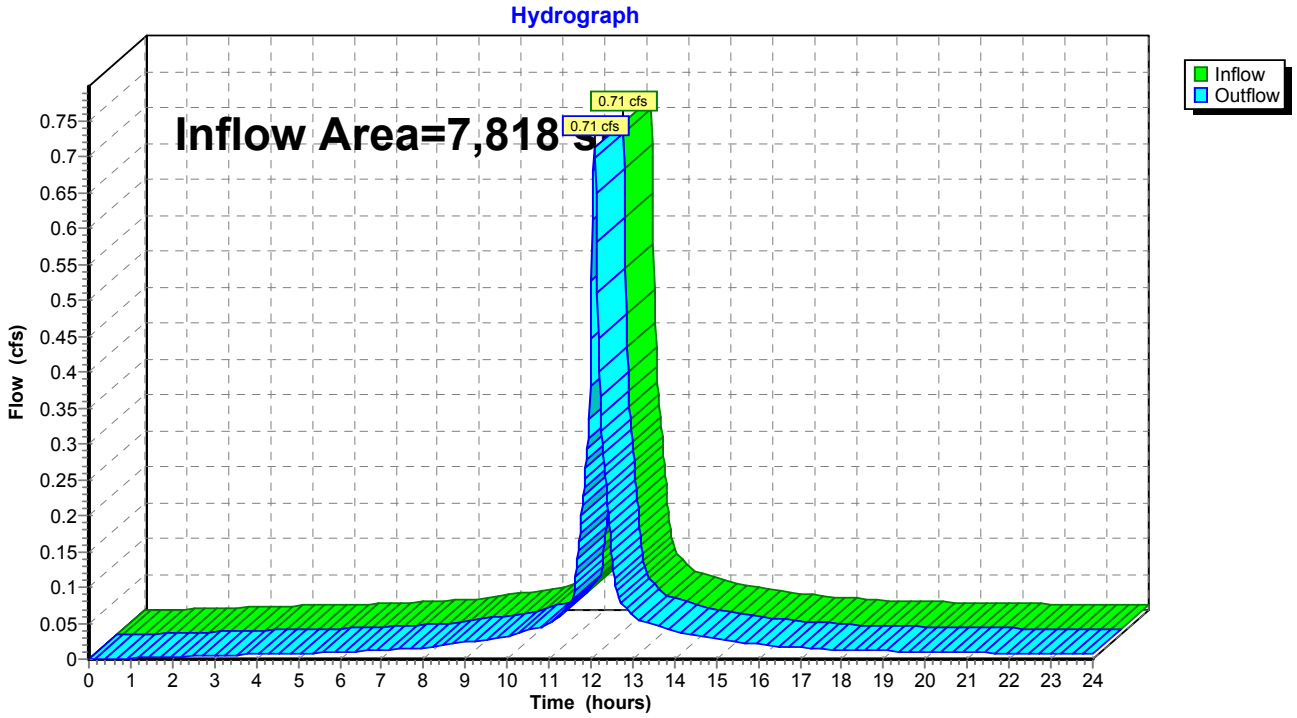
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 7,818 sf, 80.40% Impervious, Inflow Depth > 3.86" for 25-yr Storm event
Inflow = 0.71 cfs @ 12.08 hrs, Volume= 2,513 cf
Outflow = 0.71 cfs @ 12.08 hrs, Volume= 2,513 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area = 2,342 sf, 64.05% Impervious, Inflow Depth > 4.49" for 25-yr Storm event
Inflow = 0.28 cfs @ 12.09 hrs, Volume= 876 cf
Outflow = 0.01 cfs @ 11.12 hrs, Volume= 642 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.12 hrs, Volume= 642 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 60.24' @ 15.05 hrs Surf.Area= 504 sf Storage= 451 cf

Plug-Flow detention time= 275.6 min calculated for 642 cf (73% of inflow)
Center-of-Mass det. time= 188.4 min (987.3 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

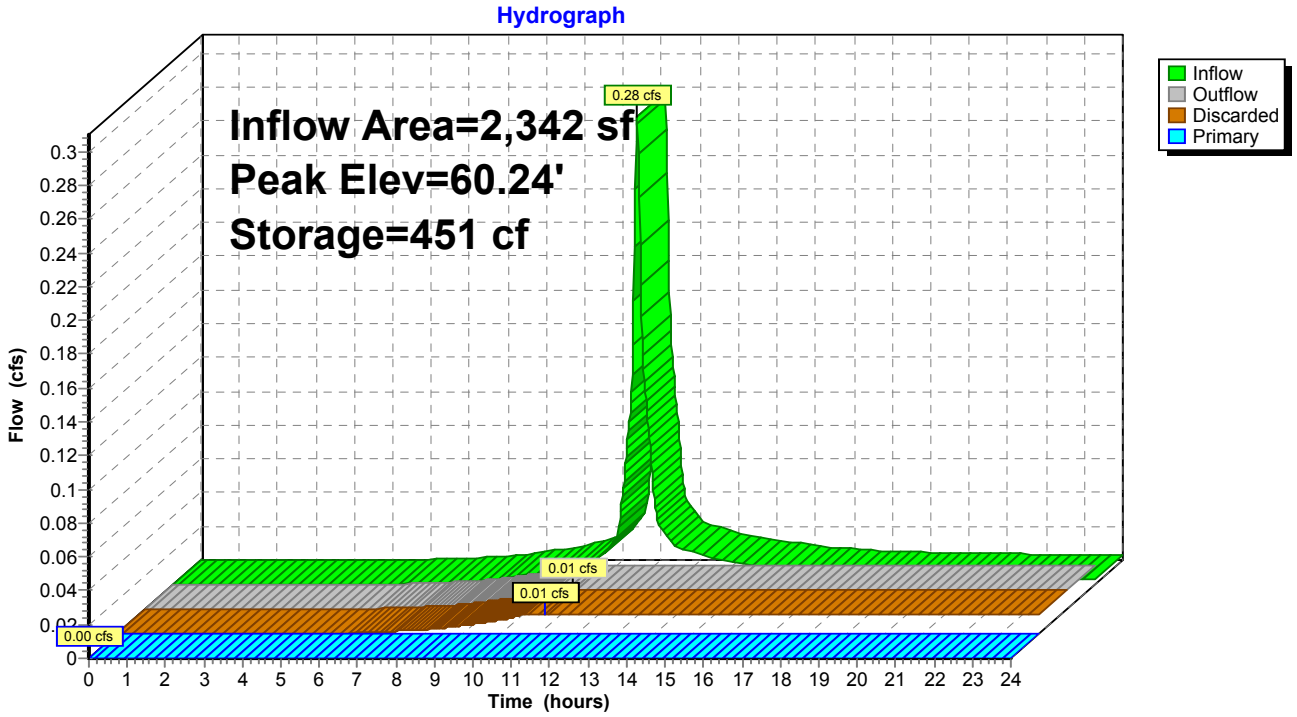
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	60.50'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.50' / 56.30' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 11.12 hrs HW=58.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond PP-1: Permeable Pavers



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=431 sf 21.11% Impervious Runoff Depth>5.20"
Tc=6.0 min CN=71 Runoff=0.06 cfs 187 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>8.47"
Tc=6.0 min CN=98 Runoff=0.37 cfs 1,318 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>5.08"
Tc=6.0 min CN=70 Runoff=0.11 cfs 349 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>8.47"
Tc=6.0 min CN=98 Runoff=0.91 cfs 3,285 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>6.90"
Tc=6.0 min CN=85 Runoff=0.42 cfs 1,347 cf

Reach DP-1: Thorndike Street Inflow=0.43 cfs 1,505 cf
Outflow=0.43 cfs 1,505 cf

Reach DP-2: Harvard Street Inflow=1.03 cfs 3,930 cf
Outflow=1.03 cfs 3,930 cf

Pond PP-1: Permeable Pavers Peak Elev=60.74' Storage=553 cf Inflow=0.42 cfs 1,347 cf
Discarded=0.01 cfs 697 cf Primary=0.12 cfs 296 cf Outflow=0.13 cfs 993 cf

Total Runoff Area = 10,115 sf Runoff Volume = 6,486 cf Average Runoff Depth = 7.69"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,243 sf

Summary for Subcatchment S1: Walkways

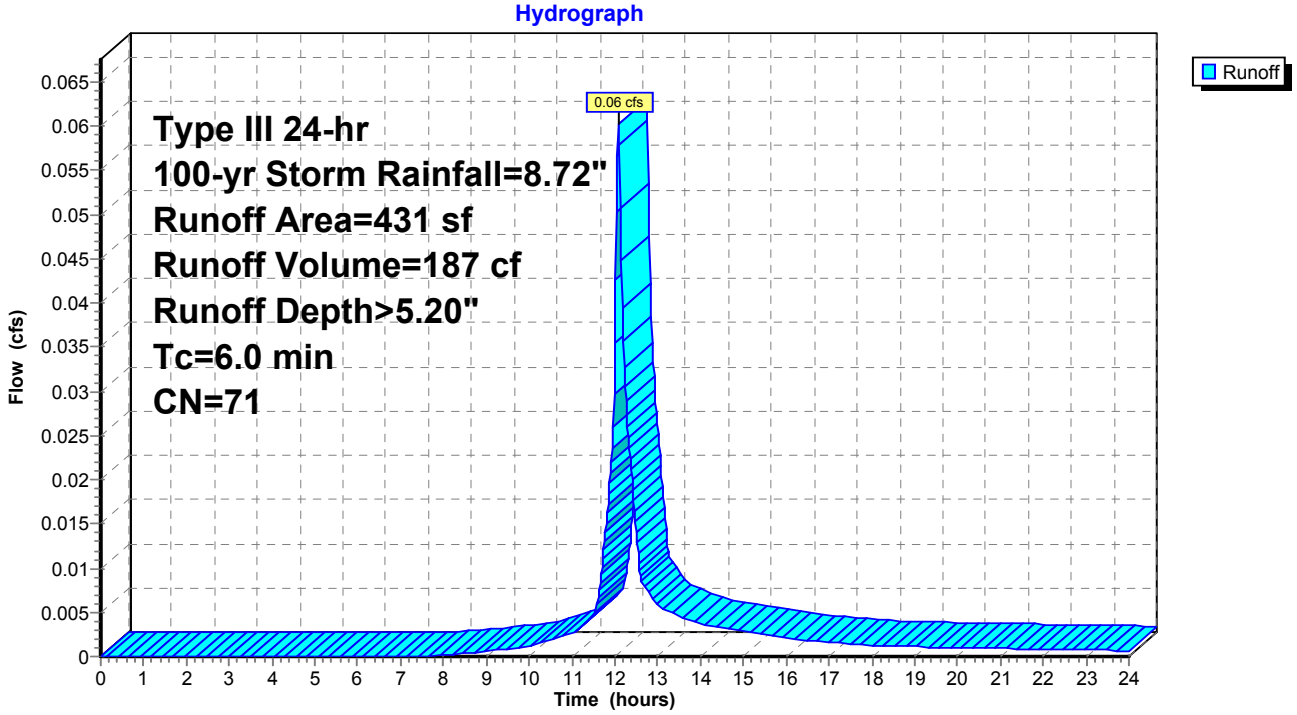
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 187 cf, Depth> 5.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	91	98	Conc walks, HSG B
	431	71	Weighted Average
	340		78.89% Pervious Area
	91		21.11% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

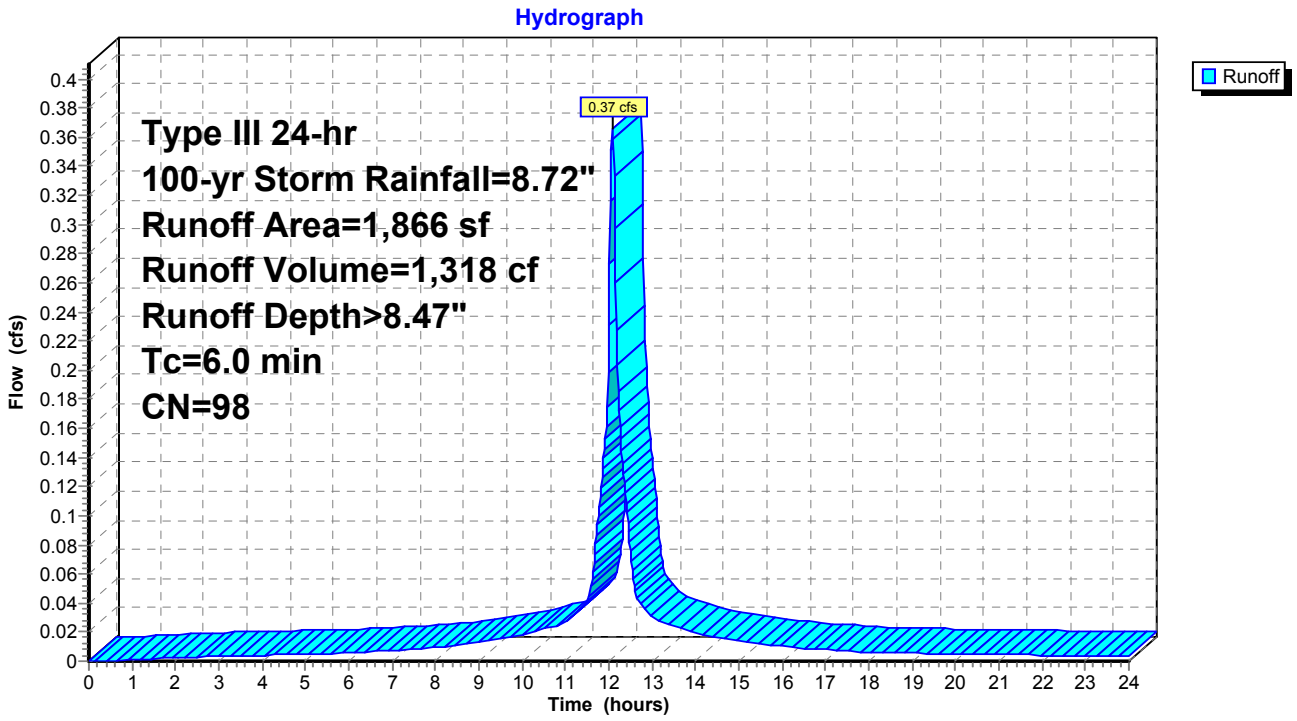
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 1,318 cf, Depth> 8.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

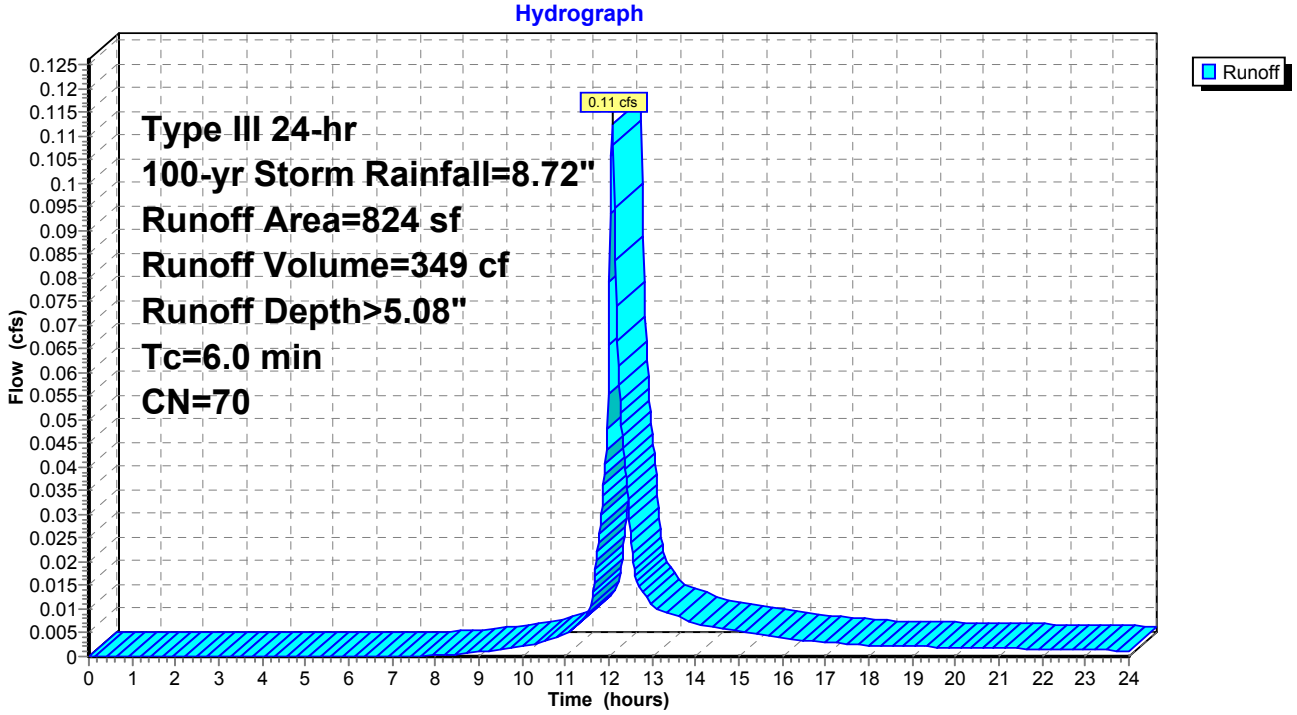
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 349 cf, Depth> 5.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

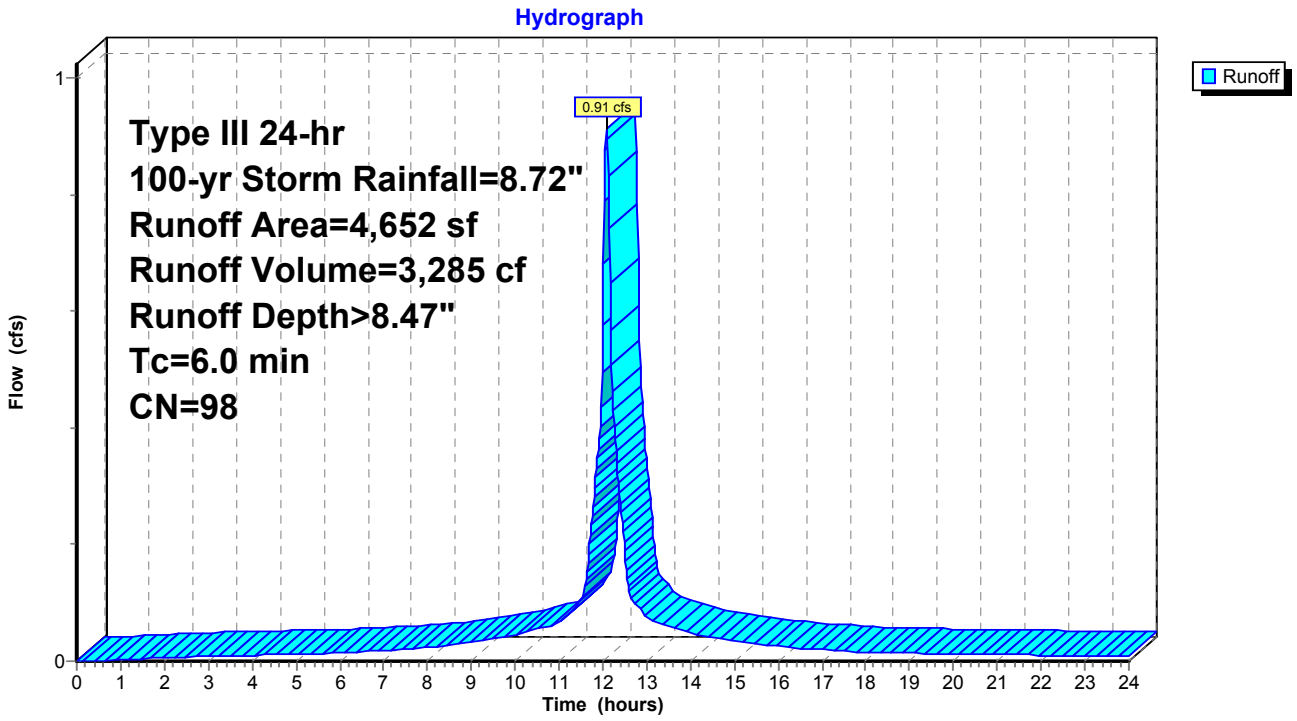
Runoff = 0.91 cfs @ 12.08 hrs, Volume= 3,285 cf, Depth> 8.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

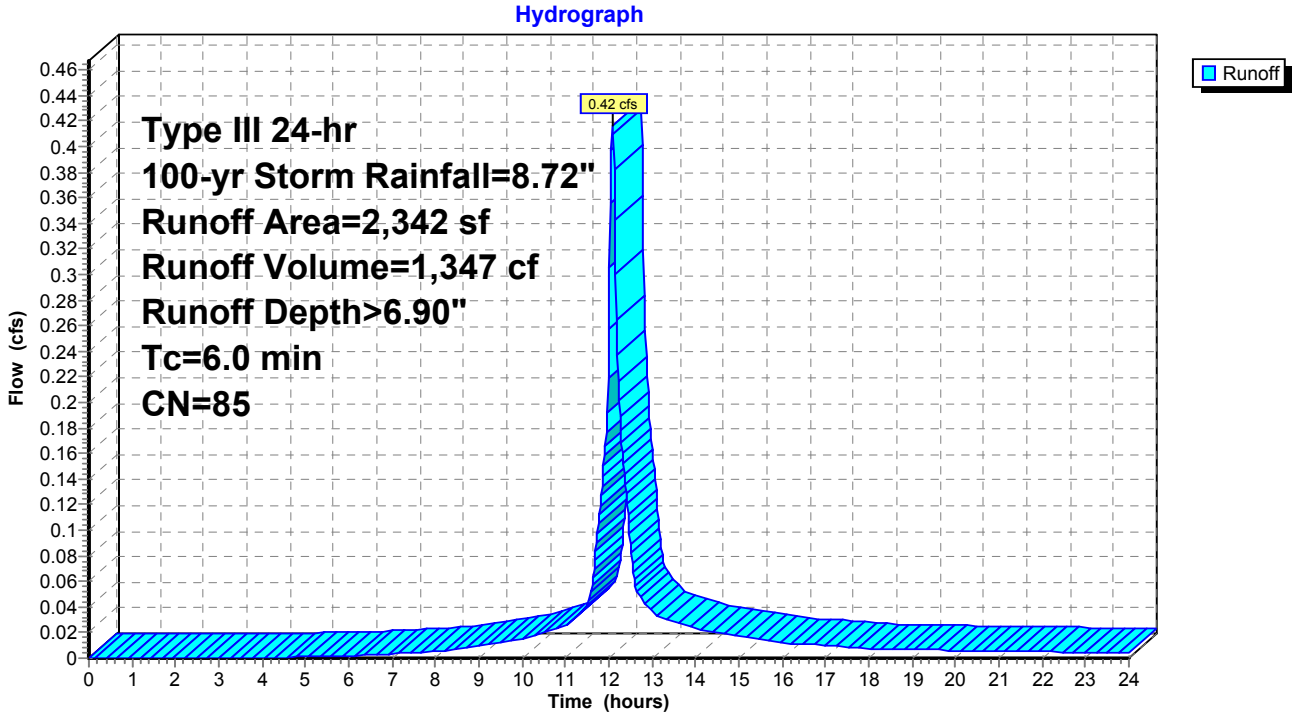
Runoff = 0.42 cfs @ 12.08 hrs, Volume= 1,347 cf, Depth> 6.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways



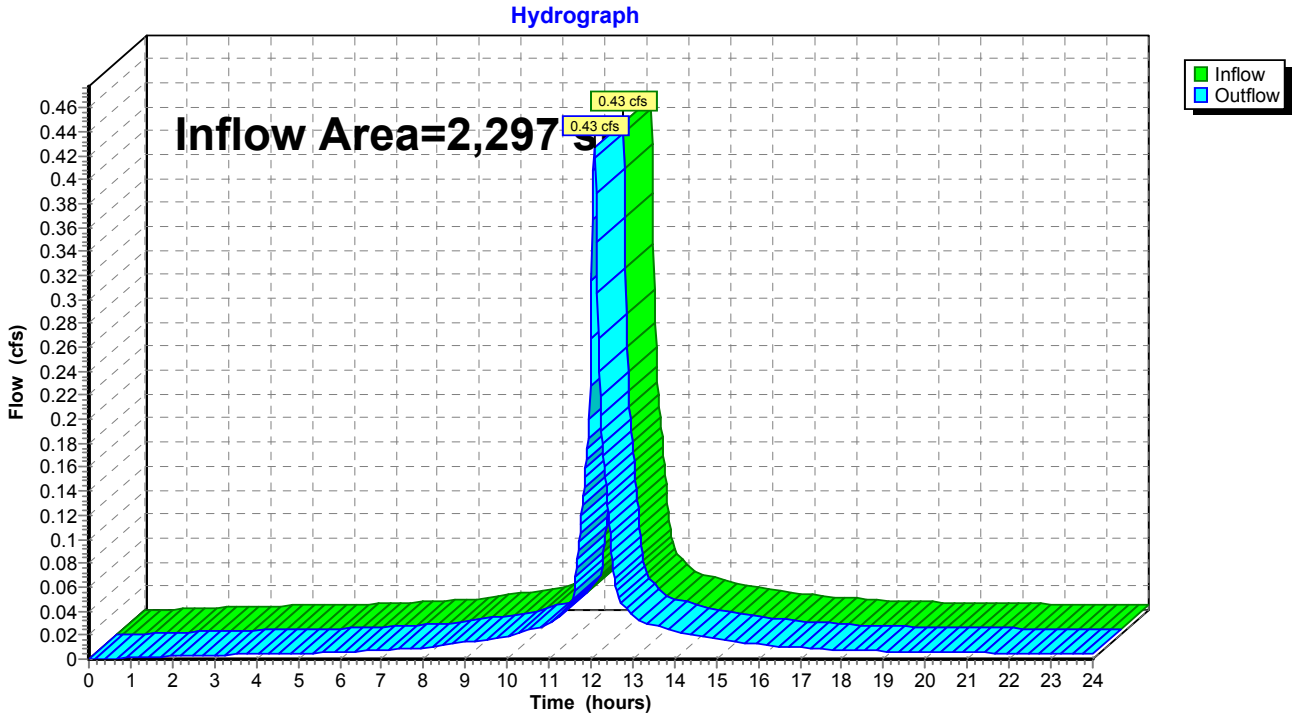
Summary for Reach DP-1: Thorndike Street

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

Inflow Area = 2,297 sf, 85.20% Impervious, Inflow Depth > 7.86" for 100-yr Storm event
Inflow = 0.43 cfs @ 12.08 hrs, Volume= 1,505 cf
Outflow = 0.43 cfs @ 12.08 hrs, Volume= 1,505 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street



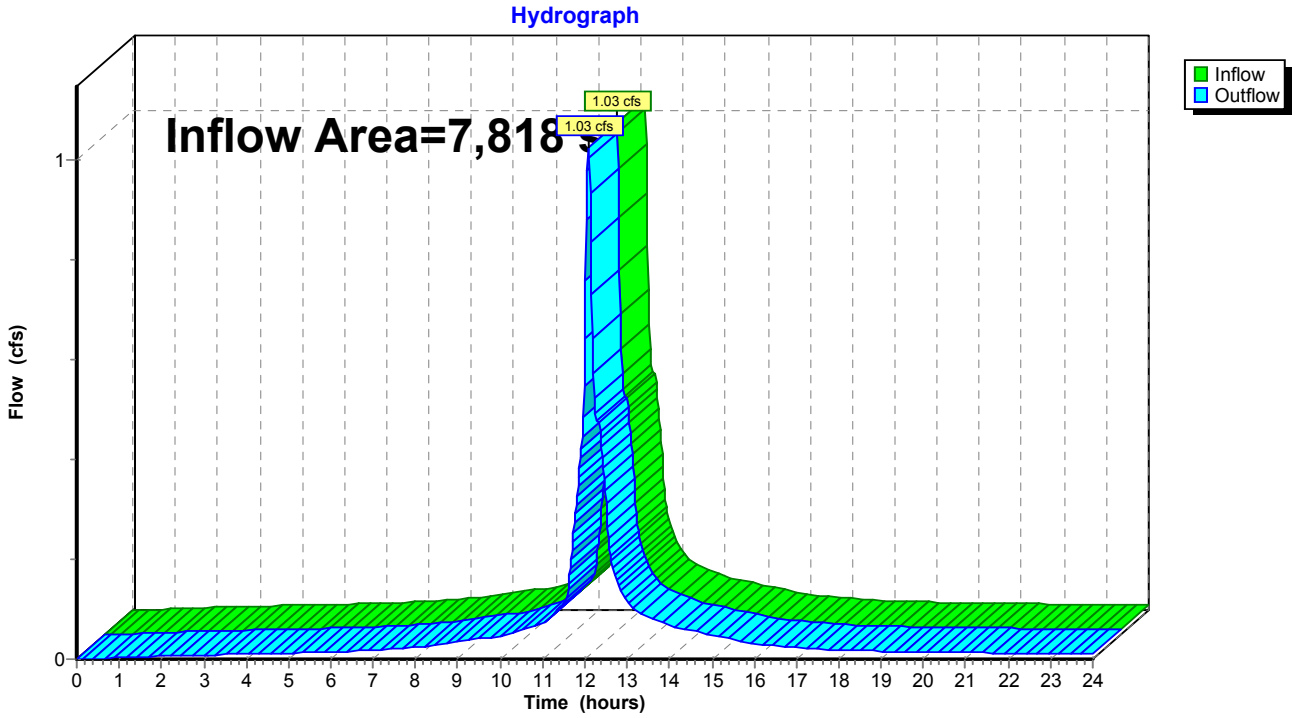
Summary for Reach DP-2: Harvard Street

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

Inflow Area = 7,818 sf, 80.40% Impervious, Inflow Depth > 6.03" for 100-yr Storm event
Inflow = 1.03 cfs @ 12.08 hrs, Volume= 3,930 cf
Outflow = 1.03 cfs @ 12.08 hrs, Volume= 3,930 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area = 2,342 sf, 64.05% Impervious, Inflow Depth > 6.90" for 100-yr Storm event
Inflow = 0.42 cfs @ 12.08 hrs, Volume= 1,347 cf
Outflow = 0.13 cfs @ 12.40 hrs, Volume= 993 cf, Atten= 69%, Lag= 19.1 min
Discarded = 0.01 cfs @ 10.10 hrs, Volume= 697 cf
Primary = 0.12 cfs @ 12.40 hrs, Volume= 296 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 60.74' @ 12.40 hrs Surf.Area= 504 sf Storage= 553 cf

Plug-Flow detention time= 200.0 min calculated for 992 cf (74% of inflow)
Center-of-Mass det. time= 114.0 min (901.1 - 787.0)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

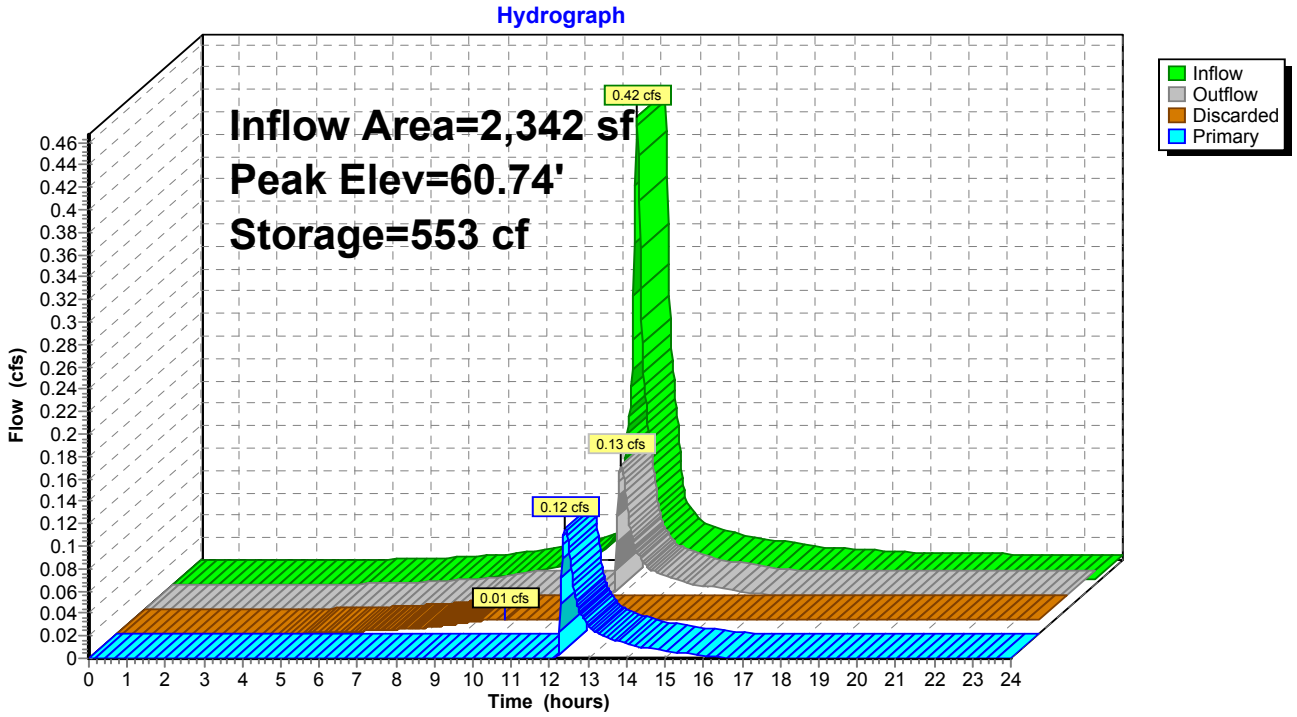
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	60.50'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.50' / 56.30' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 10.10 hrs HW=58.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.12 cfs @ 12.40 hrs HW=60.74' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 0.12 cfs @ 1.68 fps)

Pond PP-1: Permeable Pavers



A P P E N D I X C

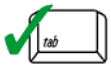
Checklist for Stormwater Report

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.

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[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

COMMONWEALTH OF MASSACHUSETTS
BRADLEY C
McKENZIE
CIVIL
No. 36917
REGISTERED
PROFESSIONAL ENGINEER

7/25/18

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): Permeable Pavers

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.

A P P E N D I X D

Illicit Discharge Compliance Statement
Supplemental BMP Calculations

Illicit Discharge Compliance Statement

I, Bradley C. McKenzie, P.E., hereby notify the Brookline Conservation Commission that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 445 Harvard Street in Brookline, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "445 Harvard Street," prepared by McKenzie Engineering Group, Inc. dated July 20, 2018 and as revised and approved by the Brookline Conservation Commission and maintenance thereof in accordance with the "Construction Phase Operations and Maintenance Plan" and "Long-Term Operations and Maintenance Plan" prepared by McKenzie Engineering Group, Inc. dated July 20, 2018 and as revised and approved by the Brookline Conservation Commission will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Bradley C. McKenzie, P.E.

Company: McKenzie Engineering Group, Inc.

Title: Owner's Representative

Signature: _____

Date: _____

MCKENZIE ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

Standard 4: Total Suspended Solids Calculation: Permeable Pavers

NAME: 445 Harvard Street
Brookline, MA
CLIENT: 445 Harvard Street Corp
COUNTY: Norfolk

Proj. No.: 218-106
Date: 7/20/2018
Revised:
Computed by: SBS
Checked by: BCM

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Porous Pavement	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = 80%

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

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

Mass. Dept. of Environmental Protection
Version 1, Automated: Mar. 4, 2008

MCKENZIE ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

445 HARVARD STREET
BROOKLINE, MA

7/20/2018

WATER QUALITY VOLUME ANALYSIS

POND	IMPERVIOUS AREA (SF) CN=98	PRECIPITATION (IN)	WATER QUALITY VOLUME REQUIRED (CF)	TREATMENT VOLUME PROVIDED (CF) UP TO PEAK ELEVATION 60.74	NET TREATMENT VOLUME PROVIDED (CF)
PP1	8,241	0.50	343	552	209
TOTAL	**8,241**		**343**	**552**	**209**

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Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

445 HARVARD STREET
BROOKLINE, MA

7/20/2018

REQUIRED RECHARGE VOLUME (CF) *"STATIC METHOD"*

WATERSHED #	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) A SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) B SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) C SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) D SOIL		REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE		0.60	8,241	0.35		0.25		0.10		240
		0.60		0.35		0.25		0.10		0
		0.60		0.35		0.25		0.10		0
							TOTAL			**240**

* Required Water Quality Volume based on 0.5 inches of runoff; Required Recharge Volume based on 0.35 inches (0.35<0.50); Target Volume is Required Water Quality Volume of 347 CF

PROVIDED RECHARGE VOLUME (CF)

UP TO PEAK ELEVATION 60.74

	REQUIRED RECHARGE VOLUME (CF)	POND	STORAGE VOLUME PROVIDED (CF)	NET STORAGE VOLUME PROVIDED (CF)
	343	PP-1	552	
TOTAL	**343**		**552**	**209**

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Norwell, MA 02061

445 HARVARD STREET
BROOKLINE, MA

7/20/2018

DRAWDOWN WITHIN 72 HOURS ANALYSIS

POND	RAWLS RATE (IN/HR)	STORAGE VOLUME PROVIDED (CF)	BOTTOM AREA (FT2)	DRAWDOWN (HR)
PP-1	1.02	552	504	13

A P P E N D I X E

Best Management Practices
Operation and Maintenance Plans

CONSTRUCTION PHASE BEST MANAGEMENT PRACTICES
OPERATION AND MAINTENANCE PLAN

for

445 Harvard Street
in
Brookline, Massachusetts
(Assessor's Parcel I.D. 067-09-00)

Submitted to:

Town of Brookline

Prepared for:

445 Harvard Street Corp
28 Lyon Road
Brookline, Massachusetts 02467

July 20, 2018

Prepared by:

ofessional Civil Engineering • Professional Land Surveying • Land Planning

MCKENZIE ENGINEERING GROUP

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TABLE OF CONTENTS

	Page
Project Narrative	
- Project Description	1
- Pre-development Condition	2
- Post-development Condition	3
Erosion and Sedimentation Controls - Best Management Practices (BMP's)	
- Structural Practices	3
- Stabilization Practices	6
- Dust Control	12
- Non-Stormwater Discharges	13
- Soil Stockpiling	13
- Pollution Prevention	13
- Inspection/Maintenance	18
- Inspection Schedule and Evaluation Checklist	19
-Spill Containment and Management Plan	21

Plans

- Figure-1 USGS Locus Map (Refer to Drainage Report)
- Site Topographic Map (Existing Conditions Plans within Plan Set)
- Site Development Map (Grading and Drainage Plans within Plan Set)
- Site Erosion and Sedimentation Plan (Grading and Drainage Plans within Plan Set)
- Construction Detail Plan (Construction Details within Plan Set)

Construction Phase Best Management Practices (BMP's)

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled 445 Harvard Street, prepared by McKenzie Engineering Group, Inc and shall comply as required per the Town of Brookline, Department of Public Works Site Plan Review Checklist (Revised December 2014).

Project Narrative

Project Description

The project proponent proposes to redevelop an approximate 10,115 SF parcel of land at the above-mentioned address, into a mixed-use development complex which will consist of five stories (and basement parking garage) with approximately 21 total units, 4,380 SF of first floor retail space, and 21 total parking spaces.

As required by the Town of Brookline, stormwater peak rate requirements for post-development do not exceed existing conditions for the 2, 10, 25, and 100-year storm event. On-site infiltration has been designed to meet the 25-year 24-Hour event (6.20" of rain) in accordance with MADEP Stormwater Management Regulations, as well as modeled to handle the peak rates of the 100-year design storm. The soil data was obtained from the USDA Natural Resources Conservation Service, Web Soil Survey as referenced in the Town of Brookline Site Plan Checklist. The survey revealed hydrologic Class B soils, in the form of Canton – Urban Land Complex. Class B soil which will be removed of all unsuitable material resulted in a Rawls rate of 1.02 in/hr being selected. In the report find all calculations and analysis (by Professional Engineer) that prove the proposed system complies with all Town of Brookline and MADEP Stormwater Rules and Regulations.

EROSION AND SEDIMENTATION CONTROLS – BMP's

Structural Practices:

1) **Silt Sock Erosion Control Barrier** – A silt sock barrier will be constructed along downward slopes at the limit of work and in locations shown on the plans. This control will be installed prior to major soil disturbance on the site. The sediment silt sock barrier should be installed as shown on the Construction Detail Plan.

   Sediment Silt Sock Design/Installation Requirements

   a) Locate the silt sock where identified on the plans.

   b) The silt sock line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the silt sack should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.

   c) The silt sock shall be staked every 8 linear feet with 1-inch by 1-inch stakes.

   d) Sediment silt socks should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized

through one growing season. Retained sediment must be removed and properly disposed of or mulched and seeded.

Sediment Silt Sock Inspection/Maintenance

a) Silt socks should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, and to see that the stakes are firmly in the ground. Repair or replace as necessary.

b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the silt sock. Take care to avoid undermining fence during cleanout.

c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.

d) Remove all silt sock materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform with the existing topography and vegetated.

2) **Stabilized Construction Entrance** – A stabilized construction entrance will be placed at the proposed entrance at Washington Street. The construction entrance will keep mud and sediment from being tracked off the construction site onto Washington Street by vehicles leaving the site. The stabilized construction entrance will be installed immediately after the establishment of the driveway entrance and associated driveway fill to maintain access to the site. During the driveway construction, access to the site shall be coordinated with the abutting projects. The construction entrance will be graded to contain stormwater runoff from the entrance to prevent sediment from washing onto the adjacent ground surface. The stabilized construction entrance shall be constructed as shown on the Construction Detail Plans.

Construction Entrance Design/Construction Requirements

a) Grade foundation of construction entrance with slightly concave shape to contain runoff within the entrance to prevent sediment from washing onto the adjacent ground surface.

b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.

c) Pad dimensions: The minimum length of the gravel pad should be 30 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater.

d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.

e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the road or street. The wash area shall be located at the stabilized construction entrance.

f) Water employed in the washing process shall be directed to the temporary sedimentation basin/dewatering area as shown on the plans prior to discharge. Sediment should be prevented from entering any watercourses.

Construction Entrance Inspection/Maintenance

a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Washington Street. This may require periodic topdressing with additional stone

b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.

c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.

d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.

e) If washing facilities are used, the temporary sedimentation basin/dewatering area should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available. Any water pumped from the temporary sedimentation basin shall be directed into a sediment dirt bag or equivalent inlet protection prior to discharge. Discharge should not be across the disturbed construction site but rather to undisturbed areas.

f) The pad shall be reshaped as needed for drainage and runoff control.

g) Broken road pavement on Washington Street shall be repaired immediately.

h) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed and only following approval by the Engineering Department or their representative. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

3) **Inlet Protection** – Inlet Protection will be utilized around the existing catch basin grates within Hospital Road at the site's frontage. The inlet protection will prevent any sediment from entering the street(s) closed drainage system. Siltsack or

equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 1-800-437-6746. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance Requirements

a) The silt sack trapping device and the catch basin should be inspected after every rain storm and repairs made as necessary.

b) Sediment should be removed from the silt sack after the sediment has reached a maximum depth of one-half the depth of the trap.

c) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

d) The silt sack must be replaced if it is ripped or torn in any way.

e) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.

- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

Temporary Seeding Planting Procedures

a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.

b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.

c) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1st to June 1st August 15th to Sept. 15th	¼ inch
Foxtail Millet	0.7	30	May 1st to June 30th	½ to ¾ inch
Oats	2	80	April 1st to July 1st August 15th to Sept. 15th	1 to 1-½ inch
Winter Rye	3	120	August 15th to Oct. 15th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

d) Use effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance

a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four hour period). Stands should be uniform and dense. Reseed and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.

b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	**Manufacturer**	**Product**	**Remarks**
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening

Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening
Erosion Control (slope stability)	Amoco	Supergro or equivalent	Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim

Amoco may be reached at (800) 445-7732

Geotextile Installation

a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance

a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.

3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

Mulch (Hay or Straw) Materials and Installation

a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance

a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.

b) Straw or grass mulches that blow or wash away should be repaired promptly.

c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.

d) Continue inspections until vegetation is well established.

4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.

b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.

c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.

d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.

e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

Land Grading Stabilization Inspection/Maintenance

a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.

b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.

c) Areas requiring revegetation should be repaired immediately. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

5) **Topsoiling** – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.

b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.

c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.

6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and re-spread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.

b) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.

c) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydro-seeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.

b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.

c) Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance

a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.

b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.

c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.

d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

Dust Control:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction access roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

The general contractor shall employ an on-site water vehicle for the control of dust as necessary.

Non-Stormwater Discharges:

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b)(14)(x).

Soil Stockpiling:

Topsoil and subsoil from the roadway grading will be stockpiled in locations shown on the plans.

Stockpile Material Construction Procedure

1) Topsoil and subsoil that are stripped will be stockpiled for later distribution on disturbed areas.

2) The stockpiles will be located as shown on the plans. These locations will allow them to not interfere with work on the site.

3) Seed the stockpiles with a temporary erosion control mix if the stockpile is to remain undisturbed for more than 30 days. The stockpiles must be stable and the side slopes should not exceed 2:1.

4) Sediment erosion control measures should be placed surrounding each stockpile.

5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

Pollution Prevention:

Fueling and Maintenance of Equipment or Vehicles

Refueling/maintenance Rules – The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. This document shall include language that shall permit the maintenance of vehicles only in designated locations on the job site. In the event of mechanical failure of a vehicle, the vehicle shall be moved to the designated maintenance area on the site to perform maintenance. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

1. Fueling operations shall take place in designated area(s) as shown on site maps. Provide temporary drip protection during fueling operations which take place outside of designated area(s). Materials necessary to address a spill shall be made readily available in a location known to the site supervisor or his/her designee.

2. Fueling operation procedures shall be in effect throughout the project duration.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Washing of Equipment and Vehicles

Vehicle Washing Rules - The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall include language that shall not permit vehicle washing on the job site. Concrete trucks shall be exempt from this rule. Concrete truck cleaning shall be confined within the work area and conducted in a manner to prevent water drainage beyond the specified area of work.
Concrete truck washout shall be conducted in designated areas and shall not be discharged in areas which would allow wash water to leave the site or enter protected areas.

Maintenance Requirements

1. The site supervisor shall maintain a log of individuals receiving these instructions.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

Building Products - Building products are not anticipated during this phase of construction.

Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

The use of pesticides and herbicides is not currently anticipated for this site. Fertilizers and landscape materials will be used to stabilize slopes and other disturbed areas.

1. Store all fertilizers and landscape materials in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.

Maintenance Requirements

1. The site supervisor shall regularly inspect the designated storage areas as well as any portions of the site under construction to ensure that all materials are properly stored. The site supervisor shall immediately address any issues and instruct personnel to secure and properly store all materials.

Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

Refueling and maintenance for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

Refueling and maintenance of equipment shall take place in designated areas whenever possible. Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee and shall employ drip pans or other suitable means of preventing fuel, hydraulic fluid, etc. from spilling or being otherwise carried offsite or into protected areas.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

Hazardous or toxic waste associated with paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations.

Hazardous or toxic waste shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations. Hazardous and toxic waste shall not be disposed of in solid waste containers intended for non-hazardous construction debris.

Maintenance Requirements

1. The site supervisor shall regularly inspect all portions of the project under construction and ensure that all hazardous or toxic materials are disposed of in accordance with the practices detailed above and shall immediately correct any improper disposal practices.

Construction and Domestic Waste

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

Construction and domestic waste shall be disposed of in a trash receptacle (dumpster) which shall be removed and disposed of at an approved land fill.

Recyclable waste material shall be stored in an appropriate container or in a designated location on site until it can be removed.

1. Trash receptacles (dumpsters) and recyclable waste material containers shall be located as needed throughout the site.

Maintenance Requirements

1. The site supervisor shall inspect all trash receptacles and containers to confirm that construction and domestic waste is properly contained, and shall also ascertain that waste is being picked up in a timely manner to ensure that no receptacles are overflowing. Pick-up schedules shall be modified or the number of receptacles shall be increased as needed.

Sanitary Waste

During the construction process, portable toilets will be provided in an appropriate location during the construction process.

Maintenance Requirements

1. The site supervisor shall execute a contract with a vendor to supply and maintain portable toilets throughout the site for the project duration. The site supervisor shall determine if a sufficient number of toilets are present to meet staffing levels and shall ensure that the toilets are regularly and properly maintained.

Washing of Applicators and Containers used for Paint, Concrete or Other Materials

Concrete washout shall be restricted to designated areas. Paints, form release oils, curing compounds, etc. shall be recycled and/or disposed of utilizing appropriate containers in accordance with manufacturer's recommendations and EPA guidelines.

1. Install straw bale and plastic liner washout pit at the designated location on site. Concrete trucks shall wash out only at washout pit or other similar acceptable facility such as a portable roll-off washout pit.
2. Provide suitable containers for recycling or disposal for cleanup of paints, form release oils, curing compounds, etc.

Maintenance Requirements

1. The site supervisor shall inspect concrete washout pits (or other acceptable facility) to ensure that they are properly maintained. If necessary, wash water in a concrete washout pit shall be vacuumed off and the hardened concrete broken up and recycled. Wash water and broken up concrete shall be properly disposed of at a suitable facility. If necessary the wash out pit shall be repaired and relined with plastic prior to continued use.
2. Containers for waste paint, form release oil, curing compounds, etc. shall be sealed and removed from the site and properly disposed of at a suitable facility. Empty containers shall replace those being removed for disposal.

Fertilizers

Fertilizers shall be used only as necessary to establish vegetative stabilized slopes and disturbed areas. Apply at recommended rates. Use only slow release fertilizers to minimize discharge of nitrogen or phosphorous.

1. Store all fertilizers in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.
2. To prevent accidental release of fertilizers, the site supervisor shall attempt to coordinate delivery of fertilizers to coincide with application and reduce the need to warehouse large quantities on-site.

Maintenance Requirements

1. Site supervisor shall make regular inspections to ensure that fertilizer is being applied at proper rates and that all perimeter controls are in place and properly maintained to control runoff which may contain fertilizer. Stored fertilizer shall be properly covered or enclosed in a designated location to prevent introduction into stormwater runoff.

Spill Prevention and Response

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing. In the event a spill occurs, the site supervisor shall be notified immediately.
The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner. Refer to the following Spill Containment & Management Plan, including Spill Report, Emergency Response Equipment Inventory, and Emergency Notification and phone numbers.

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes and submit copies of the form to the Brookline Department of Public Works.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Operation and Maintenance Plan to control or eliminate unforeseen pollution of storm water.

Project Location: 445 Harvard Street – Brookline, MA

Stormwater Management – Construction Phase
Best Management Practices – Inspection Schedule and Evaluation Checklist

Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/ Repair	Performed by
Siltsock Erosion Control Barrier	After heavy rainfall events (minimum weekly)			1. Sediment Silt Sock Design/Installation Requirements 2. Sediment Silt Sock Inspection/Maintenance	☐yes ☐no		
Stabilized Construction Entrance	After heavy rainfall events (minimum weekly)			1. Construction Entrance Design/ Construction Requirements 2. Construction Entrance Inspection/ Maintenance	☐yes ☐no		
Inlet Protection	After heavy rainfall events (minimum weekly)			1. Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance	☐yes ☐no		
Temporary Seeding	After heavy rainfall events (minimum weekly)			1. Temporary Seeding Planting Procedures 2. Temporary Seeding Inspection/ Maintenance	☐yes ☐no		
Geotextiles	After heavy rainfall events (minimum weekly)			1. Geotextile Inspection/Maintenance	☐yes ☐no		
Mulching & Netting	After heavy rainfall events (minimum weekly)			1. Mulch Maintenance	☐yes ☐no		
Land Grading	After heavy rainfall events (minimum weekly)			1. Land Grading Stabilization Inspection/ Maintenance	☐yes ☐no		
Topsoiling	After heavy rainfall events (minimum weekly)			1. Topsoiling Placement Inspection/ Maintenance	☐yes ☐no		

Permanent Seeding	After heavy rainfall events (minimum weekly)			1. Permanent Seeding Inspection/ Maintenance	☐**yes** ☐**no**		
Dust Control	After heavy rainfall events (minimum weekly)				☐**yes** ☐**no**		
					☐**yes** ☐**no**		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

<u>Notes (Include deviations from : Site Plan Approval or Order of Conditions, Construction Sequence and Approved Plan):</u>

Stormwater Control Manager _____

Spill Containment and Management Plan

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) _____

_____

Facility Manager (phone) _____

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	911
Police Department:	911
Department of Public Works:	(617) 730-2175
Board of Health Phone:	(617) 730-2300
Conservation Commission Phone:	(617) 730-2088

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date____/_____/_____ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____Make_____Size_____

S / N_____Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____

☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

_____

_____

Measures taken to contain or clean up spill_____

_____

_____

Amount of chemical / oil recovered_____Method_____

Material collected as a result of clean up

_____drums containing_____

_____drums containing_____

_____drums containing_____

Location and method of debris disposal_____

_____

Name and address of any person, firm, or corporation suffering damages_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

_____

Spill reported to General Office by_____Time_____AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date____/_____/_____ Time_____ AM / PM Inspector_____

NRC Date____/_____/_____ Time_____ AM / PM Inspector_____

Additional comments_____

_____

_____

EMERGENCY RESPONSE EQUIPMENT
INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: _____ BEEPER: _____
   PHONE: _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A _____
   PHONE: _____ CEL PHONE: _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6512

3. POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6500

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (617) 556-1133
   NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200

5. NATIONAL RESPONSE CENTER
   PHONE: (800) 424-8802

   ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
   EMERGENCY: (617) 223-7265
   BUSINESS: (617) 860-4300

6. DEPARTMENT OF PUBLIC WORKS
   CONTACT: Peter Ditto, P.E., P.L.S., Director
   PHONE: (617) 730-2175

7. CONSERVATION COMMISSION
   CONTACT: Thomas D. Brady
   PHONE: (617) 730-2088

8. BOARD OF HEALTH
   PHONE: (617) 730-2300

BEST MANAGEMENT PRACTICES
LONG-TERM
OPERATION & MAINTENANCE PLAN

for

445 Harvard Street
in
Brookline, Massachusetts
(Assessor's Parcel I.D. 067-09-00)

Submitted to:

Town of Brookline

Prepared for:

445 Harvard Street Corp
28 Lyon Road
Brookline, Massachusetts 02467

July 20, 2018

Prepared by:

ofessional Civil Engineering • Professional Land Surveying • Land Planning

MCKENZIE ENGINEERING GROUP

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TABLE OF CONTENTS

	Page
Long Term Best Management Practices (BMP's)	
- Responsible Party Contact Information	1
- Long-Term Operation and Maintenance	2
- BMP Operation and Maintenance	2
- Maintenance Responsibilities	3
- Long-Term Pollution Prevention Plan	3
- Inspection Schedule and Evaluation Checklist	6
- Spill Containment and Management Plan	7

Long-Term Operation and Maintenance Stormwater Best Management Practices

In accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (MassDEP), McKenzie Engineering Group, Inc. has prepared the following Long-Term Operations and Maintenance Plan for the 445 Harvard Street in Brookline, Massachusetts.

Responsible Party Contact Information

Stormwater Management System Owner:	445 Harvard Street Corp 28 Lyon Road Brookline, MA 02467 Victor Sheen (617) 721-3342
Brookline Department of Public Works Engineering & Transportation:	Peter Ditto, P.E., P.L.S., Director Brookline Town Hall 333 Washington Street Brookline, MA 02445 (617) 730-2175 pditto@brooklinema.gov Andrew M. Pappastergion, Commissioner Brookline Town Hall 333 Washington Street Brookline, MA 02445 (617) 730-2175 apappastergion@brooklinema.gov
Water & Sewer Division:	Frederick W. Russell, Director Brookline Town Hall 333 Washington Street Brookline, MA 02445 (617) 730-2175 frussel@brooklinema.gov

Long-Term Operations and Maintenance
General Conditions

1. The property owner shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's as illustrated on the design plans and detailed in the following long-term operations and maintenance plan.
2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Operations and Maintenance Plan.
3. The owner shall:
   a. Maintain an Operation and Maintenance Log (see Attachment A) for the last three years. The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
   b. Make the log available to the Brookline Department of Public Works and Planning Board upon request;
   c. Allow members and agents of the Brookline Department of Public Works to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. A recommended inspection and maintenance schedule is outlined below based on statewide averages. This inspection and maintenance schedule should be adhered to at a minimum for the first year of service of all BMP's referenced in this document. At the commencement of the first year of service, a more accurate inspection/maintenance schedule should be determined based on the level of service for this site.

Best Management Practices Operations and Maintenance

1. **Sidewalk Areas** –Vacuum sweepers shall sweep sidewlk areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping sidewalks in March and April before spring rains wash residual sand into the drainage system.

   Salt used for de-icing on the sidewalks during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

   Cost: The property owner should consult local sweeping contractors for detailed cost estimates.

2. **Permeable Pavers -** The permeable paver infiltration system includes the pavers themselves as well as multiple layers of stone subbase, used to promote the infiltration of stormwater runoff. In order for the stormwater to infiltrate, it is important that the permeable paver area be kept clean. The permeable pavers should be vacuum swept once per year, in the spring time, to remove built up silt and organics. The joints of the permeable pavers should be topped off 2-4 months after installation, as natural settling will occur. This may also be required periodically, as vacuum sweeping may remove a small amount of the joint aggregate.

   Cost: The property owner should consult local landscape contractors for detailed cost estimates.

3. **Pesticides, Herbicides, and Fertilizers -** Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.

   All structural BMP's as identified on the site plans will be owned and maintained by the homeowner's association of the development and shall run with the title of the property.

   Cost: Included in the routine landscaping maintenance schedule. The property owner should consult local landscaping contractors for details.

4. **Snow Removal -** Snow accumulations removed from driveway and sidewalk areas should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Excess snow should be removed from the site and properly disposed of in an approved snow disposal facility. Care must be exercised not to deposit snow in the following areas: where sand and debris can get into the watercourse.

   Cost: The property owner should consult local snow removal contractors for a detailed cost estimate.

Maintenance Responsibilities

The development will remain private and the developer and future residents of the development will be responsible for the upkeep of the drainage system as agreed upon. All post construction maintenance activities should be documented and kept on file and made available to the Brookline DPW, in addition to the Planning Board upon request.

Long-Term Pollution Prevention Plan
Good Housekeeping:

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.

- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.

Storage and Disposal of Waste and Toxics:

Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts.

The exterior storage of hazardous materials on site shall be prohibited.

The following is a list of management considerations for hazardous materials as outlined by the EPA:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport;
- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself;
- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests.

Landscape Maintenance:

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawn areas at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Abide by water restrictions and other conservation measures implemented by the Town of Brookline.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

Integrated Pest Management (IPM):

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos, which even at very low levels can be harmful to aquatic life.

The following IPM practices will be encouraged:

- Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.
- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.

Illicit Discharges:

Illicit discharges are non-stormwater discharges to the storm drain system which typically contain bacteria and other pollutants. All illicit discharges are prohibited. Any illicit discharges should be reported to MassDOT and/or the DPW as applicable to be addressed in accordance with their respective policies.

The following is a list of EPA allowed non-stormwater discharges. If the non-stormwater discharge is not listed, it is prohibited.

1. Water line flushing,
2. Landscape irrigation,
3. Diverted stream flows,
4. Rising ground waters,
5. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
6. Uncontaminated pumped ground water,
7. Discharge from potable water sources,
8. Foundation drains,
9. Air conditioning condensation,
10. Irrigation water, springs,
11. Water from crawl space pumps,
12. Footing drains,
13. Lawn watering,
14. Flows from riparian habitats and wetlands,
15. Street wash water,
16. Discharges or flows from fire fighting activities occur during emergency conditions.

Project Location: 445 Harvard Street - -Brookline, MA **Date:**

Stormwater Management – Long Term

Best Management Practices – Inspection Schedule and Evaluation Checklist

Long Term Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/ Repair	Performed by
Sidewalk Maintenance	4-times annually			1. Sand build-up 2. Trash and debris	☐**yes** ☐**no**		
Permeable Pavers	After heavy rainfall events (minimum annually)			1. Ponding after rainfall events 2. Trash and debris 3. Joint material ½ inch below lip of paver	☐**yes** ☐**no**		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

<u>Notes (Include deviations from : Site Plan Approval and Order of Conditions and Approved Plans):</u>

1. Limited or no use of sodium chloride slats, fertilizers or pesticides recommended. Slow release fertilizer recommended if necessary.

Stormwater Control Manager _____

Spill Containment and Management Plan

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) _____

_____

Facility Manager (phone) _____

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	911
Police Department:	911
Department of Public Works:	(617) 730-2175
Board of Health Phone:	(617) 730-2300
Conservation Commission Phone:	(617) 730-2088

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date____/_____/_____ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____Make_____Size_____

S / N_____Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____

☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

_____

_____

Measures taken to contain or clean up spill_____

_____

_____

Amount of chemical / oil recovered_____Method_____

Material collected as a result of clean up

_____drums containing_____

_____drums containing_____

_____drums containing_____

Location and method of debris disposal_____

_____

Name and address of any person, firm, or corporation suffering damages_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

_____

Spill reported to General Office by_____Time_____AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date____/_____/_____ Time_____ AM / PM Inspector_____

NRC Date____/_____/_____ Time_____ AM / PM Inspector_____

Additional comments_____

_____

_____

EMERGENCY RESPONSE EQUIPMENT
INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: _____ BEEPER: _____
   PHONE: _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A _____
   PHONE: _____ CEL PHONE: _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6512

3. POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6500

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (617) 556-1133
   NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200

5. NATIONAL RESPONSE CENTER
   PHONE: (800) 424-8802

   ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
   EMERGENCY: (617) 223-7265
   BUSINESS: (617) 860-4300

6. DEPARTMENT OF PUBLIC WORKS
   CONTACT: Peter Ditto, P.E., P.L.S., Director
   PHONE: (617) 730-2175

7. CONSERVATION COMMISSION
   CONTACT: Thomas D. Brady
   PHONE: (617) 730-2088

8. BOARD OF HEALTH
   PHONE: (617) 730-2300

SECTION 12

EXISTING CONDITIONS SUMMARY

EMBARC STUDIO
ARCHITECTURE + DESIGN
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445 Harvard Street
Brookline, MA

PROJECT NARRATIVE

Located at the intersection of Harvard Street and Thorndike Street, the proposed building replaces an active service station (with both gas and mechanic repair services). Currently there are 29 surface parking spaces provided, and this area in addition to the extent of the asphalt paving and current building covers over 100% of the entire site. The existing building at 445 Harvard Street will be replaced with a single twenty-five unit, five-story building with basement parking accessed off of Thorndike Street. This design has incorporated a basement level that allows for 20 parking spaces in addition to utility and trash rooms and bike storage racks.

At 445 Harvard Street, the ground floor (first level) of the proposed building will house 4,360 square feet of new commercial space with entrances along Harvard Street and Thorndike St, similar to those of commercial entries in adjacent buildings to this project. A separate lobby off of Thorndike Street will provide access to the residential units and lounge. A drop off area with short term parking will occur within the internal drive, along with access to bike storage and a trash room for use by both the residential and commercial spaces in the basement. Additionally, similar to 455 Harvard Street, we are proposing to close in the curb cut along Harvard Street and create a 30' long loading zone.

The exterior of the building has been designed with elements that promote a horizontal aesthetic for the building: A combination of full height store front system and large format panels ground the base of the building. The second through fifth floors housing the residential units play off of the traditional Brookline vernacular with materials that will draw from the neighboring structures (various cladding, siding materials and color palate). The top floor has been set back by approximately six feet to reduce the visual height of the building. All units throughout the building have been designed to provide layouts that promote open kitchen/living/dining spaces, with comfortably sized bedrooms, bathrooms, laundry, storage areas and private balconies. All units will have individual washer and dryer units, along with individual heating and cooling systems. Specific attention will be placed on making this a "sustainable" project, carefully selecting products from appliances through building components to achieve this level of sustainability.

The design provides for a range of unit sizes, coupled with the affordable component that will provide much needed quality housing that fits well within the immediate context and surrounding neighborhoods of Brookline.

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SECTION 13

ARCHITECTURAL AND LANDSCAPING PLAN

445 HARVARD STREET

BROOKLINE, MA 02446

AURA PROPERTIES

ZBA SUBMISSION

JULY 25, 2018

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AERIAL VIEW
445 HARVARD STREET
BROOKLINE, MA 02446

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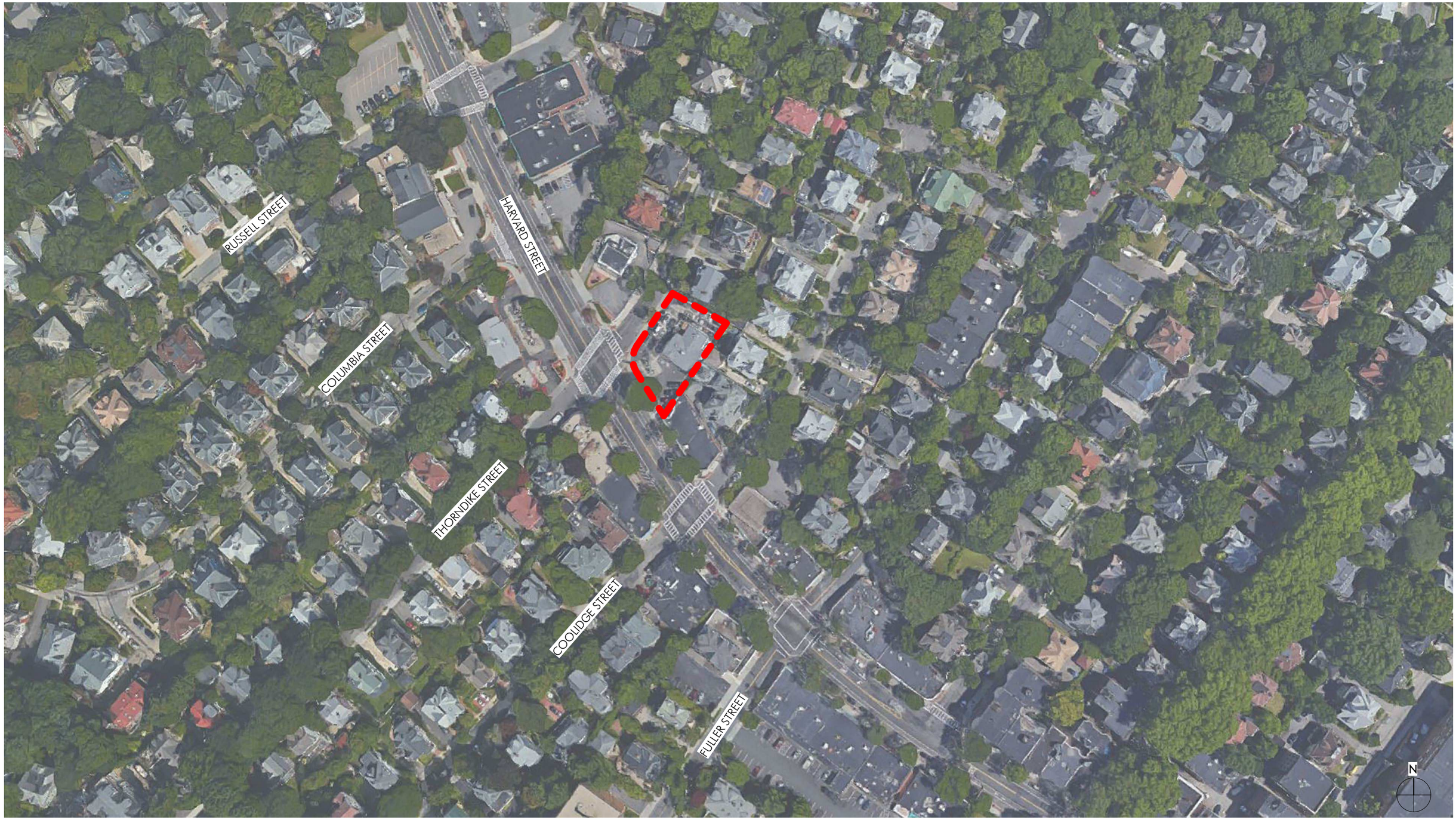

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SITE CONTEXT
445 HARVARD STREET
BROOKLINE, MA 02446

02

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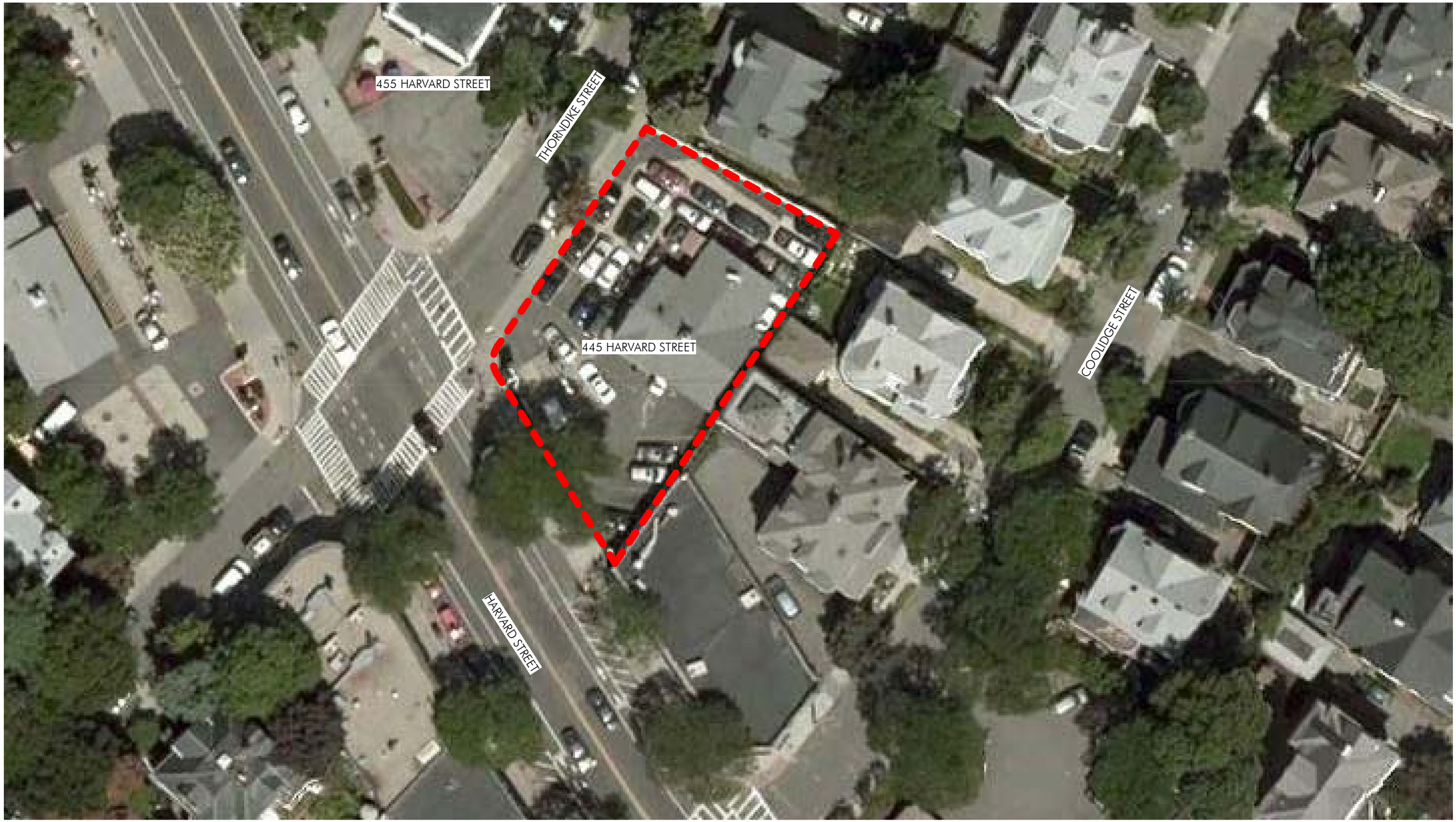

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SITE VEW
445 HARVARD STREET
BROOKLINE, MA 02446

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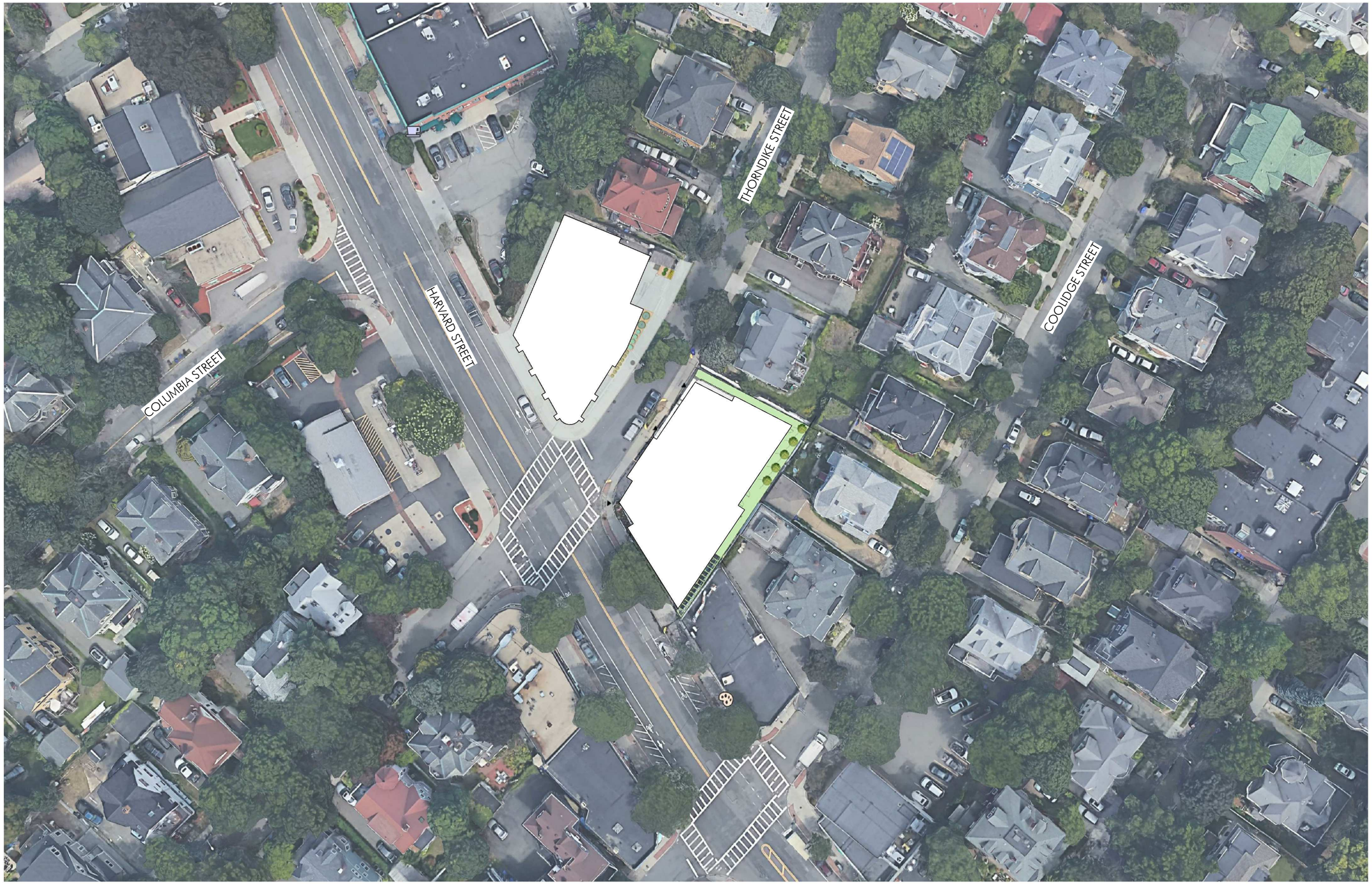

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SITE PLAN DIAGRAM
445 HARVARD STREET
BROOKLINE, MA 02446

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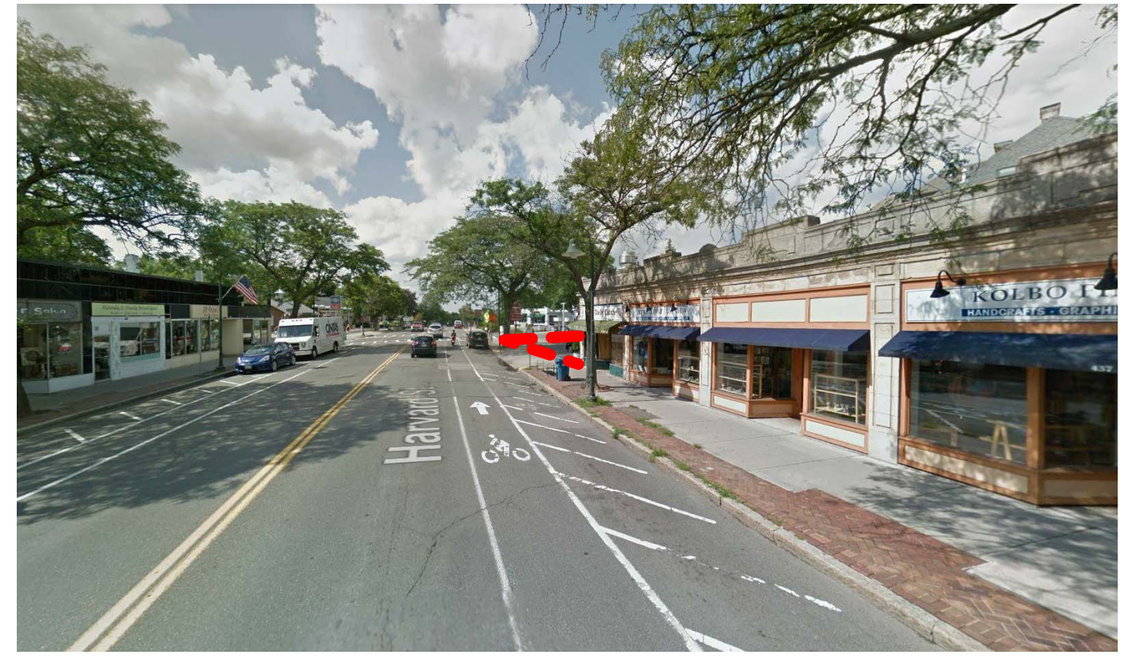
VIEW 1 CORNER OF HARVARD AND THORNDIKE STREETS



VIEW 3 LOOKING NORTHWEST UP HARVARD STREET

VIEW 1 LOOKING SOUTHWEST DOWN THORNDIKE STREET

VIEW 4 LOOKING SOUTHEAST DOWN HARVARD STREET

EMBARC STUDIO
ARCHITECTURE + DESIGN

SITE PHOTOS
445 HARVARD STREET
BROOKLINE, MA 02446

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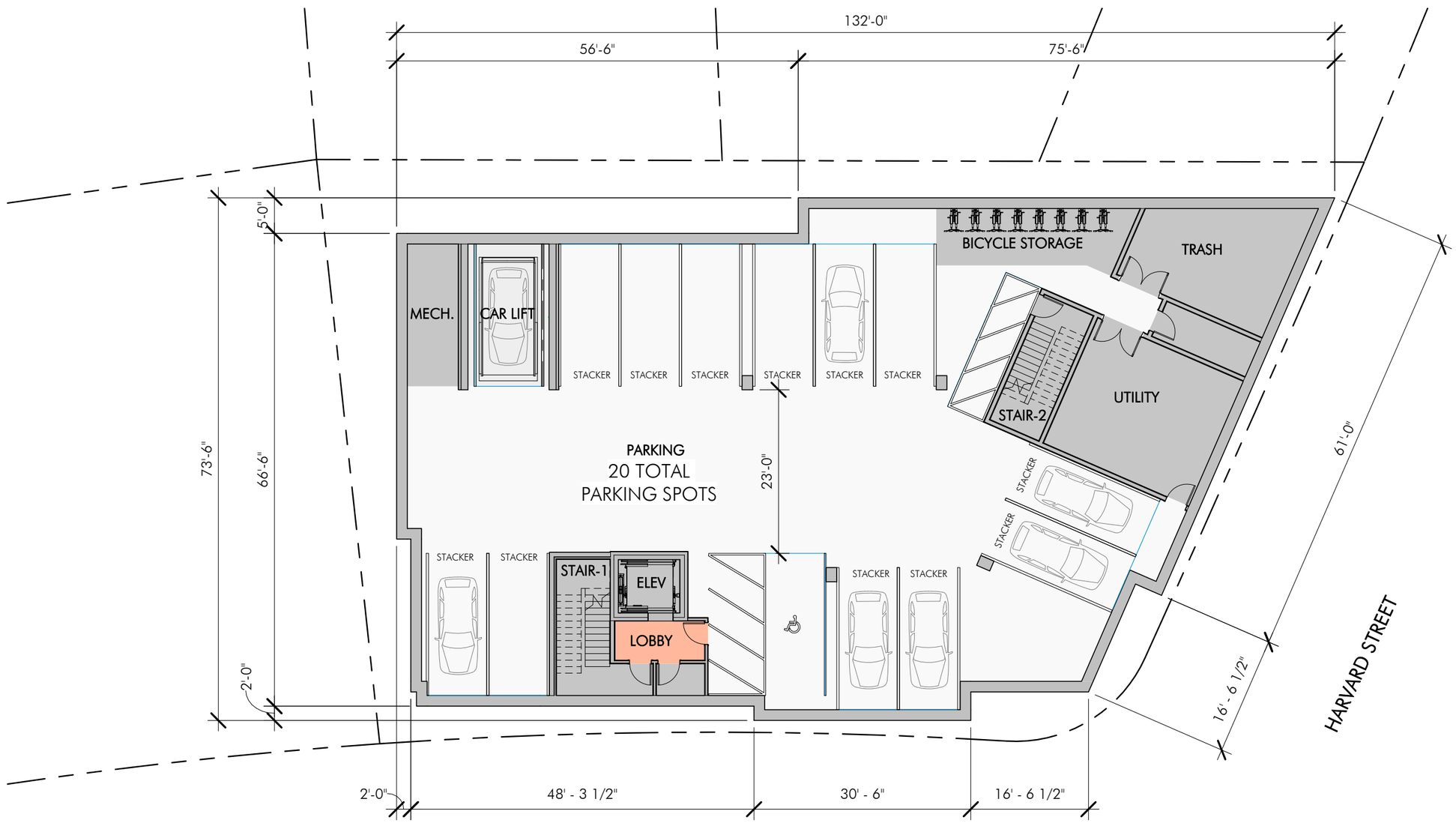

1/16" = 1'-0"

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BASEMENT FLOOR PLAN
445 HARVARD STREET
BROOKLINE, MA 02446

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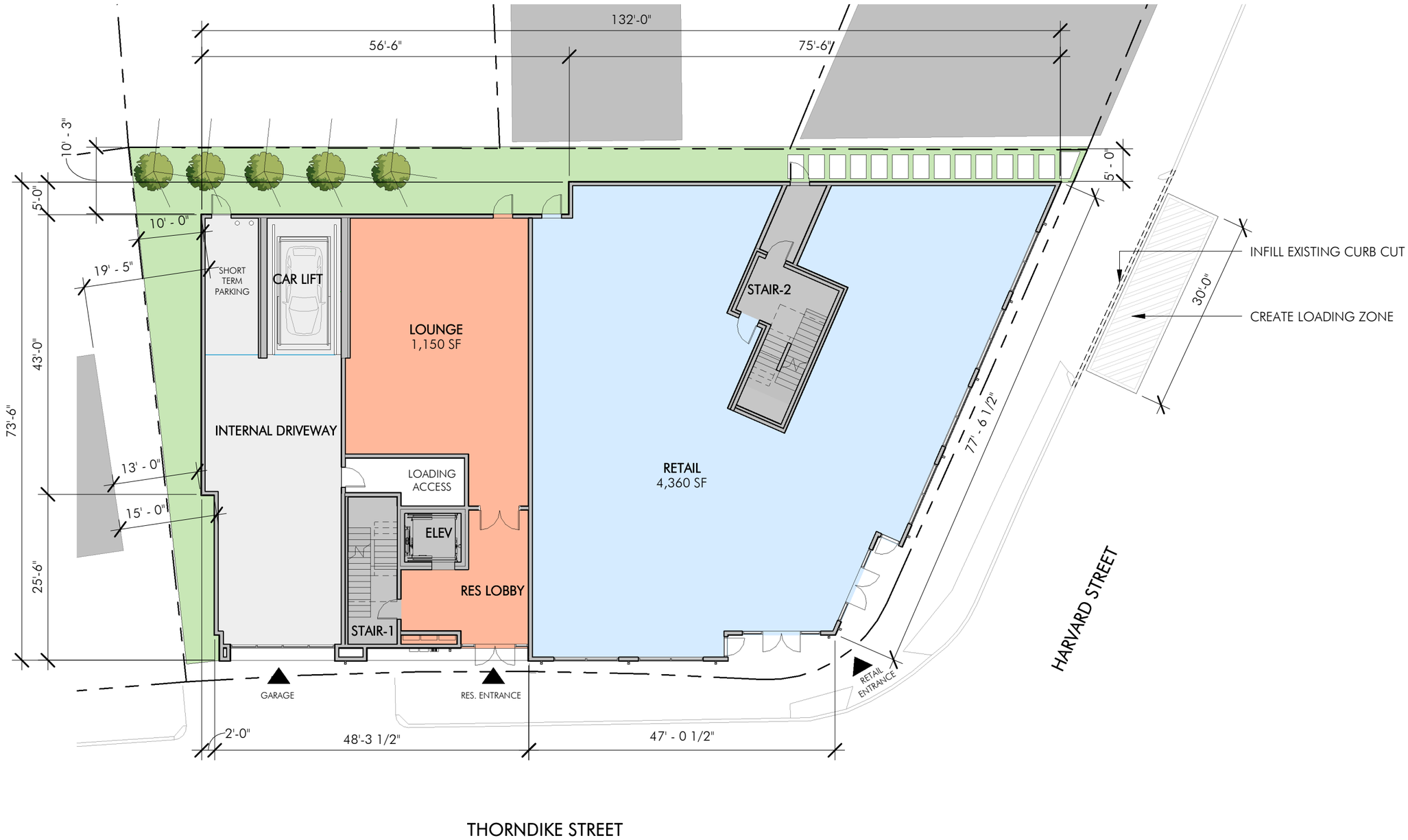

1/16" = 1'-0"

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GROUND FLOOR PLAN
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BROOKLINE, MA 02446

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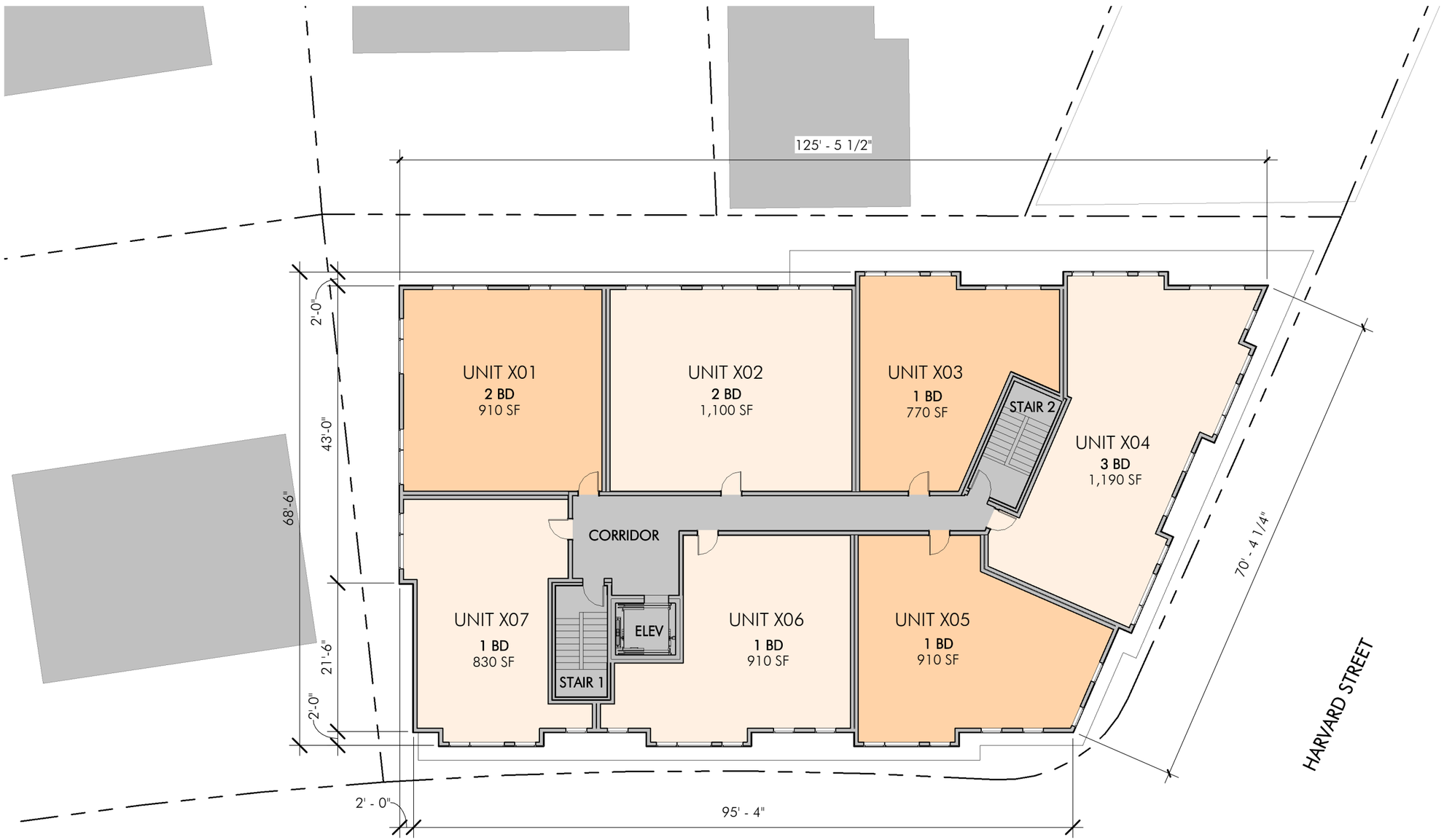

N

1/16" = 1'-0"

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2ND AND 3RD FLOOR PLAN

445 HARVARD STREET
BROOKLINE, MA 02446

08

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4TH FLOOR PLAN
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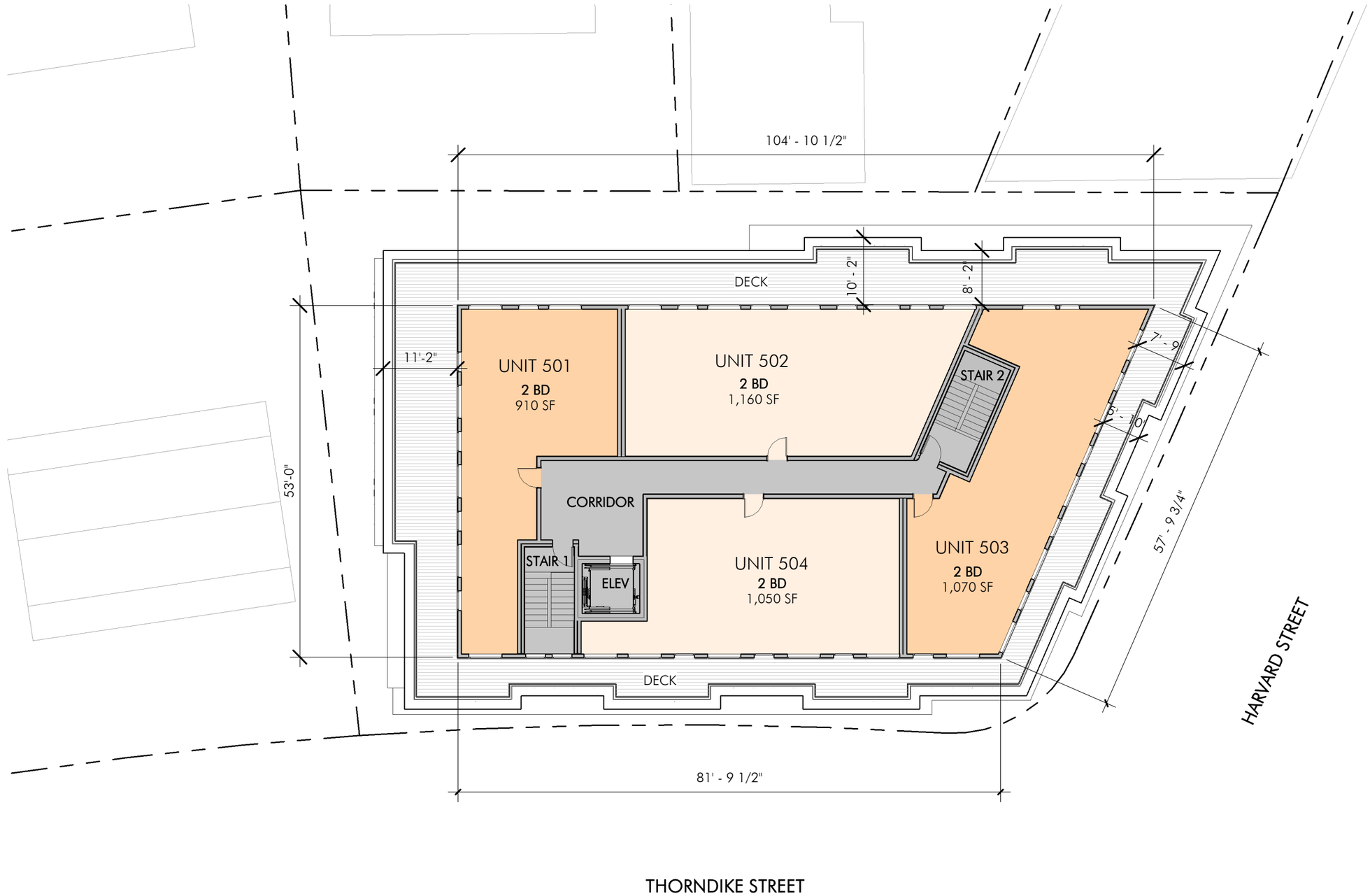

1/16" = 1'-0"

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PENTHOUSE FLOOR PLAN
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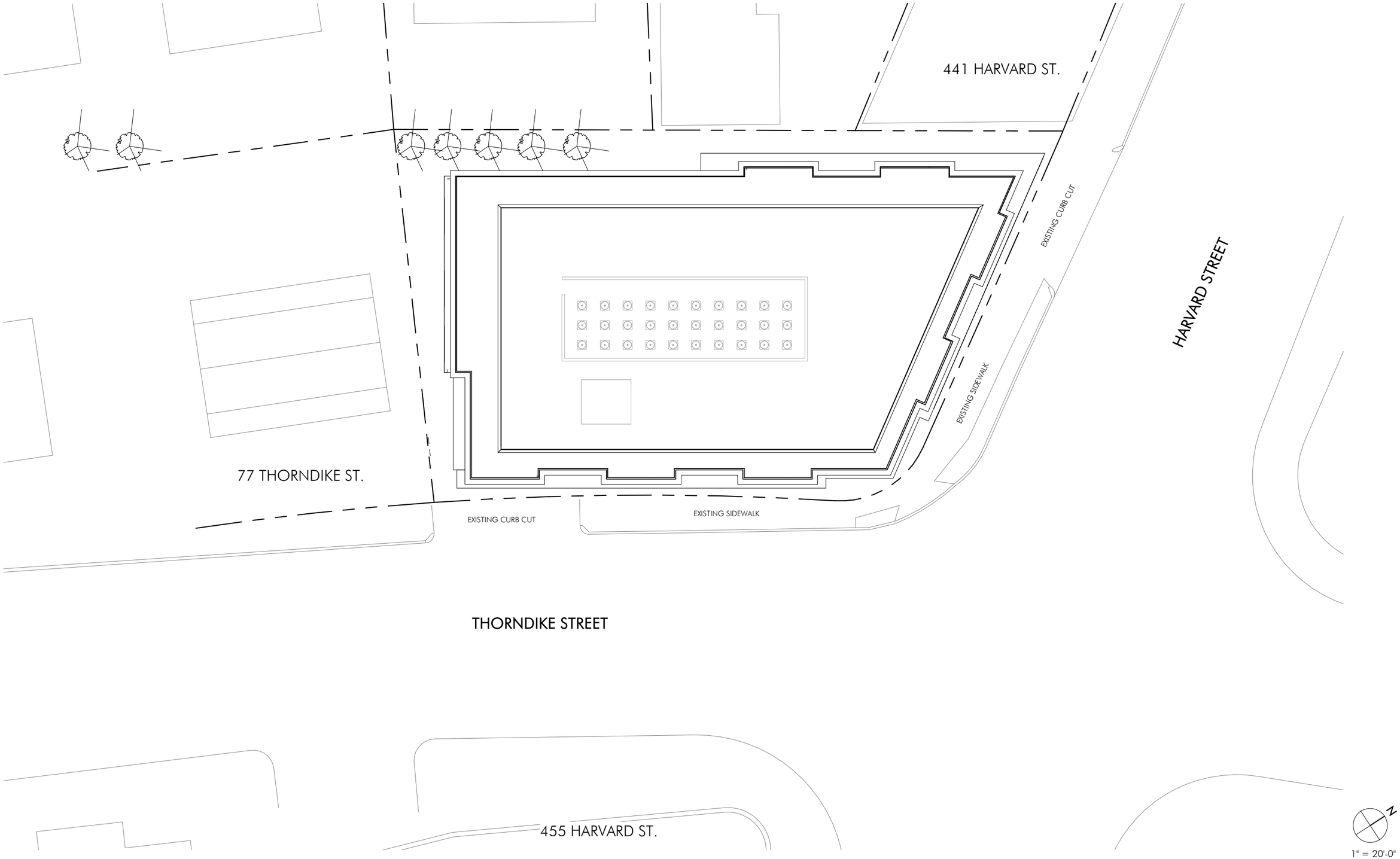

1" = 20'-0"

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ROOF PLAN
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SOUTH ELEVATION ON HARVARD STREET
445 HARVARD STREET
BROOKLINE, MA 02446

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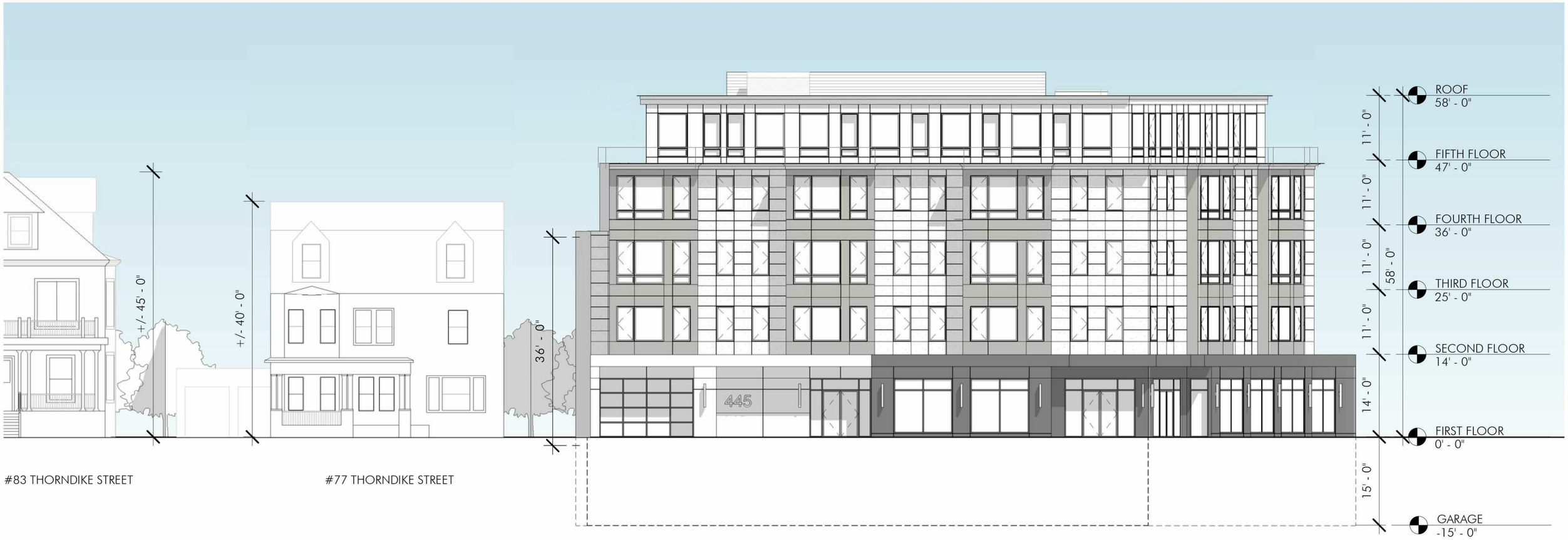

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NORTH ELEVATION ON THORNDIKE STREET
445 HARVARD STREET
BROOKLINE, MA 02446

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VIEW FROM HARVARD STREET

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STREET PERSPECTIVE
445 HARVARD STREET
BROOKLINE, MA 02446

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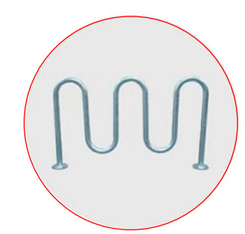
LARGE FORMAT VENEER PANEL

LARGE FORMAT CEMENT FIBER PANEL

BLACK ALUMINUM CASEMENT WINDOWS



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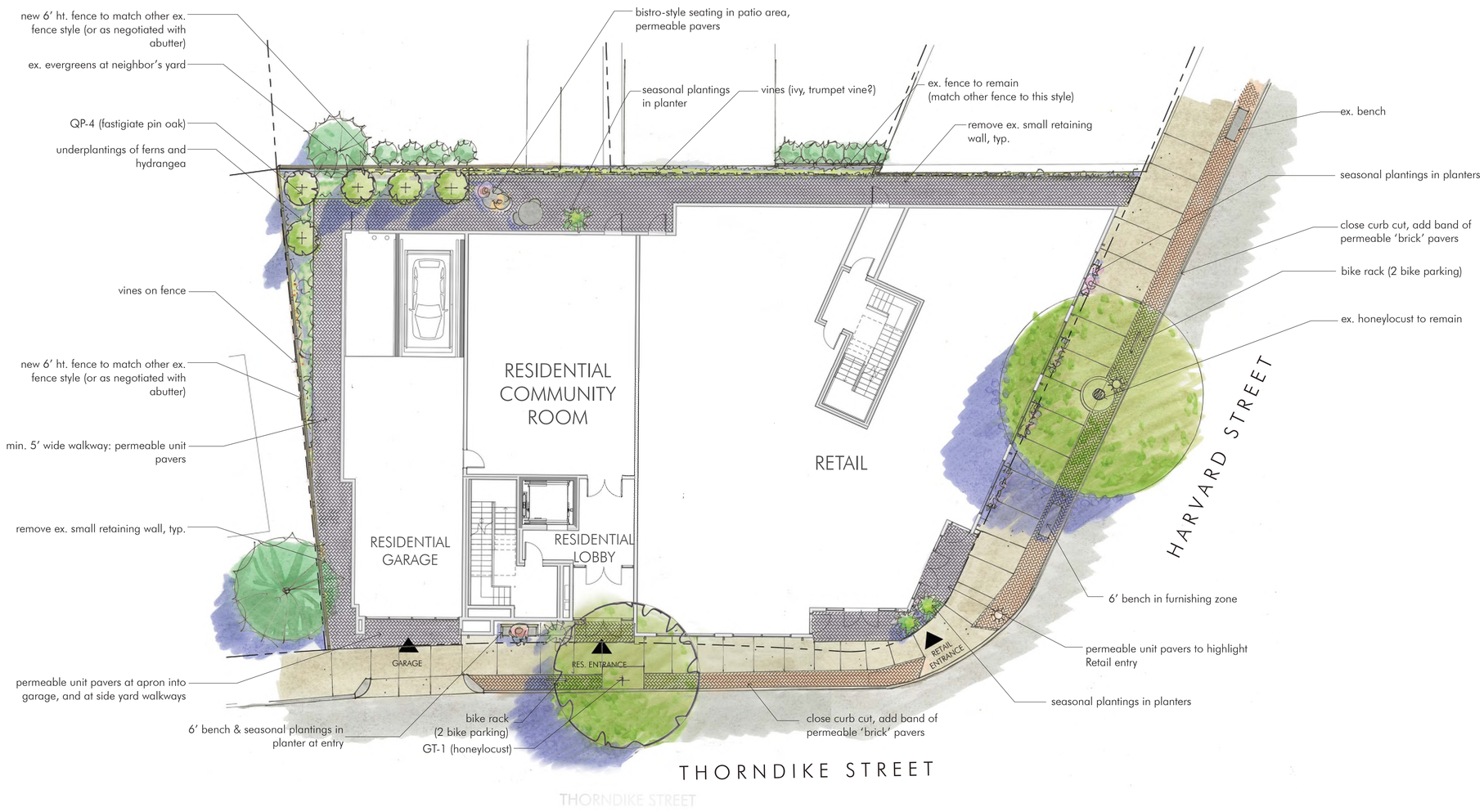

SCALE: 1" = 10'-0"

0 5' 10' 25'

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VERDANT LANDSCAPE ARCHITECTURE

LANDSCAPE PLAN

445 HARVARD STREET
BROOKLINE, MA 02445

JULY 20, 2018

L-1

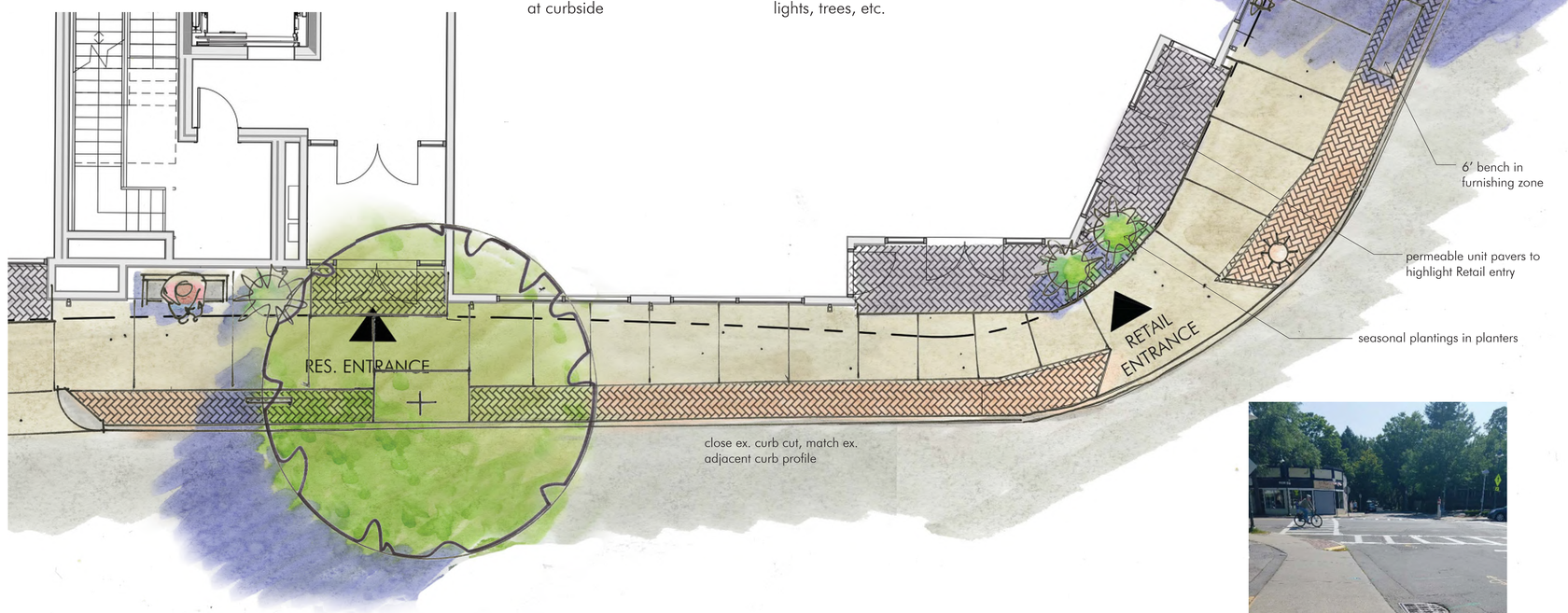
seasonal plantings in planters

durable streetscape bench - black steel by Dumor

permeable brick paved band at curbside

furnishing zone populated by lights, trees, etc.

black metal bike rack



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VERDANT
LANDSCAPE ARCHITECTURE

STREETSCAPE
445 HARVARD STREET
BROOKLINE, MA 02445

JULY 20, 2018

L-2

Oakleaf Hydrangea

Fastigiate Pin Oak

vine-covered fence

permeable concrete unit paver - Ideal Aqua brick, 'Quarry Blend'

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VERDANT
LANDSCAPE ARCHITECTURE

SIDE/REAR YARDS
445 HARVARD STREET
BROOKLINE, MA 02445

JULY 20, 2018

L-3

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ARCHITECTURE + DESIGN

445 HARVARD STREET

Unit Breakout

JULY 25, 2018

GROSS SQUARE FEET						
	RENTABLE				COMMON	
			UNIT TYPE	GSF		GSF
GROUND LEVEL	RETAIL 1			4,360	HALL|DRIVEWAY|LOBBY LOUNGE	2,190 1,150
LEVEL 2	UNIT 201 UNIT 202 UNIT 203 UNIT 204 UNIT 205 UNIT 206 UNIT 207		2 BED 2 BED 1 BED 3 BED 1 BED 1 BED 1 BED	910 1,100 770 1,190 910 910 830	HALL|STAIRS	820
LEVEL 3	UNIT 301 UNIT 302 UNIT 303 UNIT 304 UNIT 305 UNIT 306 UNIT 307		2 BED 2 BED 1 BED 3 BED 1 BED 1 BED 1 BED	910 1,100 770 1,190 910 910 830	HALL|STAIRS	820
LEVEL 4	UNIT 401 UNIT 402 UNIT 403 UNIT 404 UNIT 405 UNIT 406 UNIT 407		1 BED 2 BED 1 BED 3 BED 1 BED 1 BED 1 BED	830 1,100 770 1,190 900 910 720	HALL|STAIRS	820
LEVEL 5	UNIT 501 UNIT 502 UNIT 503 UNIT 504		2 BED 2 BED 2 BED 2 BED	910 1,160 1,070 1,050	HALL|STAIRS	810
TOTAL RESIDENTAL AND COMMERCIAL				28,210		6,610

TOTAL RESIDENTIAL	**23,850**
TOTAL COMMERCIAL	**4,360**
TOTAL BUILDING GSF	**34,820**
TOTAL PARKING SPACES	**20**
FAR	**3.44**

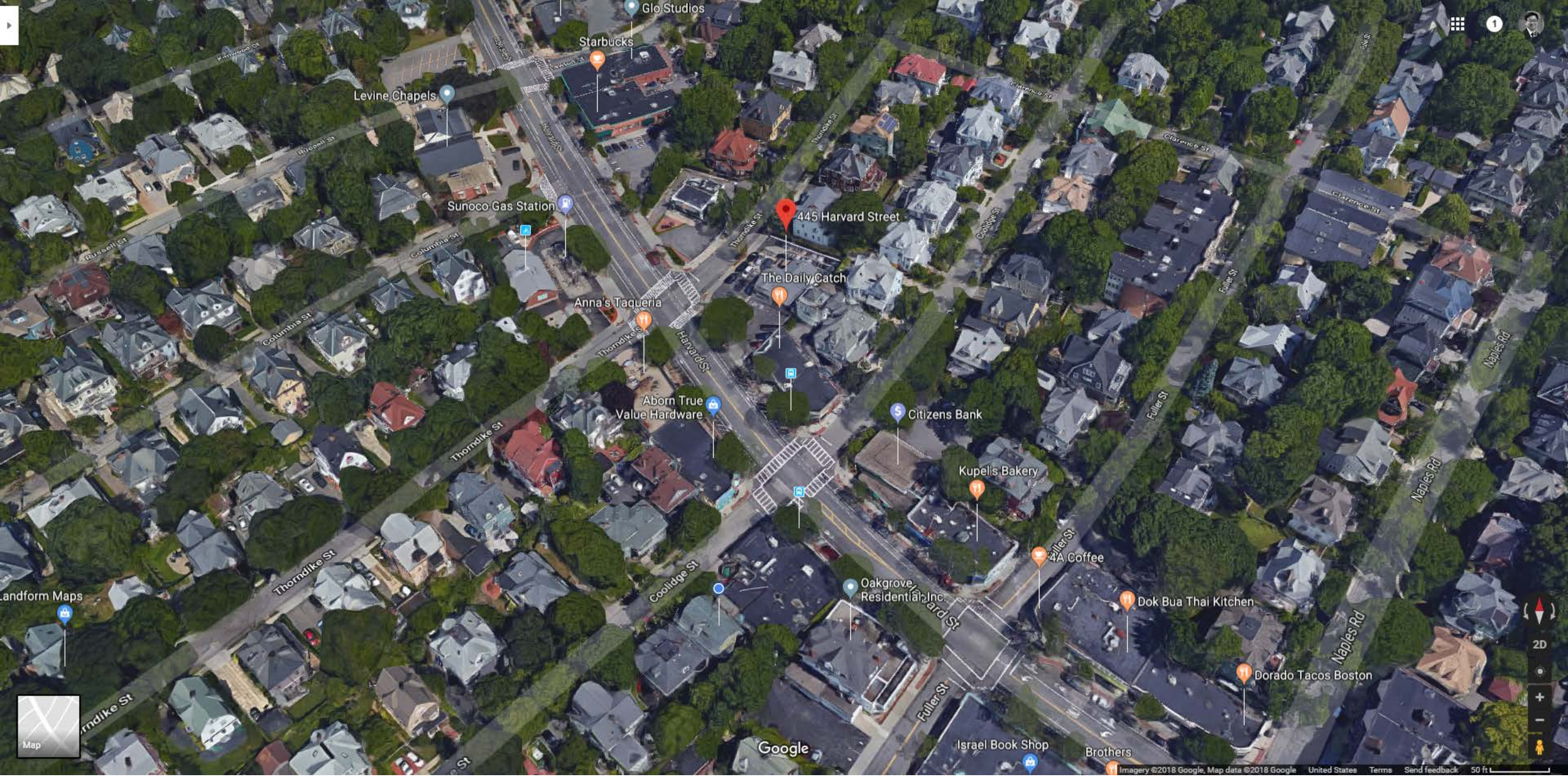
***SITE: 10,122 SF**

UNIT BREAKDOWN:		AVERAGE SIZE	
1 BED	13	844	
2 BED	9	1,034	
3 BED	3	1,190	
TOTAL	25	954	

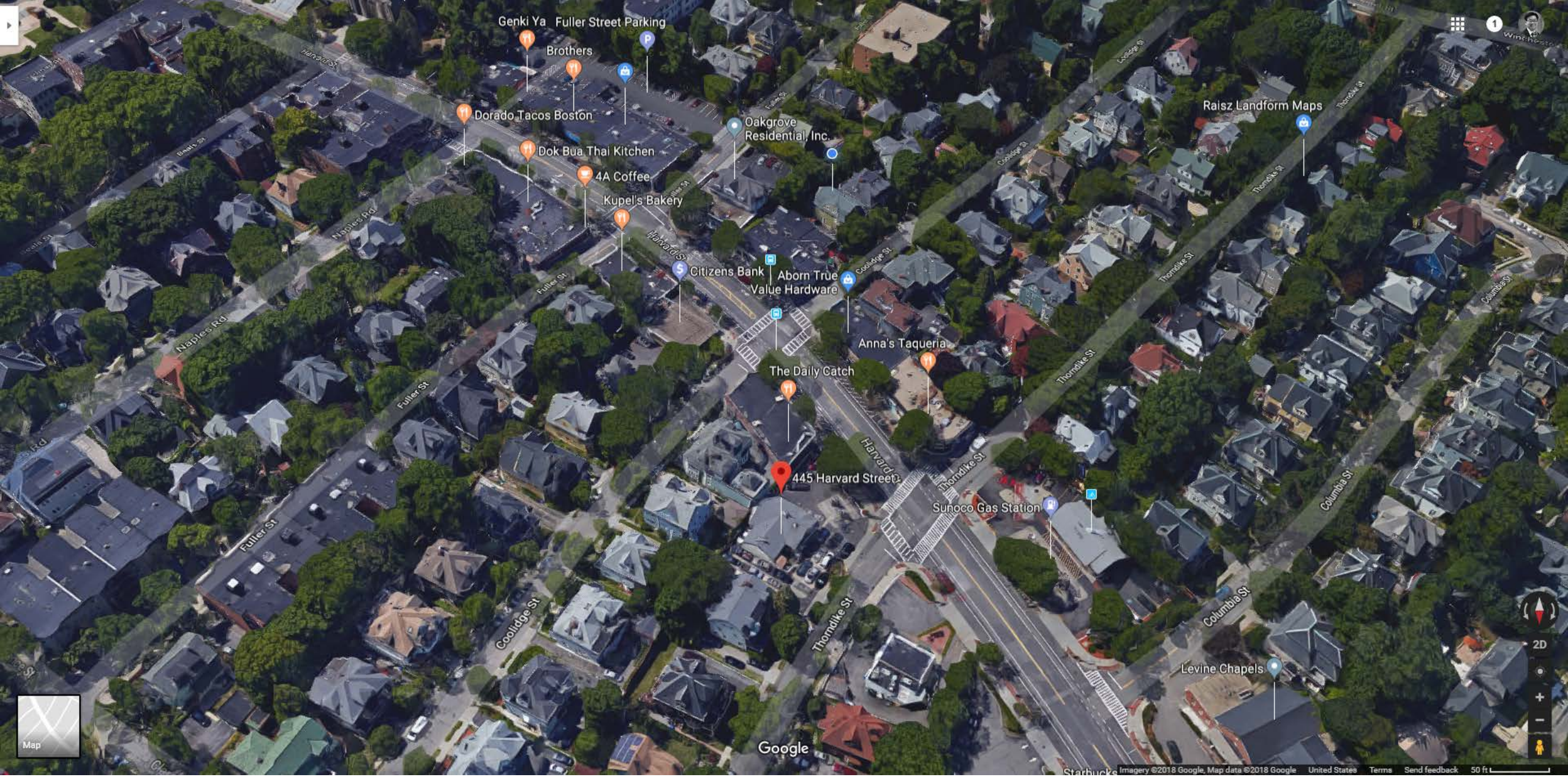
PARKING/UNIT RATIO	**0.8**

SECTION 14

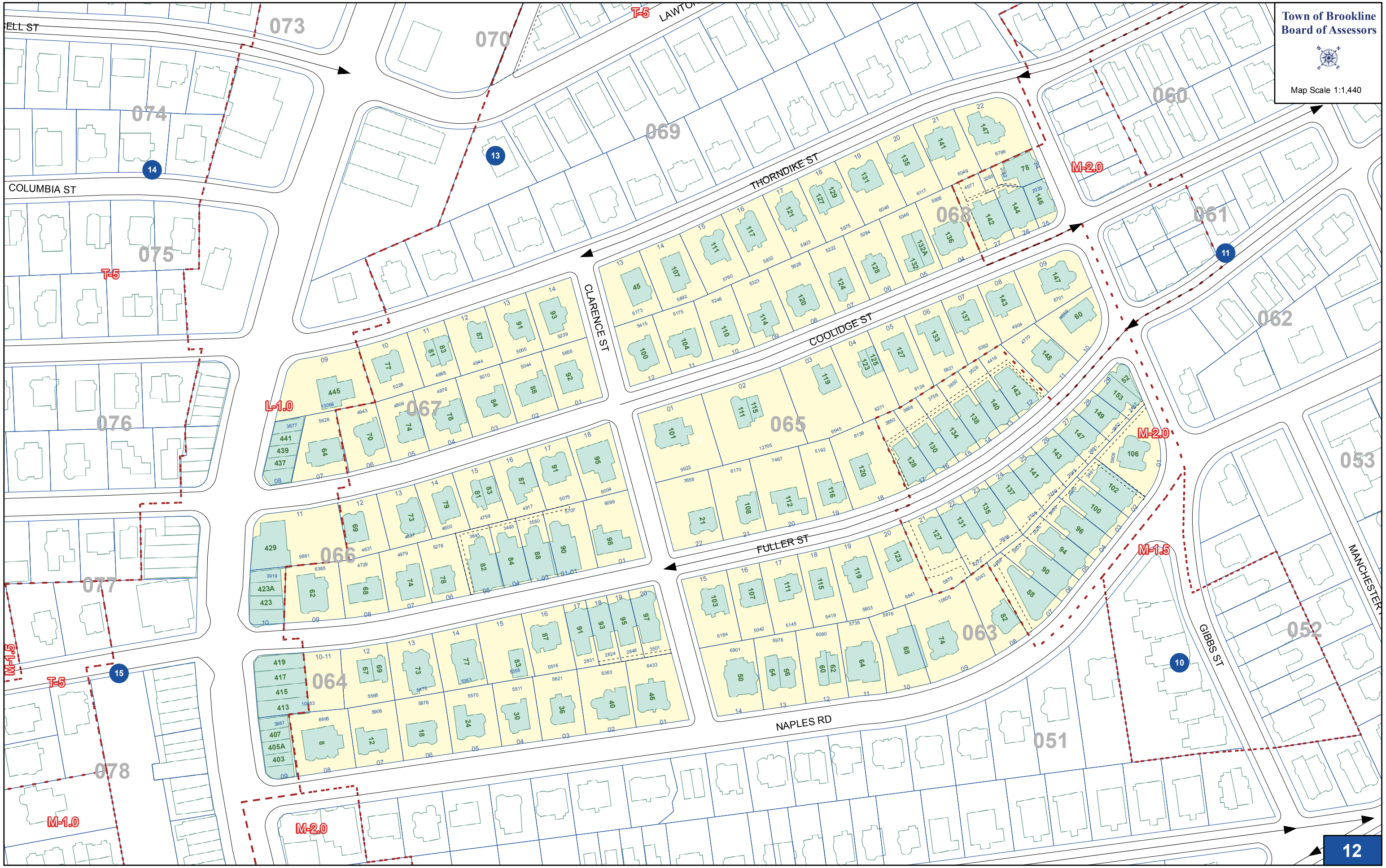
AERIAL PHOTOS & LOCUS MAP



445 Harvard Street
Brookline

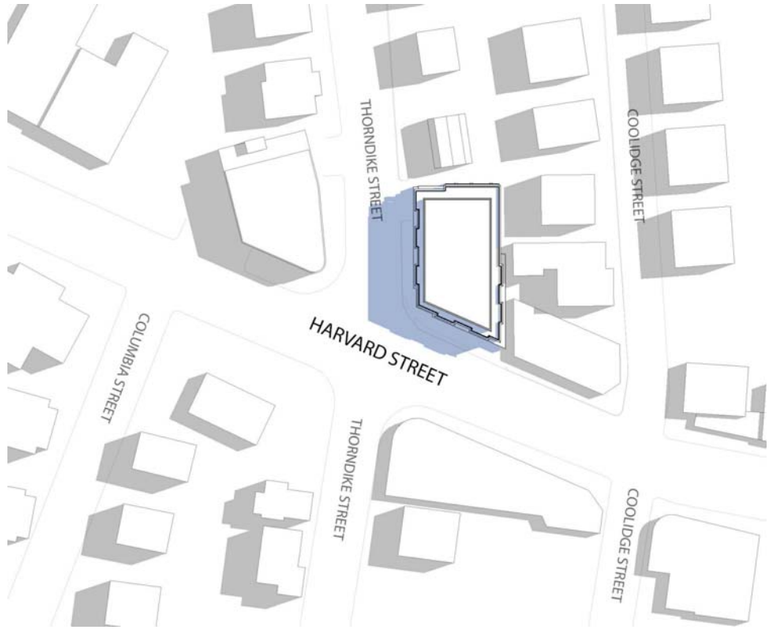


445 Harvard Street
Brookline


Town of Brookline
Board of Assessors
Map Scale 1:1,440
ELL ST
COLUMBIA ST
LAWTON
THORNDIKE ST
CLARENCE ST
COOLIDGE ST
FULLER ST
NAPLES RD
GIBBS ST
MANCHESTER
073
070
074
069
060
075
068
061
062
076
067
065
066
053
077
063
052
064
051
078
T-5
M-2.0
L-1.0
M-1.5
M-1.0
13
14
11
15
10
12

SECTION 15

SHADOW STUDY



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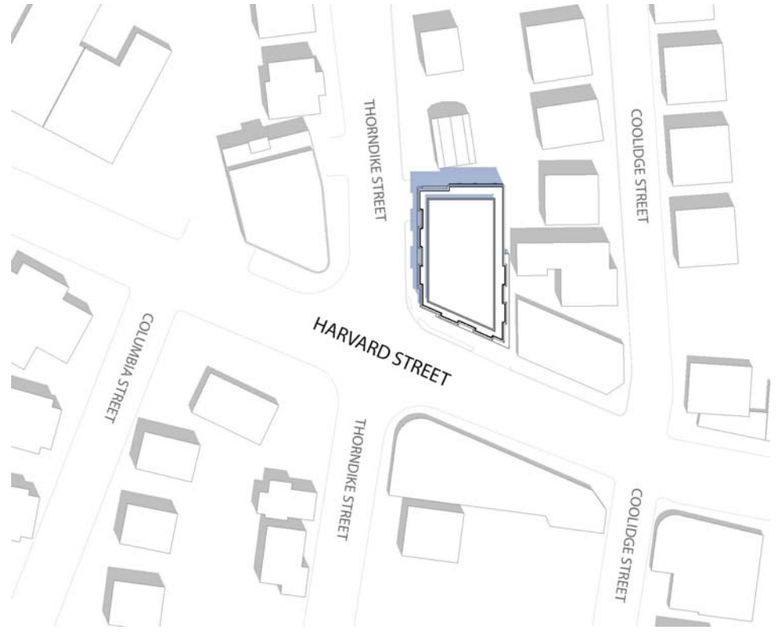
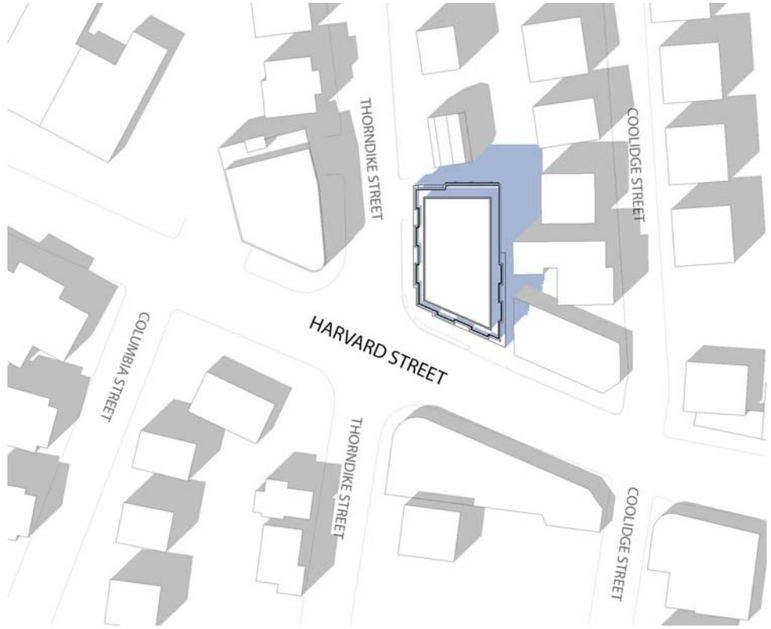


12PM



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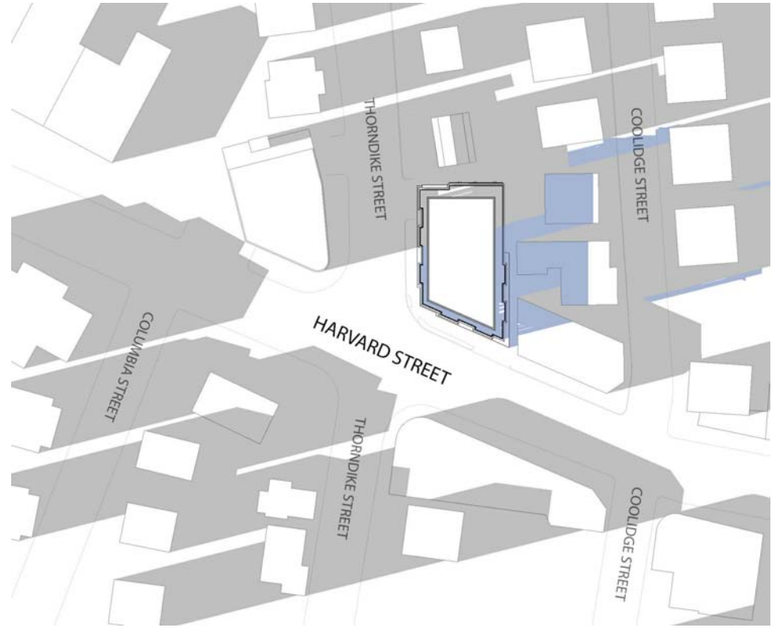

6PM

SUMMER SOLSTICE

EXISTING SHADOW

PROPOSED SHADOW

EMBARC STUDIO
ARCHITECTURE + DESIGN

SHADOW STUDIES
445 HARVARD STREET
BROOKLINE, MA 02446

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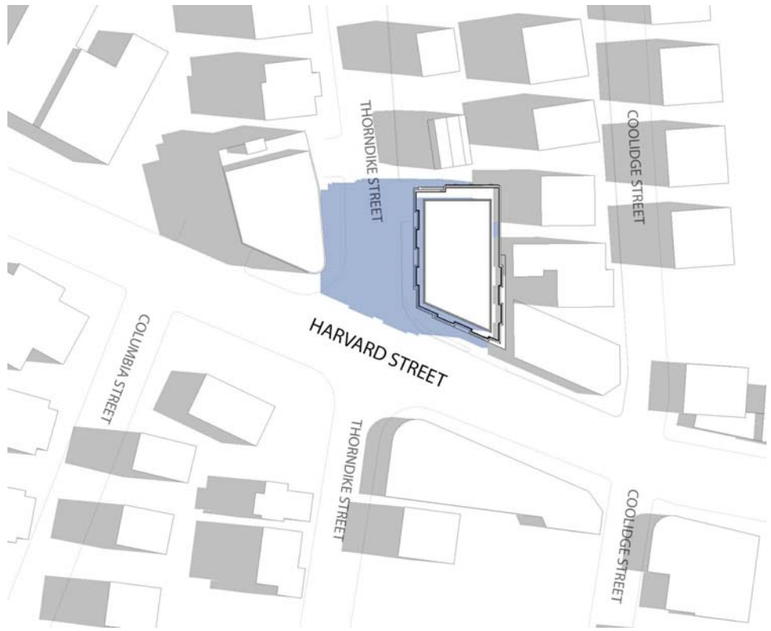

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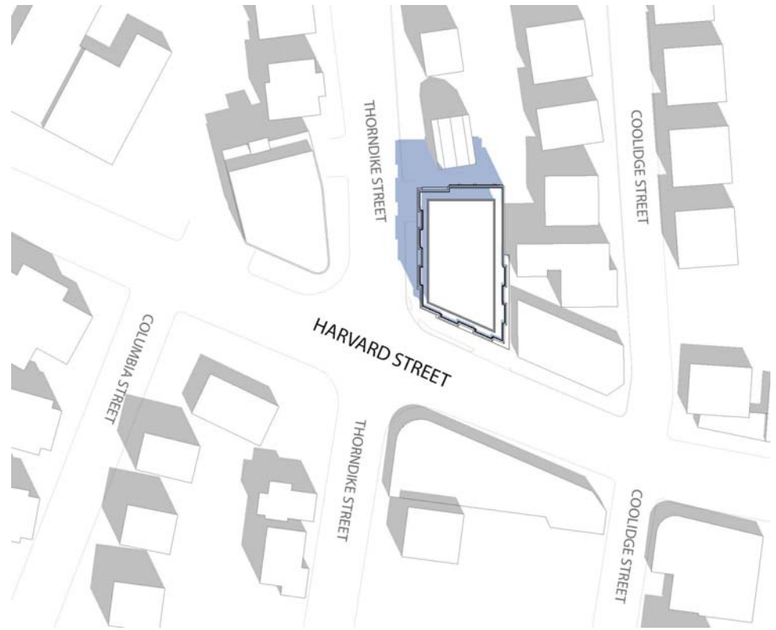
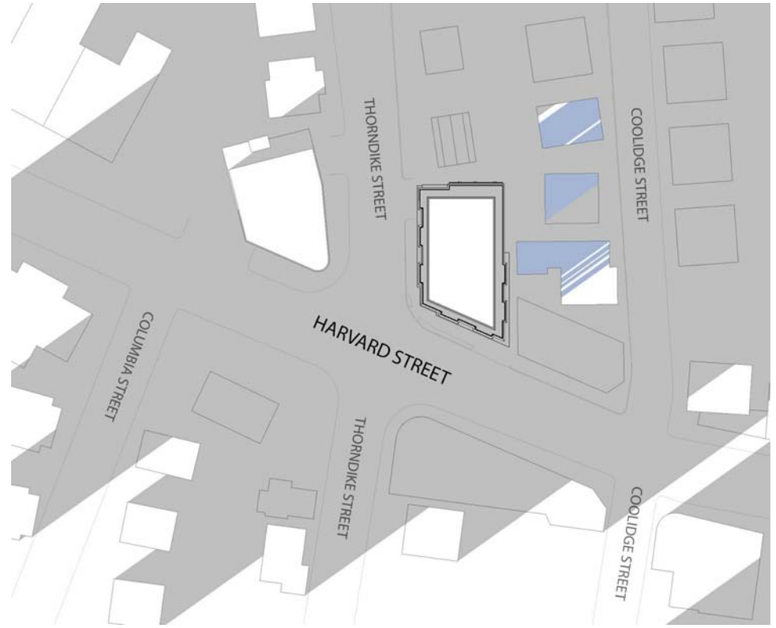


12PM

3PM



6PM

FALL/SPRING EQUINOX

EXISTING SHADOW

PROPOSED SHADOW

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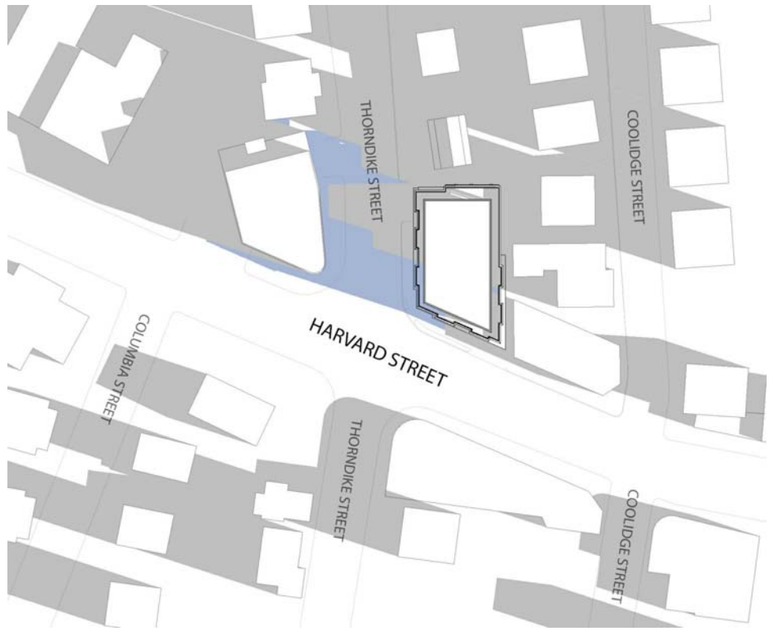


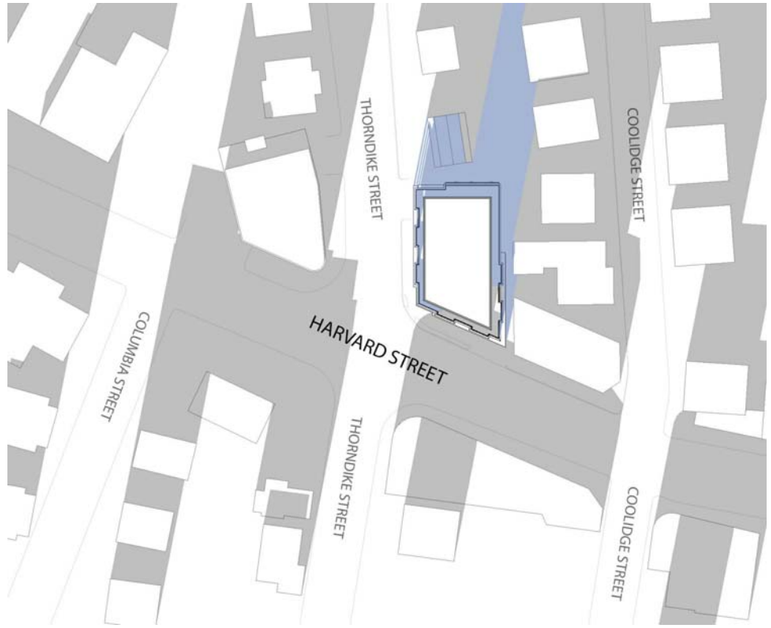
9AM

12PM

WINTER SOLSTICE

EXISTING SHADOW

PROPOSED SHADOW



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SECTION 16

STORMWATER MANAGEMENT SUMMARY

DRAINAGE CALCULATIONS AND STORMWATER MANAGEMENT PLAN

For:

445 HARVARD STREET

Located:

445 HARVARD STREET
(ASSESSOR'S ID 067-09-00)
BROOKLINE, MASSACHUSETTS 02467

Submitted to:

TOWN OF BROOKLINE

Prepared For:

445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

JULY 20, 2018

MCKENZIE ENGINEERING GROUP

Professional Civil Engineering • Professional Land Surveying • Land Planning

150 Longwater Drive, Suite 101
Norwell, MA 02061
Tel: 781-792-3900
Fax: 781-792-0333
www.mckeng.com

TABLE OF CONTENTS

1. NARRATIVE	Page
▪ Project Summary	1
▪ Pre-Development Condition	1
▪ Post-Development Condition	2
▪ Stormwater Best Management Practices (BMP's)	3
▪ Erosion and Sedimentation Control	3
▪ Compliance with Stormwater Management Standards	3
▪ Figure 1 (USGS Locus Map)	7
▪ Figure 2 (FEMA Flood Map)	8
▪ Figure 3 (NRCS Soils Map)	9
▪ Figure 4 (NHESP Map)	10

2. APPENDICES

- APPENDIX A: Pre-Development Condition
- APPENDIX B: Post Development Condition
- APPENDIX C: Checklist for Stormwater Report
- APPENDIX D: Illicit Discharge Compliance Statement
  Supplemental BMP Calculations
- APPENDIX E: Best Management Practices Operation & Maintenance Plans

Preliminary Hydrologic Analysis
Comprehensive Permit Development
445 Harvard Street
Brookline, Massachusetts

Project Summary

The project proponent, 445 Harvard Street Corp proposes to redevelop a 10,113 square foot parcel of land located at 445 Harvard Street in Brookline, Massachusetts. The proposed redevelopment is being permitted under MGL Ch. 40B Comprehensive Permit and will consist of 21 multi-family residential units with 4,370 square feet of retail space available on the first floor. The proposed development will involve the construction of a five (5) story plus one (1) basement level parking building, sidewalks, access drive, utilities, stormwater management structures and other related infrastructure.

The site has frontage on Harvard Street to the southwest and Thorndike Street to the northwest and is shown on the Brookline Assessor's Map as Parcel 067-09-00. The site is otherwise surrounded by developed residential/commercial property as shown on Figure 1 - USGS Locus Map.

The project will access the existing utility infrastructure located on Thorndike Street and Harvard Street, including sanitary sewer, water, gas, electric, telephone, and cable television. Parking areas will be contained within the building and will drain to oil/sediment traps prior to discharge into the municipal sewer system, as required. The stormwater management system will be designed to comply with the Department of Environment Protection's Stormwater Management Regulations to the extent practicable as required under Standards 6 and 7 and will utilize an existing closed drainage system on Thorndike Street and Harvard Street as an overflow connection.

The existing and proposed site conditions are illustrated on the project *site plans* entitled "445 Harvard Street", prepared by McKenzie Engineering Group, Inc. dated July 20, 2018.

This report contains stormwater runoff calculations for the pre-development and post-development conditions and includes the sizing of the proposed low impact drainage system and stormwater best management practices (BMPs). All stormwater management facilities will be designed to mitigate peak rates of runoff, provide renovation of stormwater and meet the requirements of the DEP's Stormwater Management Regulations.

Pre-Development Condition

The property is located within L-1.0 Zoning District. The parcel comprises approximately 10,113 square feet and contains no wetlands and is currently fully developed and is occupied by an existing building and bituminous concrete pavement parking area and is comprised of approximately 97% impervious surfaces.

The existing topography generally ranges in elevation from approximately 63 ft. (in the northeast portion of the site to an elevation of approximately 60 in the southeast portion of the site. The parcel slopes in a westerly direction from its northern boundary towards Thorndike Street and a southerly direction towards Harvard Street.

Review of available environmental databases such as MassGIS reveals that the site is not located within a mapped Natural Heritage Area, a Zone II Groundwater Recharge Area, the Town of Brookline Aquifer Protection District Zone, an Interim Wellhead Protection Area (IWPA), or a Contributing Watershed to Outstanding Resource Water (ORW).

The site is located within Zone X, Area of Minimal Flooding as shown on FEMA Flood Insurance Rate Map Panel No. 25021C0032E (not printed). Refer to Figure 2 – FEMA Flood Map.

The Natural Resources Conservation Service (NRCS) has identified the soil on the site as 628C, Canton – Urban Land Complex, 3 to15% slopes with hydrologic soil group (HSG) B. Refer to Figure 3 - NRCS Soils Map.

The existing watershed analyzed in this report is comprised of approximately 10,113 square feet which includes the subject parcel. The watershed consists of two sub-catchment areas and two (2) Design Points (DP-1) Thorndike Street and (DP-2) Harvard Street. Refer to the Pre-Development Watershed Plan WS-1 in Appendix A for a delineation of drainage subcatchments for the pre-development design condition.

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method based program "HydroCAD" was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas.

Post-Development Condition

445 Harvard Street is proposed as a 21-unit redevelopment to be permitted in accordance with Massachusetts General Laws 40B § 20-23. The project consists of the construction of a five (5) story plus one (1) basement level parking building, sidewalks, access drive, utilities, stormwater management structures and other related infrastructure. The impervious surfaces have been reduced from 97% to 81%.

The project will access the existing utility infrastructure located on Thorndike Street and Harvard Street, including sanitary sewer, water, gas, electric, telephone, and cable television. Parking areas will be contained within the building and will drain to oil/sediment traps prior to discharge into the municipal sewer system, as required. The stormwater management system will be designed to comply with the Department of Environment Protection's Stormwater Management Regulations to the extent practicable as required under Standards 6 and 7 and will utilize an existing closed drainage system on Thorndike Street and Harvard Street as an overflow connection.

Watershed areas were analyzed in the post-development condition to design low impact stormwater management facilities to mitigate impacts resulting from redeveloping the property. The objective in designing the proposed drainage facilities for the project was to maintain existing drainage patterns to the extent practicable and to ensure that the post-development rates of runoff are less than pre-development rates at the design point. Refer to the Post-Development Watershed Plan WS-2 in Appendix B for a delineation of post-development drainage subareas. The design point for the post-development design conditions correspond to those analyzed for the pre-development design condition.

Refer to site plans for the drainage system design. All BMPs shall be supported by a comprehensive Construction Phase Pollution Prevention and Erosion Control Plan and Post-Development BMP Operation and Maintenance Plan.

Low Impact Design Elements

Permeable pavers walkways are being proposed to provide groundwater recharge and to reduce stormwater runoff volume. The storage reservoir will be sized to hold the Required Water Quality or Required Recharge Volume, whichever is larger, using the Static Method, and

will be designed to dewater within 72 hours. Refer to the Supplemental Calculations in Appendix D.

Stormwater Best Management Practices (BMP's)

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. The proposed stormwater management system will provide 80% Total Suspended Solids (TSS) removal through the use of permeable pavers. Refer to the TSS Removal Worksheets in Appendix D for TSS removal rates.

Erosion and Sedimentation Controls

Silt sock erosion control barriers will be placed at the limit of work prior to the commencement of any construction activity. The integrity of the silt sock will be maintained by periodic inspection and replacement as necessary. The silt sock will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Riprap outlet protection for the rain garden is proposed to ensure that minimal velocities will be realized before flows are discharged into wetland areas. Refer to the Erosion Control details on the Site Development Plans and BMP Operation and Maintenance Plan for proposed erosion control measures to be employed for the project.

Compliance with Stormwater Management Standards

Standard 1 – No New Untreated Discharges

The proposed redevelopment will not introduce any new untreated discharges to a wetland area or waters of the Commonwealth of Massachusetts.

Standard 2 – Peak Rate Attenuation

In the pre-development and post-development stormwater analysis, the watershed area analyzed was approximately 10,113 SF consisting of the subject parcel to be redeveloped. Refer to Existing Watershed Delineation Plan WS-1 for a delineation of drainage subareas for the pre-development design condition and refer to Post-Development Watershed Delineation Plan WS-2 for a delineation of drainage subareas for the post-development design condition.

Drainage calculations were performed by employing SCS TR-20 methods for the 2, 10, 25, and 100-year Type III storm events. Refer to Appendix A and B for computer results. All drainage structures will be designed employing the Rational Method and the Mass. DPW Design Manual to accommodate peak flows generated by a minimum of a 25-year storm event or a 100-year storm event where applicable. The stormwater management systems were designed to accommodate peak flows generated by a 100-year storm event.

The peak rates of runoff and elevations are as follows:

Table 1 – Pre-Development Results

	Design Storm							
	2-Year Storm 3.35" of Rainfall		10-Year Storm 4.96" of Rainfall		25-Year Storm 6.20" of Rainfall		100-Year Storm 8.72" of Rainfall	
Design Point	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)
DP-1	1,204	0.35	1,825	0.52	2,303	0.65	3,267	0.91
DP-2	1,370	0.40	2,100	0.60	2,663	0.76	3,810	1.07

Table 2 – Post-Development Results								
	Design Storm							
	2-Year Storm 3.35" of Rainfall		10-Year Storm 4.96" of Rainfall		25-Year Storm 6.20" of Rainfall		100-Year Storm 8.72" of Rainfall	
Design Point	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)	Volume (CF)	Flow (CFS)
DP-1	519	0.15	808	0.23	1,100	0.30	1,851	0.43
DP-2	1,270	0.37	1,967	0.56	2,513	0.71	3,703	1.03

A comparison of the pre-development and post-development peak rates of runoff indicates that the peak rates and volumes of runoff for the post-development condition will be reduced in comparison to the pre-development condition for all storm events.

Standard 3 – Groundwater Recharge

Runoff will be infiltrated by permeable pavers, which will the meet the Stormwater Guidelines for infiltration:

- Infiltration structures will be a minimum of two (2) feet above seasonal high groundwater.
- Utilize the "Simple Dynamic" method for sizing the storage volume, which takes into account the fact that stormwater is exfiltrating from the infiltration basin at the same time that the basin is filling.
- Hydraulic conductivity are based on soil data from the Geotechnical Report and values developed from Rawls, Brakensiek and Saxton, 1982, Estimation of Soil Water Properties, *Transactions of the American Society of Agricultural Engineers*, vol.25, no. 5.
- Refer to Appendix D for infiltration and drawdown calculations

Groundwater Recharge Volume

	Soil Type	**Target Depth Factor (F) (in)**	**Total Impervious Area (sf)**	**Required Recharge Volume (cf)[1]**	**Provided Recharge Volume (cf)[2]**
Permeable Pavers	B	0.35	8,241	240	383

1. Required Recharge Volume = Target Depth Factor x Impervious Area / (d+Kt) [Simple dynamic method]

(Refer to supplemental calculations in Appendix D)

2. Provided Recharge Volume = Volume Provided from Bottom of System to invert.

The permeable pavers storage layer has been designed to store and infiltrate 383 cubic feet of runoff and completely drain within 72 hours. The drawdown analysis is based on the required recharge volume exfiltrating at the Rawls Rates based on the soil textural analysis at the

proposed exfiltration location. Refer to Appendix D for calculations.

Standard 4 – Water Quality

The total required water quality treatment volume was calculated to be 343 cubic feet. The half-inch rule has been applied to the water quality volume calculations. The water quality treatment volume will be provided within the permeable paver storage layer.

Water Quality Volume Required vs. Volume Provided

Permeable Pavers	Impervious Contributing Area (ft^2)	Required Water Quality Volume[1] (ft^3)	Provided Water Quality Volume (ft^3)
PP-1	8,241	343	383

1. Required Water Quality Volume = Impervious Area (sq.ft) x (0.5”/1 acre) x (1ft/12”)

The permeable paver storage layer will provide both water quality treatment and recharge. Per Standard 4, Water Quality, the BMP must be sized to treat or hold the Target Volume, the larger of the Required Water Quality Volume and the Required Recharge Volume. The Required Water Quality Volume is based on the half-inch of runoff and the Required Recharge Volume is based on 0.34-inches (Soil Type B); 0.50 inches if greater than 0.35 inches, therefore the Target Volume is the Required Recharge Volume of 343 cubic feet. Refer to Appendix D supplemental calculations.

The majority of the runoff generated at the site will be in the form of roof water runoff which does not require treatment for TSS. The use of permeable pavers for the walkways will provide 80% Total Suspended Solids (TSS). Refer to Appendix D for TSS Removal Calculation Worksheets.

The Long-Term Pollution Prevention Plan has been incorporated into the Post-Development Operation and Maintenance Plan. Refer to Appendix E for BMP Operation and Maintenance Plans.

Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPL)

The proposed project does not include land uses with higher potential pollutant loads. Not Applicable.

Standard 6 – Critical Areas

The proposed project does not discharge to any critical areas. Not Applicable.

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

The proposed project is a redevelopment project. The site will be designed to comply with the Stormwater Management Regulations to the extent practicable as required for a redevelopment project.

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

The project will require a NPDES Construction General Permit but the Stormwater Pollution Prevention Plan (SWPPP) has not been submitted. The SWPPP will be submitted prior to any

proposed construction. A Construction Phase BMP Operation and Maintenance Plan will be provided as a basis for the SWPPP during final design.

Standard 9 – Operation and Maintenance Plan

The Post Construction Operation and Maintenance Plan has been developed for the Stormwater Management System. Refer to Appendix E.

Standard 10 – Prohibition of Illicit Discharges

No illicit discharges are anticipated on site. An Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction best management practices. Measures to prevent illicit discharges will be included in the Long-Term Pollution Prevention Plan.

FIGURE - 1

0 500' 1000' 1250'

U.S. GEOLOGICAL SURVEY
7.5 ▯ ▯5 MINUTE SERIES

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USGS LOCUS MAP

445 HARVARD STREET
PARCEL ID ▯067-0▯-00
BROOKLINE, MASSACHUSETTS

FIGURE - 2

0 1000' 2000' 2500'

COMMUNITY PANEL NO: 2502□C020□E

E□□ECTIVE DATE: □ULY □7, 20□2

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FEMA FLOOD MAP

445 HARVARD STREET
PARCEL ID □067-0□-00
BROOKLINE, MASSACHUSETTS

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
628C	CANTON–URBAN LAND COMPLEX, 3% TO 15% SLOPES	B

FIGURE - 3

0 250' 500' 625'

NRCS SOIL SURVEY
NOR□OLK □ SU□□OLK COUNTY

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NRCS SOILS MAP

445 HARVARD STREET
PARCEL ID □067-0□-00
BROOKLINE, MASSACHUSETTS

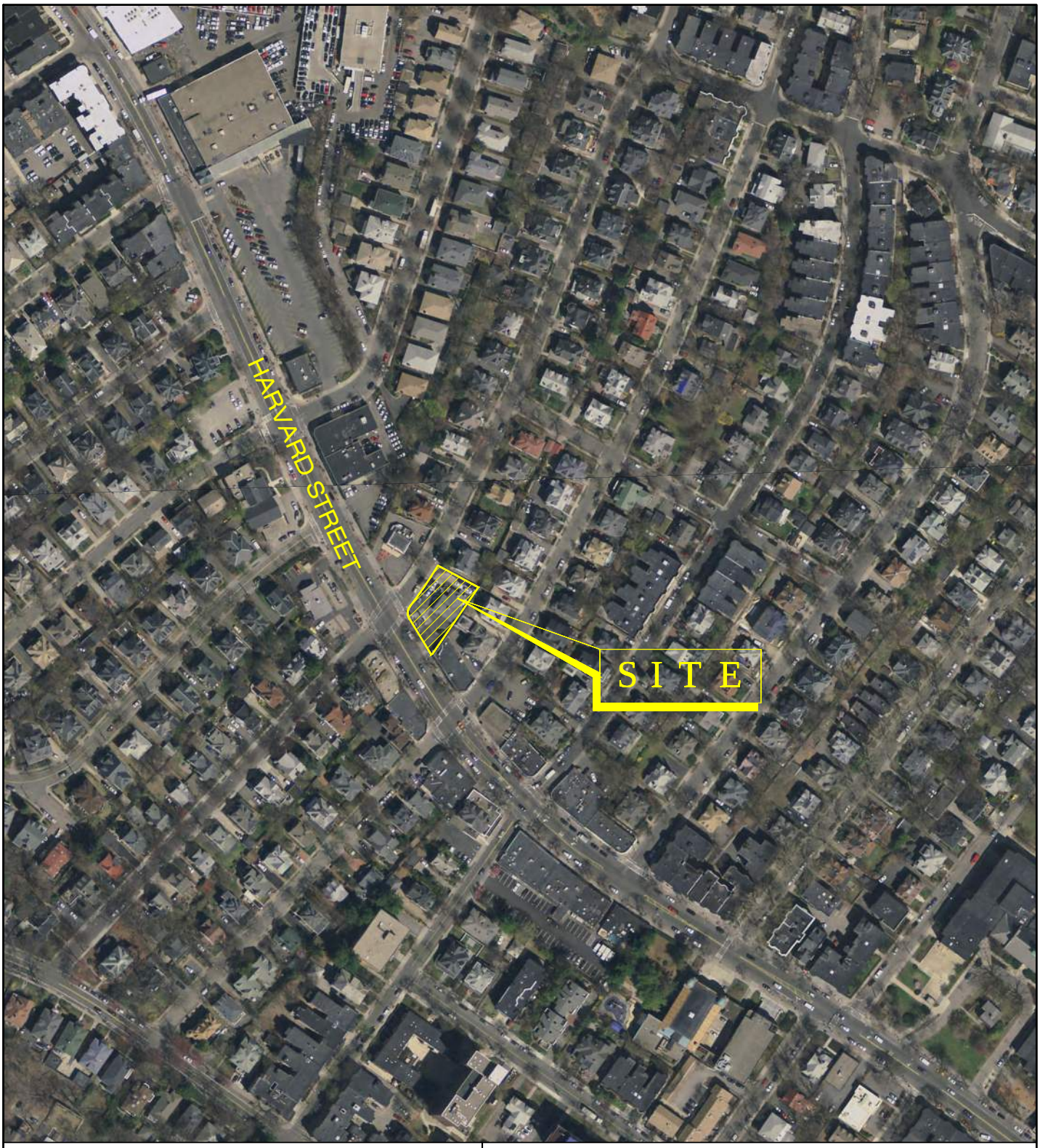

FIGURE - 4

0 250' 500' 625'

□4TH EDITION MASSACHUSETTS
NATURAL HERITAGE ATLAS

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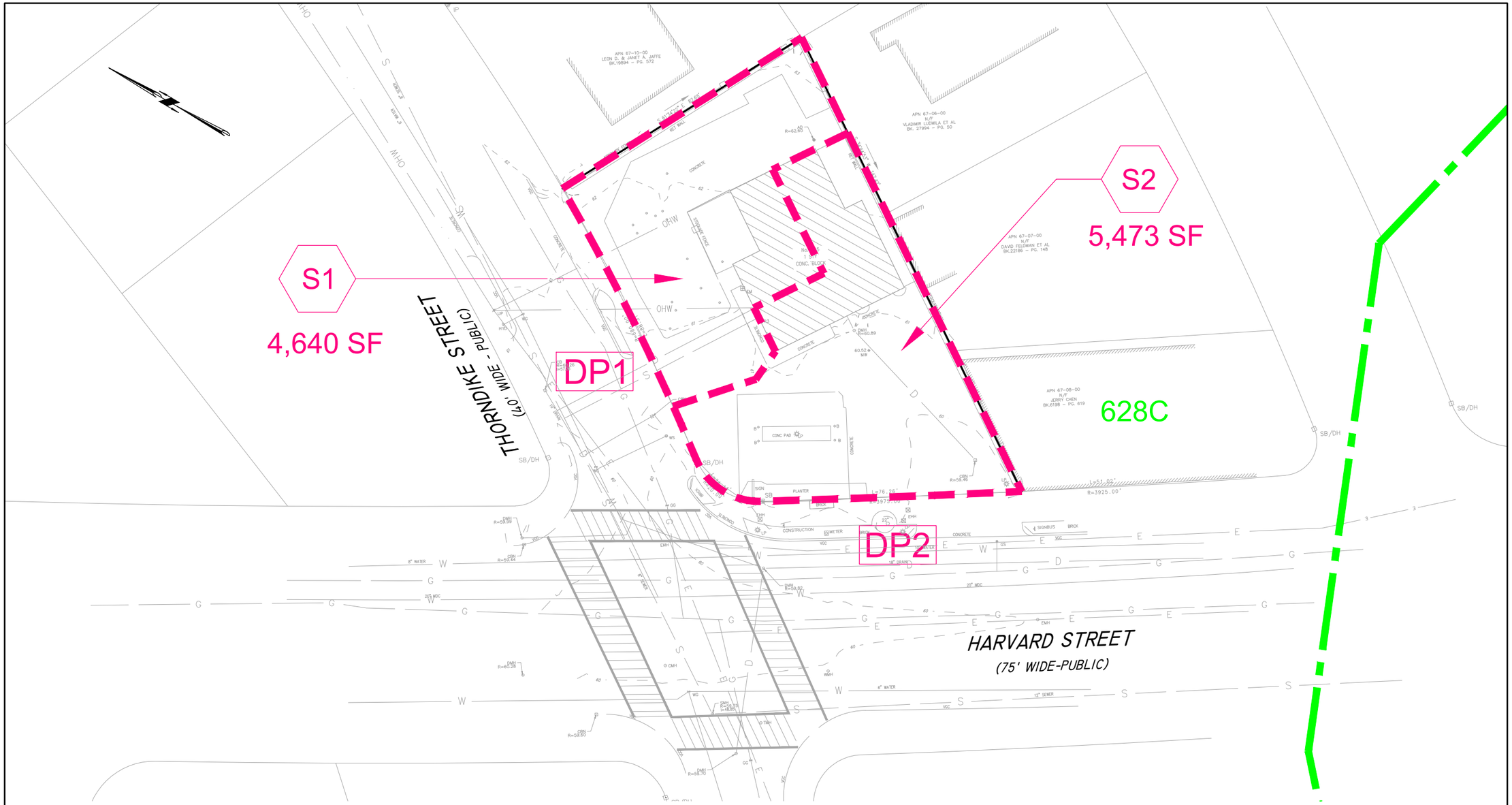
NATURAL HERITAGE & ENDANGERED SPECIES MAP

445 HARVARD STREET
PARCEL ID □067-0□-00
BROOKLINE, MASSACHUSETTS

A P P E N D I X A

Pre-Development Condition



LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
628C	CANTON-URBAN LAND COMPLEX, 3 TO 15% SLOPES	B

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REV	DATE	DESCRIPTION	BY	APP

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445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL ENGINEER:

OWNER/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

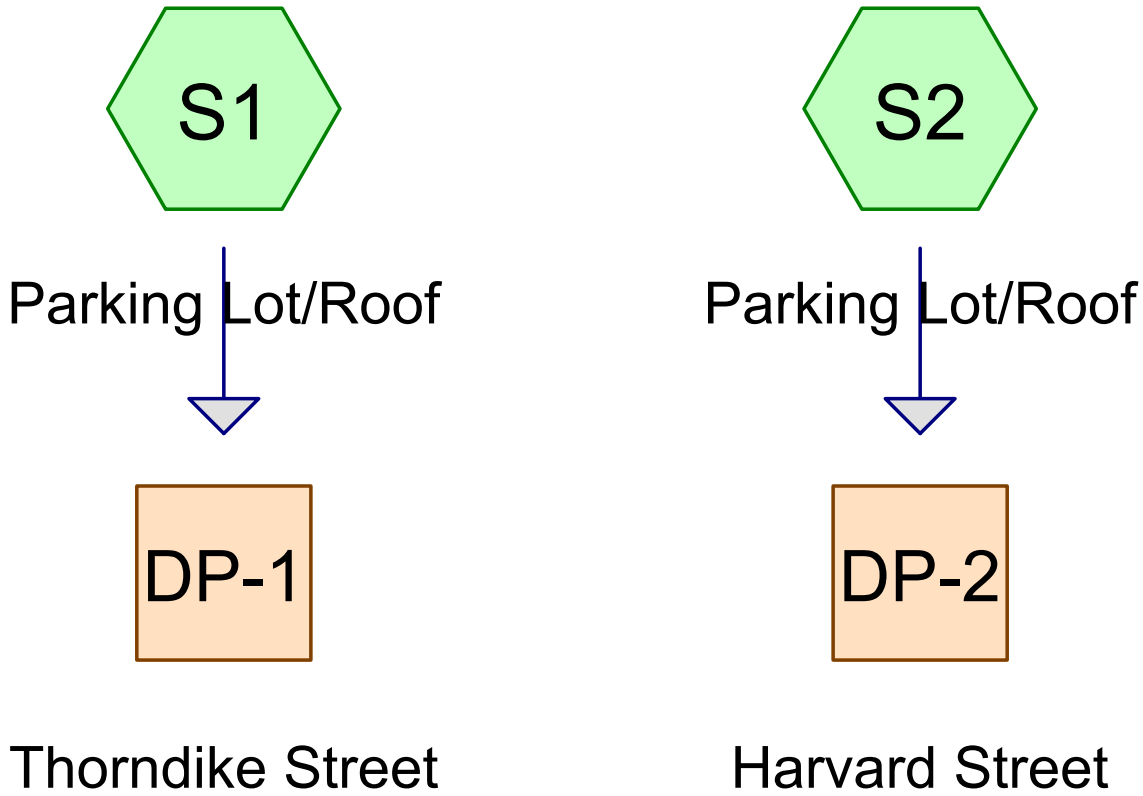
PERMIT PLAN SET

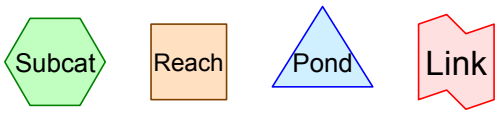
DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20 2018
SCALE:	1"=30'
PROJECT NO.:	218-106

DWG. TITLE:
Pre-Dev. Watershed Plan

DWG. No: WS-1

M:\MES\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL - 445 HARVARD\DWGS\SUBMISSIONS\1\218-106 WS-1.DWG





Routing Diagram for 218-106 Existing
Prepared by McKenzie Engineering Group, Inc.
HydroCAD® 10.00-21 s/n 00452 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
276	61	>75% Grass cover, Good, HSG B (S1, S2)
7,579	98	Paved parking, HSG B (S1, S2)
218	98	Retaining wall, HSG B (S1, S2)
2,040	98	Roofs, HSG B (S1, S2)
10,113	**97**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,113	HSG B	S1, S2
0	HSG C	
0	HSG D	
0	Other	
10,113		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	276	0	0	0	276	>75% Grass cover, Good	
0	7,579	0	0	0	7,579	Paved parking	
0	218	0	0	0	218	Retaining wall	
0	2,040	0	0	0	2,040	Roofs	
0	**10,113**	**0**	**0**	**0**	**10,113**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,640 sf 98.79% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=98 Runoff=0.35 cfs 1,204 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=97 Runoff=0.40 cfs 1,370 cf

Reach DP-1: Thorndike Street Inflow=0.35 cfs 1,204 cf
Outflow=0.35 cfs 1,204 cf

Reach DP-2: Harvard Street Inflow=0.40 cfs 1,370 cf
Outflow=0.40 cfs 1,370 cf

Total Runoff Area = 10,113 sf Runoff Volume = 2,574 cf Average Runoff Depth = 3.05"
2.73% Pervious = 276 sf 97.27% Impervious = 9,837 sf

Summary for Subcatchment S1: Parking Lot/Roof

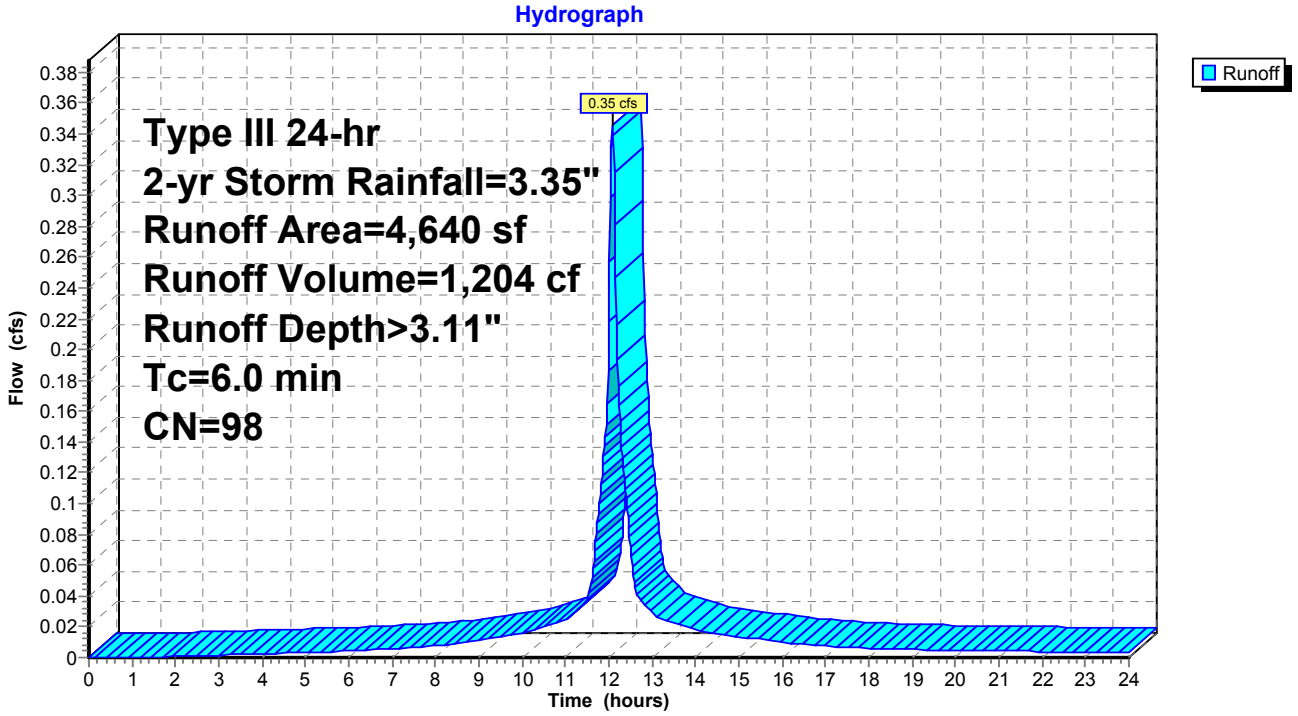
Runoff = 0.35 cfs @ 12.08 hrs, Volume= 1,204 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,882	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,640	98	Weighted Average
	56		1.21% Pervious Area
	4,584		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

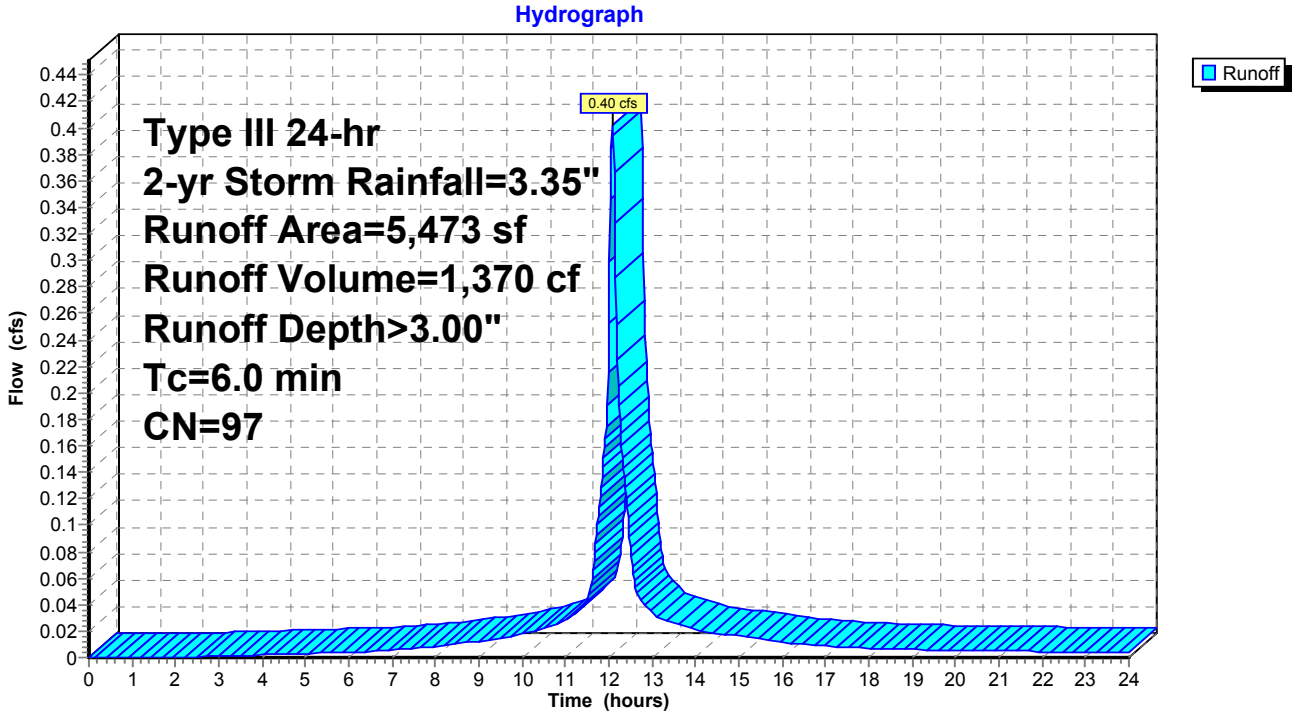
Runoff = 0.40 cfs @ 12.08 hrs, Volume= 1,370 cf, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof

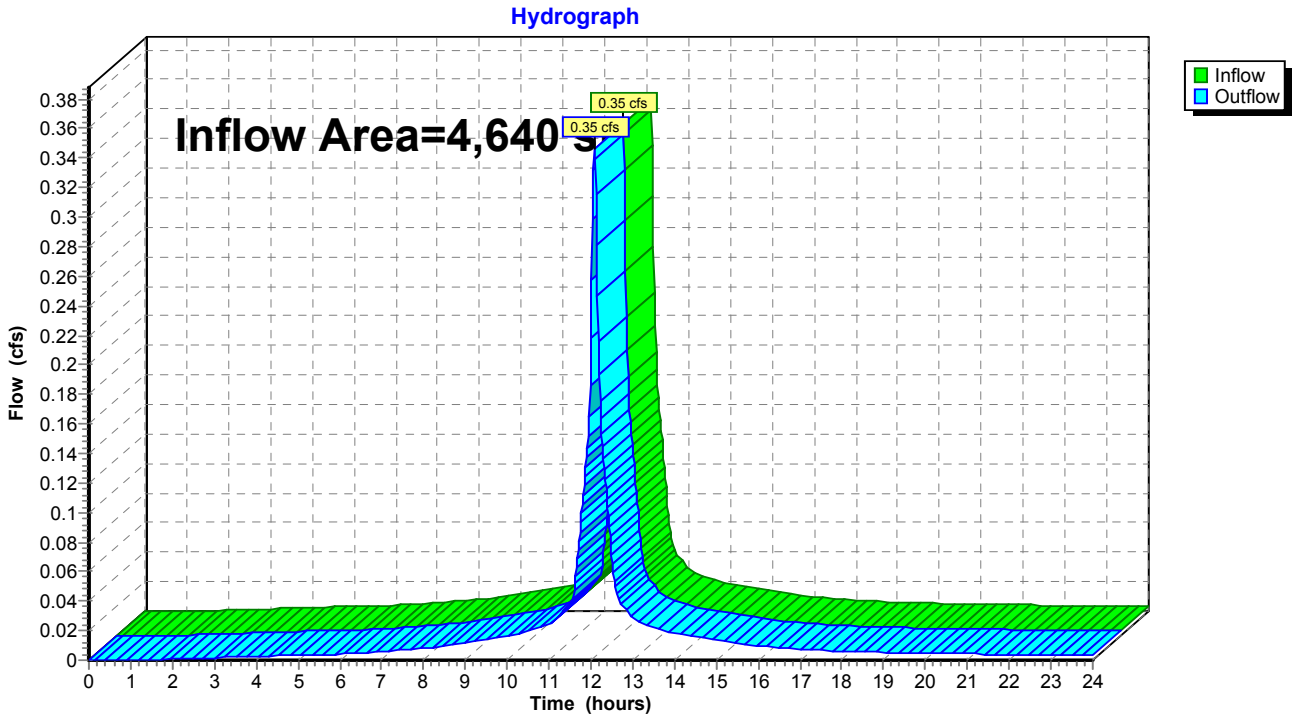


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,640 sf, 98.79% Impervious, Inflow Depth > 3.11" for 2-yr Storm event
Inflow = 0.35 cfs @ 12.08 hrs, Volume= 1,204 cf
Outflow = 0.35 cfs @ 12.08 hrs, Volume= 1,204 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

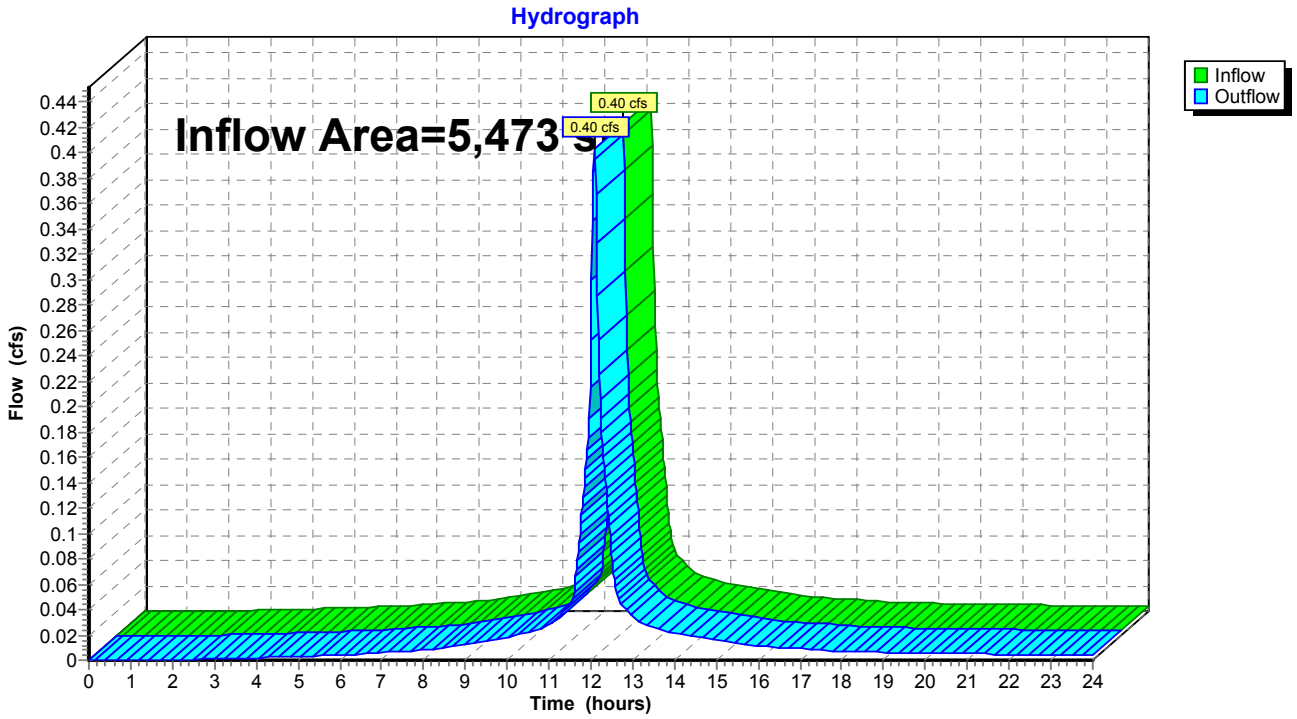


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 3.00" for 2-yr Storm event
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 1,370 cf
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 1,370 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,640 sf 98.79% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=98 Runoff=0.52 cfs 1,825 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>4.60"
Tc=6.0 min CN=97 Runoff=0.60 cfs 2,100 cf

Reach DP-1: Thorndike Street Inflow=0.52 cfs 1,825 cf
Outflow=0.52 cfs 1,825 cf

Reach DP-2: Harvard Street Inflow=0.60 cfs 2,100 cf
Outflow=0.60 cfs 2,100 cf

Total Runoff Area = 10,113 sf Runoff Volume = 3,925 cf Average Runoff Depth = 4.66"
2.73% Pervious = 276 sf 97.27% Impervious = 9,837 sf

Summary for Subcatchment S1: Parking Lot/Roof

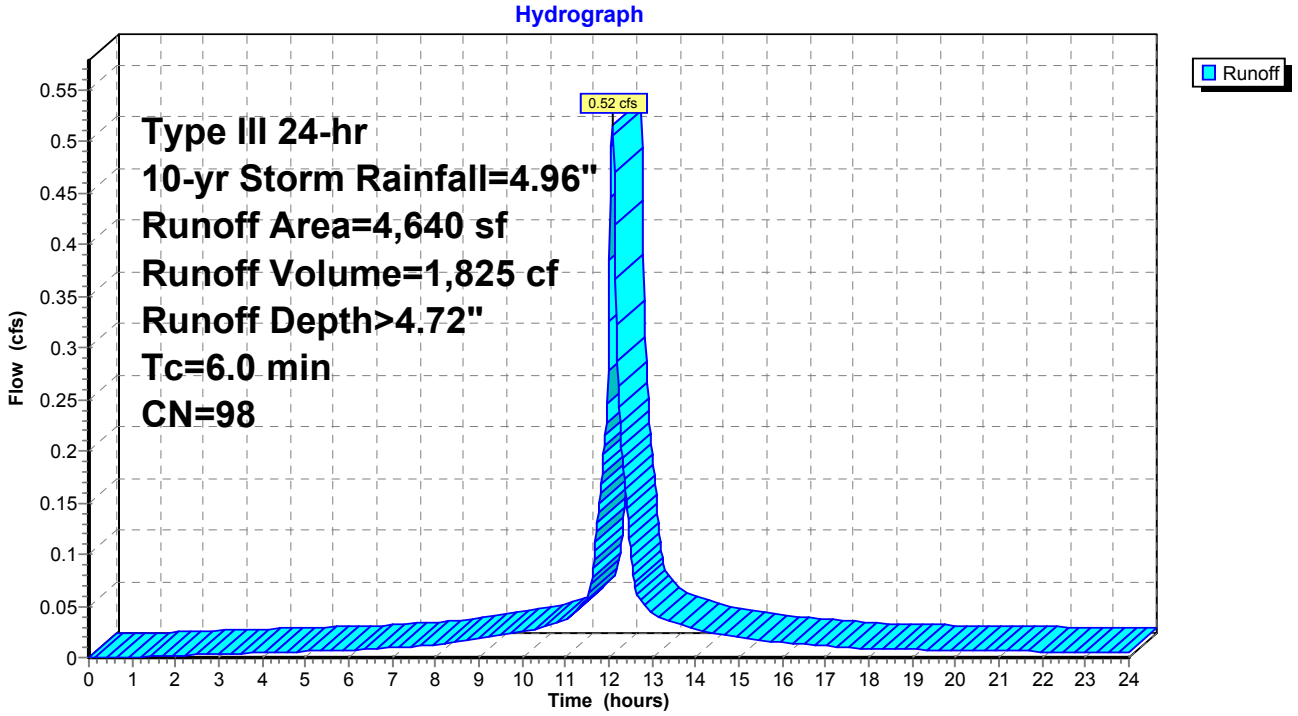
Runoff = 0.52 cfs @ 12.08 hrs, Volume= 1,825 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,882	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,640	98	Weighted Average
	56		1.21% Pervious Area
	4,584		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

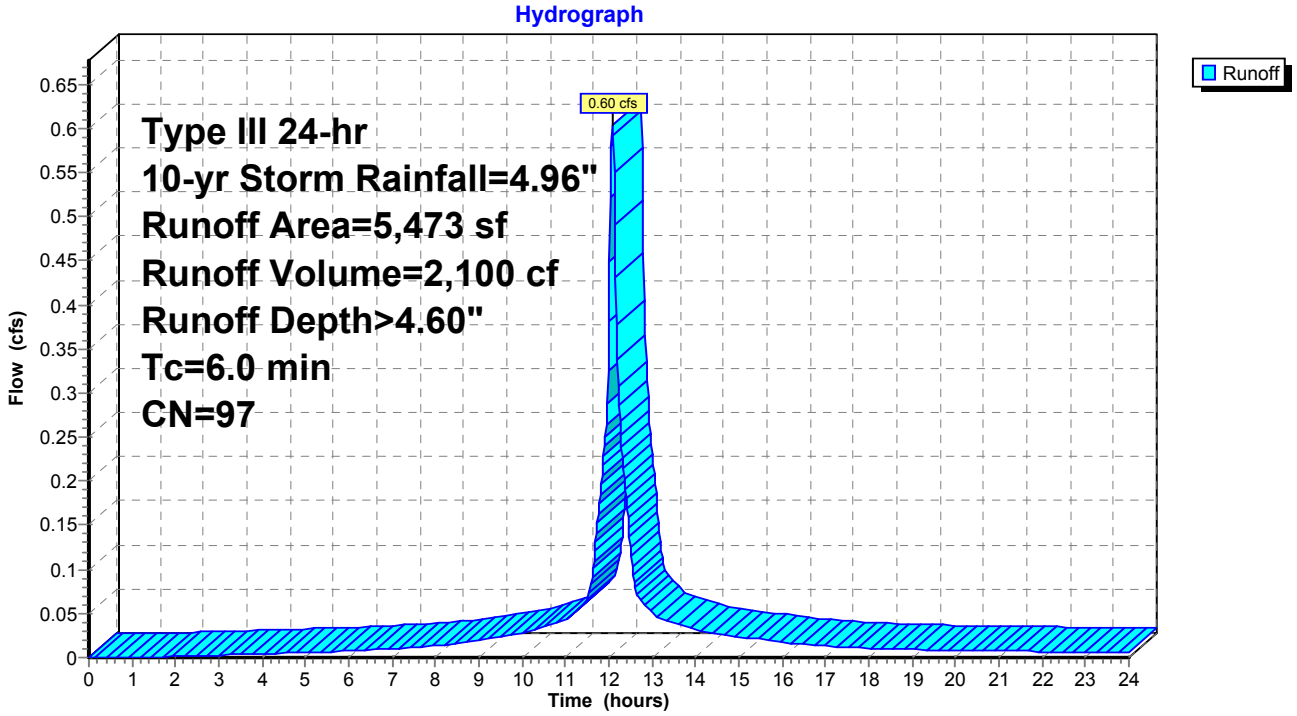
Runoff = 0.60 cfs @ 12.08 hrs, Volume= 2,100 cf, Depth> 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof

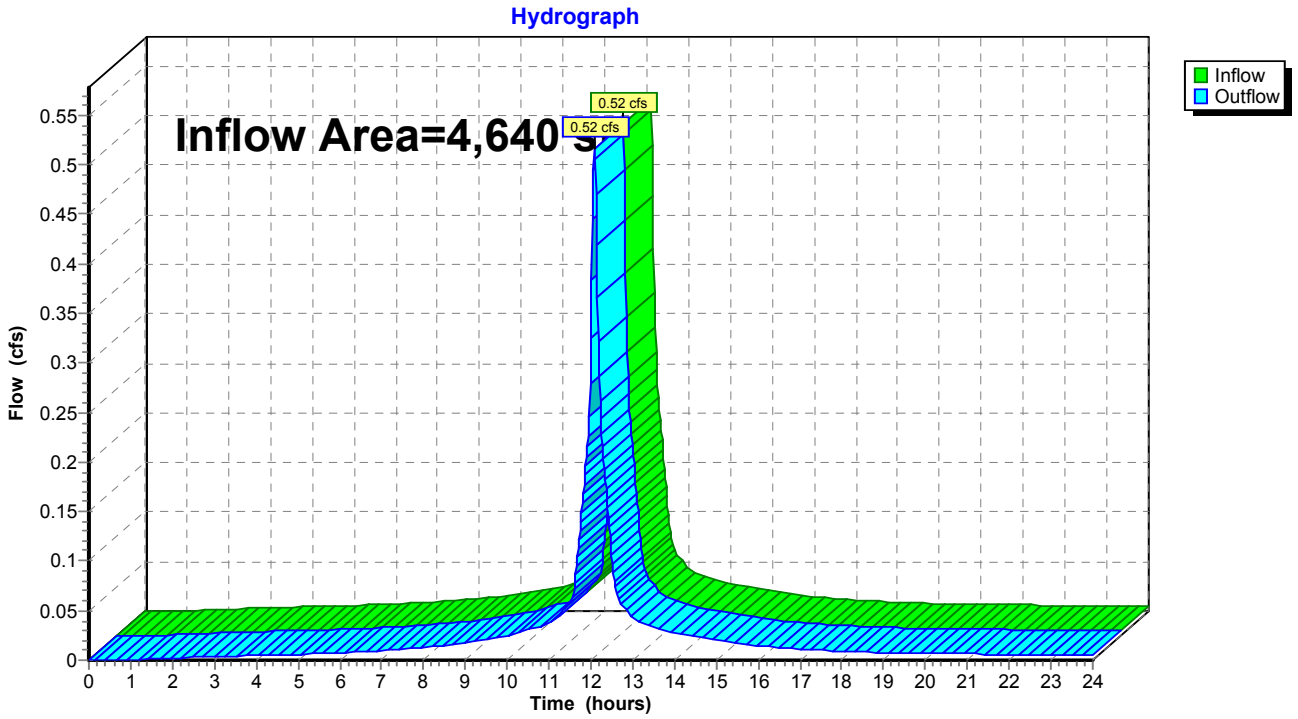


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,640 sf, 98.79% Impervious, Inflow Depth > 4.72" for 10-yr Storm event
Inflow = 0.52 cfs @ 12.08 hrs, Volume= 1,825 cf
Outflow = 0.52 cfs @ 12.08 hrs, Volume= 1,825 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

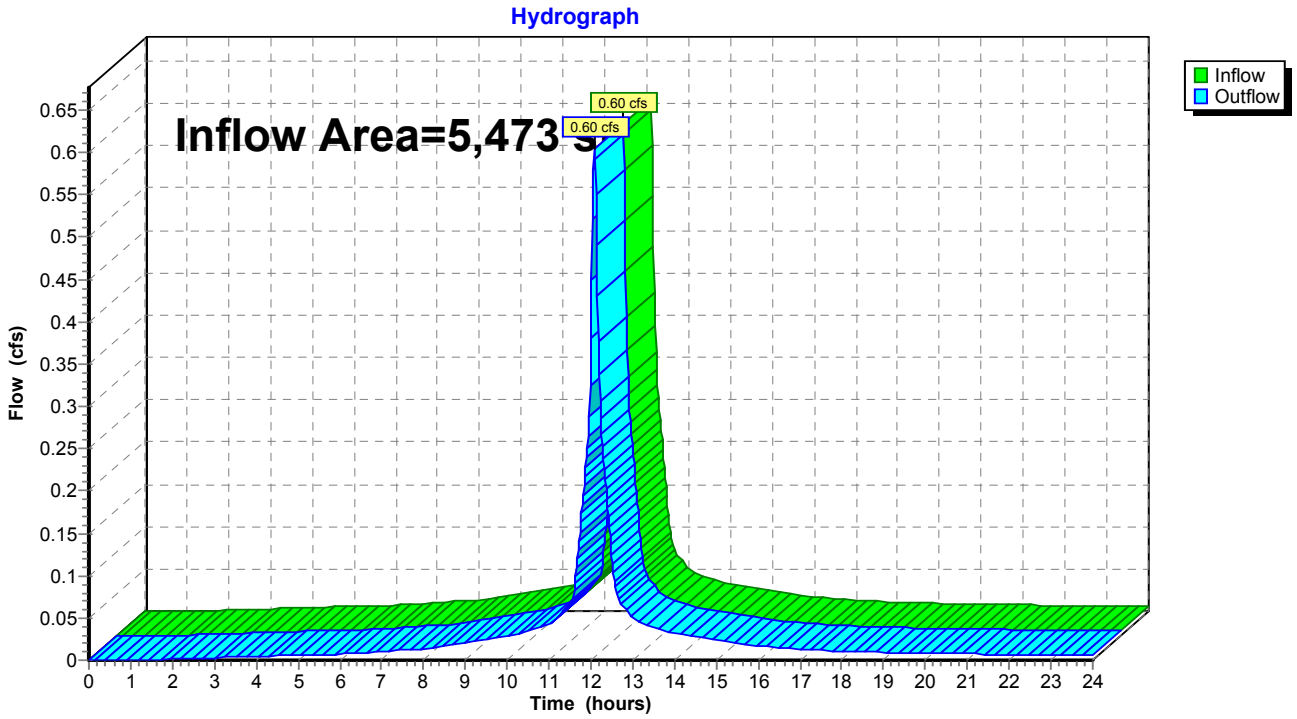


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 4.60" for 10-yr Storm event
Inflow = 0.60 cfs @ 12.08 hrs, Volume= 2,100 cf
Outflow = 0.60 cfs @ 12.08 hrs, Volume= 2,100 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,640 sf 98.79% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=98 Runoff=0.65 cfs 2,303 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>5.84"
Tc=6.0 min CN=97 Runoff=0.76 cfs 2,663 cf

Reach DP-1: Thorndike Street Inflow=0.65 cfs 2,303 cf
Outflow=0.65 cfs 2,303 cf

Reach DP-2: Harvard Street Inflow=0.76 cfs 2,663 cf
Outflow=0.76 cfs 2,663 cf

Total Runoff Area = 10,113 sf Runoff Volume = 4,967 cf Average Runoff Depth = 5.89"
2.73% Pervious = 276 sf 97.27% Impervious = 9,837 sf

Summary for Subcatchment S1: Parking Lot/Roof

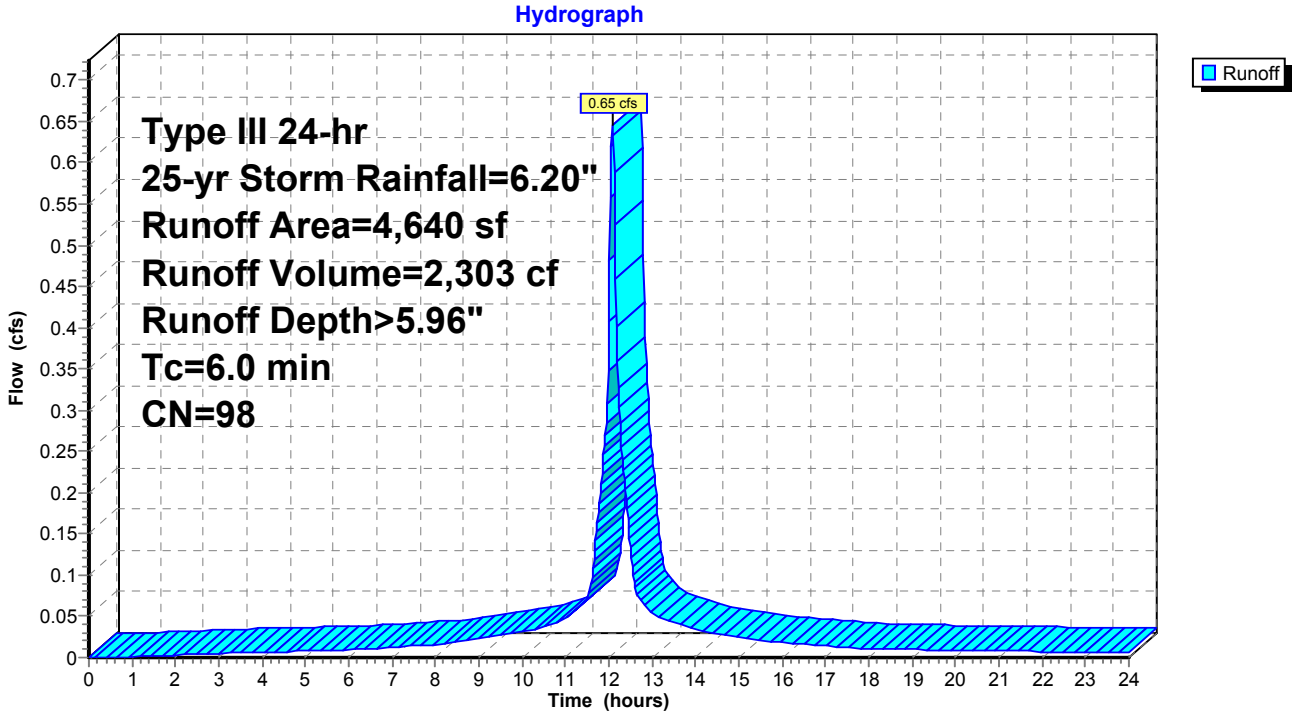
Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,303 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,882	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,640	98	Weighted Average
	56		1.21% Pervious Area
	4,584		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

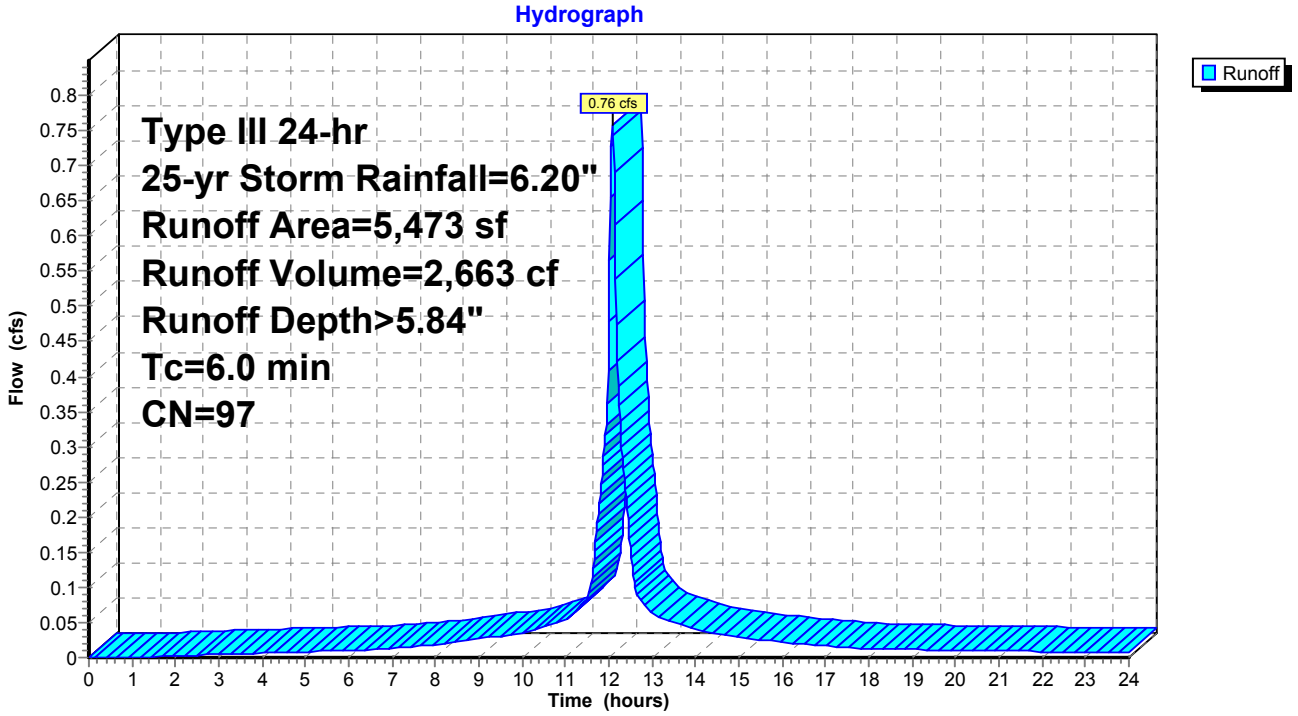
Runoff = 0.76 cfs @ 12.08 hrs, Volume= 2,663 cf, Depth> 5.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof

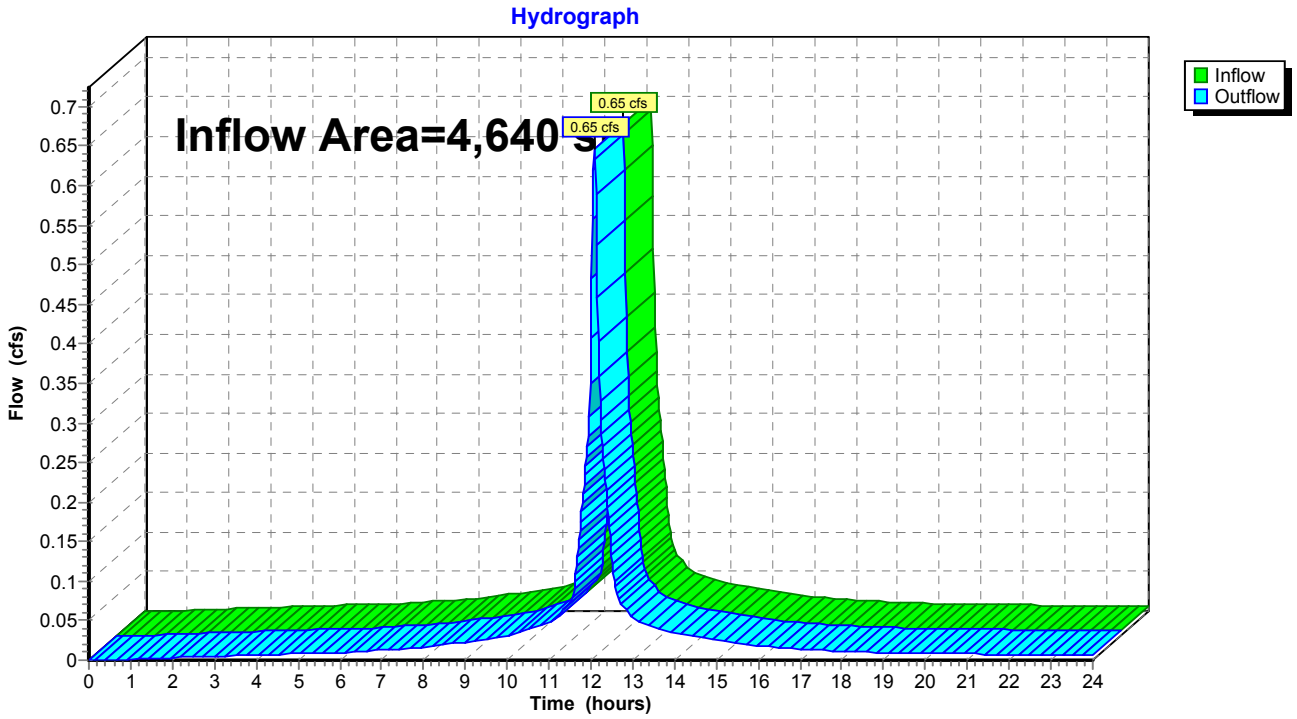


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,640 sf, 98.79% Impervious, Inflow Depth > 5.96" for 25-yr Storm event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 2,303 cf
Outflow = 0.65 cfs @ 12.08 hrs, Volume= 2,303 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

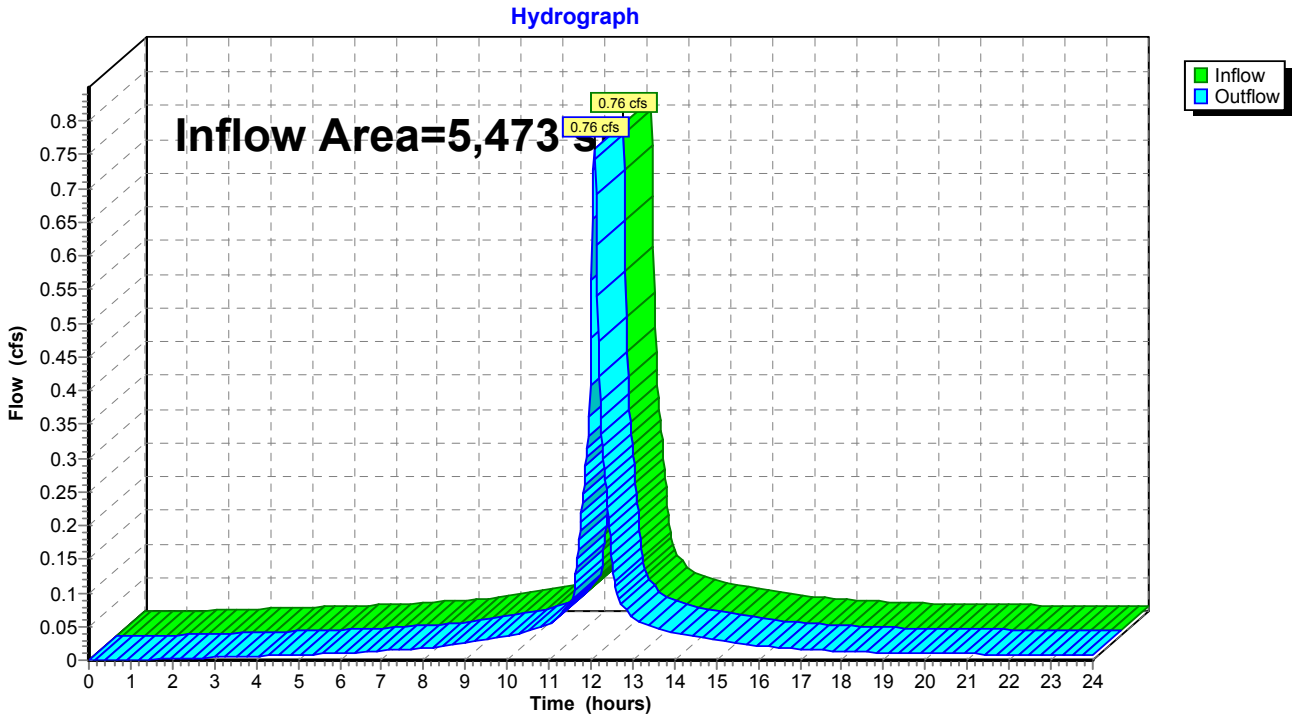


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 5.84" for 25-yr Storm event
Inflow = 0.76 cfs @ 12.08 hrs, Volume= 2,663 cf
Outflow = 0.76 cfs @ 12.08 hrs, Volume= 2,663 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S1: Parking Lot/Roof Runoff Area=4,640 sf 98.79% Impervious Runoff Depth>8.47"
Tc=6.0 min CN=98 Runoff=0.91 cfs 3,276 cf

Subcatchment S2: Parking Lot/Roof Runoff Area=5,473 sf 95.98% Impervious Runoff Depth>8.35"
Tc=6.0 min CN=97 Runoff=1.07 cfs 3,810 cf

Reach DP-1: Thorndike Street Inflow=0.91 cfs 3,276 cf
Outflow=0.91 cfs 3,276 cf

Reach DP-2: Harvard Street Inflow=1.07 cfs 3,810 cf
Outflow=1.07 cfs 3,810 cf

Total Runoff Area = 10,113 sf Runoff Volume = 7,086 cf Average Runoff Depth = 8.41"
2.73% Pervious = 276 sf 97.27% Impervious = 9,837 sf

Summary for Subcatchment S1: Parking Lot/Roof

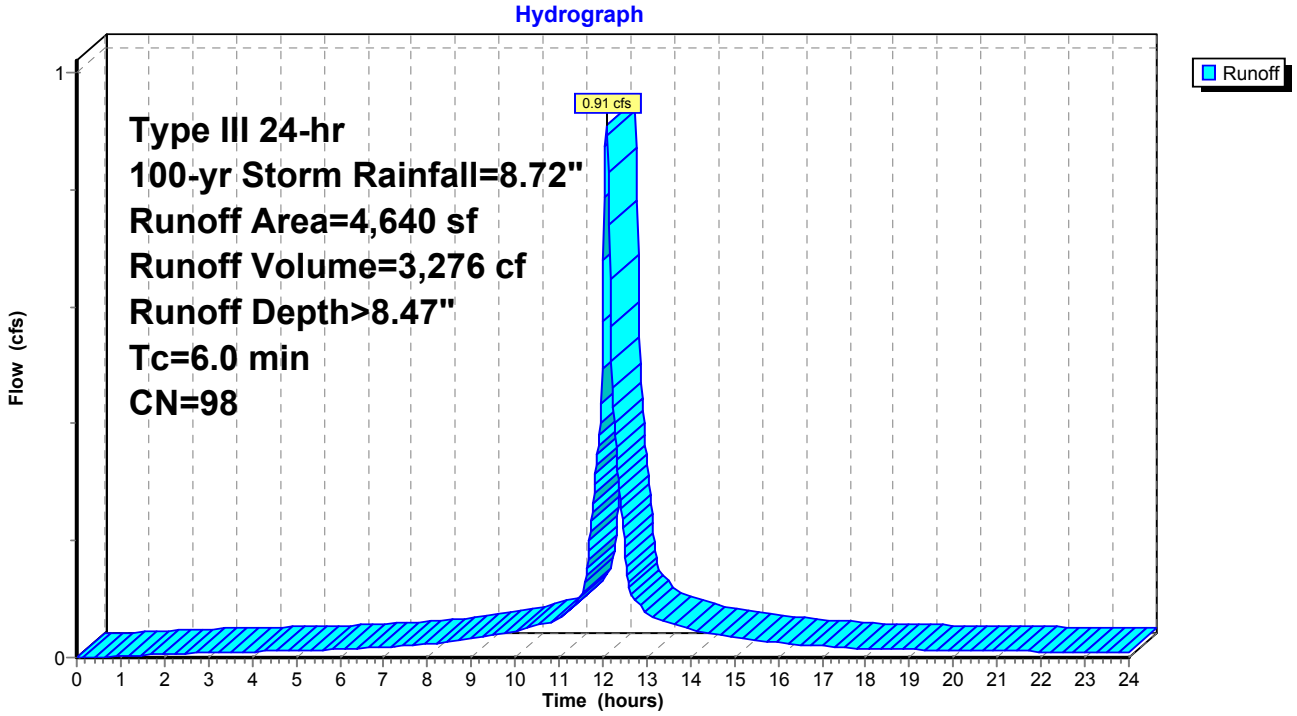
Runoff = 0.91 cfs @ 12.08 hrs, Volume= 3,276 cf, Depth> 8.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
	56	61	>75% Grass cover, Good, HSG B
*	597	98	Roofs, HSG B
*	3,882	98	Paved parking, HSG B
*	105	98	Retaining wall, HSG B
	4,640	98	Weighted Average
	56		1.21% Pervious Area
	4,584		98.79% Impervious Area

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

Subcatchment S1: Parking Lot/Roof



Summary for Subcatchment S2: Parking Lot/Roof

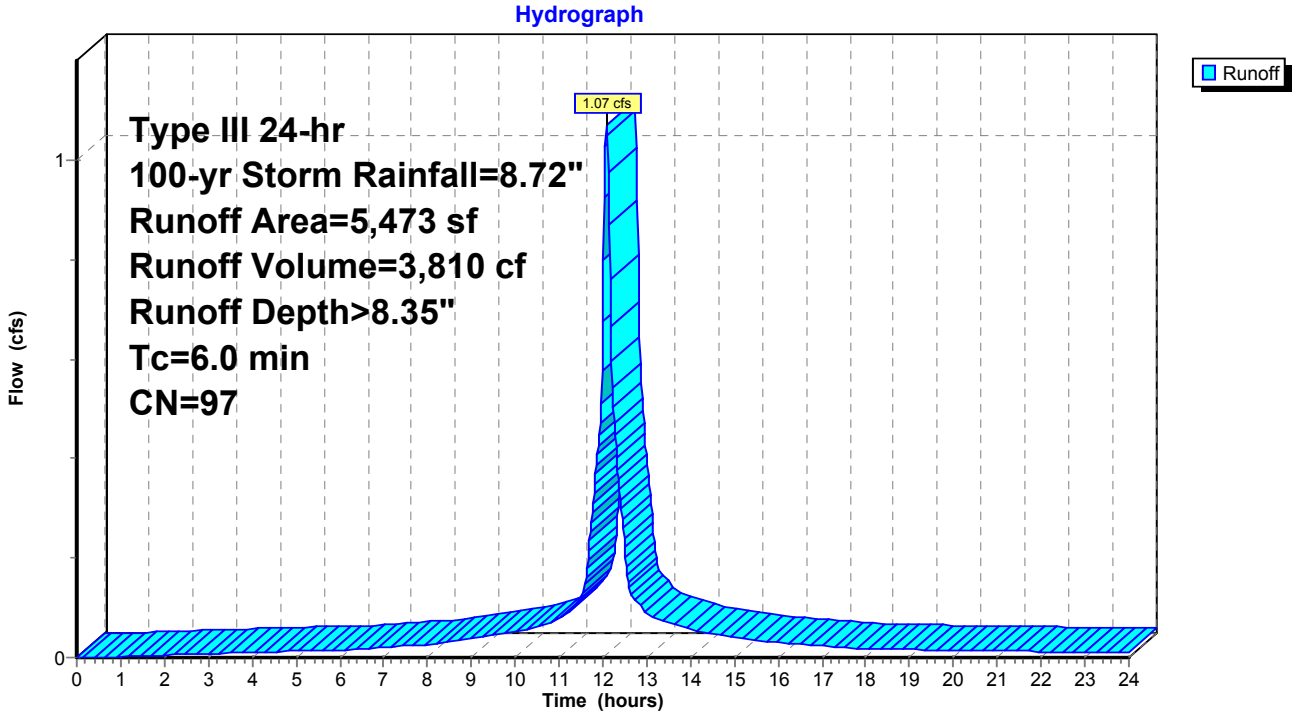
Runoff = 1.07 cfs @ 12.08 hrs, Volume= 3,810 cf, Depth> 8.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	1,443	98	Roofs, HSG B
*	3,697	98	Paved parking, HSG B
	220	61	>75% Grass cover, Good, HSG B
*	113	98	Retaining wall, HSG B
	5,473	97	Weighted Average
	220		4.02% Pervious Area
	5,253		95.98% Impervious Area

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

Subcatchment S2: Parking Lot/Roof

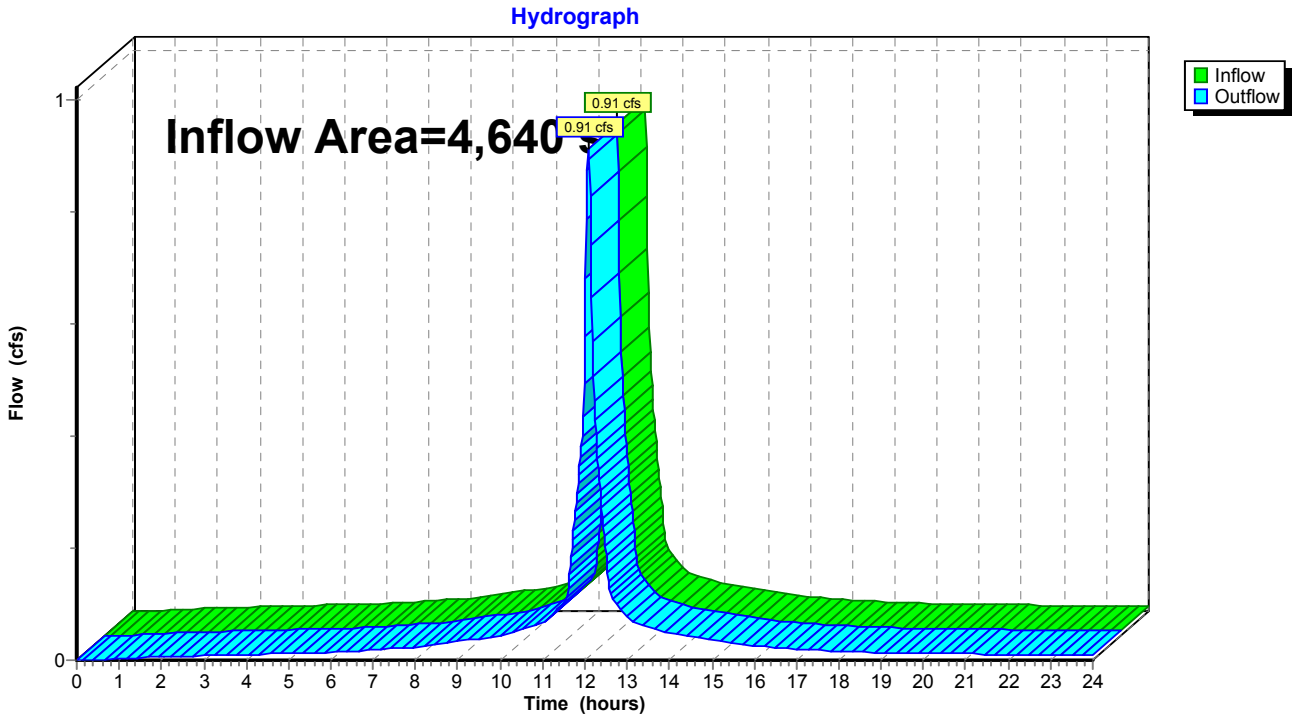


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,640 sf, 98.79% Impervious, Inflow Depth > 8.47" for 100-yr Storm event
Inflow = 0.91 cfs @ 12.08 hrs, Volume= 3,276 cf
Outflow = 0.91 cfs @ 12.08 hrs, Volume= 3,276 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

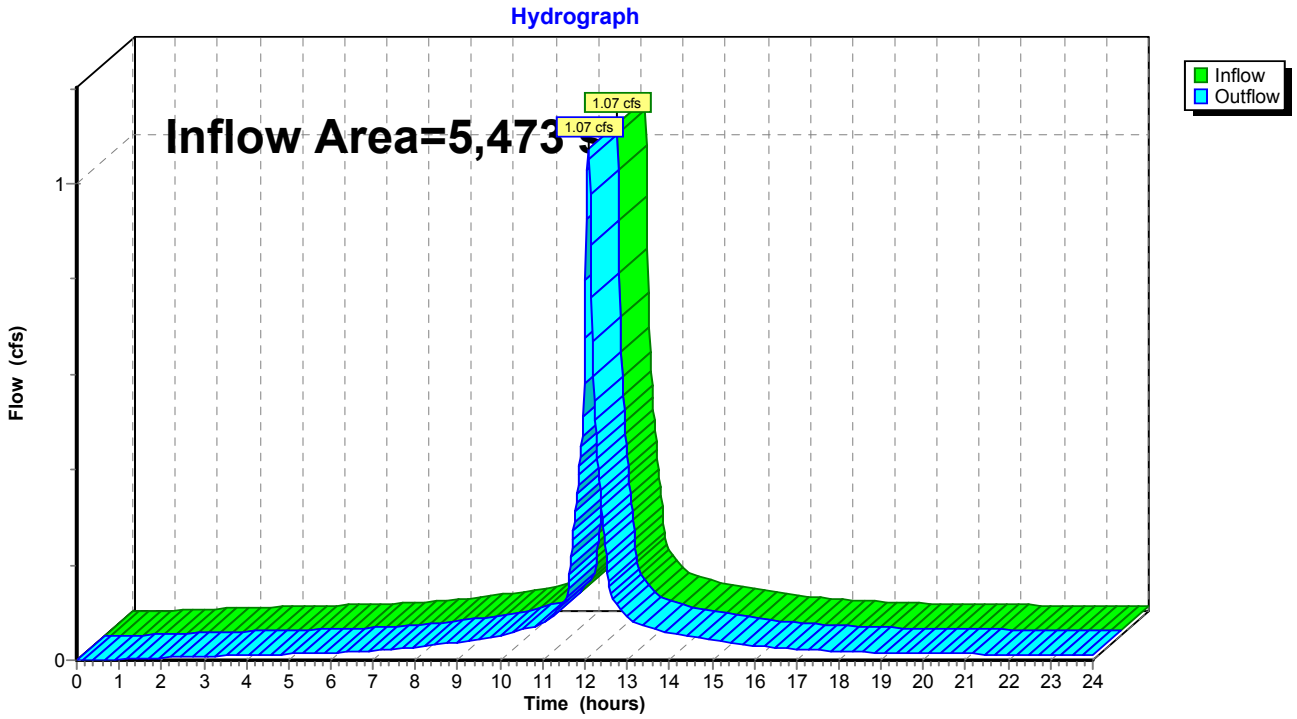


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,473 sf, 95.98% Impervious, Inflow Depth > 8.35" for 100-yr Storm event
Inflow = 1.07 cfs @ 12.08 hrs, Volume= 3,810 cf
Outflow = 1.07 cfs @ 12.08 hrs, Volume= 3,810 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



A P P E N D I X B

Post-Development Condition

S1-R
1,866 SF

S1
429 SF

S3
2,342 SF

S2
824 SF

S2-R
4,652 SF
628C

DP1

DP2

THORNDIKE STREET
(40' WIDE - PUBLIC)

HARVARD STREET
(75' WIDE-PUBLIC)

0' 30' 60' 90'

LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
628C	CANTON-URBAN LAND COMPLEX, 3 TO 15% SLOPES	B

© MCKENZIE ENGINEERING GROUP, INC.

REV	DATE	DESCRIPTION	BY	APP

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
Ph: 781-792-3900
www.mckeng.com

445 HARVARD STREET

445 HARVARD STREET
BROOKLINE, MASSACHUSETTS
(ASSESSOR'S PARCEL ID# 067-09-00)

PROFESSIONAL ENGINEER:

OWNER/APPLICANT:
445 HARVARD STREET CORP
28 LYON ROAD
BROOKLINE, MASSACHUSETTS 02467

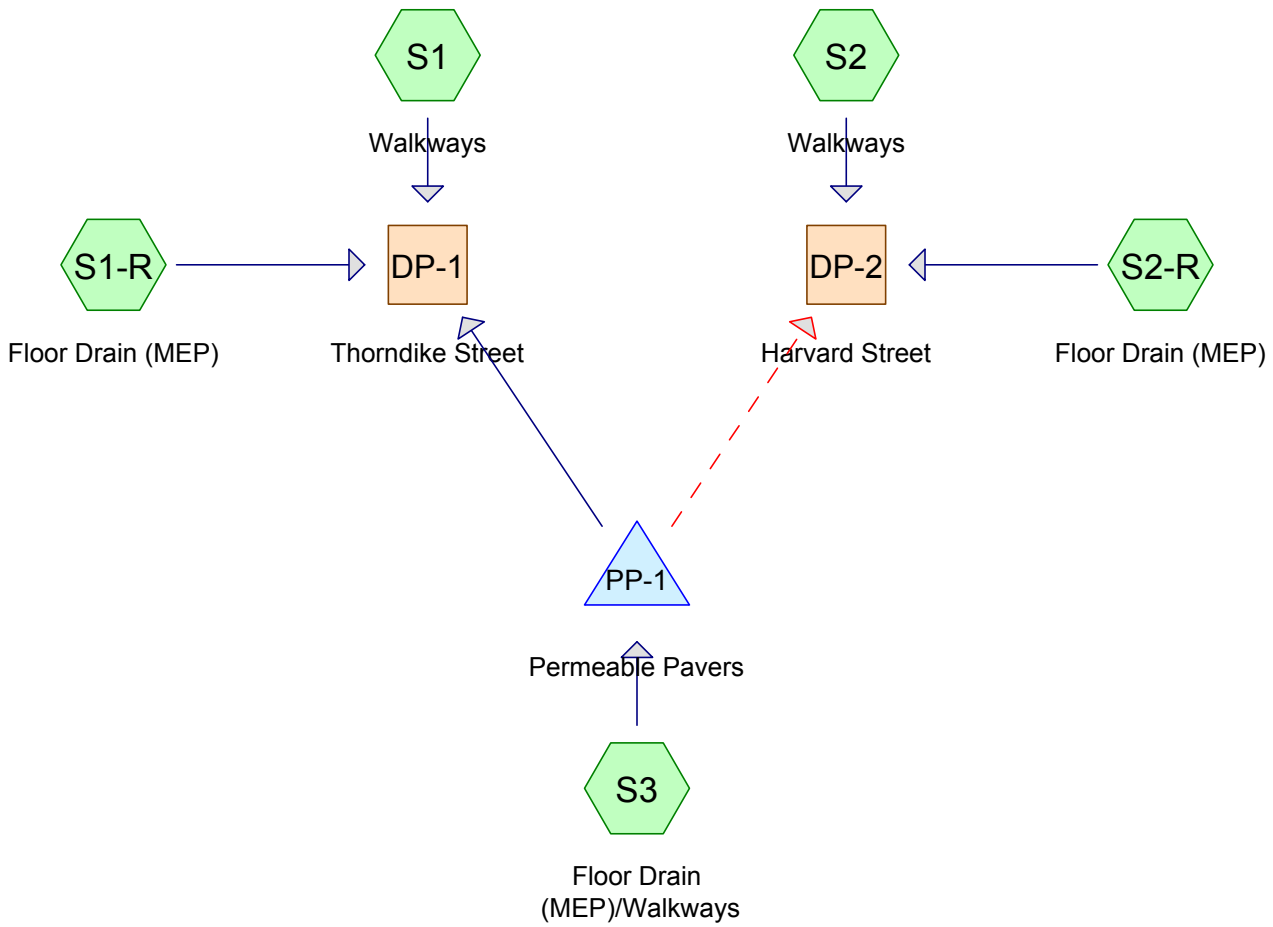
PERMIT PLAN SET

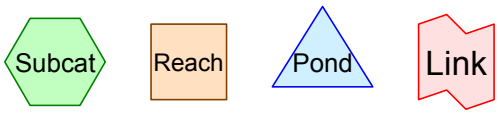
DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	JULY 20, 2018
SCALE:	1"=30'
PROJECT NO.:	218-106

DWG. TITLE:
Post-Dev. Watershed Plan

DWG. No: WS-2

M:\MEG\2018 PROJECTS\218-106 OAKGROVE RESIDENTIAL - 445 HARVARD\DWGS\SUBMISSIONS\1\218-106 WS-2.DWG





Routing Diagram for 218-106 Proposed-1
Prepared by McKenzie Engineering Group, Inc.
HydroCAD® 10.00-21 s/n 00452 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
338	61	>75% Grass cover, Good, HSG B (S3)
223	98	Conc walks, HSG B (S1, S2)
1,534	64	Permeable pavers, HSG B (S1, S2, S3)
8,018	98	Roofs, HSG B (S1-R, S2-R, S3)
10,113	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,113	HSG B	S1, S1-R, S2, S2-R, S3
0	HSG C	
0	HSG D	
0	Other	
10,113		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	338	0	0	0	338	>75% Grass cover, Good	
0	223	0	0	0	223	Conc walks	
0	1,534	0	0	0	1,534	Permeable pavers	
0	8,018	0	0	0	8,018	Roofs	
0	**10,113**	**0**	**0**	**0**	**10,113**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	PP-1	60.00	56.30	88.5	0.0418	0.013	4.0	0.0	0.0
2	PP-1	59.90	58.00	42.0	0.0452	0.013	4.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=429 sf 20.75% Impervious Runoff Depth>0.97"
Tc=6.0 min CN=71 Runoff=0.01 cfs 35 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=98 Runoff=0.14 cfs 484 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>0.92"
Tc=6.0 min CN=70 Runoff=0.02 cfs 63 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=98 Runoff=0.35 cfs 1,207 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>1.88"
Tc=6.0 min CN=85 Runoff=0.12 cfs 368 cf

Reach DP-1: Thorndike Street Inflow=0.15 cfs 519 cf
Outflow=0.15 cfs 519 cf

Reach DP-2: Harvard Street Inflow=0.37 cfs 1,270 cf
Outflow=0.37 cfs 1,270 cf

Pond PP-1: Permeable Pavers Peak Elev=58.67' Storage=136 cf Inflow=0.12 cfs 368 cf
Discarded=0.01 cfs 368 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.01 cfs 368 cf

Total Runoff Area = 10,113 sf Runoff Volume = 2,157 cf Average Runoff Depth = 2.56"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,241 sf

Summary for Subcatchment S1: Walkways

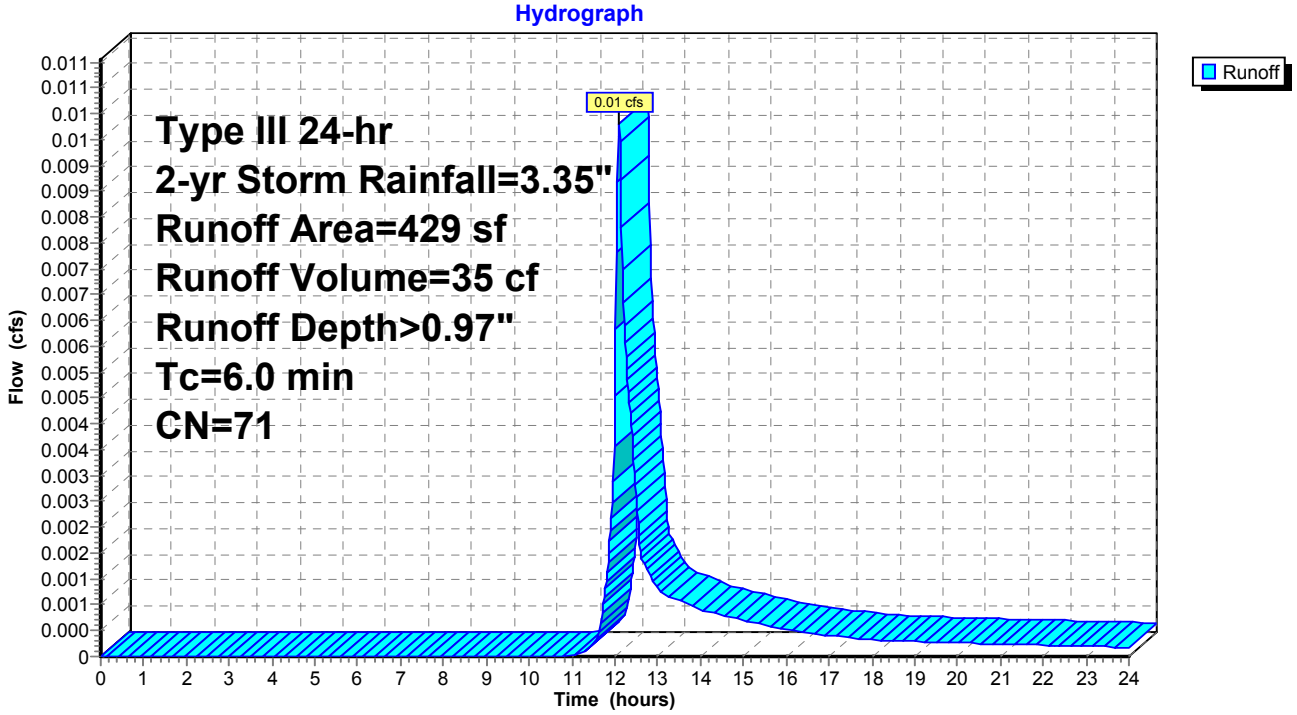
Runoff = 0.01 cfs @ 12.10 hrs, Volume= 35 cf, Depth> 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	89	98	Conc walks, HSG B
	429	71	Weighted Average
	340		79.25% Pervious Area
	89		20.75% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

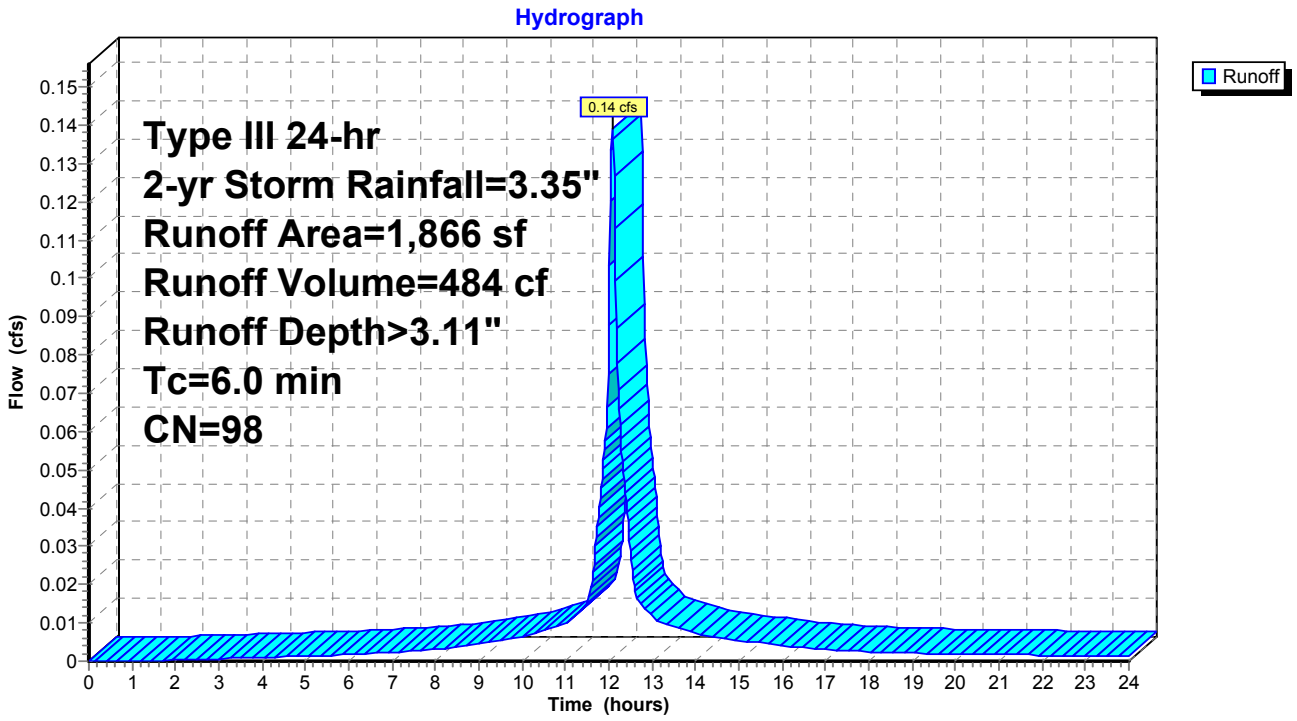
Runoff = 0.14 cfs @ 12.08 hrs, Volume= 484 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

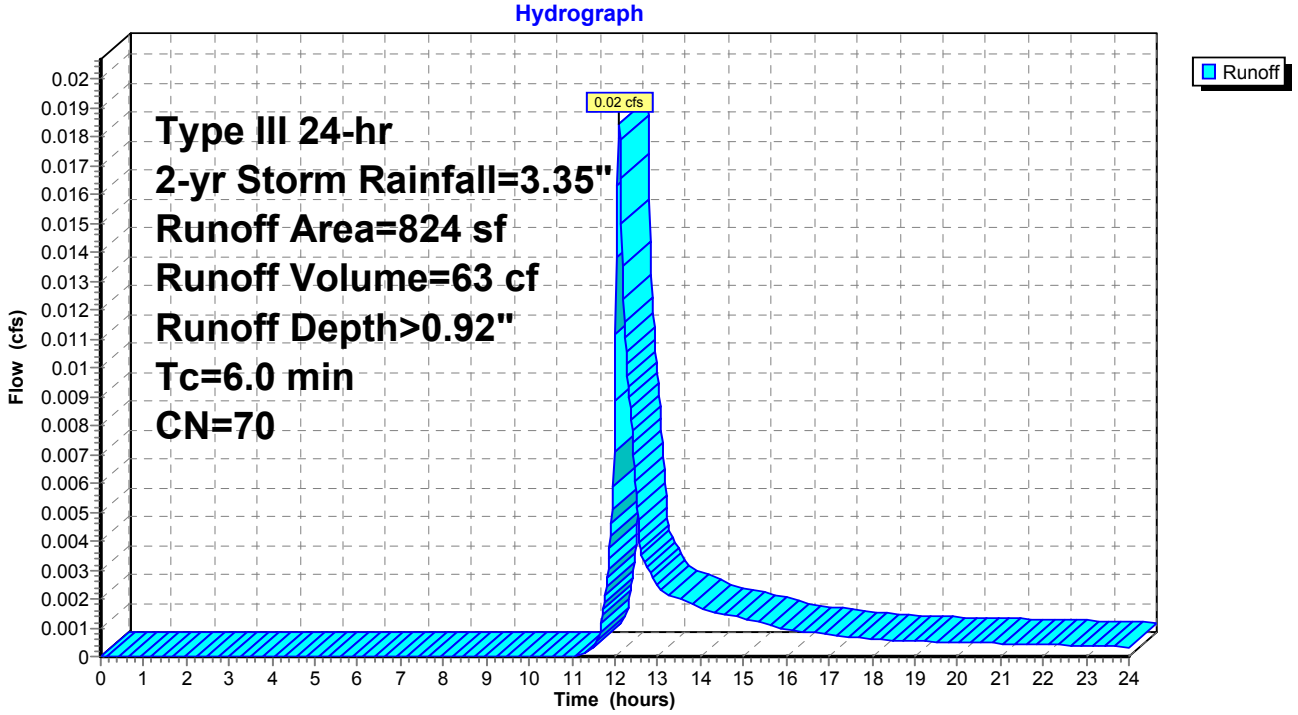
Runoff = 0.02 cfs @ 12.10 hrs, Volume= 63 cf, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

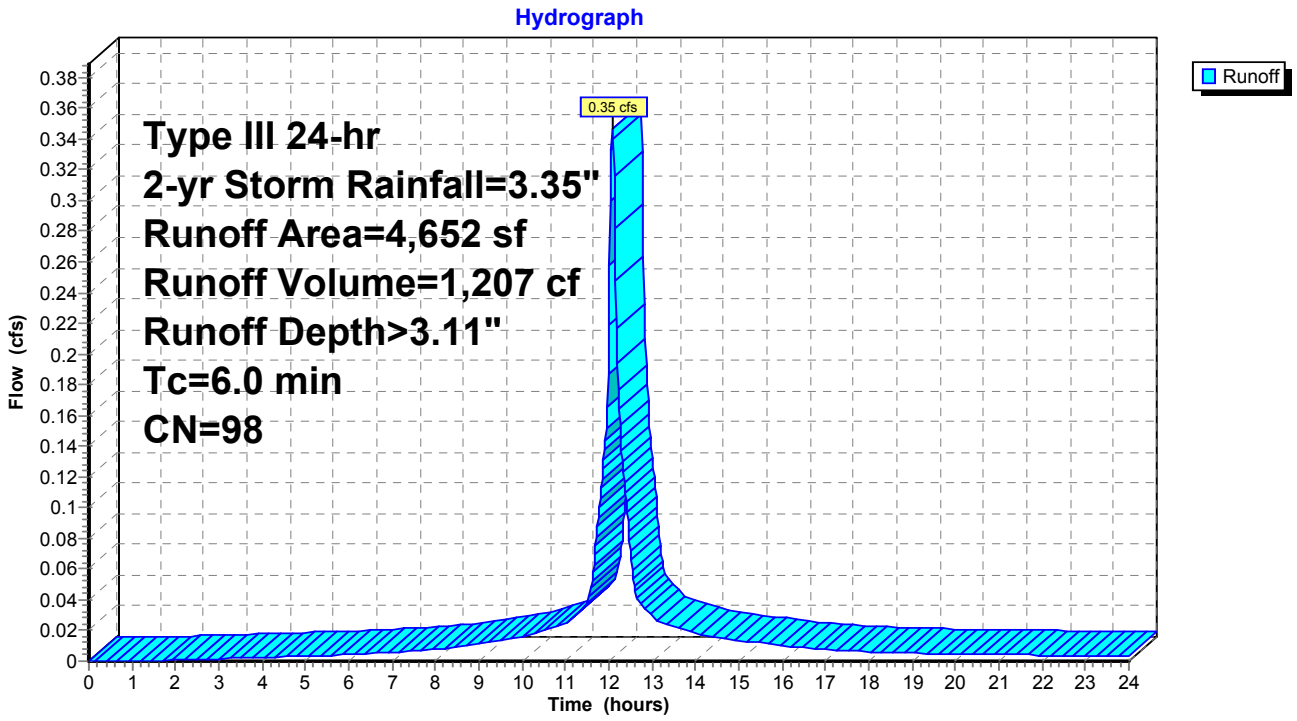
Runoff = 0.35 cfs @ 12.08 hrs, Volume= 1,207 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

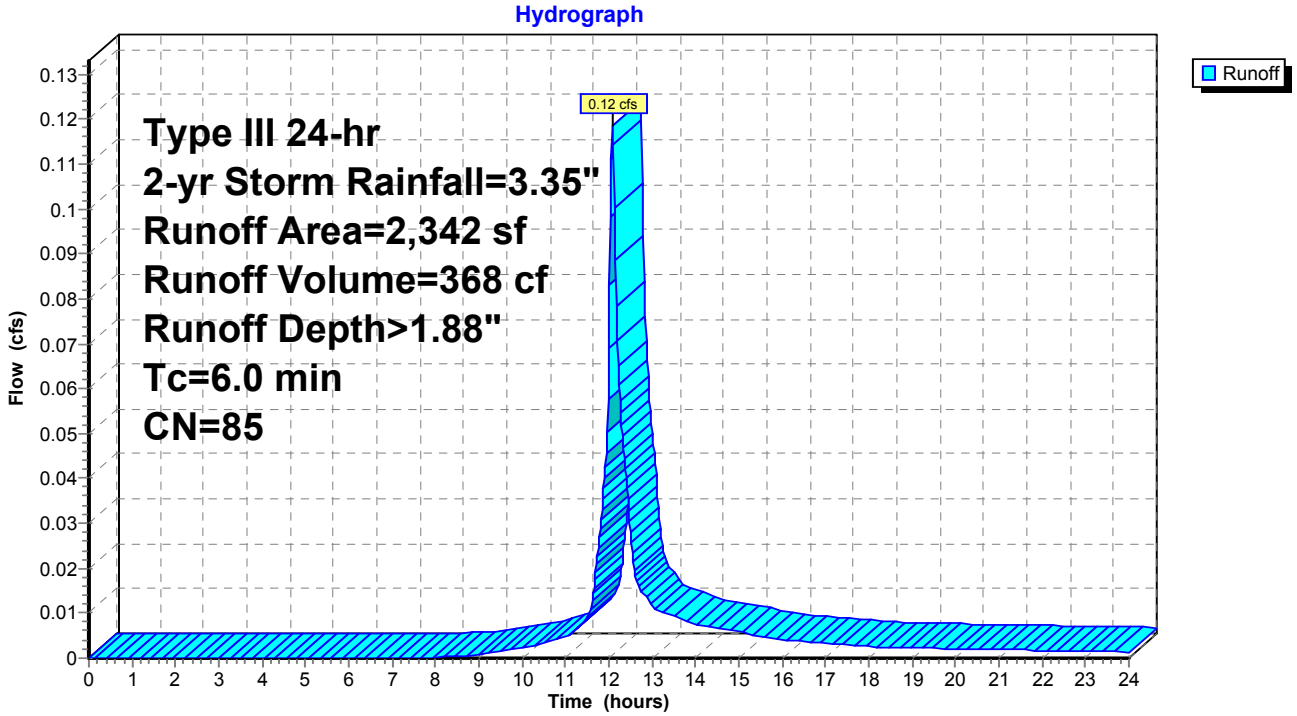
Runoff = 0.12 cfs @ 12.09 hrs, Volume= 368 cf, Depth> 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Storm Rainfall=3.35"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways

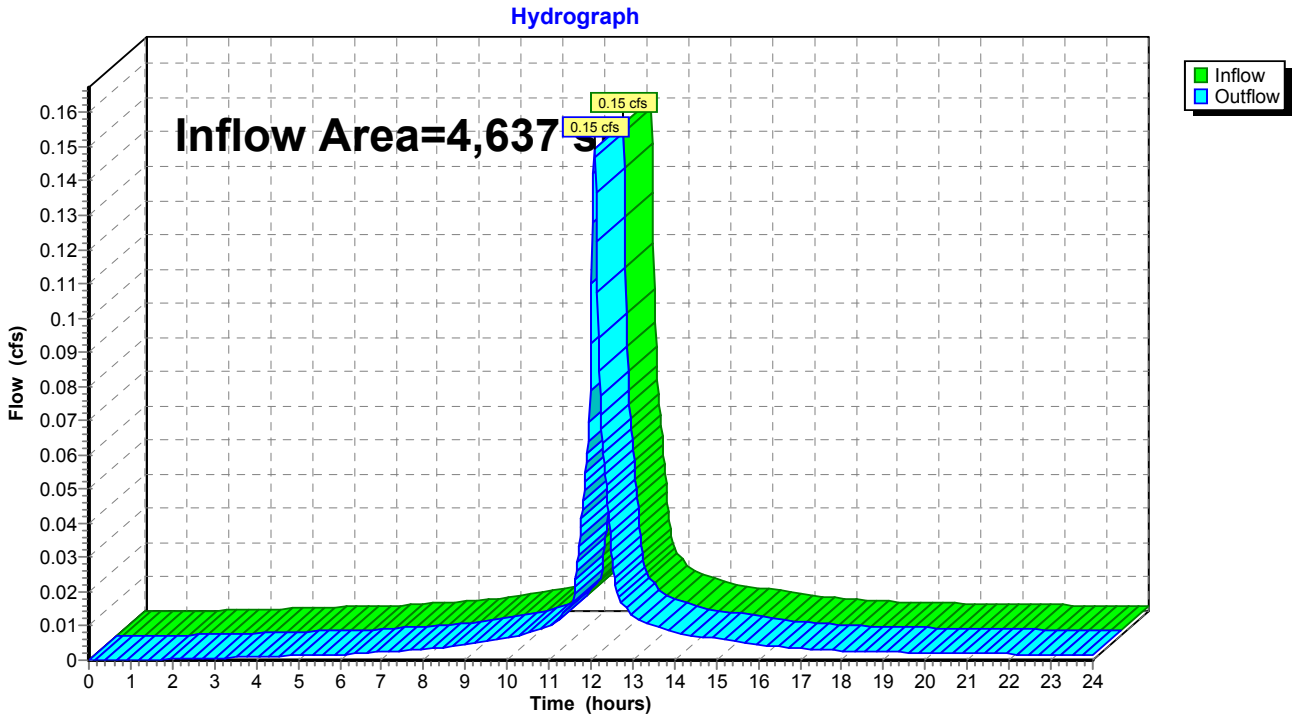


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,637 sf, 74.51% Impervious, Inflow Depth > 1.34" for 2-yr Storm event
Inflow = 0.15 cfs @ 12.08 hrs, Volume= 519 cf
Outflow = 0.15 cfs @ 12.08 hrs, Volume= 519 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

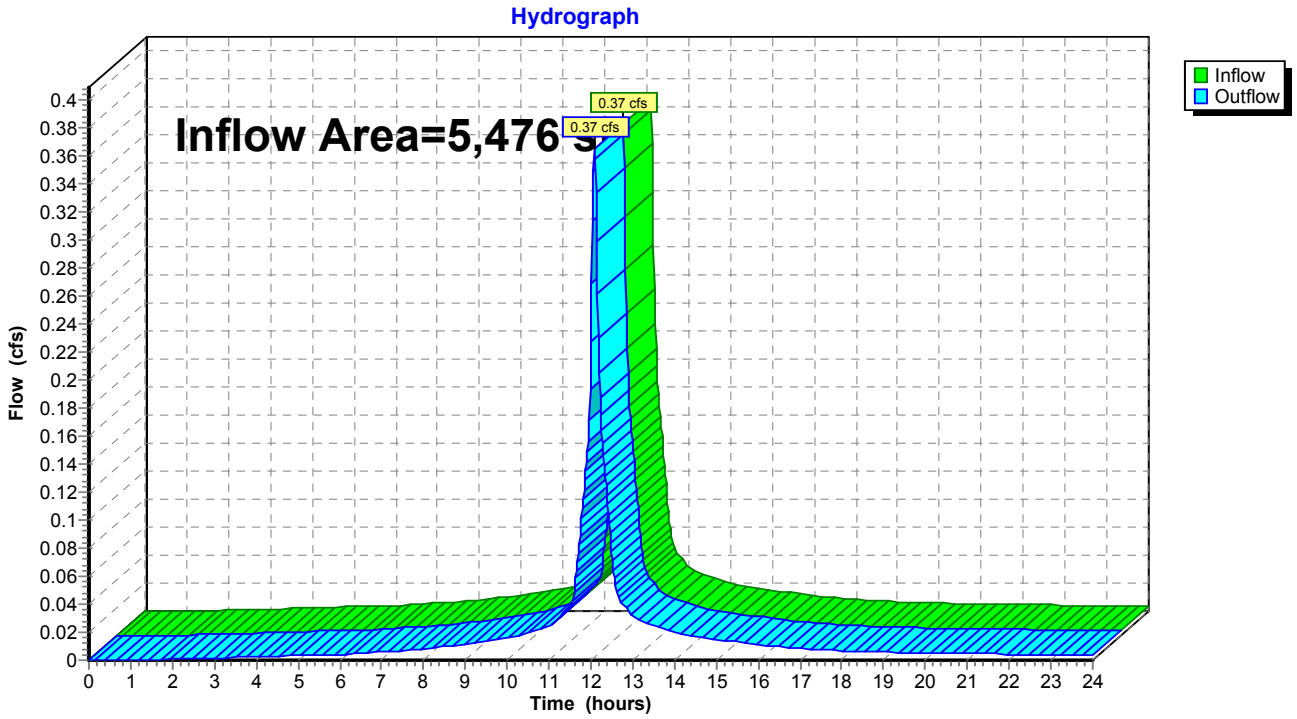


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,476 sf, 87.40% Impervious, Inflow Depth > 2.78" for 2-yr Storm event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 1,270 cf
Outflow = 0.37 cfs @ 12.08 hrs, Volume= 1,270 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area =	2,342 sf, 64.05% Impervious, Inflow Depth > 1.88" for 2-yr Storm event				
Inflow =	0.12 cfs @	12.09 hrs,	Volume=	368 cf	
Outflow =	0.01 cfs @	11.78 hrs,	Volume=	368 cf,	Atten= 90%, Lag= 0.0 min
Discarded =	0.01 cfs @	11.78 hrs,	Volume=	368 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 58.67' @ 12.99 hrs Surf.Area= 504 sf Storage= 136 cf

Plug-Flow detention time= 94.2 min calculated for 367 cf (100% of inflow)
Center-of-Mass det. time= 93.8 min (917.2 - 823.4)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

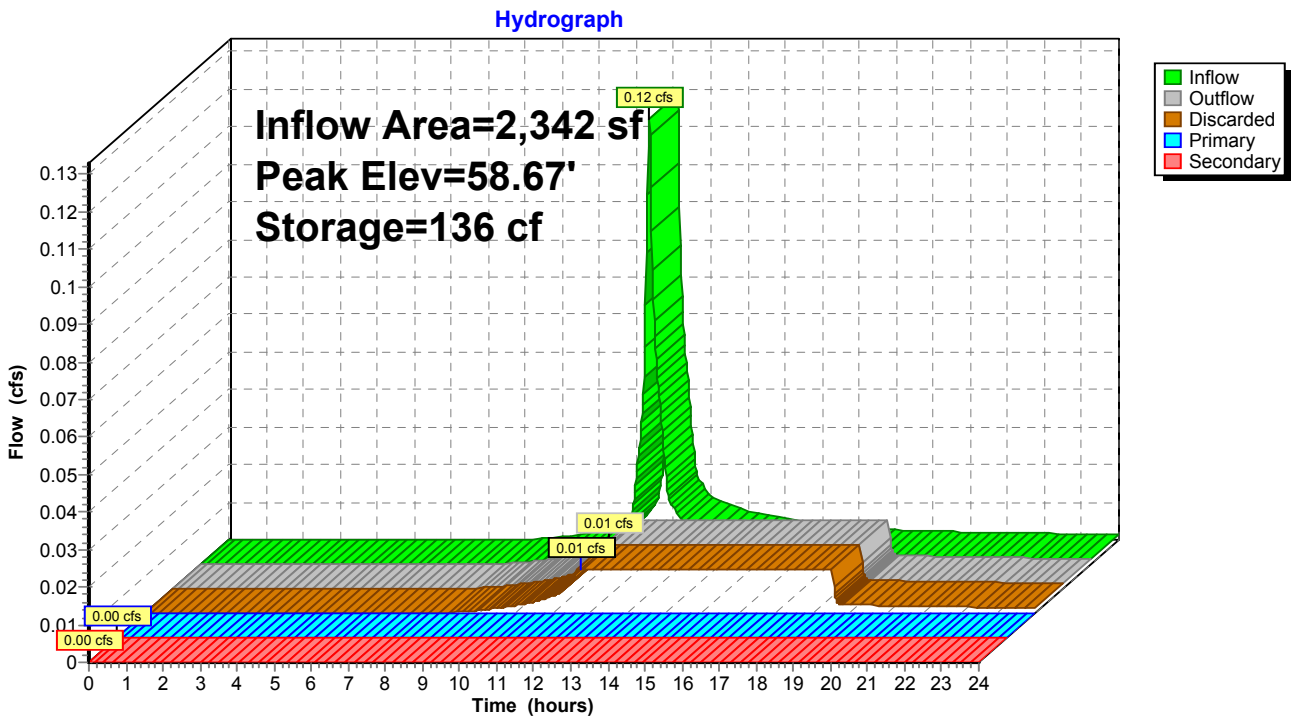
Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	60.00'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.00' / 56.30' S= 0.0418 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	59.90'	**4.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.90' / 58.00' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 11.78 hrs HW=58.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)

Pond PP-1: Permeable Pavers



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=429 sf 20.75% Impervious Runoff Depth>2.08"
Tc=6.0 min CN=71 Runoff=0.02 cfs 74 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=98 Runoff=0.21 cfs 734 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>2.00"
Tc=6.0 min CN=70 Runoff=0.04 cfs 138 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=98 Runoff=0.52 cfs 1,830 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=85 Runoff=0.21 cfs 649 cf

Reach DP-1: Thorndike Street Inflow=0.23 cfs 808 cf
Outflow=0.23 cfs 808 cf

Reach DP-2: Harvard Street Inflow=0.56 cfs 1,967 cf
Outflow=0.56 cfs 1,967 cf

Pond PP-1: Permeable Pavers Peak Elev=59.48' Storage=299 cf Inflow=0.21 cfs 649 cf
Discarded=0.01 cfs 609 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.01 cfs 609 cf

Total Runoff Area = 10,113 sf Runoff Volume = 3,425 cf Average Runoff Depth = 4.06"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,241 sf

Summary for Subcatchment S1: Walkways

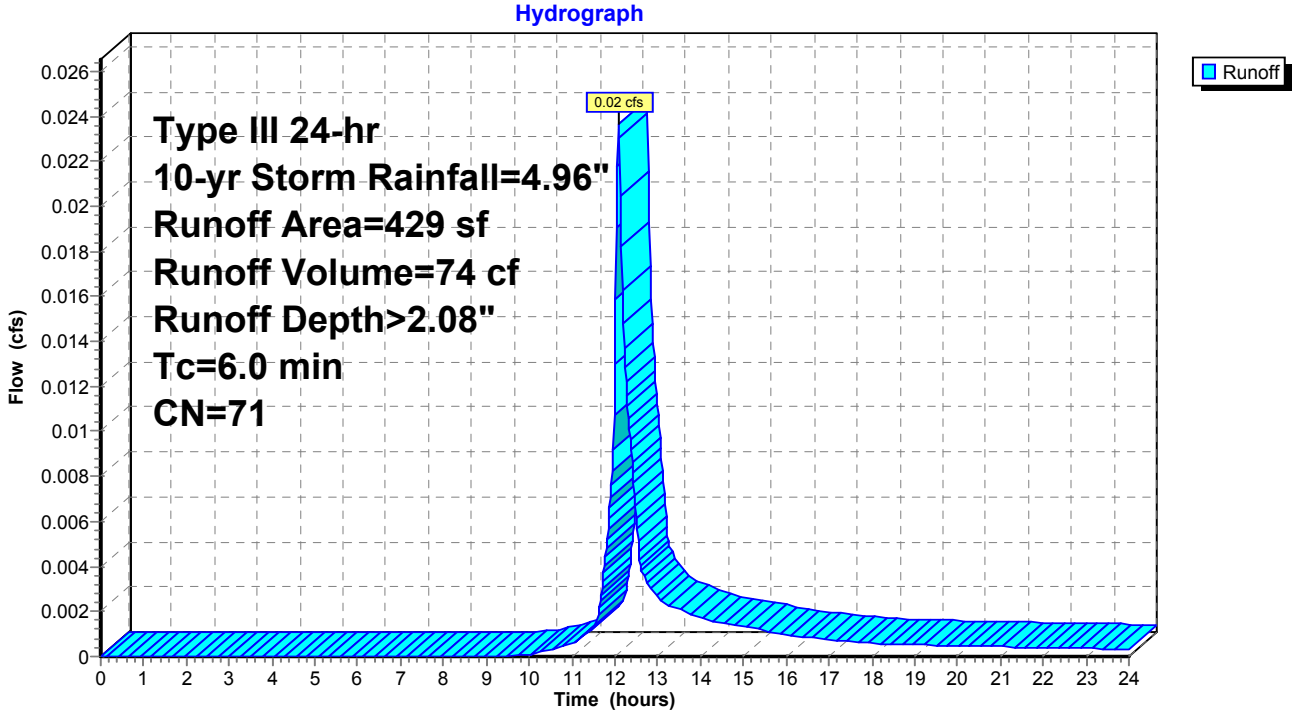
Runoff = 0.02 cfs @ 12.09 hrs, Volume= 74 cf, Depth> 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	89	98	Conc walks, HSG B
	429	71	Weighted Average
	340		79.25% Pervious Area
	89		20.75% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

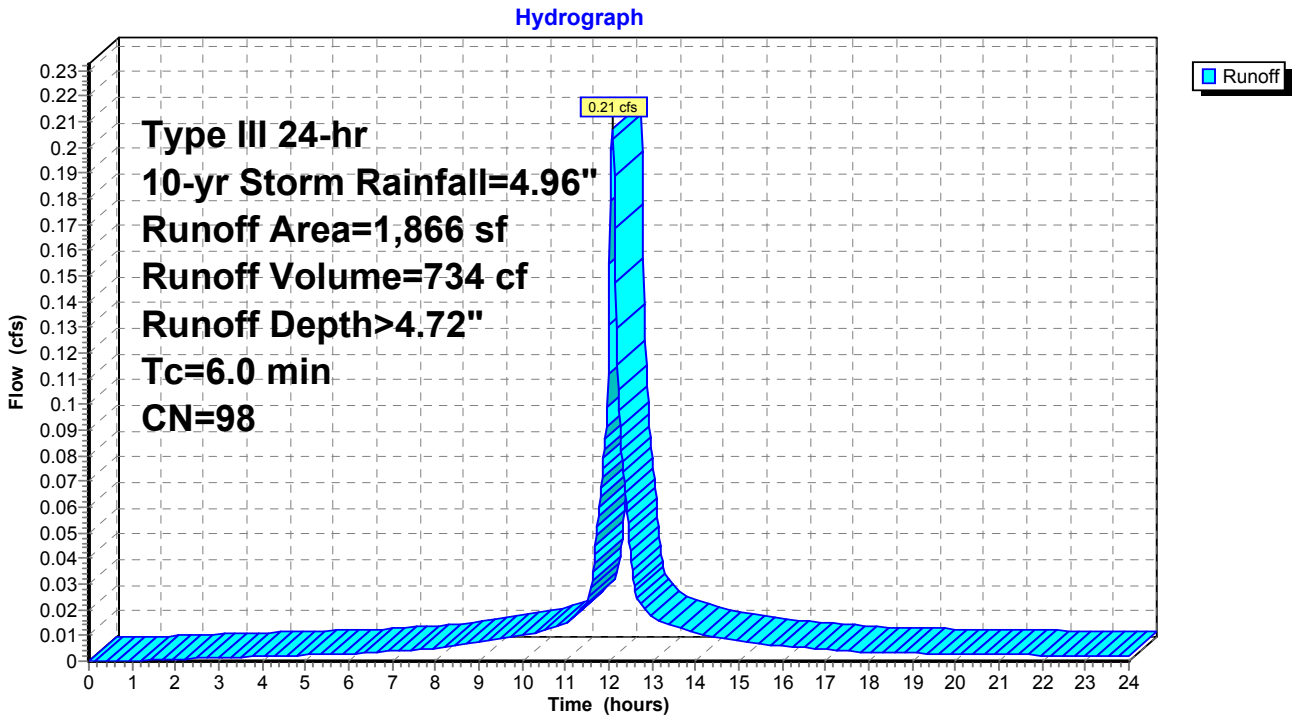
Runoff = 0.21 cfs @ 12.08 hrs, Volume= 734 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

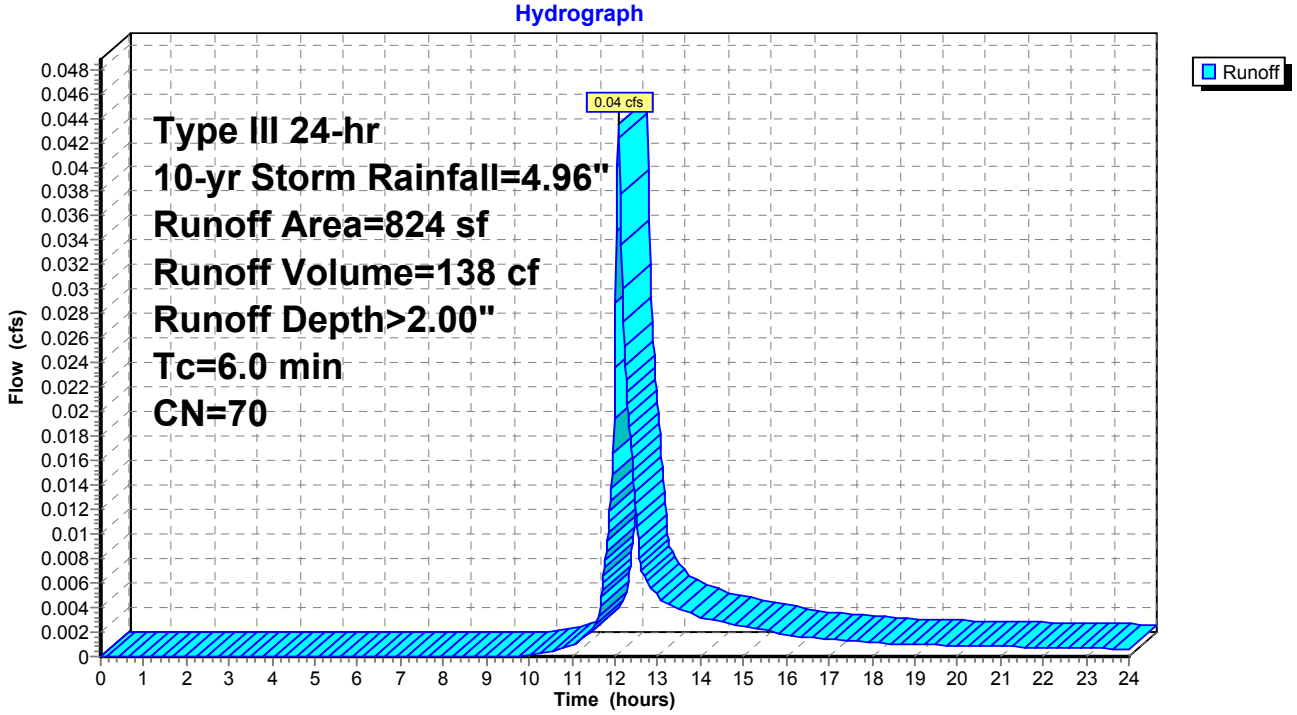
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 138 cf, Depth> 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

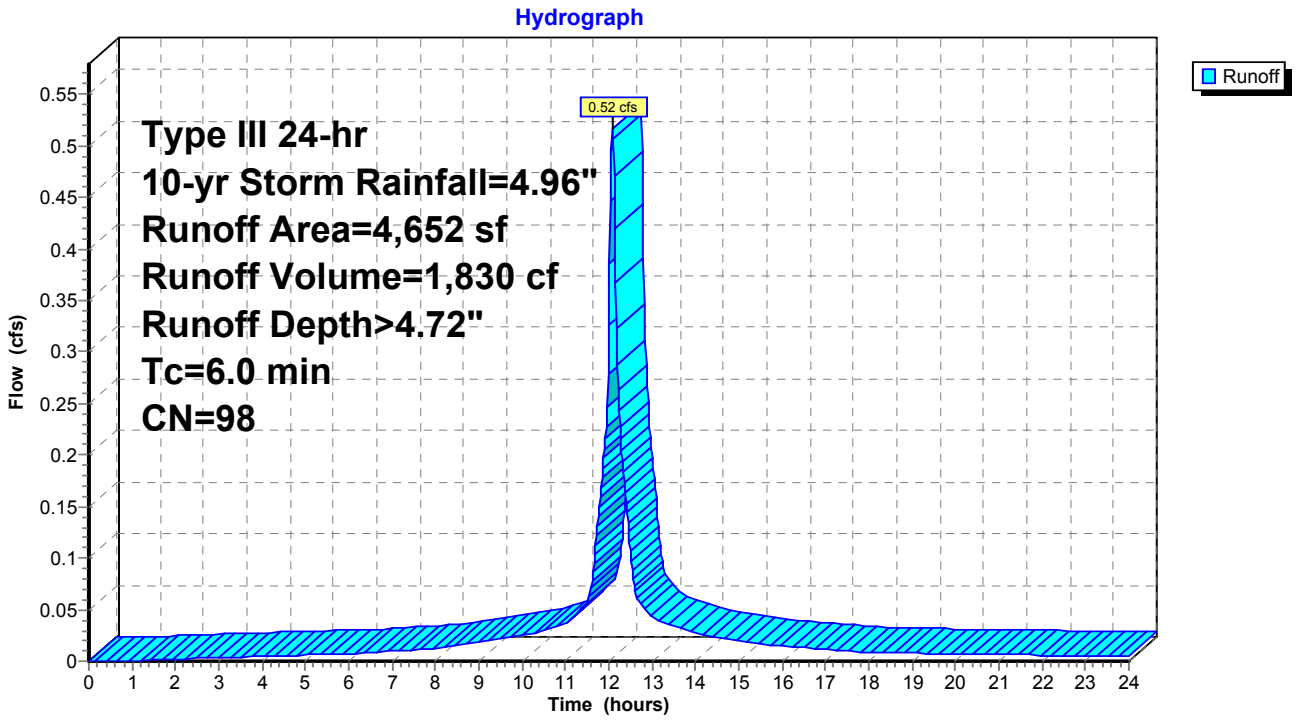
Runoff = 0.52 cfs @ 12.08 hrs, Volume= 1,830 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

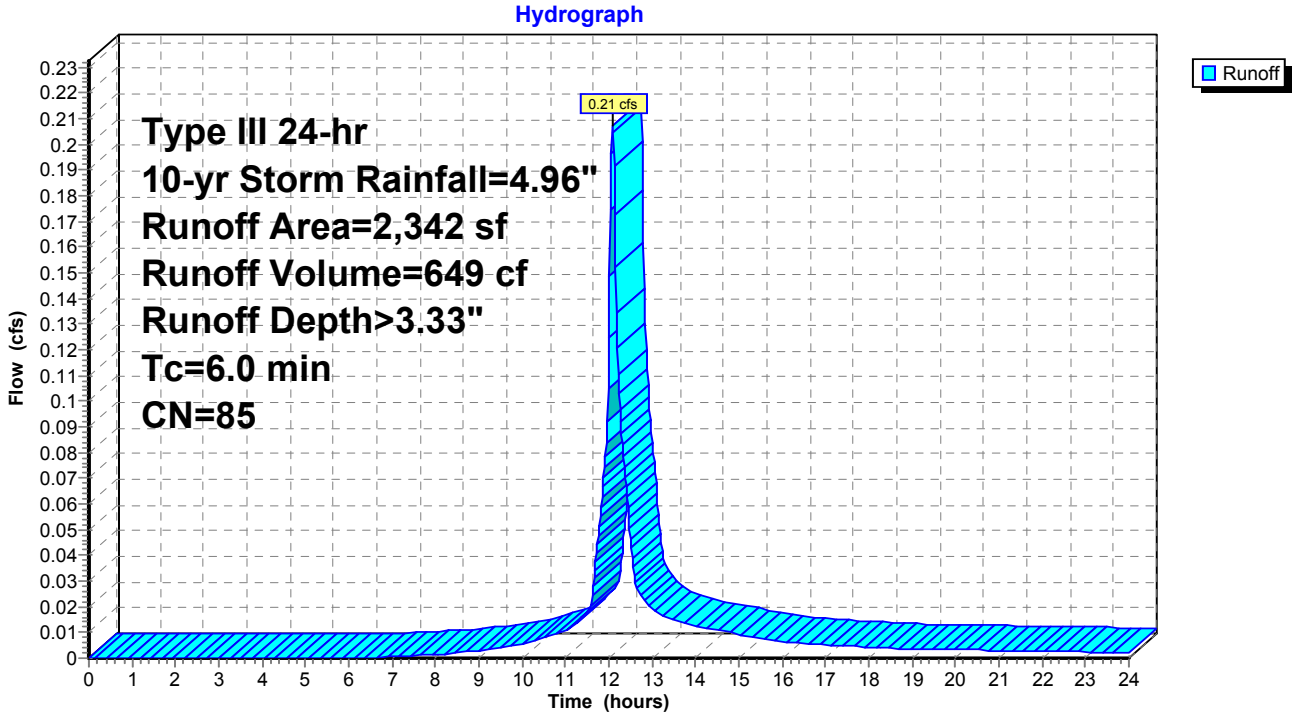
Runoff = 0.21 cfs @ 12.09 hrs, Volume= 649 cf, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Storm Rainfall=4.96"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways

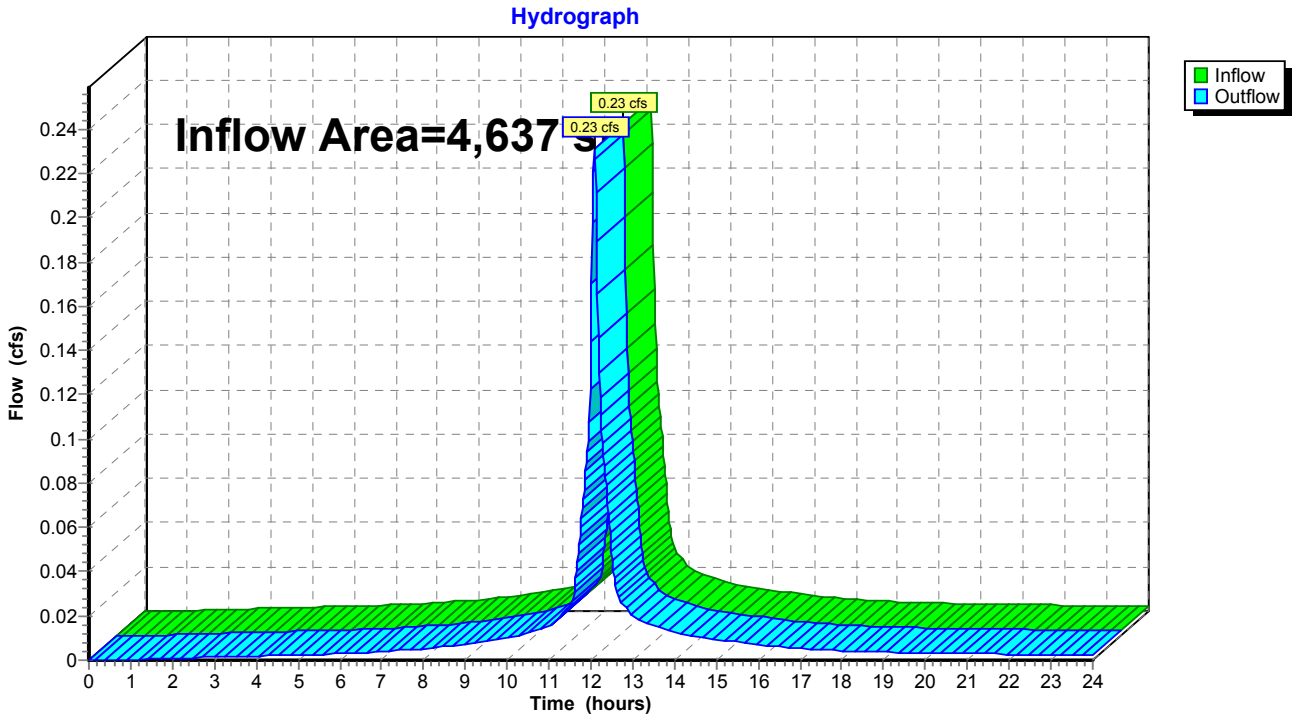


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,637 sf, 74.51% Impervious, Inflow Depth > 2.09" for 10-yr Storm event
Inflow = 0.23 cfs @ 12.08 hrs, Volume= 808 cf
Outflow = 0.23 cfs @ 12.08 hrs, Volume= 808 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

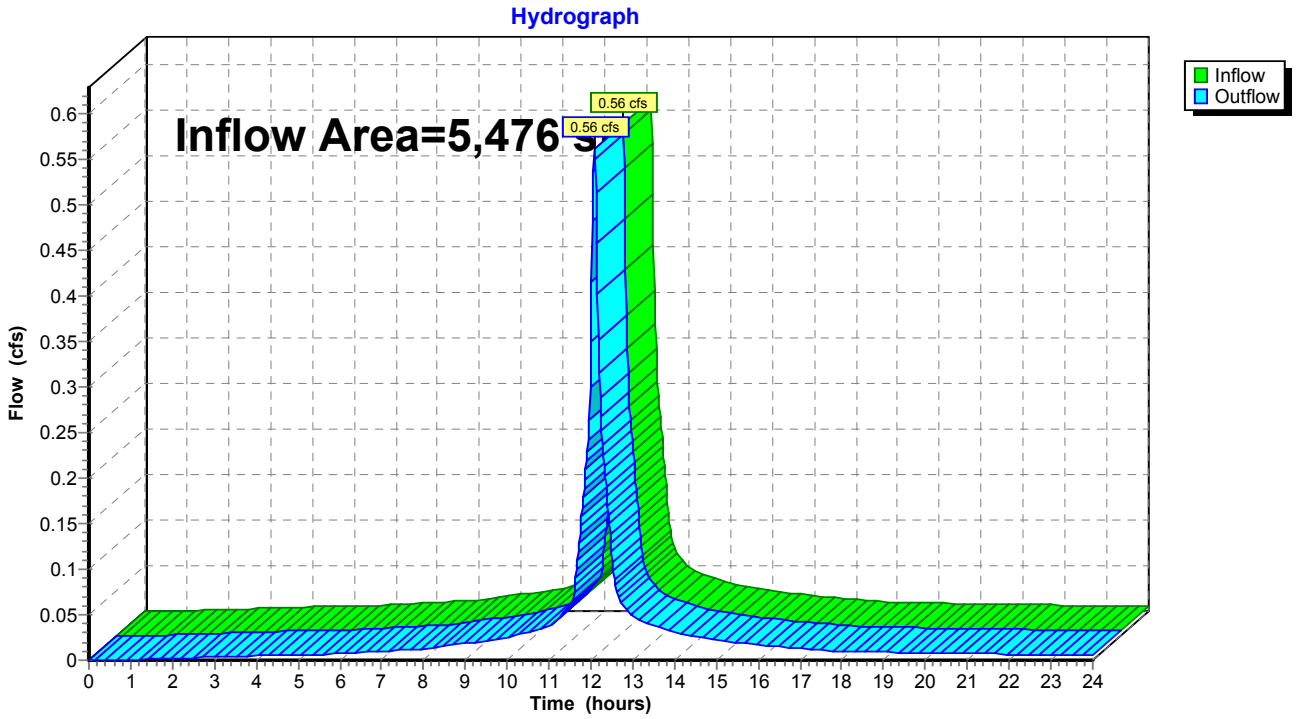


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,476 sf, 87.40% Impervious, Inflow Depth > 4.31" for 10-yr Storm event
Inflow = 0.56 cfs @ 12.08 hrs, Volume= 1,967 cf
Outflow = 0.56 cfs @ 12.08 hrs, Volume= 1,967 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area =	2,342 sf, 64.05% Impervious, Inflow Depth > 3.33" for 10-yr Storm event				
Inflow =	0.21 cfs @	12.09 hrs,	Volume=	649 cf	
Outflow =	0.01 cfs @	11.52 hrs,	Volume=	609 cf,	Atten= 94%, Lag= 0.0 min
Discarded =	0.01 cfs @	11.52 hrs,	Volume=	609 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 59.48' @ 14.08 hrs Surf.Area= 504 sf Storage= 299 cf

Plug-Flow detention time= 236.5 min calculated for 609 cf (94% of inflow)
Center-of-Mass det. time= 203.5 min (1,010.7 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

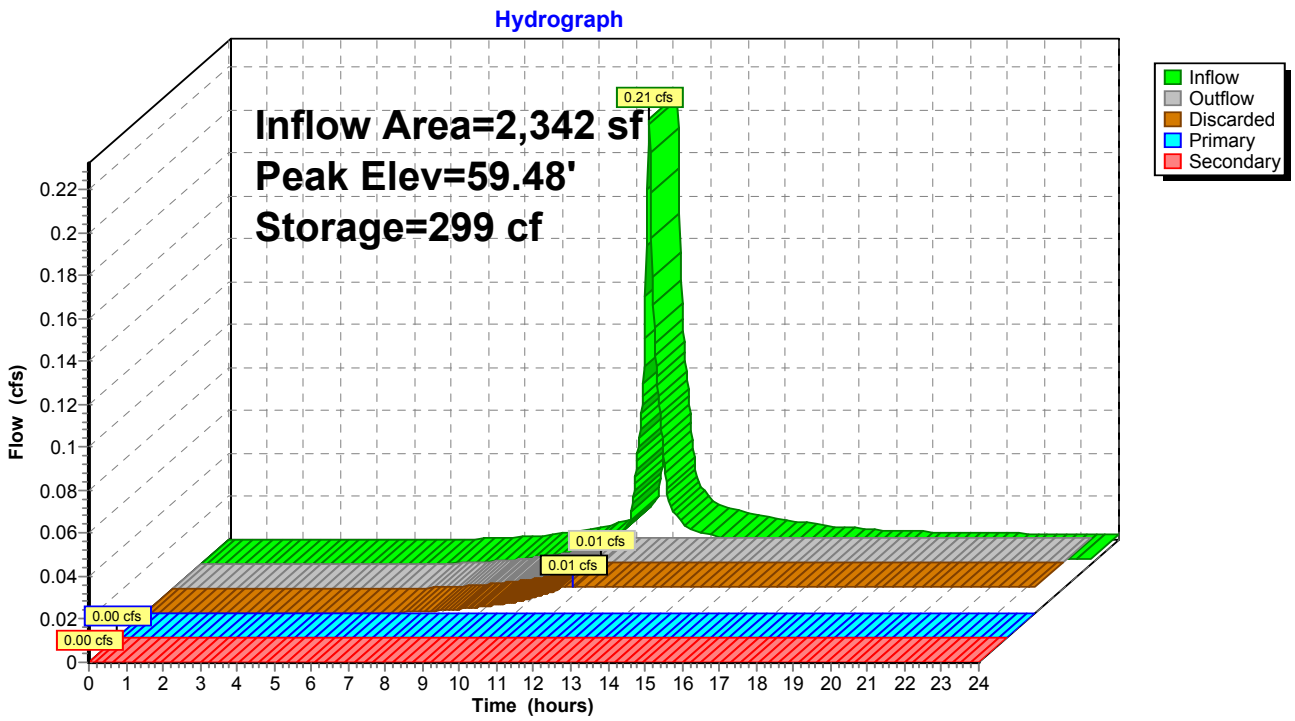
Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	60.00'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.00' / 56.30' S= 0.0418 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	59.90'	**4.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.90' / 58.00' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 11.52 hrs HW=58.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)

Pond PP-1: Permeable Pavers



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=429 sf 20.75% Impervious Runoff Depth>3.06"
Tc=6.0 min CN=71 Runoff=0.04 cfs 109 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=98 Runoff=0.26 cfs 926 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>2.96"
Tc=6.0 min CN=70 Runoff=0.07 cfs 203 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=98 Runoff=0.65 cfs 2,309 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>4.49"
Tc=6.0 min CN=85 Runoff=0.28 cfs 876 cf

Reach DP-1: Thorndike Street Inflow=0.30 cfs 1,100 cf
Outflow=0.30 cfs 1,100 cf

Reach DP-2: Harvard Street Inflow=0.71 cfs 2,513 cf
Outflow=0.71 cfs 2,513 cf

Pond PP-1: Permeable Pavers Peak Elev=59.98' Storage=399 cf Inflow=0.28 cfs 876 cf
Discarded=0.01 cfs 642 cf Primary=0.02 cfs 64 cf Secondary=0.00 cfs 0 cf Outflow=0.03 cfs 707 cf

Total Runoff Area = 10,113 sf Runoff Volume = 4,424 cf Average Runoff Depth = 5.25"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,241 sf

Summary for Subcatchment S1: Walkways

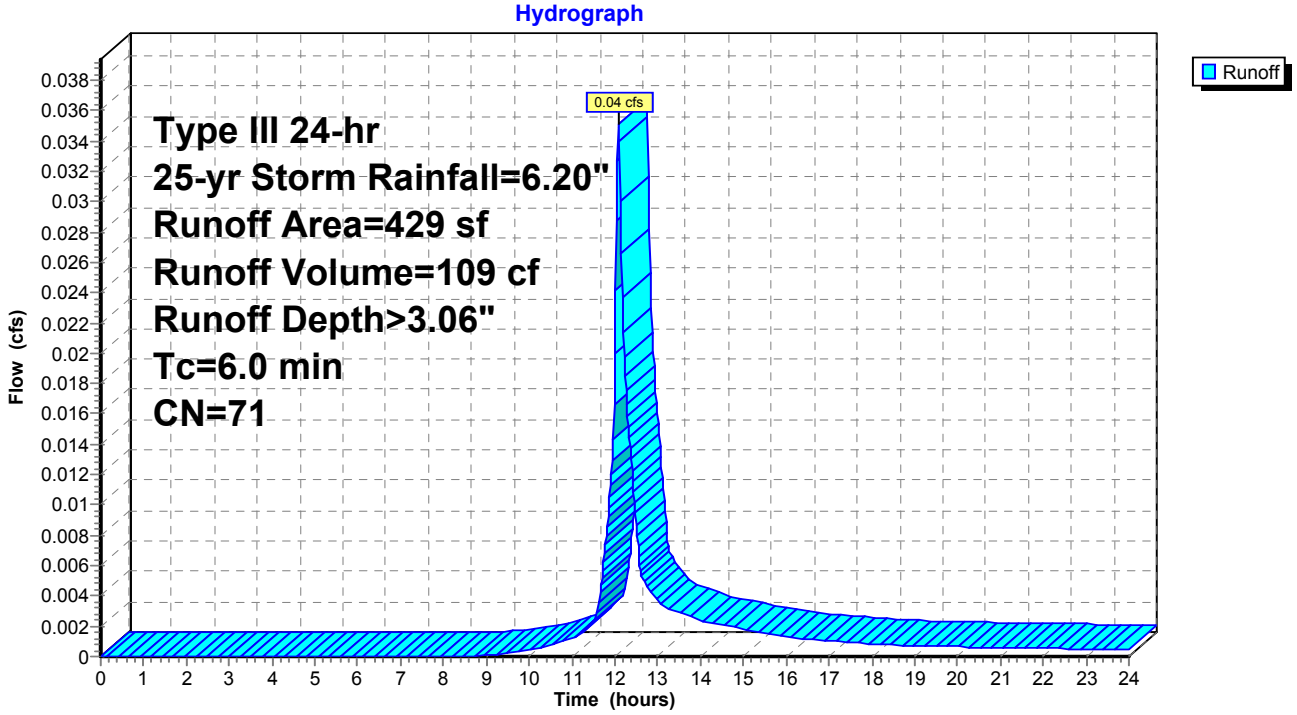
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 109 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	89	98	Conc walks, HSG B
	429	71	Weighted Average
	340		79.25% Pervious Area
	89		20.75% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

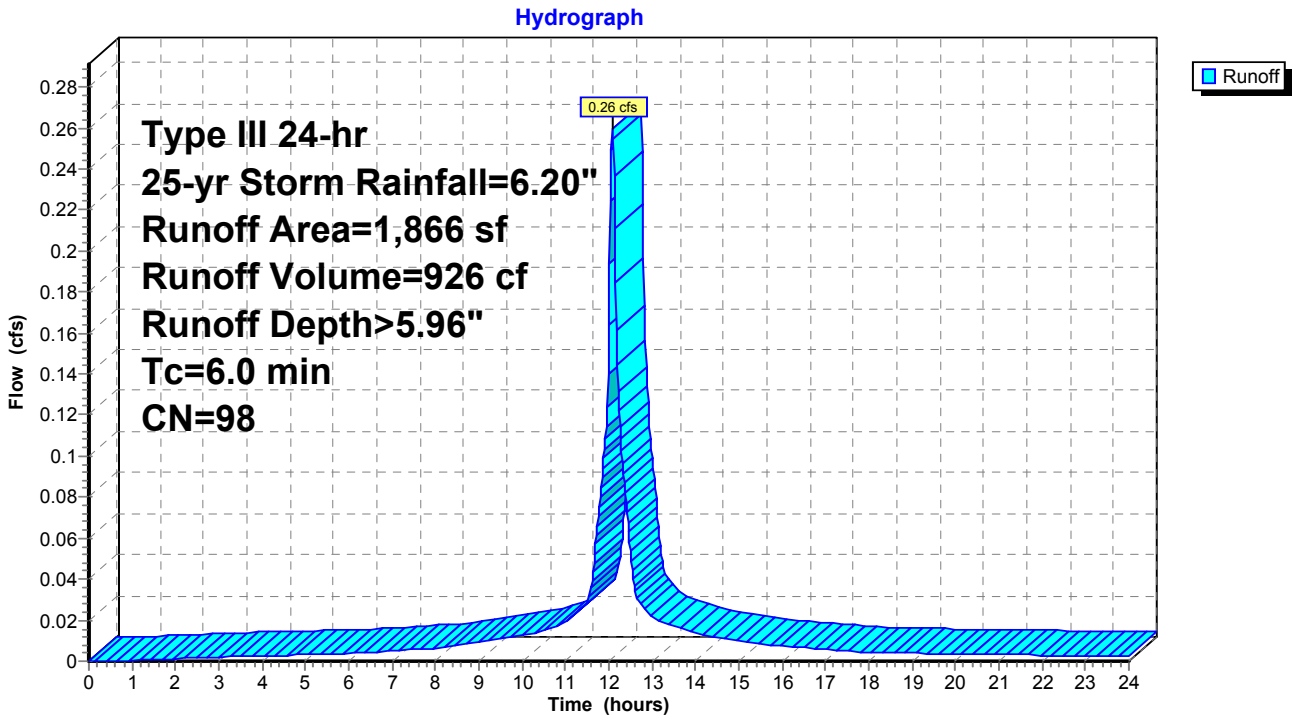
Runoff = 0.26 cfs @ 12.08 hrs, Volume= 926 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

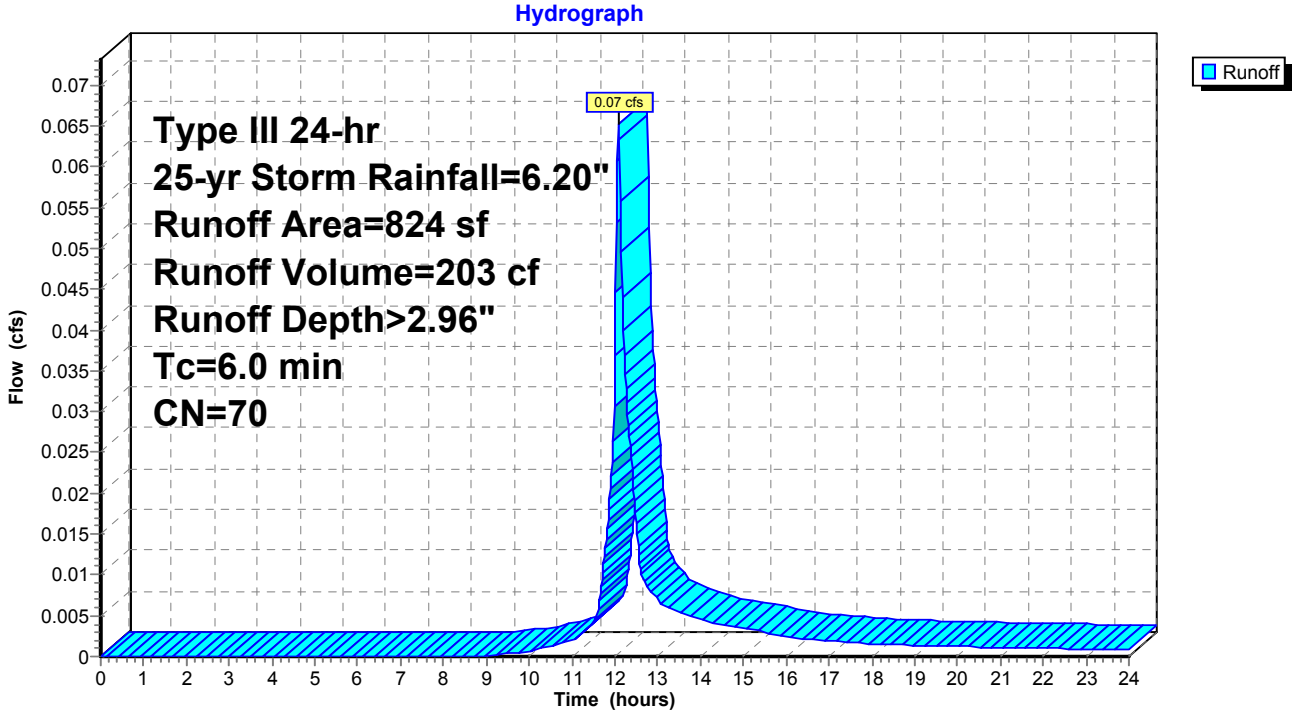
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 203 cf, Depth> 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

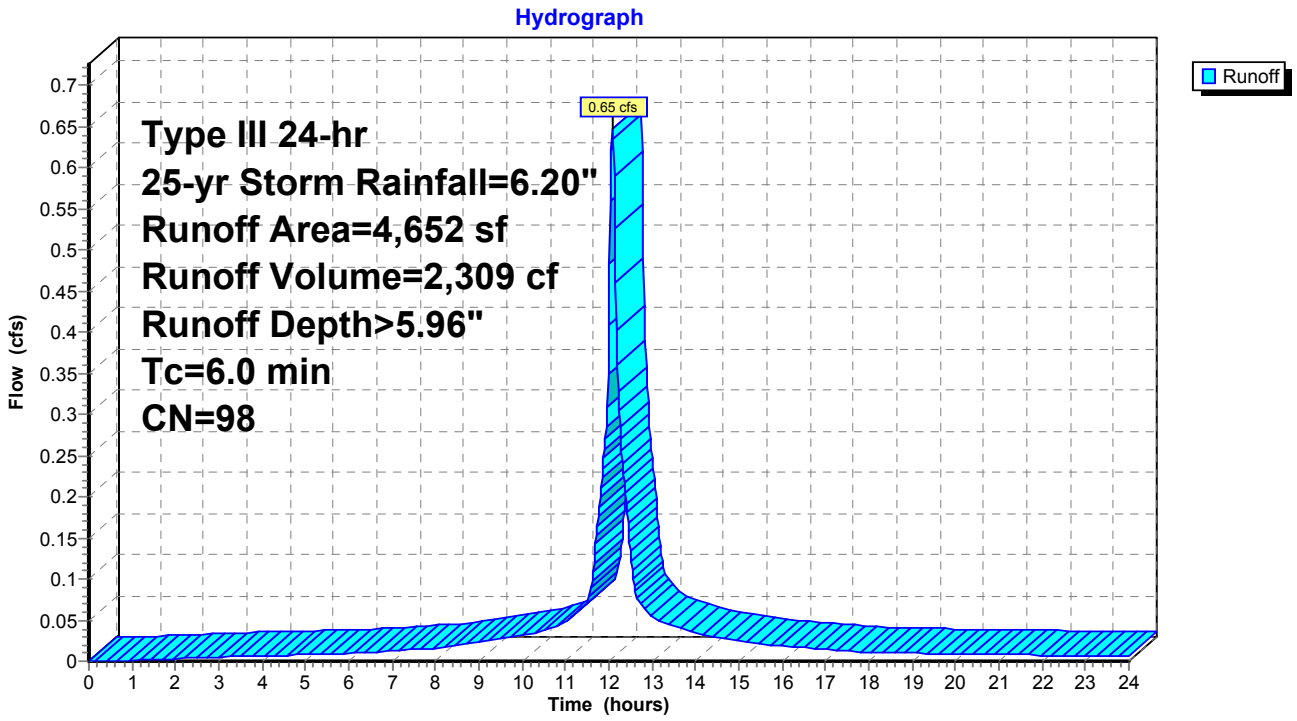
Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,309 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

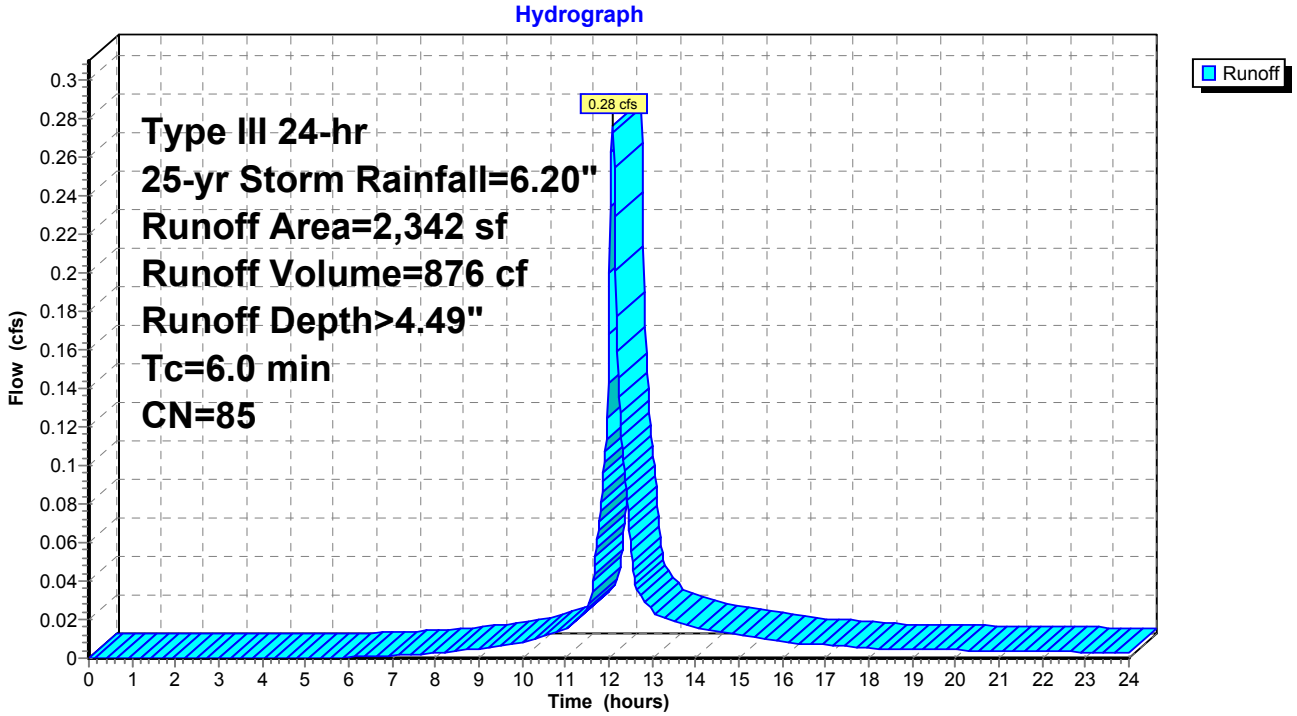
Runoff = 0.28 cfs @ 12.09 hrs, Volume= 876 cf, Depth> 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Storm Rainfall=6.20"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways

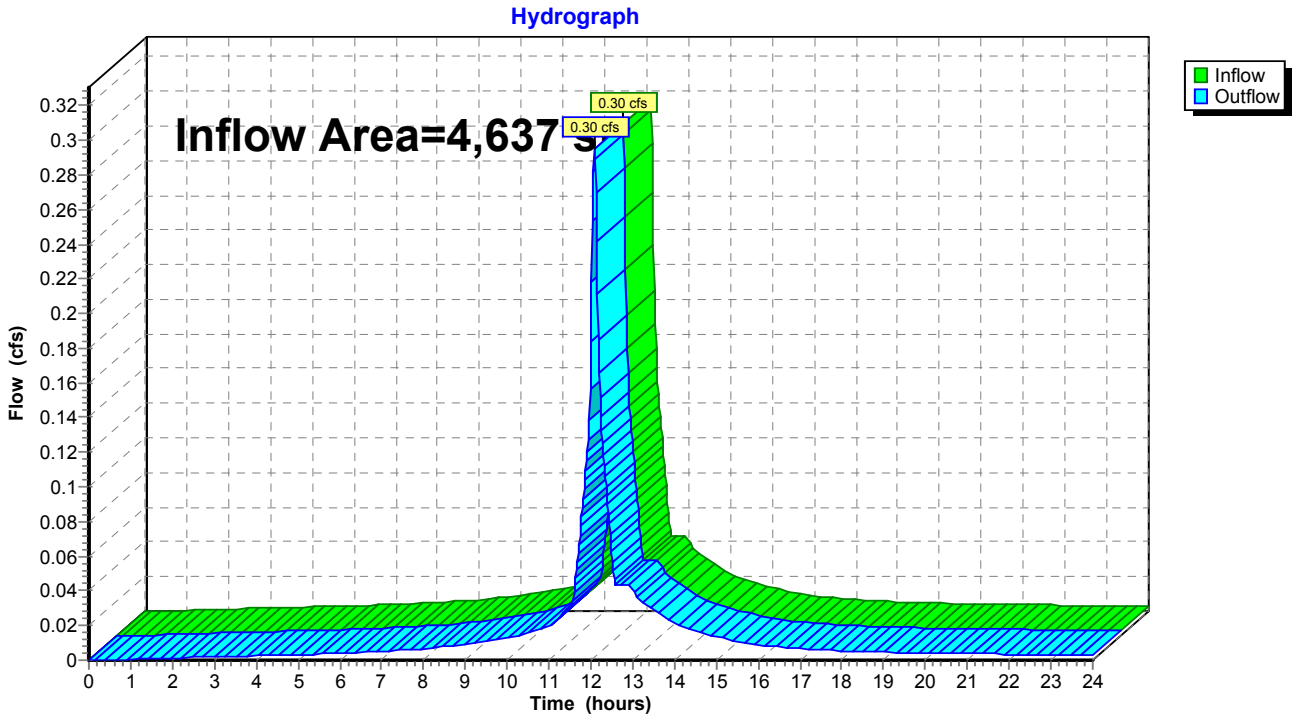


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,637 sf, 74.51% Impervious, Inflow Depth > 2.85" for 25-yr Storm event
Inflow = 0.30 cfs @ 12.08 hrs, Volume= 1,100 cf
Outflow = 0.30 cfs @ 12.08 hrs, Volume= 1,100 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

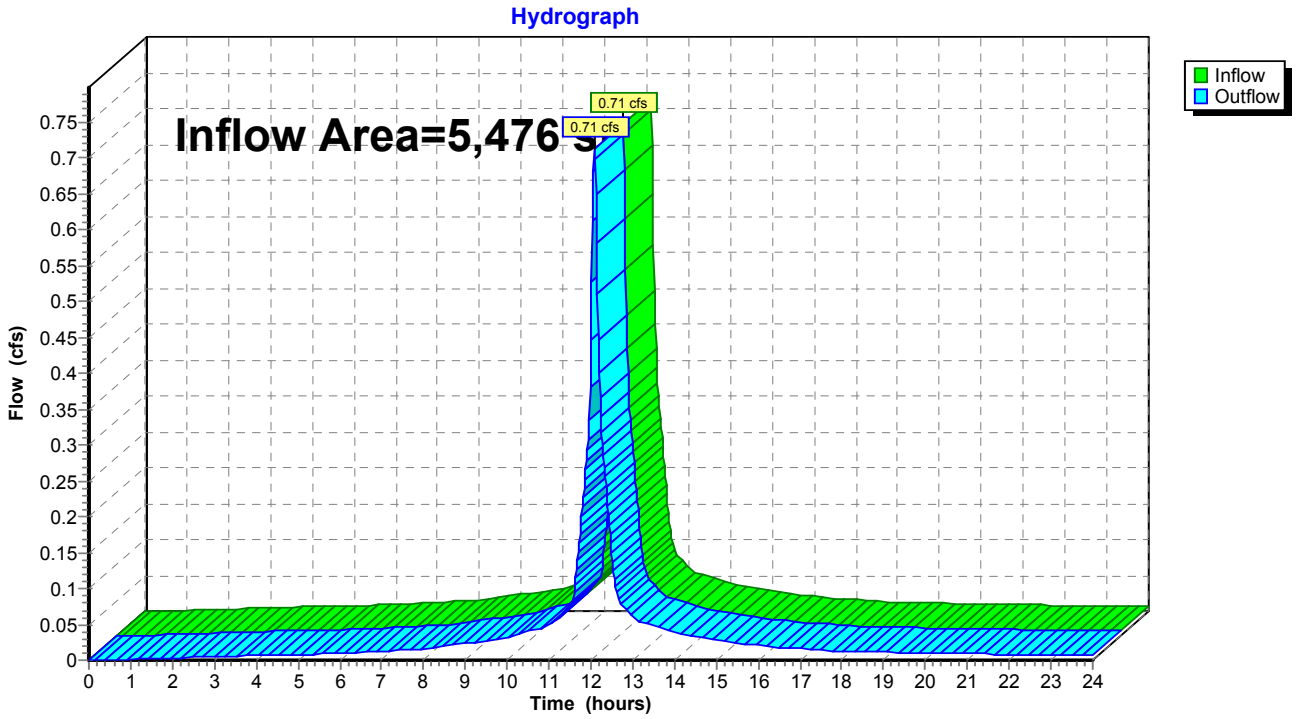


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,476 sf, 87.40% Impervious, Inflow Depth > 5.51" for 25-yr Storm event
Inflow = 0.71 cfs @ 12.08 hrs, Volume= 2,513 cf
Outflow = 0.71 cfs @ 12.08 hrs, Volume= 2,513 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area =	2,342 sf, 64.05% Impervious, Inflow Depth > 4.49" for 25-yr Storm event				
Inflow =	0.28 cfs @	12.09 hrs,	Volume=	876 cf	
Outflow =	0.03 cfs @	12.92 hrs,	Volume=	707 cf,	Atten= 90%, Lag= 50.0 min
Discarded =	0.01 cfs @	11.12 hrs,	Volume=	642 cf	
Primary =	0.02 cfs @	12.92 hrs,	Volume=	64 cf	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 59.98' @ 12.92 hrs Surf.Area= 504 sf Storage= 399 cf

Plug-Flow detention time= 246.0 min calculated for 707 cf (81% of inflow)
Center-of-Mass det. time= 172.2 min (971.0 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

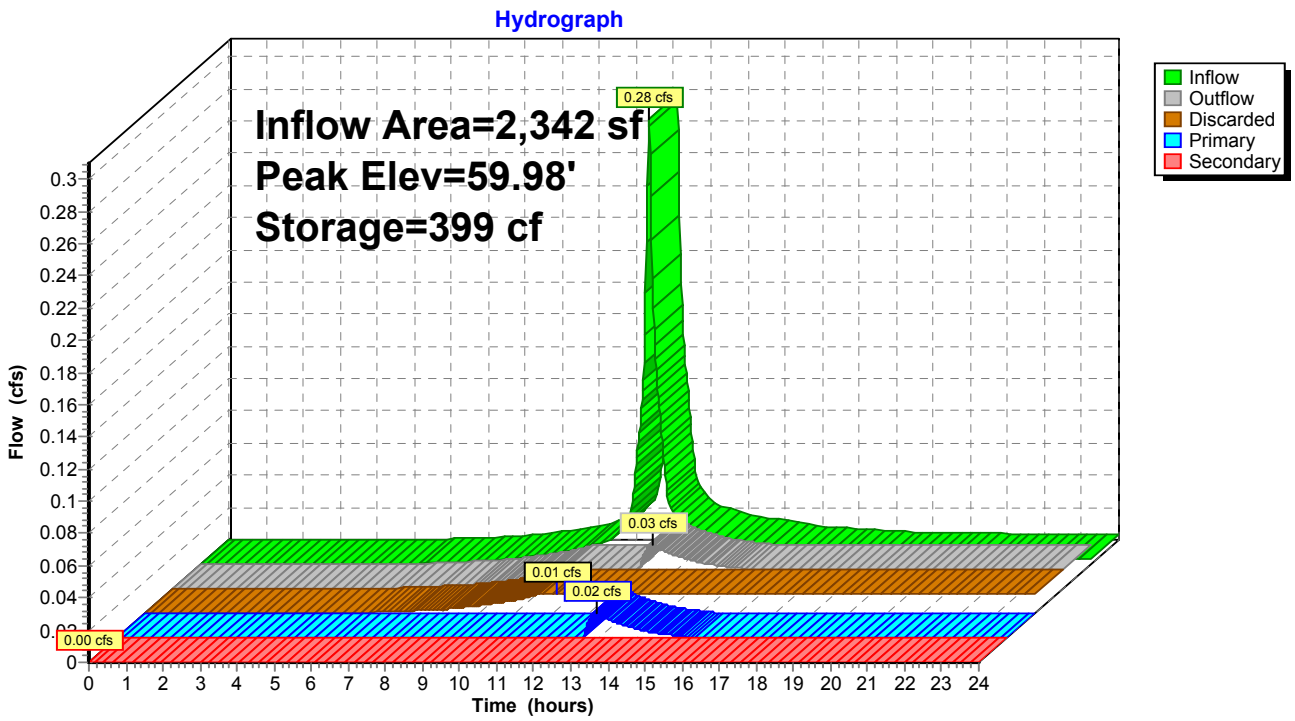
Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	60.00'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.00' / 56.30' S= 0.0418 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	59.90'	**4.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.90' / 58.00' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 11.12 hrs HW=58.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.02 cfs @ 12.92 hrs HW=59.98' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Inlet Controls 0.02 cfs @ 0.96 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond PP-1: Permeable Pavers



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentS1: Walkways Runoff Area=429 sf 20.75% Impervious Runoff Depth>5.20"
Tc=6.0 min CN=71 Runoff=0.06 cfs 186 cf

SubcatchmentS1-R: Floor Drain (MEP) Runoff Area=1,866 sf 100.00% Impervious Runoff Depth>8.47"
Tc=6.0 min CN=98 Runoff=0.37 cfs 1,318 cf

SubcatchmentS2: Walkways Runoff Area=824 sf 16.26% Impervious Runoff Depth>5.08"
Tc=6.0 min CN=70 Runoff=0.11 cfs 349 cf

SubcatchmentS2-R: Floor Drain (MEP) Runoff Area=4,652 sf 100.00% Impervious Runoff Depth>8.47"
Tc=6.0 min CN=98 Runoff=0.91 cfs 3,285 cf

SubcatchmentS3: Floor Drain Runoff Area=2,342 sf 64.05% Impervious Runoff Depth>6.90"
Tc=6.0 min CN=85 Runoff=0.42 cfs 1,347 cf

Reach DP-1: Thorndike Street Inflow=0.43 cfs 1,851 cf
Outflow=0.43 cfs 1,851 cf

Reach DP-2: Harvard Street Inflow=1.03 cfs 3,703 cf
Outflow=1.03 cfs 3,703 cf

Pond PP-1: Permeable Pavers Peak Elev=60.19' Storage=441 cf Inflow=0.42 cfs 1,347 cf
Discarded=0.01 cfs 697 cf Primary=0.15 cfs 348 cf Secondary=0.07 cfs 69 cf Outflow=0.23 cfs 1,114 cf

Total Runoff Area = 10,113 sf Runoff Volume = 6,485 cf Average Runoff Depth = 7.70"
18.51% Pervious = 1,872 sf 81.49% Impervious = 8,241 sf

Summary for Subcatchment S1: Walkways

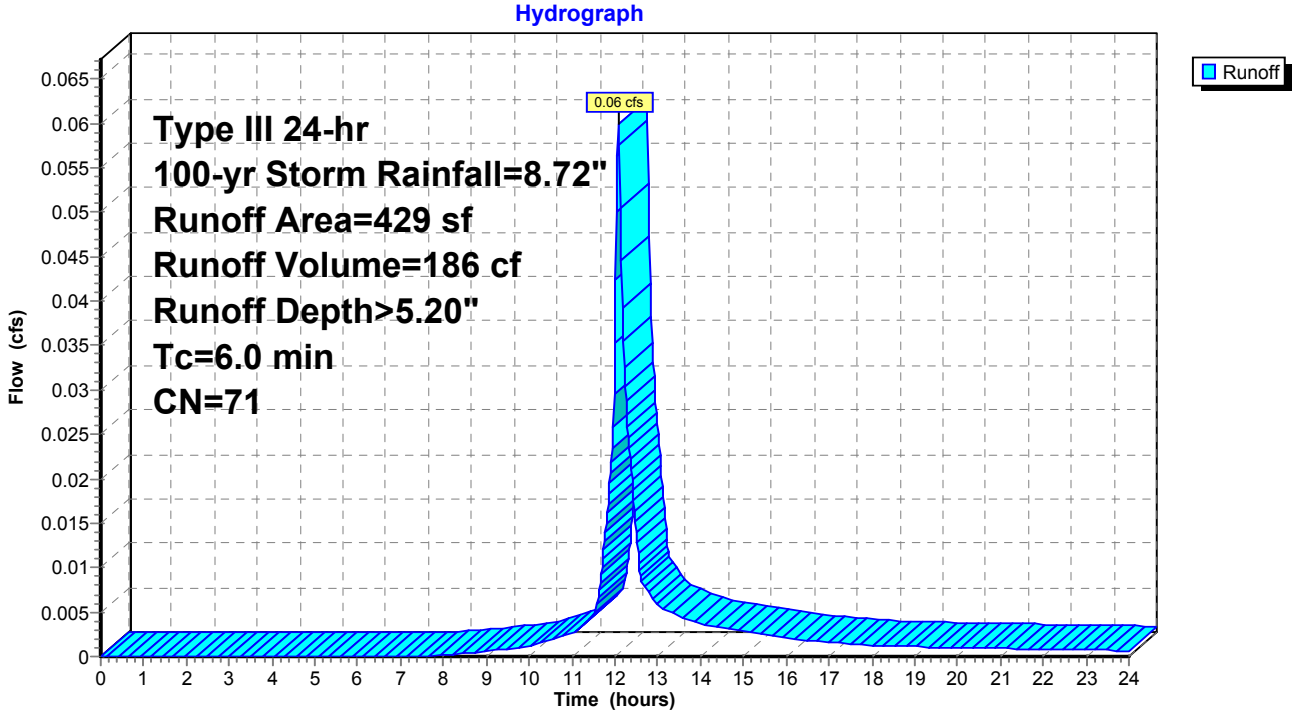
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 186 cf, Depth> 5.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	340	64	Permeable pavers, HSG B
*	89	98	Conc walks, HSG B
	429	71	Weighted Average
	340		79.25% Pervious Area
	89		20.75% Impervious Area

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

Subcatchment S1: Walkways



Summary for Subcatchment S1-R: Floor Drain (MEP)

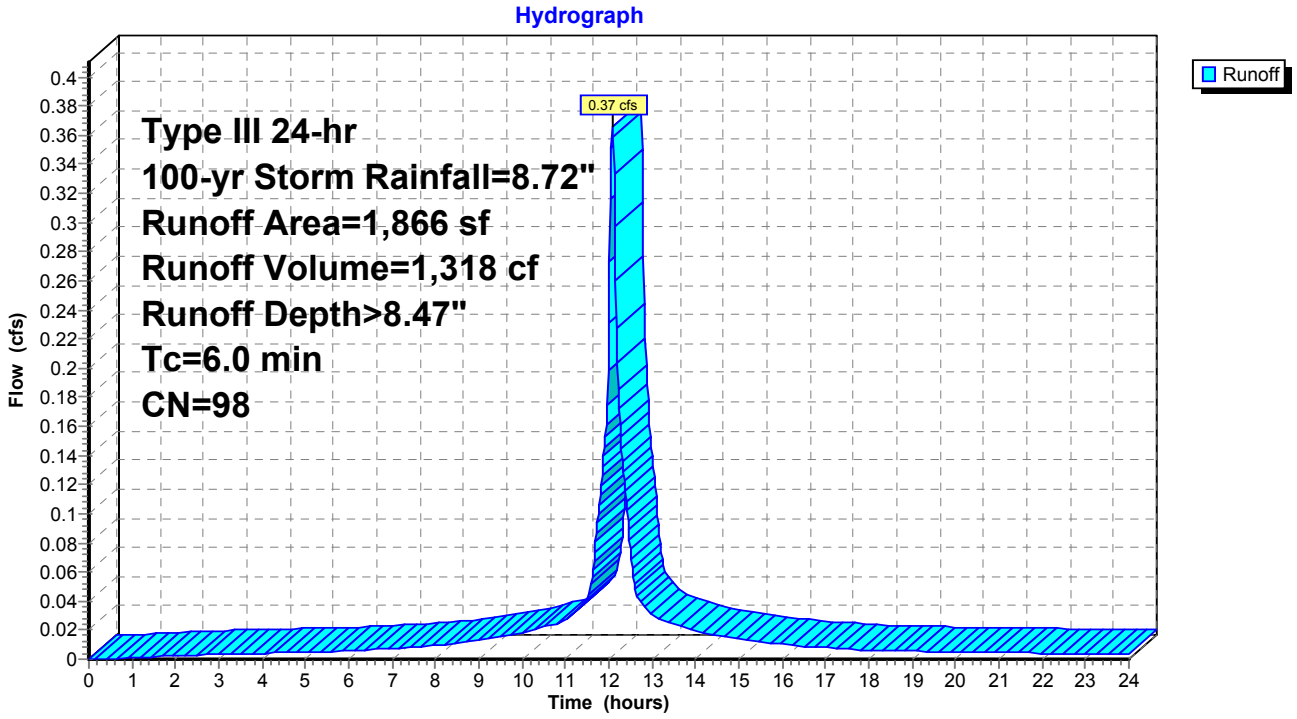
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 1,318 cf, Depth> 8.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

Area (sf)	CN	Description
1,866	98	Roofs, HSG B
1,866		100.00% Impervious Area

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

Subcatchment S1-R: Floor Drain (MEP)



Summary for Subcatchment S2: Walkways

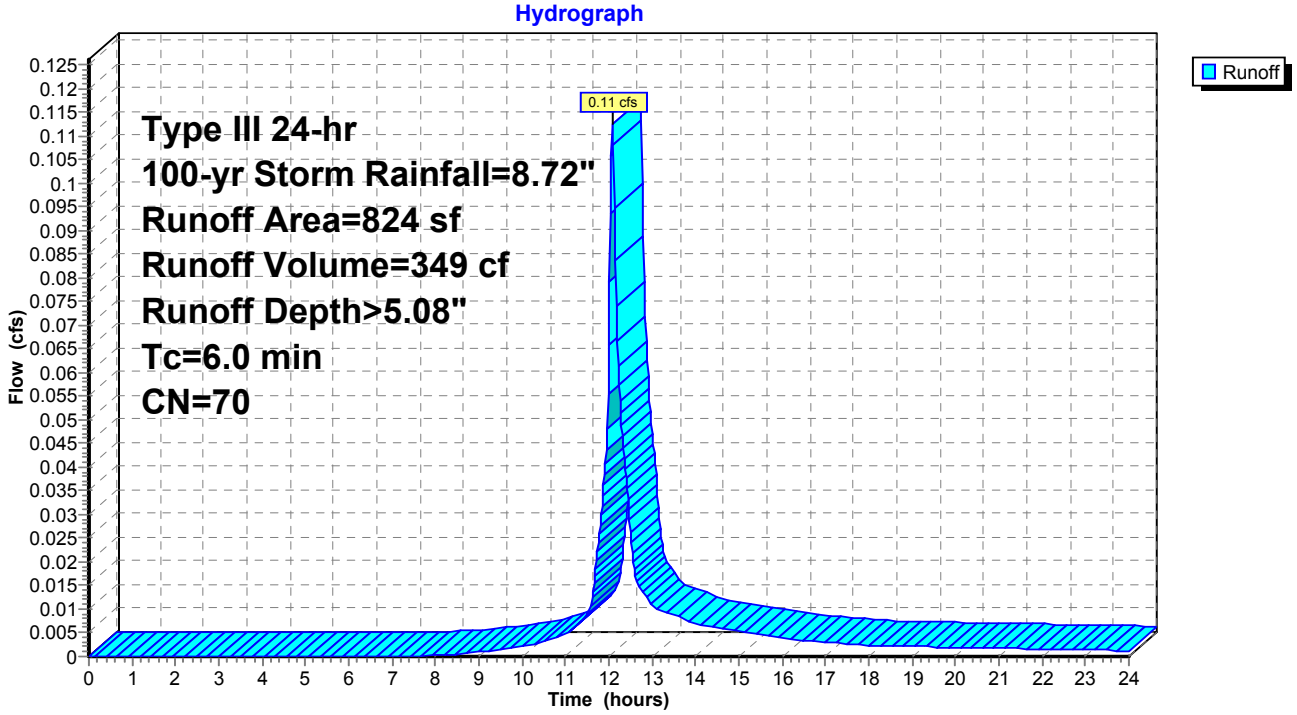
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 349 cf, Depth> 5.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	134	98	Conc walks, HSG B
*	690	64	Permeable pavers, HSG B
	824	70	Weighted Average
	690		83.74% Pervious Area
	134		16.26% Impervious Area

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

Subcatchment S2: Walkways



Summary for Subcatchment S2-R: Floor Drain (MEP)

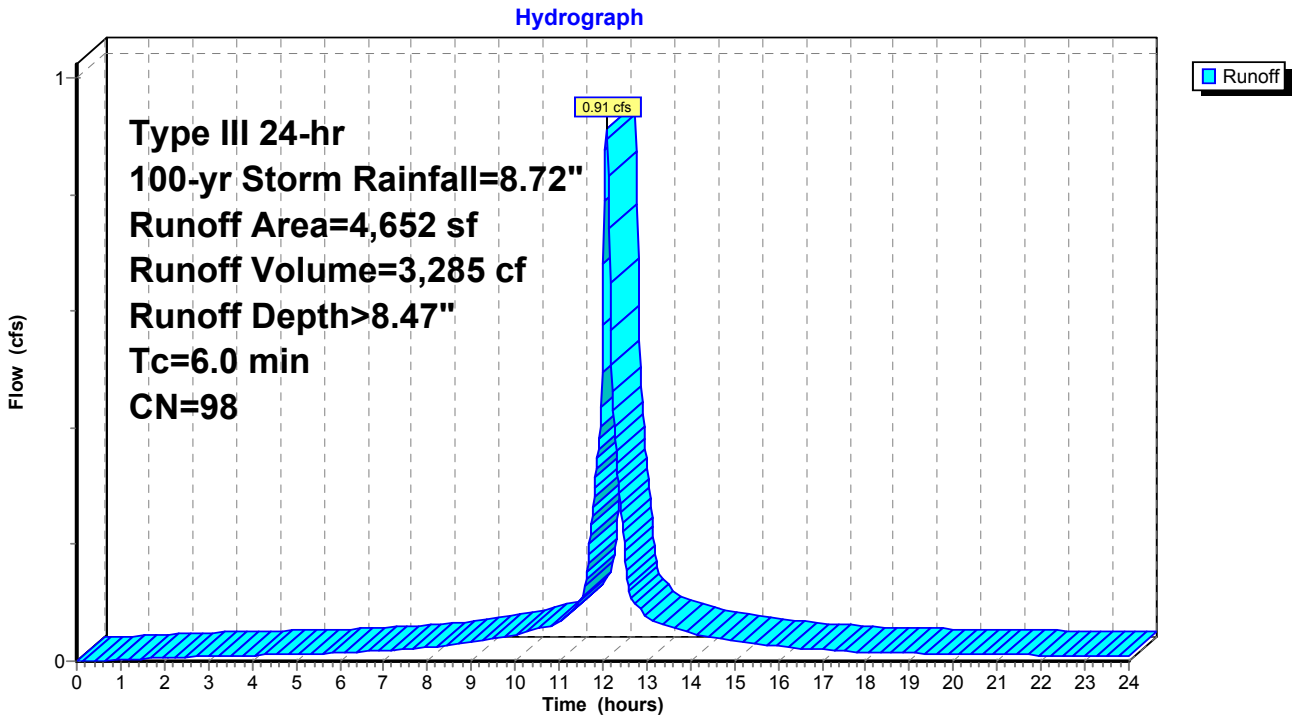
Runoff = 0.91 cfs @ 12.08 hrs, Volume= 3,285 cf, Depth> 8.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

Area (sf)	CN	Description
4,652	98	Roofs, HSG B
4,652		100.00% Impervious Area

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

Subcatchment S2-R: Floor Drain (MEP)



Summary for Subcatchment S3: Floor Drain (MEP)/Walkways

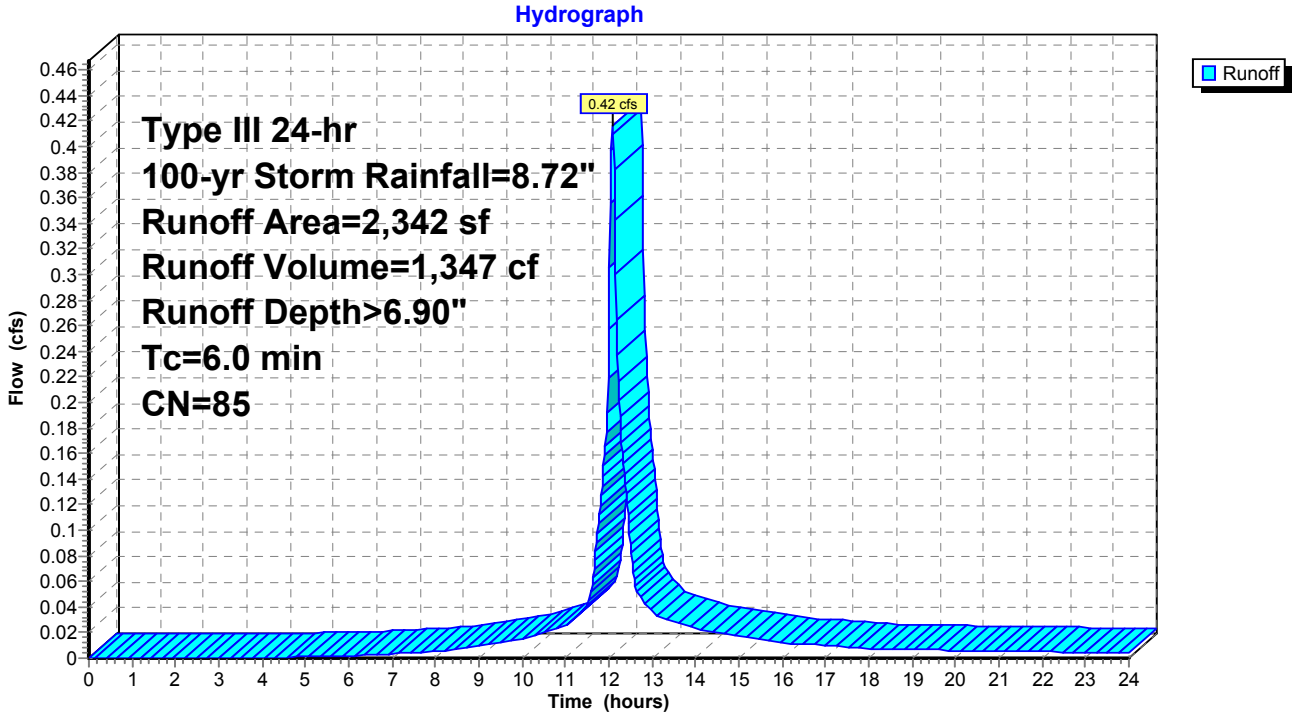
Runoff = 0.42 cfs @ 12.08 hrs, Volume= 1,347 cf, Depth> 6.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Storm Rainfall=8.72"

	Area (sf)	CN	Description
*	504	64	Permeable pavers, HSG B
	1,500	98	Roofs, HSG B
	338	61	>75% Grass cover, Good, HSG B
	2,342	85	Weighted Average
	842		35.95% Pervious Area
	1,500		64.05% Impervious Area

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

Subcatchment S3: Floor Drain (MEP)/Walkways

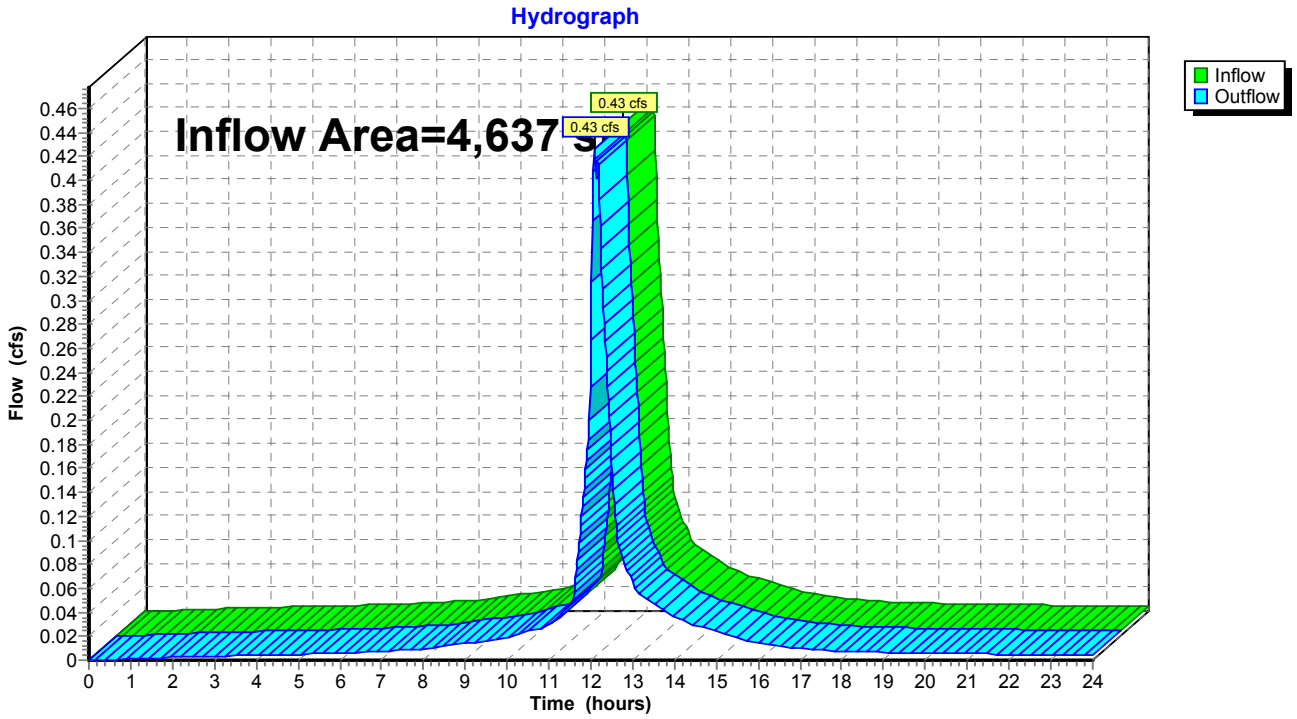


Summary for Reach DP-1: Thorndike Street

Inflow Area = 4,637 sf, 74.51% Impervious, Inflow Depth > 4.79" for 100-yr Storm event
Inflow = 0.43 cfs @ 12.08 hrs, Volume= 1,851 cf
Outflow = 0.43 cfs @ 12.08 hrs, Volume= 1,851 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1: Thorndike Street

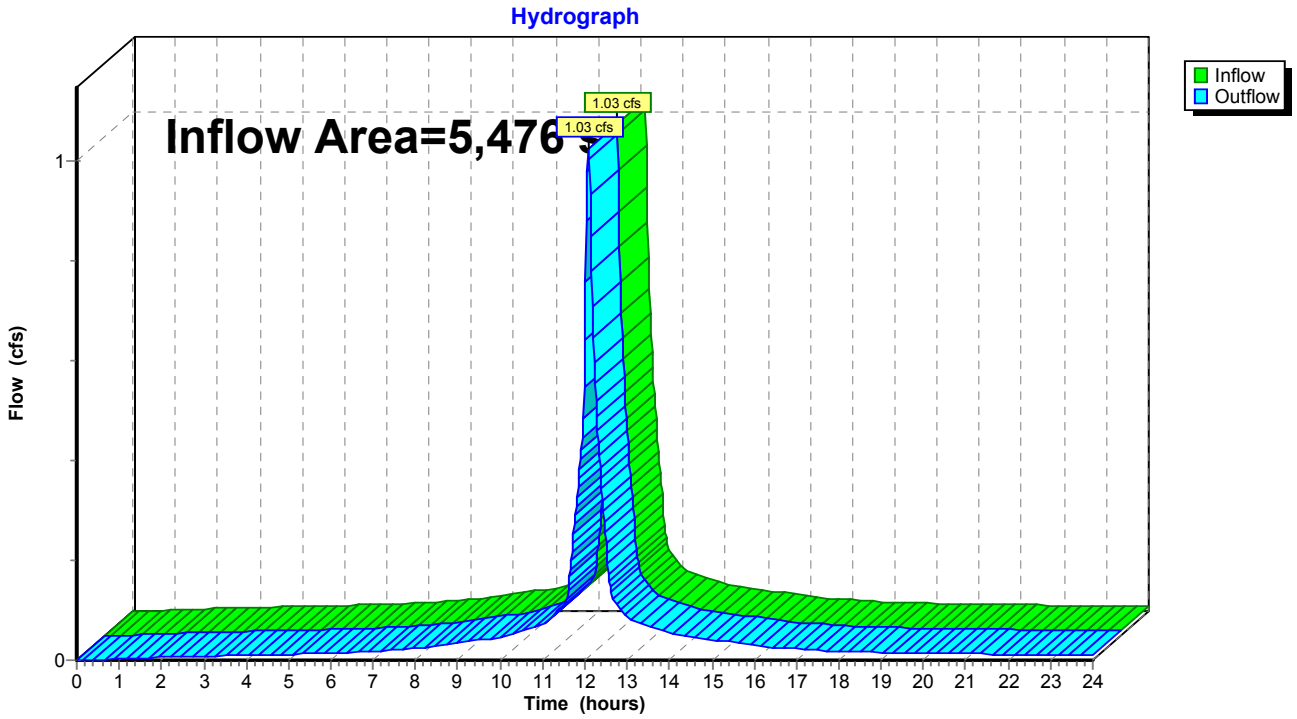


Summary for Reach DP-2: Harvard Street

Inflow Area = 5,476 sf, 87.40% Impervious, Inflow Depth > 8.12" for 100-yr Storm event
Inflow = 1.03 cfs @ 12.08 hrs, Volume= 3,703 cf
Outflow = 1.03 cfs @ 12.08 hrs, Volume= 3,703 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2: Harvard Street



Summary for Pond PP-1: Permeable Pavers

Inflow Area =	2,342 sf, 64.05% Impervious, Inflow Depth > 6.90" for 100-yr Storm event				
Inflow =	0.42 cfs @	12.08 hrs,	Volume=	1,347 cf	
Outflow =	0.23 cfs @	12.21 hrs,	Volume=	1,114 cf,	Atten= 45%, Lag= 7.4 min
Discarded =	0.01 cfs @	10.10 hrs,	Volume=	697 cf	
Primary =	0.15 cfs @	12.21 hrs,	Volume=	348 cf	
Secondary =	0.07 cfs @	12.21 hrs,	Volume=	69 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 60.19' @ 12.21 hrs Surf.Area= 504 sf Storage= 441 cf

Plug-Flow detention time= 164.6 min calculated for 1,113 cf (83% of inflow)
Center-of-Mass det. time= 95.8 min (882.8 - 787.0)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	605 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,512 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	504	0	0
61.00	504	1,512	1,512

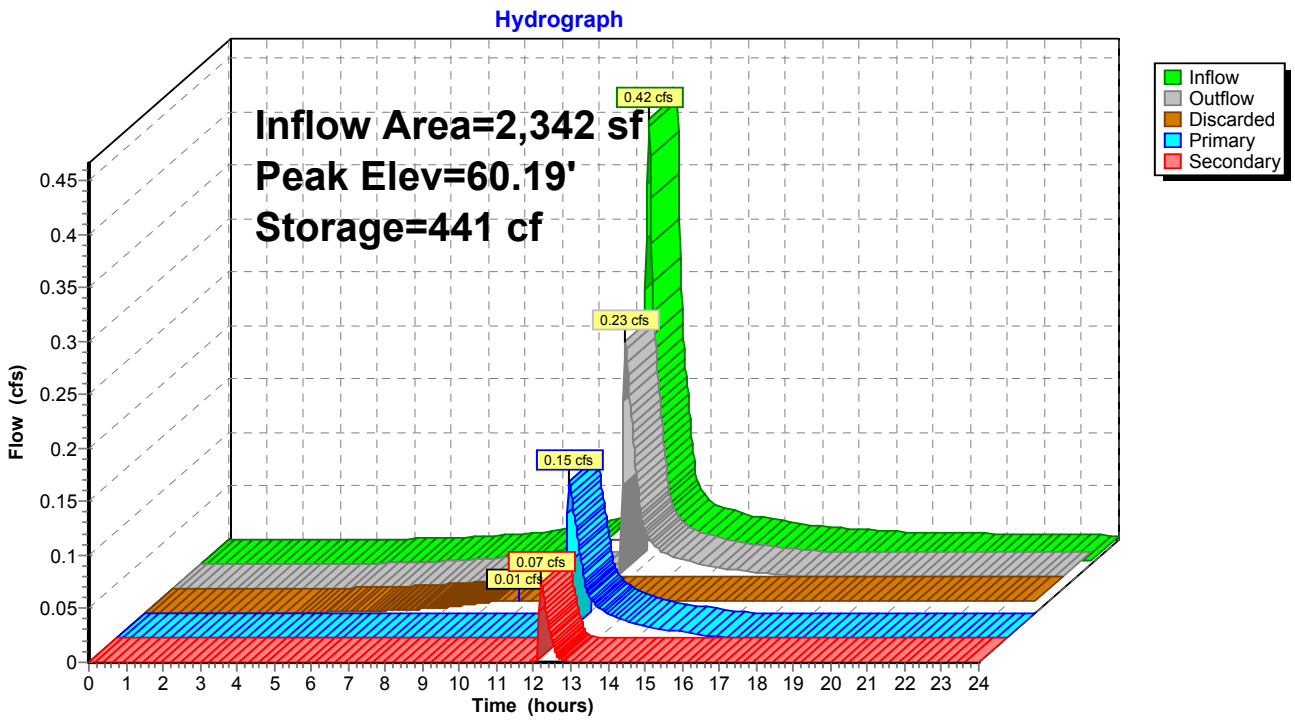
Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	60.00'	**4.0" Round Culvert** L= 88.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.00' / 56.30' S= 0.0418 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#3	Primary	59.90'	**4.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.90' / 58.00' S= 0.0452 '/' Cc= 0.900 n= 0.013, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 10.10 hrs HW=58.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.14 cfs @ 12.21 hrs HW=60.19' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Inlet Controls 0.14 cfs @ 1.82 fps)

Secondary OutFlow Max=0.07 cfs @ 12.21 hrs HW=60.19' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 0.07 cfs @ 1.47 fps)

Pond PP-1: Permeable Pavers



A P P E N D I X C

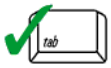
Checklist for Stormwater Report

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.

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[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

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): Permeable Pavers

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.

A P P E N D I X D

Illicit Discharge Compliance Statement
Supplemental BMP Calculations

Illicit Discharge Compliance Statement

I, Bradley C. McKenzie, P.E., hereby notify the Brookline Conservation Commission that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 445 Harvard Street in Brookline, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "445 Harvard Street," prepared by McKenzie Engineering Group, Inc. dated July 20, 2018 and as revised and approved by the Brookline Conservation Commission and maintenance thereof in accordance with the "Construction Phase Operations and Maintenance Plan" and "Long-Term Operations and Maintenance Plan" prepared by McKenzie Engineering Group, Inc. dated July 20, 2018 and as revised and approved by the Brookline Conservation Commission will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Bradley C. McKenzie, P.E.

Company: McKenzie Engineering Group, Inc.

Title: Owner's Representative

Signature: _____

Date: _____

MCKENZIE ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

Standard 4: Total Suspended Solids Calculation: Permeable Pavers

NAME: 445 Harvard Street
Brookline, MA
CLIENT: 445 Harvard Street Corp
COUNTY: Norfolk

Proj. No.: 218-106
Date: 7/20/2018
Revised:
Computed by: SBS
Checked by: BCM

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Porous Pavement	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = 80%

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

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

Mass. Dept. of Environmental Protection
Version 1, Automated: Mar. 4, 2008

MCKENZIE ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

445 HARVARD STREET
BROOKLINE, MA

7/20/2018

WATER QUALITY VOLUME ANALYSIS

POND	IMPERVIOUS AREA (SF) CN=98	PRECIPITATION (IN)	WATER QUALITY VOLUME REQUIRED (CF)	TREATMENT VOLUME PROVIDED (CF) UP TO ELEVATION 111.20	NET TREATMENT VOLUME PROVIDED (CF)
PP1	8,241	0.50	343	383	40
TOTAL	**8,241**		**343**	**383**	**40**

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Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

445 HARVARD STREET
BROOKLINE, MA

7/20/2018

REQUIRED RECHARGE VOLUME (CF) *"STATIC METHOD"*

WATERSHED #	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) A SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) B SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) C SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) D SOIL		REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE		0.60	8,241	0.35		0.25		0.10		240
		0.60		0.35		0.25		0.10		0
		0.60		0.35		0.25		0.10		0
							TOTAL			**240**

* Required Water Quality Volume based on 0.5 inches of runoff; Required Recharge Volume based on 0.35 inches (0.35<0.50); Target Volume is Required Water Quality Volume of 347 CF

PROVIDED RECHARGE VOLUME (CF)

BELOW INVERT

	REQUIRED RECHARGE VOLUME (CF)	POND	STORAGE VOLUME PROVIDED (CF)	NET STORAGE VOLUME PROVIDED (CF)
	343	PP-1	383	
TOTAL	**343**		**383**	**40**

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Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

445 HARVARD STREET
BROOKLINE, MA

7/20/2018

DRAWDOWN WITHIN 72 HOURS ANALYSIS

`

POND	RAWLS RATE (IN/HR)	STORAGE VOLUME PROVIDED (CF)	BOTTOM AREA (FT2)	DRAWDOWN (HR)
PP-1	1.02	383	504	9

A P P E N D I X E

Best Management Practices
Operation and Maintenance Plans

CONSTRUCTION PHASE BEST MANAGEMENT PRACTICES
OPERATION AND MAINTENANCE PLAN

for

445 Harvard Street
in
Brookline, Massachusetts
(Assessor's Parcel I.D. 067-09-00)

Submitted to:

Town of Brookline

Prepared for:

445 Harvard Street Corp
28 Lyon Road
Brookline, Massachusetts 02467

July 20, 2018

Prepared by:

ofessional Civil Engineering • Professional Land Surveying • Land Planning

MCKENZIE ENGINEERING GROUP

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TABLE OF CONTENTS

	Page
Project Narrative	
- Project Description	1
- Pre-development Condition	2
- Post-development Condition	3
Erosion and Sedimentation Controls - Best Management Practices (BMP's)	
- Structural Practices	3
- Stabilization Practices	6
- Dust Control	12
- Non-Stormwater Discharges	13
- Soil Stockpiling	13
- Pollution Prevention	13
- Inspection/Maintenance	18
- Inspection Schedule and Evaluation Checklist	19
-Spill Containment and Management Plan	21

Plans

- Figure-1 USGS Locus Map (Refer to Drainage Report)
- Site Topographic Map (Existing Conditions Plans within Plan Set)
- Site Development Map (Grading and Drainage Plans within Plan Set)
- Site Erosion and Sedimentation Plan (Grading and Drainage Plans within Plan Set)
- Construction Detail Plan (Construction Details within Plan Set)

Construction Phase Best Management Practices (BMP's)

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled 445 Harvard Street, prepared by McKenzie Engineering Group, Inc and shall comply as required per the Town of Brookline, Department of Public Works Site Plan Review Checklist (Revised December 2014).

Project Narrative

Project Description

The project proponent proposes to redevelop an approximate 10,113 s.f. parcel of land at the above-mentioned address, into a mixed-use development complex which will consist of five stories (and basement parking garage) with approximately 21 total units, 4,380 s.f. of first floor retail space, and 21 total parking spaces.

As required by the Town of Brookline, stormwater peak rate requirements for post-development do not exceed existing conditions for the 2, 10, 25, and 100-year storm event. On-site infiltration has been designed to meet the 25-year 24-Hour event (6.20" of rain) in accordance with MADEP Stormwater Management Regulations, as well as modeled to handle the peak rates of the 100-year design storm. The soil data was obtained from the USDA Natural Resources Conservation Service, Web Soil Survey as referenced in the Town of Brookline Site Plan Checklist. The survey revealed hydrologic Class B soils, in the form of Canton – Urban Land Complex. Class B soil which will be removed of all unsuitable material resulted in a Rawls rate of 1.02 in/hr being selected. In the report find all calculations and analysis (by Professional Engineer) that prove the proposed system complies with all Town of Brookline and MADEP Stormwater Rules and Regulations.

EROSION AND SEDIMENTATION CONTROLS – BMP's

Structural Practices:

1) **Silt Sock Erosion Control Barrier** – A silt sock barrier will be constructed along downward slopes at the limit of work and in locations shown on the plans. This control will be installed prior to major soil disturbance on the site. The sediment silt sock barrier should be installed as shown on the Construction Detail Plan.

   Sediment Silt Sock Design/Installation Requirements

   a) Locate the silt sock where identified on the plans.

   b) The silt sock line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the silt sack should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.

   c) The silt sock shall be staked every 8 linear feet with 1-inch by 1-inch stakes.

   d) Sediment silt socks should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized

through one growing season. Retained sediment must be removed and properly disposed of or mulched and seeded.

Sediment Silt Sock Inspection/Maintenance

a) Silt socks should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, and to see that the stakes are firmly in the ground. Repair or replace as necessary.

b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the silt sock. Take care to avoid undermining fence during cleanout.

c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.

d) Remove all silt sock materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform with the existing topography and vegetated.

2) **Stabilized Construction Entrance** – A stabilized construction entrance will be placed at the proposed entrance at Washington Street. The construction entrance will keep mud and sediment from being tracked off the construction site onto Washington Street by vehicles leaving the site. The stabilized construction entrance will be installed immediately after the establishment of the driveway entrance and associated driveway fill to maintain access to the site. During the driveway construction, access to the site shall be coordinated with the abutting projects. The construction entrance will be graded to contain stormwater runoff from the entrance to prevent sediment from washing onto the adjacent ground surface. The stabilized construction entrance shall be constructed as shown on the Construction Detail Plans.

Construction Entrance Design/Construction Requirements

a) Grade foundation of construction entrance with slightly concave shape to contain runoff within the entrance to prevent sediment from washing onto the adjacent ground surface.

b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.

c) Pad dimensions: The minimum length of the gravel pad should be 30 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater.

d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.

e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the road or street. The wash area shall be located at the stabilized construction entrance.

f) Water employed in the washing process shall be directed to the temporary sedimentation basin/dewatering area as shown on the plans prior to discharge. Sediment should be prevented from entering any watercourses.

Construction Entrance Inspection/Maintenance

a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Washington Street. This may require periodic topdressing with additional stone

b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.

c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.

d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.

e) If washing facilities are used, the temporary sedimentation basin/dewatering area should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available. Any water pumped from the temporary sedimentation basin shall be directed into a sediment dirt bag or equivalent inlet protection prior to discharge. Discharge should not be across the disturbed construction site but rather to undisturbed areas.

f) The pad shall be reshaped as needed for drainage and runoff control.

g) Broken road pavement on Washington Street shall be repaired immediately.

h) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed and only following approval by the Engineering Department or their representative. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

3) **Inlet Protection** – Inlet Protection will be utilized around the existing catch basin grates within Hospital Road at the site's frontage. The inlet protection will prevent any sediment from entering the street(s) closed drainage system. Siltsack or

equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 1-800-437-6746. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance Requirements

a) The silt sack trapping device and the catch basin should be inspected after every rain storm and repairs made as necessary.

b) Sediment should be removed from the silt sack after the sediment has reached a maximum depth of one-half the depth of the trap.

c) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

d) The silt sack must be replaced if it is ripped or torn in any way.

e) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.

- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

Temporary Seeding Planting Procedures

a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.

b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.

c) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1st to June 1st August 15th to Sept. 15th	¼ inch
Foxtail Millet	0.7	30	May 1st to June 30th	½ to ¾ inch
Oats	2	80	April 1st to July 1st August 15th to Sept. 15th	1 to 1-½ inch
Winter Rye	3	120	August 15th to Oct. 15th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

d) Use effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance

a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four hour period). Stands should be uniform and dense. Reseed and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.

b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	**Manufacturer**	**Product**	**Remarks**
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening

Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening
Erosion Control (slope stability)	Amoco	Supergro or equivalent	Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim

Amoco may be reached at (800) 445-7732

Geotextile Installation

a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance

a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.

3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

Mulch (Hay or Straw) Materials and Installation

a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance

a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.

b) Straw or grass mulches that blow or wash away should be repaired promptly.

c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.

d) Continue inspections until vegetation is well established.

4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.

b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.

c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.

d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.

e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

Land Grading Stabilization Inspection/Maintenance

a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.

b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.

c) Areas requiring revegetation should be repaired immediately. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

5) **Topsoiling** – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.

b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.

c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.

6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and re-spread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.

b) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.

c) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydro-seeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.

b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.

c) Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance

a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.

b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.

c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.

d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

Dust Control:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction access roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

The general contractor shall employ an on-site water vehicle for the control of dust as necessary.

Non-Stormwater Discharges:

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b)(14)(x).

Soil Stockpiling:

Topsoil and subsoil from the roadway grading will be stockpiled in locations shown on the plans.

Stockpile Material Construction Procedure

1) Topsoil and subsoil that are stripped will be stockpiled for later distribution on disturbed areas.

2) The stockpiles will be located as shown on the plans. These locations will allow them to not interfere with work on the site.

3) Seed the stockpiles with a temporary erosion control mix if the stockpile is to remain undisturbed for more than 30 days. The stockpiles must be stable and the side slopes should not exceed 2:1.

4) Sediment erosion control measures should be placed surrounding each stockpile.

5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

Pollution Prevention:

Fueling and Maintenance of Equipment or Vehicles

Refueling/maintenance Rules – The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. This document shall include language that shall permit the maintenance of vehicles only in designated locations on the job site. In the event of mechanical failure of a vehicle, the vehicle shall be moved to the designated maintenance area on the site to perform maintenance. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

1. Fueling operations shall take place in designated area(s) as shown on site maps. Provide temporary drip protection during fueling operations which take place outside of designated area(s). Materials necessary to address a spill shall be made readily available in a location known to the site supervisor or his/her designee.

2. Fueling operation procedures shall be in effect throughout the project duration.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Washing of Equipment and Vehicles

Vehicle Washing Rules - The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall include language that shall not permit vehicle washing on the job site. Concrete trucks shall be exempt from this rule. Concrete truck cleaning shall be confined within the work area and conducted in a manner to prevent water drainage beyond the specified area of work.
Concrete truck washout shall be conducted in designated areas and shall not be discharged in areas which would allow wash water to leave the site or enter protected areas.

Maintenance Requirements

1. The site supervisor shall maintain a log of individuals receiving these instructions.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

Building Products - Building products are not anticipated during this phase of construction.

Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

The use of pesticides and herbicides is not currently anticipated for this site. Fertilizers and landscape materials will be used to stabilize slopes and other disturbed areas.

1. Store all fertilizers and landscape materials in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.

Maintenance Requirements

1. The site supervisor shall regularly inspect the designated storage areas as well as any portions of the site under construction to ensure that all materials are properly stored. The site supervisor shall immediately address any issues and instruct personnel to secure and properly store all materials.

Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

Refueling and maintenance for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

Refueling and maintenance of equipment shall take place in designated areas whenever possible. Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee and shall employ drip pans or other suitable means of preventing fuel, hydraulic fluid, etc. from spilling or being otherwise carried offsite or into protected areas.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

Hazardous or toxic waste associated with paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations.

Hazardous or toxic waste shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations. Hazardous and toxic waste shall not be disposed of in solid waste containers intended for non-hazardous construction debris.

Maintenance Requirements

1. The site supervisor shall regularly inspect all portions of the project under construction and ensure that all hazardous or toxic materials are disposed of in accordance with the practices detailed above and shall immediately correct any improper disposal practices.

Construction and Domestic Waste

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

Construction and domestic waste shall be disposed of in a trash receptacle (dumpster) which shall be removed and disposed of at an approved land fill.

Recyclable waste material shall be stored in an appropriate container or in a designated location on site until it can be removed.

1. Trash receptacles (dumpsters) and recyclable waste material containers shall be located as needed throughout the site.

Maintenance Requirements

1. The site supervisor shall inspect all trash receptacles and containers to confirm that construction and domestic waste is properly contained, and shall also ascertain that waste is being picked up in a timely manner to ensure that no receptacles are overflowing. Pick-up schedules shall be modified or the number of receptacles shall be increased as needed.

Sanitary Waste

During the construction process, portable toilets will be provided in an appropriate location during the construction process.

Maintenance Requirements

1. The site supervisor shall execute a contract with a vendor to supply and maintain portable toilets throughout the site for the project duration. The site supervisor shall determine if a sufficient number of toilets are present to meet staffing levels and shall ensure that the toilets are regularly and properly maintained.

Washing of Applicators and Containers used for Paint, Concrete or Other Materials

Concrete washout shall be restricted to designated areas. Paints, form release oils, curing compounds, etc. shall be recycled and/or disposed of utilizing appropriate containers in accordance with manufacturer's recommendations and EPA guidelines.

1. Install straw bale and plastic liner washout pit at the designated location on site. Concrete trucks shall wash out only at washout pit or other similar acceptable facility such as a portable roll-off washout pit.
2. Provide suitable containers for recycling or disposal for cleanup of paints, form release oils, curing compounds, etc.

Maintenance Requirements

1. The site supervisor shall inspect concrete washout pits (or other acceptable facility) to ensure that they are properly maintained. If necessary, wash water in a concrete washout pit shall be vacuumed off and the hardened concrete broken up and recycled. Wash water and broken up concrete shall be properly disposed of at a suitable facility. If necessary the wash out pit shall be repaired and relined with plastic prior to continued use.
2. Containers for waste paint, form release oil, curing compounds, etc. shall be sealed and removed from the site and properly disposed of at a suitable facility. Empty containers shall replace those being removed for disposal.

Fertilizers

Fertilizers shall be used only as necessary to establish vegetative stabilized slopes and disturbed areas. Apply at recommended rates. Use only slow release fertilizers to minimize discharge of nitrogen or phosphorous.

1. Store all fertilizers in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.
2. To prevent accidental release of fertilizers, the site supervisor shall attempt to coordinate delivery of fertilizers to coincide with application and reduce the need to warehouse large quantities on-site.

Maintenance Requirements

1. Site supervisor shall make regular inspections to ensure that fertilizer is being applied at proper rates and that all perimeter controls are in place and properly maintained to control runoff which may contain fertilizer. Stored fertilizer shall be properly covered or enclosed in a designated location to prevent introduction into stormwater runoff.

Spill Prevention and Response

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing. In the event a spill occurs, the site supervisor shall be notified immediately.
The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner. Refer to the following Spill Containment & Management Plan, including Spill Report, Emergency Response Equipment Inventory, and Emergency Notification and phone numbers.

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes and submit copies of the form to the Brookline Department of Public Works.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Operation and Maintenance Plan to control or eliminate unforeseen pollution of storm water.

Project Location: 445 Harvard Street – Brookline, MA

Stormwater Management – Construction Phase
Best Management Practices – Inspection Schedule and Evaluation Checklist

Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/ Repair	Performed by
Siltsock Erosion Control Barrier	After heavy rainfall events (minimum weekly)			1. Sediment Silt Sock Design/Installation Requirements 2. Sediment Silt Sock Inspection/Maintenance	☐yes ☐no		
Stabilized Construction Entrance	After heavy rainfall events (minimum weekly)			1. Construction Entrance Design/ Construction Requirements 2. Construction Entrance Inspection/ Maintenance	☐yes ☐no		
Inlet Protection	After heavy rainfall events (minimum weekly)			1. Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance	☐yes ☐no		
Temporary Seeding	After heavy rainfall events (minimum weekly)			1. Temporary Seeding Planting Procedures 2. Temporary Seeding Inspection/ Maintenance	☐yes ☐no		
Geotextiles	After heavy rainfall events (minimum weekly)			1. Geotextile Inspection/Maintenance	☐yes ☐no		
Mulching & Netting	After heavy rainfall events (minimum weekly)			1. Mulch Maintenance	☐yes ☐no		
Land Grading	After heavy rainfall events (minimum weekly)			1. Land Grading Stabilization Inspection/ Maintenance	☐yes ☐no		
Topsoiling	After heavy rainfall events (minimum weekly)			1. Topsoiling Placement Inspection/ Maintenance	☐yes ☐no		

Permanent Seeding	After heavy rainfall events (minimum weekly)			1. Permanent Seeding Inspection/ Maintenance	☐**yes** ☐**no**		
Dust Control	After heavy rainfall events (minimum weekly)				☐**yes** ☐**no**		
					☐**yes** ☐**no**		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

<u>Notes (Include deviations from : Site Plan Approval or Order of Conditions, Construction Sequence and Approved Plan):</u>

Stormwater Control Manager _____

Spill Containment and Management Plan

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) _____

_____

Facility Manager (phone) _____

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	911
Police Department:	911
Department of Public Works:	(617) 730-2175
Board of Health Phone:	(617) 730-2300
Conservation Commission Phone:	(617) 730-2088

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date____/_____/_____ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____Make_____Size_____

S / N_____Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____

☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

_____

_____

Measures taken to contain or clean up spill_____

_____

_____

Amount of chemical / oil recovered_____Method_____

Material collected as a result of clean up

_____drums containing_____

_____drums containing_____

_____drums containing_____

Location and method of debris disposal_____

_____

Name and address of any person, firm, or corporation suffering damages_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

_____

Spill reported to General Office by_____Time_____AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date____/_____/_____ Time_____ AM / PM Inspector_____

NRC Date____/_____/_____ Time_____ AM / PM Inspector_____

Additional comments_____

_____

_____

EMERGENCY RESPONSE EQUIPMENT
INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: _____ BEEPER: _____
   PHONE: _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A _____
   PHONE: _____ CEL PHONE: _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6512

3. POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6500

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (617) 556-1133
   NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200

5. NATIONAL RESPONSE CENTER
   PHONE: (800) 424-8802

   ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
   EMERGENCY: (617) 223-7265
   BUSINESS: (617) 860-4300

6. DEPARTMENT OF PUBLIC WORKS
   CONTACT: Peter Ditto, P.E., P.L.S., Director
   PHONE: (617) 730-2175

7. CONSERVATION COMMISSION
   CONTACT: Thomas D. Brady
   PHONE: (617) 730-2088

8. BOARD OF HEALTH
   PHONE: (617) 730-2300

BEST MANAGEMENT PRACTICES
LONG-TERM
OPERATION & MAINTENANCE PLAN

for

445 Harvard Street
in
Brookline, Massachusetts
(Assessor's Parcel I.D. 067-09-00)

Submitted to:

Town of Brookline

Prepared for:

445 Harvard Street Corp
28 Lyon Road
Brookline, Massachusetts 02467

July 20, 2018

Prepared by:

ofessional Civil Engineering • Professional Land Surveying • Land Planning

MCKENZIE ENGINEERING GROUP

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Norwell, MA 02061
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TABLE OF CONTENTS

	Page
Long Term Best Management Practices (BMP's)	
- Responsible Party Contact Information	1
- Long-Term Operation and Maintenance	2
- BMP Operation and Maintenance	2
- Maintenance Responsibilities	3
- Long-Term Pollution Prevention Plan	3
- Inspection Schedule and Evaluation Checklist	6
- Spill Containment and Management Plan	7

Long-Term Operation and Maintenance Stormwater Best Management Practices

In accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (MassDEP), McKenzie Engineering Group, Inc. has prepared the following Long-Term Operations and Maintenance Plan for the 445 Harvard Street in Brookline, Massachusetts.

Responsible Party Contact Information

Stormwater Management System Owner:	445 Harvard Street Corp 28 Lyon Road Brookline, MA 02467 Victor Sheen (617) 721-3342
Brookline Department of Public Works Engineering & Transportation:	Peter Ditto, P.E., P.L.S., Director Brookline Town Hall 333 Washington Street Brookline, MA 02445 (617) 730-2175 pditto@brooklinema.gov Andrew M. Pappastergion, Commissioner Brookline Town Hall 333 Washington Street Brookline, MA 02445 (617) 730-2175 apappastergion@brooklinema.gov
Water & Sewer Division:	Frederick W. Russell, Director Brookline Town Hall 333 Washington Street Brookline, MA 02445 (617) 730-2175 frussel@brooklinema.gov

Long-Term Operations and Maintenance
General Conditions

1. The property owner shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's as illustrated on the design plans and detailed in the following long-term operations and maintenance plan.
2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Operations and Maintenance Plan.
3. The owner shall:
   a. Maintain an Operation and Maintenance Log (see Attachment A) for the last three years. The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
   b. Make the log available to the Brookline Department of Public Works and Planning Board upon request;
   c. Allow members and agents of the Brookline Department of Public Works to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. A recommended inspection and maintenance schedule is outlined below based on statewide averages. This inspection and maintenance schedule should be adhered to at a minimum for the first year of service of all BMP's referenced in this document. At the commencement of the first year of service, a more accurate inspection/maintenance schedule should be determined based on the level of service for this site.

Best Management Practices Operations and Maintenance

1. **Sidewalk Areas** –Vacuum sweepers shall sweep sidewlk areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping sidewalks in March and April before spring rains wash residual sand into the drainage system.

   Salt used for de-icing on the sidewalks during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

   Cost: The property owner should consult local sweeping contractors for detailed cost estimates.

2. **Permeable Pavers -** The permeable paver infiltration system includes the pavers themselves as well as multiple layers of stone subbase, used to promote the infiltration of stormwater runoff. In order for the stormwater to infiltrate, it is important that the permeable paver area be kept clean. The permeable pavers should be vacuum swept once per year, in the spring time, to remove built up silt and organics. The joints of the permeable pavers should be topped off 2-4 months after installation, as natural settling will occur. This may also be required periodically, as vacuum sweeping may remove a small amount of the joint aggregate.

   Cost: The property owner should consult local landscape contractors for detailed cost estimates.

3. **Pesticides, Herbicides, and Fertilizers -** Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.

   All structural BMP's as identified on the site plans will be owned and maintained by the homeowner's association of the development and shall run with the title of the property.

   Cost: Included in the routine landscaping maintenance schedule. The property owner should consult local landscaping contractors for details.

4. **Snow Removal -** Snow accumulations removed from driveway and sidewalk areas should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Excess snow should be removed from the site and properly disposed of in an approved snow disposal facility. Care must be exercised not to deposit snow in the following areas: where sand and debris can get into the watercourse.

   Cost: The property owner should consult local snow removal contractors for a detailed cost estimate.

Maintenance Responsibilities

The development will remain private and the developer and future residents of the development will be responsible for the upkeep of the drainage system as agreed upon. All post construction maintenance activities should be documented and kept on file and made available to the Brookline DPW, in addition to the Planning Board upon request.

Long-Term Pollution Prevention Plan
Good Housekeeping:

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.

- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.

Storage and Disposal of Waste and Toxics:

Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts.

The exterior storage of hazardous materials on site shall be prohibited.

The following is a list of management considerations for hazardous materials as outlined by the EPA:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport;
- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself;
- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests.

Landscape Maintenance:

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawn areas at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Abide by water restrictions and other conservation measures implemented by the Town of Brookline.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

Integrated Pest Management (IPM):

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos, which even at very low levels can be harmful to aquatic life.

The following IPM practices will be encouraged:

- Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.
- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.

Illicit Discharges:

Illicit discharges are non-stormwater discharges to the storm drain system which typically contain bacteria and other pollutants. All illicit discharges are prohibited. Any illicit discharges should be reported to MassDOT and/or the DPW as applicable to be addressed in accordance with their respective policies.

The following is a list of EPA allowed non-stormwater discharges. If the non-stormwater discharge is not listed, it is prohibited.

1. Water line flushing,
2. Landscape irrigation,
3. Diverted stream flows,
4. Rising ground waters,
5. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
6. Uncontaminated pumped ground water,
7. Discharge from potable water sources,
8. Foundation drains,
9. Air conditioning condensation,
10. Irrigation water, springs,
11. Water from crawl space pumps,
12. Footing drains,
13. Lawn watering,
14. Flows from riparian habitats and wetlands,
15. Street wash water,
16. Discharges or flows from fire fighting activities occur during emergency conditions.

Project Location: 445 Harvard Street - -Brookline, MA **Date:**

Stormwater Management – Long Term

Best Management Practices – Inspection Schedule and Evaluation Checklist

Long Term Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/ Repair	Performed by
Sidewalk Maintenance	4-times annually			1. Sand build-up 2. Trash and debris	☐**yes** ☐**no**		
Permeable Pavers	After heavy rainfall events (minimum annually)			1. Ponding after rainfall events 2. Trash and debris 3. Joint material ½ inch below lip of paver	☐**yes** ☐**no**		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

<u>Notes (Include deviations from : Site Plan Approval and Order of Conditions and Approved Plans):</u>

1. Limited or no use of sodium chloride slats, fertilizers or pesticides recommended. Slow release fertilizer recommended if necessary.

Stormwater Control Manager _____

Spill Containment and Management Plan

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) _____

_____

Facility Manager (phone) _____

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	911
Police Department:	911
Department of Public Works:	(617) 730-2175
Board of Health Phone:	(617) 730-2300
Conservation Commission Phone:	(617) 730-2088

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date____/_____/_____ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____Make_____Size_____

S / N_____Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____

☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

_____

_____

Measures taken to contain or clean up spill_____

_____

_____

Amount of chemical / oil recovered_____Method_____

Material collected as a result of clean up

_____drums containing_____

_____drums containing_____

_____drums containing_____

Location and method of debris disposal_____

_____

Name and address of any person, firm, or corporation suffering damages_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

_____

Spill reported to General Office by_____Time_____AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date____/_____/_____ Time_____ AM / PM Inspector_____

NRC Date____/_____/_____ Time_____ AM / PM Inspector_____

Additional comments_____

_____

_____

EMERGENCY RESPONSE EQUIPMENT
INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: _____ BEEPER: _____
   PHONE: _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A _____
   PHONE: _____ CEL PHONE: _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6512

3. POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (617) 972 6500

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (617) 556-1133
   NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200

5. NATIONAL RESPONSE CENTER
   PHONE: (800) 424-8802

   ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
   EMERGENCY: (617) 223-7265
   BUSINESS: (617) 860-4300

6. DEPARTMENT OF PUBLIC WORKS
   CONTACT: Peter Ditto, P.E., P.L.S., Director
   PHONE: (617) 730-2175

7. CONSERVATION COMMISSION
   CONTACT: Thomas D. Brady
   PHONE: (617) 730-2088

8. BOARD OF HEALTH
   PHONE: (617) 730-2300

SECTION 2

PROJECT DATA SUMMARY

PROJECT DATA SUMMARY

1. Applicant

445 Harvard LLC (the "Applicant") has been organized under the General Laws of the State of Massachusetts and is qualified for the express purpose of undertaking the planning, development and operating of “JFK Place”, a mixed-use apartment development in the Coolidge Corner neighborhood of Brookline. The Applicant will develop 25 rental units and approximately 4,380 square foot of commercial space on a limited dividend basis, as required under all laws and regulations of the Commonwealth of Massachusetts. Robert Engler of SEB, LLC, is the Applicant’s 40B housing consultant with extensive experience numerous housing developments over the past 40 years. The Applicant respectfully requests that all notices from the Board in connection with this Application be sent to Robert Engler/SEB, LLC, 257 Hillside Avenue, Needham, MA 02494.

2. Description of the Development

JFK Place will consist of 25 rental units on 4 floors above a ground floor commercial space and parking garage containing 20 parking spaces. The units will range in size from 800 square foot 1-bedroom to 1,170 square foot 3-bedroom units; 5 of the 25 units will be available to households qualifying under DHCD and 40B guidelines as low or moderate income, in this case 50% of Area Median Income. These units will remain affordable in perpetuity.

The bedroom mix will be as follows:

13	1 BR
9	2 BR
3	3 BR

Preliminary architectural and engineering drawings are attached hereto under separate cover.

3. Local Need

According to figures compiles by the DHCD in September 2017, Brookline’s subsidizing housing inventory represents 9.4% of its total housing stock, below the threshold requirements established in 1969 under Chapter 40B.

4. Exceptions and Approvals Required

The proposed site is located in a local business zone (L-1) which does allow for multifamily uses. A Comprehensive Permit will be requested as well as other exceptions to the underlying zoning in order to develop this project as proposed.

CONCLUSION

For all of the foregoing reasons, and for the additional reasons the Applicant will present at the scheduled public hearing on this Application, the Applicant respectfully requests the Board, after complying with the procedural requirements as provided by law, to issue to the Applicant a Comprehensive Permit for the development.

SECTION 3

APPLICANT STATUS

APPLICANT STATUS

445 Harvard LLC agrees to conform to the limited dividend requirements of Chapter 40B which, in turn, require that the developer abide by whatever such requirements are imposed by the affordable housing program being proposed, in this case – Massachusetts Housing Partnership. Accordingly, the Applicant will be signing a Regulatory Agreement which will govern both the affordable housing requirements and the limited dividend restrictions over time. An annual report addressing these issues will be filed by the Applicant's CPA and provided to Massachusetts Housing Partnership with copies to the Town.

SECTION 4

PROJECT ELIGIBILITY LETTER

Massachusetts
Housing
Partnership

160 Federal Street
Boston, Massachusetts 02110
Tel: 617-330-9955
Fax: 617-330-1919

462 Main Street
Amherst, Massachusetts 01002
Tel: 413-253-7379
Fax: 413-253-3002

www.mhp.net

July 2, 2018

Shimon Cohen, Manager
445 Harvard, LLC
28 Lyons Road
Brookline, MA 02467

Re: 445 Harvard Avenue, Brookline, Massachusetts (the "Project") Determination of Project Eligibility – MHP's Permanent Rental Financing Program

Dear Mr. Cohen:

This letter is in response to your request for a determination of Project Eligibility under the provisions of the Commonwealth of Massachusetts comprehensive permit process (M.G.L. Chapter 40B, 760 C.M.R. 56, and the Massachusetts Department of Housing and Community Development's Comprehensive Permit Guidelines) (collectively, the "Comprehensive Permit Rules") for the above-referenced Project. The Project, as proposed in your application dated March 23, 2018 as amended on June 11, 2018 and June 21, 2018, shall consist of twenty-five (25) rental housing including twelve (12) one-bedroom units, ten (10) two-bedroom units and three (3) three-bedroom units, located in a newly constructed, five-story building with ground floor commercial space, on a .23-acre parcel of land. Access to 20 parking spaces will be provided in a subsurface parking garage for a resulting parking ratio of .6/1.

In connection with your request, and in accordance with the Comprehensive Permit Rules, MHP has performed an on-site inspection of the Project, and has reviewed initial pro forma and other pertinent information submitted by 445 Harvard, LLC (the "Applicant"), and has considered comments received from the Town of Brookline (the "Town").

Based upon our review, we find the following:

1) The Project, as proposed, appears generally eligible under the requirements of MHP's Permanent Rental Financing Program (the "Program"), certain terms of which are set forth on Exhibit A, attached hereto, subject to final approval.

2) The site of the proposed Project is an appropriate location for residential development. Specifically (a) the site was identified in Town planning documents as an appropriate location for multi-family and affordable housing; (b) the site is walking distance to a wide variety of service, civic and commercial uses; (c) the site has access to public transit via the MBTA bus and Green Line service, and is less than one mile from major highways; and (d) the site has access to existing utilities including gas, water, sewer, and electricity.

The Town's Subsidized Housing Inventory (SHI) shows 2454 affordable units (9.4%). Prior municipal action aimed at addressing the need for affordable housing include: (a) dedication of staff and community resources including a permanent Housing Advisory Board, Affordable Housing Trust and two full-time housing planners; (b) completion of a Housing Production Plan in 2016, which was approved by DHCD; (c) establishment of an Affordable Housing Trust Fund in 1987, which has collected more than $12 million and spent more than $9 million for the creation of new affordable units and the preservation of existing ones; (d) establishment of an Inclusionary Zoning By-Law in 1987, resulting in the creation of 104 affordable units as well as $6.4 million in contributions to the Town's Housing Trust Fund; (e) contribution of $2.3 million for capital improvements by the Brookline Housing Authority; and (f) financial support for the extension of affordability at expiring use properties.

Evidence of an unmet demand for new affordable housing in Brookline is set forth as follows: (a) data from the 2012-2017 American Community Survey (ACS) shows that 40% of the households earn less than 80% of area median income (AMI), 30% earn less than 50% AMI, and 20% earn less than 30% AMI; and (b) U.S. Department of Housing and Urban Development (HUD) data for Brookline shows a deficit of 355 housing units affordable to renter-occupied households earning up to 50% AMI and there are 3,590 renter-occupied households that are paying more than 50% of household income on housing costs and are considered severely cost-burdened.

While the Town's municipal actions to meet housing needs are positive they do not warrant a conclusion that the site is not generally appropriate for municipal development.

3) The conceptual Project design is generally appropriate for the site. Specifically (a) the building's street level façade continues the surrounding pattern of ground-level commercial use along Harvard Street; (b) building elevations are well composed and varied; (c) the building's form, footprint and orientation conform with neighborhood development patterns (d) building height and mass are mitigated by stepped-back upper stories; (e) the provision of enclosed parking within the lower level of the building will reduce visual impacts on the surrounding neighborhood.

The following general design recommendations should be considered during the comprehensive permit process:

(a) Identify specific measures aimed at further mitigating the Project's light and visual impacts on abutting properties, including screening and fencing;

(b) Develop detailed landscape plan addressing the preservation of existing vegetation on and near the site boundaries, and appropriate landscape treatments at the street level; and

(c) Develop street-level façade details aimed at encouraging the success of the

commercial space including lighting, signage, and entry treatments.

MHP expects that the Town's concerns regarding traffic, parking, noise, fire safety, geotechnical, storm water and drainage will be addressed during the comprehensive permit process.

4) Based upon comparable rentals and potential competition from other projects, the proposed Project appears financially feasible within the Brookline market.

5) The Project appears financially feasible on the basis of estimated development and operating costs set forth in the initial pro forma provided by the Applicant and a land value determination value consistent with the Comprehensive Permit Rules. In addition, the Project budgets are consistent with the Comprehensive Permit Rules relative to cost examination and limitations on profit and distributions.

6) The Applicant is a single-purpose entity that will be subject to MHP's limited dividend requirements. The Applicant meets the general eligibility standards of the Program.

7) The site is controlled by the Applicant through ownership.

This letter is intended to be a written preliminary determination of Project Eligibility under the Comprehensive Permit Rules, establishing fundability by a subsidizing agency under a low and moderate income housing subsidy program, which qualifies the Project for consideration for a Comprehensive Permit under M.G.L. Chapter 40B.

This preliminary determination of eligibility is subject to final review of eligibility and final approval by MHP, and is expressly limited to the specific Project proposed in the request for determination of Project Eligibility submitted to MHP and subject to the minimum affordability and additional requirements set forth in Exhibit A hereto. The requirements of the Comprehensive Permit must not result in a loan to value ratio exceeding MHP requirements. Changes to the proposed Project, including without limitation, alterations in unit mix, proposed rents, development team, unit design, development costs and/or income restrictions may affect eligibility and final approval. Accordingly, you are encouraged to keep MHP informed of the status and progress of your application for a Comprehensive Permit and any changes to the Project that may affect program eligibility and/or financial projections. In addition, MHP requires that it be notified (1) when the applicant applies to the local ZBA for a comprehensive permit; (2) when the ZBA issues a decision; and (3) when any appeals are filed.

Please note that this preliminary determination of Project Eligibility is not a commitment or guarantee of or by MHP for financing, either expressed or implied, and, in the event that you determine not to apply to MHP for permanent financing and/or in the event that your application for permanent financing with MHP is denied, this letter shall be of no further force and effect. Also, please note that this letter shall be of no force or effect if the applicant has not filed for a Comprehensive Permit within two years of the date of this letter.

Final review and approval under the Comprehensive Permit Rules will be undertaken by MHP only in conjunction with an application to MHP for permanent mortgage financing for the Project. After the ZBA's issuance of a Comprehensive Permit for the Project, MHP would be pleased to entertain a request for permanent mortgage financing pursuant to and in accordance with MHP's standard underwriting process. At that time, MHP shall require a complete loan application, a copy of the decision of the ZBA and any amendments thereto, a copy of the decision, if any, by the Housing Appeals Committee and revised preliminary plans and designs, if applicable, as well as such additional documents and information as is required as part of the loan underwriting process.

Should you have any comments or questions concerning this letter, please do not hesitate to call Laura Shufelt at 857-317-8582.

Sincerely,

Judith S. Jacobson
Deputy Director & General Counsel

cc: Roberta Rubin, Chief Counsel, Department of Housing and Community Development
Neil Wishinsky, Chair, Brookline Select Board
Jesse Geller, Chair, Brookline Zoning Board of Appeals
Alison Steinfeld, Director, Planning and Community Development Department

EXHIBIT A

Affordability Requirements:	At least five (5) of the units must be affordable to households earning up to fifty (50%) of the median area income. Such units shall include a mix of bedroom sizes satisfactory to MHP. The affordability requirements will be documented through an affordable housing agreement that will be recorded prior to the mortgage and shall create covenants running with the property for a minimum period of thirty (30) years. Comprehensive permit requirements may extend the affordability requirements beyond the initial 30-year term.
Limited Dividend Policy:	The Owner must comply with MHP's limited dividend policy.

SECTION 5

DEVELOPMENT TEAM

DEVELOPMENT TEAM

DEVELOPER:	445 Harvard LLC 28 Lyon Road Brookline, MA 02467 Tel: 617.838.5136 Contact: Shimon Cohen shmcon@comcast.net
DEVELOPMENT MANAGER:	AURA Properties 49 Coolidge Street Brookline, MA 02446 Tel: 617.721.3342 Contact: Victor Sheen vsheen@auraboston.com
DEVELOPMENT CONSULTANT:	SEB, LLC 1257 Hillside Avenue Needham, MA 02494 Tel: 617.782.2300 x 201 Contact: Robert Engler bob@s-e-b.com
ARCHITECT:	EMBARC Studio 60 K Street, Floor 3 Boston, MA 02127 Tel: 617.766.8330 Contact: Dartagnan Brown dbrown@embarcstudio.com
CIVIL ENGINEER:	McKenzie Engineering Group 150 Long Water Drive, Suite 101 Norwell, MA 02061 Tel 781.792.3900 Contact: Brad McKenzie BMckenzie@mckeng.com
TRAFFIC CONSULTANT:	Vanasse & Associates 35 New England Business Center Andover, MA 01810 Tel: 978.474.8800 Contact: Jeff Dirk jdirk@rdva.com

LANDSCAPE ARCHITECT:	Verdant Landscape Architecture 318 Harvard Street, Suite 25 Brookline, MA 02446 Tel: 617.735.1180 Contact: Blair Hines bh@verdantla.com
LEGAL COUNSEL:	Eckert Seamans Cherin & Mellott, LLC 2 International Place, Floor 16 Boston, MA 02110 Tel: 617.342.6816 Contract: Todd Whilton twhilton@eckertseamans.com

SECTION 6

SITE CONTROL

QUITCLAIM DEED

445 Harvard Street Corp., a Massachusetts corporation, with an address of 28 Lyon Road, Brookline, Massachusetts 02467,

for consideration of less than One Hundred and 00/100 ($100.00) Dollars,

grants to **445 Harvard, LLC**, a Massachusetts limited liability company, with an address of 28 Lyon Road, Brookline, Massachusetts 02467, with QUITCLAIM COVENANTS

See attached Exhibit A for description

For grantor's title see Deed recorded with the Norfolk County Registry of Deeds on November 13, 2001 in Book 15748, at Page 321.

The premises are conveyed subject to a Mortgage dated April 26, 2006 and recorded with Norfolk County Registry of Deeds in Book 23594, Page 485 securing the original amount of $1,150,000.00, and a Conditional Assignment of Rents to Lender dated April 26, 2006, recorded with Norfolk Deeds in Book 23594, Page 499, which the Grantee herein assumes to pay and perform all of the obligations under said Mortgage and Assignment.

This conveyance does not constitute all or substantially all of the assets of the Grantor located in the Commonwealth of Massachusetts.

Witness my hand and seal this 9 day of February, 2018.

445 HARVARD STREET CORP., a Massachusetts corporation

By _____
Shimon Cohen, President and Treasurer

445 Harvard Street, Brookline Massachusetts

{K0702809.1}

COMMONWEALTH OF MASSACHUSETTS

NORFOLK, SS.

On this 9th day of February, 2018, before me, the undersigned notary public, personally appeared Shimon Cohen, Manager of said limited liability company, personally known to me or else proved to me through satisfactory evidence of identification, which was Mass Driver's license, to be the person whose name is signed on the preceding document, and acknowledged to me that he signed it voluntarily for its stated purpose.

DEAN P. PLAKIAS
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
June 17, 2022

Notary Public
My commission expires:

EXHIBIT A

A certain parcel of land with the buildings thereon situated in Brookline, Norfolk County, Massachusetts and being shown as Lot A on a plan entitled "Plan of Land Brookline, Mass, Scale-1 inch = 10 feet Jan. 22, 1949 J.F. Hennessy, Civil Eng'r Brookline, Mass", recorded with Norfolk County Registry of Deeds as Plan No. 299 of 1949 in Book 2820, Page 246.

SOUTHWESTERLY	by Harvard Street, seventy six and 26/100 (76.26) feet;
SOUTHWESTERLY,	
WESTERLY and	
NORTHWESTERLY	by the curve of Harvard Street and Thorndike Street, twenty four and 11/100 (24.11) feet;
NORTHWESTERLY	by Thorndike Street, eighty eight and 31/100 (88.31) feet;
NORTHEASTERLY	by Lot B, as shown on said plan, eighty two and 67/100 (82.67) feet; and
SOUTHEASTERLY	by land of M.S. Keene, A.H. Silver and R. Wise, as shown on said plan, one hundred forty seven and 42/100 (147.42) feet.

Containing 10,068 square feet of land, according to said plan.

SECTION 7

DHCD SUSIDIZED HOUSING INVENTORY

Department of Housing and Community Development
Chapter 40B Subsidized Housing Inventory (SHI)
as of September 14, 2017

Community	2010 Census Year Round Housing Units	Total Development Units	SHI Units	%
Abington	6,364	518	485	7.6%
Acton	8,475	1,144	568	6.7%
Acushnet	4,097	127	97	2.4%
Adams	4,337	321	321	7.4%
Agawam	12,090	556	505	4.2%
Alford	231	0	0	0.0%
Amesbury	7,041	898	738	10.5%
Amherst	9,621	1,130	1,083	11.3%
Andover	12,324	2,000	1,637	13.3%
Aquinnah	158	41	41	25.9%
Arlington	19,881	1,429	1,121	5.6%
Ashburnham	2,272	144	29	1.3%
Ashby	1,150	0	0	0.0%
Ashfield	793	2	2	0.3%
Ashland	6,581	514	410	6.2%
Athol	5,148	310	310	6.0%
Attleboro	17,978	1,155	1,155	6.4%
Auburn	6,808	251	251	3.7%
Avon	1,763	70	70	4.0%
Ayer	3,440	454	299	8.7%
Barnstable	20,550	1,763	1,462	7.1%
Barre	2,164	83	83	3.8%
Becket	838	0	0	0.0%
Bedford	5,322	1,174	972	18.3%
Belchertown	5,771	418	392	6.8%
Bellingham	6,341	733	551	8.7%
Belmont	10,117	675	365	3.6%
Berkley	2,169	103	24	1.1%
Berlin	1,183	254	109	9.2%
Bernardston	930	24	24	2.6%
Beverly	16,522	2,153	1,919	11.6%
Billerica	14,442	1,766	1,118	7.7%
Blackstone	3,606	165	123	3.4%
Blandford	516	1	1	0.2%
Bolton	1,729	192	62	3.6%
Boston	269,482	54,409	51,283	19.0%
Bourne	8,584	1,198	660	7.7%
Boxborough	2,062	325	268	13.0%
Boxford	2,730	72	31	1.1%

Boylston	1,765	26	26	1.5%
Braintree	14,260	1,679	1,382	9.7%
Brewster	4,803	306	255	5.3%
Bridgewater	8,288	645	546	6.6%
Brimfield	1,491	71	71	4.8%
Brockton	35,514	4,619	4,619	13.0%
Brookfield	1,452	19	19	1.3%
Brookline	26,201	3,151	2,454	9.4%
Buckland	866	3	3	0.3%
Burlington	9,627	1,707	1,283	13.3%
Cambridge	46,690	7,102	6,911	14.8%
Canton	8,710	1,195	1,090	12.5%
Carlisle	1,740	57	51	2.9%
Carver	4,514	146	146	3.2%
Charlemont	615	3	3	0.5%
Charlton	4,774	83	83	1.7%
Chatham	3,460	180	174	5.0%
Chelmsford	13,741	1,591	1,072	7.8%
Chelsea	12,592	2,439	2,434	19.3%
Cheshire	1,481	0	0	0.0%
Chester	585	13	13	2.2%
Chesterfield	524	17	17	3.2%
Chicopee	25,074	2,637	2,601	10.4%
Chilmark	418	3	3	0.7%
Clarksburg	706	9	9	1.3%
Clinton	6,375	549	549	8.6%
Cohasset	2,898	325	311	10.7%
Colrain	731	0	0	0.0%
Concord	6,852	926	804	11.7%
Conway	803	0	0	0.0%
Cummington	426	16	16	3.8%
Dalton	2,860	159	159	5.6%
Danvers	11,071	1,565	1,149	10.4%
Dartmouth	11,775	1,001	971	8.2%
Dedham	10,115	1,149	1,104	10.9%
Deerfield	2,154	33	33	1.5%
Dennis	7,653	338	324	4.2%
Dighton	2,568	420	144	5.6%
Douglas	3,147	140	140	4.4%
Dover	1,950	69	18	0.9%
Dracut	11,318	861	585	5.2%
Dudley	4,360	104	104	2.4%
Dunstable	1,085	0	0	0.0%
Duxbury	5,532	441	410	7.4%
East Bridgewater	4,897	230	176	3.6%
East Brookfield	888	0	0	0.0%
East Longmeadow	6,072	513	445	7.3%

Eastham	2,632	63	54	2.1%
Easthampton	7,567	1,021	522	6.9%
Easton	8,105	979	787	9.7%
Edgartown	1,962	94	89	4.5%
Egremont	596	0	0	0.0%
Erving	778	0	0	0.0%
Essex	1,477	40	40	2.7%
Everett	16,691	1,061	1,061	6.4%
Fairhaven	7,003	486	486	6.9%
Fall River	42,650	4,847	4,751	11.1%
Falmouth	14,870	1,230	959	6.4%
Fitchburg	17,058	1,680	1,486	8.7%
Florida	335	0	0	0.0%
Foxborough	6,853	869	859	12.5%
Framingham	27,443	2,871	2,871	10.5%
Franklin	11,350	1,814	1,352	11.9%
Freetown	3,263	104	86	2.6%
Gardner	9,064	1,356	1,356	15.0%
Georgetown	3,031	352	352	11.6%
Gill	591	24	24	4.1%
Gloucester	13,270	1,009	972	7.3%
Goshen	440	5	5	1.1%
Gosnold	41	0	0	0.0%
Grafton	7,160	732	365	5.1%
Granby	2,451	67	67	2.7%
Granville	630	0	0	0.0%
Great Barrington	3,072	378	306	10.0%
Greenfield	8,325	1,173	1,155	13.9%
Groton	3,930	343	217	5.5%
Groveland	2,423	137	80	3.3%
Hadley	2,200	264	264	12.0%
Halifax	2,971	28	28	0.9%
Hamilton	2,783	124	84	3.0%
Hampden	1,941	60	60	3.1%
Hancock	326	0	0	0.0%
Hanover	4,832	575	575	11.9%
Hanson	3,572	270	157	4.4%
Hardwick	1,185	9	8	0.7%
Harvard	1,982	247	113	5.7%
Harwich	6,121	335	335	5.5%
Hatfield	1,549	52	52	3.4%
Haverhill	25,557	2,770	2,555	10.0%
Hawley	137	0	0	0.0%
Heath	334	0	0	0.0%
Hingham	8,841	2,798	1,005	11.4%
Hinsdale	918	0	0	0.0%
Holbrook	4,262	440	440	10.3%

Holden	6,624	514	407	6.1%
Holland	1,051	13	13	1.2%
Holliston	5,077	447	236	4.6%
Holyoke	16,320	3,278	3,253	19.9%
Hopedale	2,278	119	119	5.2%
Hopkinton	5,087	842	724	14.2%
Hubbardston	1,627	49	49	3.0%
Hudson	7,962	1,051	892	11.2%
Hull	4,964	84	84	1.7%
Huntington	919	44	44	4.8%
Ipswich	5,735	564	511	8.9%
Kingston	4,881	359	204	4.2%
Lakeville	3,852	590	274	7.1%
Lancaster	2,544	223	140	5.5%
Lanesborough	1,365	28	28	2.1%
Lawrence	27,092	4,076	4,057	15.0%
Lee	2,702	173	176	6.5%
Leicester	4,231	176	176	4.2%
Lenox	2,473	178	178	7.2%
Leominster	17,805	1,493	1,456	8.2%
Leverett	792	2	2	0.3%
Lexington	11,946	1,500	1,321	11.1%
Leyden	300	0	0	0.0%
Lincoln	2,153	310	238	11.2%
Littleton	3,443	649	444	12.9%
Longmeadow	5,874	272	272	4.6%
Lowell	41,308	5,253	5,180	12.5%
Ludlow	8,337	293	293	3.5%
Lunenburg	4,037	195	195	4.8%
Lynn	35,701	4,435	4,435	12.4%
Lynnfield	4,319	744	495	11.5%
Malden	25,122	2,607	2,542	10.1%
Manchester	2,275	137	115	5.1%
Mansfield	8,725	1,035	939	10.8%
Marblehead	8,528	399	333	3.9%
Marion	2,014	204	156	7.7%
Marlborough	16,347	1,962	1,866	11.4%
Marshfield	9,852	775	572	5.8%
Mashpee	6,473	363	337	5.2%
Mattapoisett	2,626	70	70	2.7%
Maynard	4,430	398	380	8.6%
Medfield	4,220	358	304	7.2%
Medford	23,968	2,243	1,694	7.1%
Medway	4,603	468	284	6.2%
Melrose	11,714	1,425	932	8.0%
Mendon	2,072	77	40	1.9%
Merrimac	2,527	397	141	5.6%

Methuen	18,268	1,931	1,641	9.0%
Middleborough	8,921	979	589	6.6%
Middlefield	230	2	2	0.9%
Middleton	3,011	173	151	5.0%
Milford	11,379	976	708	6.2%
Millbury	5,592	244	221	4.0%
Millis	3,148	181	118	3.7%
Millville	1,157	26	26	2.2%
Milton	9,641	737	481	5.0%
Monroe	64	0	0	0.0%
Monson	3,406	138	138	4.1%
Montague	3,926	408	376	9.6%
Monterey	465	0	0	0.0%
Montgomery	337	0	0	0.0%
Mount Washington	80	0	0	0.0%
Nahant	1,612	48	48	3.0%
Nantucket	4,896	179	121	2.5%
Natick	14,052	1,798	1,458	10.4%
Needham	11,047	1,503	1,397	12.6%
New Ashford	104	0	0	0.0%
New Bedford	42,816	5,144	5,110	11.9%
New Braintree	386	0	0	0.0%
New Marlborough	692	0	0	0.0%
New Salem	433	0	0	0.0%
Newbury	2,699	94	94	3.5%
Newburyport	8,015	713	599	7.5%
Newton	32,346	2,543	2,425	7.5%
Norfolk	3,112	218	128	4.1%
North Adams	6,681	866	866	13.0%
North Andover	10,902	1,389	931	8.5%
North Attleborough	11,553	306	294	2.5%
North Brookfield	2,014	142	142	7.1%
North Reading	5,597	652	540	9.6%
Northampton	12,604	1,586	1,356	10.8%
Northborough	5,297	719	610	11.5%
Northbridge	6,144	468	453	7.4%
Northfield	1,290	27	27	2.1%
Norton	6,707	897	533	7.9%
Norwell	3,652	452	297	8.1%
Norwood	12,441	1,047	1,035	8.3%
Oak Bluffs	2,138	158	146	6.8%
Oakham	702	0	0	0.0%
Orange	3,461	405	405	11.7%
Orleans	3,290	334	304	9.2%
Otis	763	0	0	0.0%
Oxford	5,520	404	404	7.3%
Palmer	5,495	310	269	4.9%

Paxton	1,590	62	62	3.9%
Peabody	22,135	2,174	2,051	9.3%
Pelham	564	0	0	0.0%
Pembroke	6,477	771	616	9.5%
Pepperell	4,335	197	130	3.0%
Peru	354	0	0	0.0%
Petersham	525	0	0	0.0%
Phillipston	658	8	8	1.2%
Pittsfield	21,031	2,057	1,936	9.2%
Plainfield	283	0	0	0.0%
Plainville	3,459	619	572	16.5%
Plymouth	22,285	976	721	3.2%
Plympton	1,039	63	51	4.9%
Princeton	1,324	26	26	2.0%
Provincetown	2,122	256	208	9.8%
Quincy	42,547	4,096	4,096	9.6%
Randolph	11,980	1,280	1,280	10.7%
Raynham	5,052	604	489	9.7%
Reading	9,584	1,341	831	8.7%
Rehoboth	4,252	99	27	0.6%
Revere	21,956	1,790	1,780	8.1%
Richmond	706	4	4	0.6%
Rochester	1,865	8	8	0.4%
Rockland	7,030	645	450	6.4%
Rockport	3,460	135	135	3.9%
Rowe	177	0	0	0.0%
Rowley	2,226	179	94	4.2%
Royalston	523	3	3	0.6%
Russell	687	8	8	1.2%
Rutland	2,913	86	86	3.0%
Salem	18,998	2,467	2,425	12.8%
Salisbury	3,842	797	592	15.4%
Sandisfield	401	0	0	0.0%
Sandwich	8,183	605	307	3.8%
Saugus	10,754	808	732	6.8%
Savoy	318	0	0	0.0%
Scituate	7,163	360	315	4.4%
Seekonk	5,272	96	87	1.7%
Sharon	6,413	741	683	10.7%
Sheffield	1,507	30	30	2.0%
Shelburne	893	51	51	5.7%
Sherborn	1,479	41	34	2.3%
Shirley	2,417	57	57	2.4%
Shrewsbury	13,919	957	860	6.2%
Shutesbury	758	2	2	0.3%
Somerset	7,335	273	273	3.7%
Somerville	33,632	3,278	3,250	9.7%

South Hadley	7,091	424	424	6.0%
Southampton	2,310	44	44	1.9%
Southborough	3,433	808	472	13.7%
Southbridge	7,517	499	499	6.6%
Southwick	3,852	164	164	4.3%
Spencer	5,137	268	267	5.2%
Springfield	61,556	10,458	10,192	16.6%
Sterling	2,918	269	68	2.3%
Stockbridge	1,051	113	113	10.8%
Stoneham	9,399	501	495	5.3%
Stoughton	10,742	1,495	1,240	11.5%
Stow	2,500	337	185	7.4%
Sturbridge	3,759	357	209	5.6%
Sudbury	5,921	887	669	11.3%
Sunderland	1,718	0	0	0.0%
Sutton	3,324	176	50	1.5%
Swampscott	5,795	218	212	3.7%
Swansea	6,290	247	236	3.8%
Taunton	23,844	1,720	1,529	6.4%
Templeton	3,014	516	238	7.9%
Tewksbury	10,803	1,312	1,044	9.7%
Tisbury	1,965	123	109	5.5%
Tolland	222	0	0	0.0%
Topsfield	2,157	173	155	7.2%
Townsend	3,356	199	160	4.8%
Truro	1,090	28	25	2.3%
Tyngsborough	4,166	853	447	10.7%
Tyringham	149	0	0	0.0%
Upton	2,820	223	178	6.3%
Uxbridge	5,284	434	264	5.0%
Wakefield	10,459	1,276	758	7.2%
Wales	772	43	43	5.6%
Walpole	8,984	497	485	5.4%
Waltham	24,805	2,724	1,834	7.4%
Ware	4,539	387	387	8.5%
Wareham	9,880	894	764	7.7%
Warren	2,202	101	101	4.6%
Warwick	363	0	0	0.0%
Washington	235	0	0	0.0%
Watertown	15,521	1,745	1,072	6.9%
Wayland	4,957	370	254	5.1%
Webster	7,788	722	722	9.3%
Wellesley	9,090	663	573	6.3%
Wellfleet	1,550	36	30	1.9%
Wendell	419	5	5	1.2%
Wenham	1,404	186	118	8.4%
West Boylston	2,729	413	223	8.2%

West Bridgewater	2,658	175	121	4.6%
West Brookfield	1,578	68	68	4.3%
West Newbury	1,558	116	39	2.5%
West Springfield	12,629	429	429	3.4%
West Stockbridge	645	0	0	0.0%
West Tisbury	1,253	38	23	1.8%
Westborough	7,304	1,265	974	13.3%
Westfield	16,001	1,166	1,158	7.2%
Westford	7,671	1,028	635	8.3%
Westhampton	635	17	17	2.7%
Westminster	2,826	274	87	3.1%
Weston	3,952	285	167	4.2%
Westport	6,417	498	232	3.6%
Westwood	5,389	810	576	10.7%
Weymouth	23,337	1,908	1,771	7.6%
Whately	654	2	2	0.3%
Whitman	5,513	200	200	3.6%
Wilbraham	5,442	306	305	5.6%
Williamsburg	1,165	51	51	4.4%
Williamstown	2,805	249	201	7.2%
Wilmington	7,788	1,067	799	10.3%
Winchendon	4,088	331	331	8.1%
Winchester	7,920	292	244	3.1%
Windsor	387	0	0	0.0%
Winthrop	8,253	638	638	7.7%
Woburn	16,237	1,587	1,419	8.7%
Worcester	74,383	10,076	9,977	13.4%
Worthington	553	22	22	4.0%
Wrentham	3,821	485	485	12.7%
Yarmouth	12,037	634	527	4.4%
Totals	**2,692,186**	**297,863**	**262,223**	**9.7%**

*This data is derived from Information provided to the Department of Housing and Community Development (DHCD) by individual communities and is subject to change as new information is obtained and use restrictions expire.

SECTION 8

SAMPLE REGULATORY AGREEMENT

Massachusetts
Housing Partnership Fund

CHAPTER 40B REGULATORY AND AFFORDABLE HOUSING AGREEMENT FOR LIMITED DIVIDEND ORGANIZATIONS

This Chapter 40B Regulatory and Affordable Housing Agreement For Limited Dividend Organizations ("Agreement") is entered into this ___ day of _____, 201_ by and between _____, a_____[corporation] [_____limited liability company][_____limited partnership], having a mailing address of _____ (the "Borrower"), and the MASSACHUSETTS HOUSING PARTNERSHIP FUND BOARD, a Massachusetts body politic and corporate with its principal place of business at 160 Federal Street, Boston, Massachusetts 02110 (the "Lender")**.**

R E C I T A L S

A. The Borrower is the owner of certain real property known and numbered as _____, _____, Massachusetts, being more particularly described on Exhibit A attached hereto (the "Mortgaged Property"), on which the Borrower intends to construct a housing development known as "_____" consisting of _____(____) units of residential rental housing (the "Housing Development").

B. The Mortgaged Property is subject to and has the benefit of a comprehensive permit, issued by the Town of _____, acting by and through its Zoning Board of Appeals (the "Municipality") pursuant to M.G.L. c. 40B, §§ 20-23 and regulations promulgated thereunder (the "Act") and recorded with the _____Registry of Deeds in Book ___, Page __ (the "Comprehensive Permit").

C. The Lender is a subsidizing agency under the Act and has agreed to make a permanent mortgage loan to the Borrower in the original principal amount of $_____ (the "Loan") as provided in a certain Commitment Letter dated _____.

D. The Lender requires, as a condition to making the Loan, that the Borrower enter into this Agreement in order to create certain covenants running with the Mortgaged Property for the purpose of ensuring that the Affordable Housing Units (as defined below) are rented to Families (as defined below) who meet the income and other eligibility criteria set forth in this Agreement for the period set forth herein.

E. The Borrower has agreed to enter into this Agreement imposing covenants running with the Mortgaged Property as a condition of the Loan, which Agreement shall be binding upon the Borrower and all subsequent owners of the Mortgaged Property, for the purposes of providing for the monitoring and enforcement of the limited dividend requirement, the affordable housing restrictions and the affirmative marketing requirements for the period set forth herein.

Please return to:
Judith S. Jacobson, Deputy Director & General Counsel
Massachusetts Housing Partnership
160 Federal Street
Boston, MA 02110

A G R E E M E N T

For good and valuable consideration, and with the intent of being legally bound, the parties hereto agree as follows:

1. Paragraphs A through E set forth in the Recitals section above are incorporated herein by reference as if fully re-stated.

2. Definitions.

(a) Affordable Housing Unit: An [80%][50%] AMI Unit.
(b) AMI: The median income for the area in which the Mortgaged Property is located, adjusted for household size, as determined by HUD.
(c) Annual Limited Dividend Financial Report: An annual report to be prepared by the Borrower on a form prescribed by the Lender pursuant to Lender's Limited Dividend Policy.
(d) Base Fee: The Base Fee adopted by the Lender and further defined in Section 14(c) of this Agreement in connection with determining the annual monitoring services fees for monitoring the Borrower's compliance with this Agreement during the Fee-Based Monitoring Period.
(e) Borrower's Equity: $_____, as the same may be adjusted from time to time, as determined by and in accordance with Lender's Limited Dividend Policy defined below. The parties acknowledge that Borrower's Equity is based on projected project costs and will be updated on or before the Loan Closing Date to reflect actual costs or as-complete appraised value, as Borrower shall select.
(f) CPI-U: The Consumer Price Index for Urban Consumers, further distinguished as the index for "Selected Areas, Northeast-Urban, Size A" published by the Bureau of Labor Statistics of the United States Department of Labor, or any comparable successor or substitute index designated by the Lender appropriately adjusted.
(g) Default. As defined in Section 15(a).
(h) Development Revenues: All rental income, receipts and other revenue derived from the operation of the Mortgaged Property other than revenues derived from any sales, financing, or other capital transaction.
(i) DHCD: The Massachusetts Department of Housing and Community Development or any successor agency overseeing the implementation of the Act.
(j) [80% AMI Unit: A unit that is rented to and occupied by, or is available for rent to and occupancy by, a Family with income at or below eighty percent (80%) of AMI.]
(k) Event of Default. As defined in Section 15(a).
(l) Excess Equity: Annual net cash flow as calculated in accordance with the Annual Limited Dividend Report in excess of the MAALD (as defined below).
(m) Excess Equity Account: An interest-bearing account maintained by the Lender for the benefit of the Mortgaged Property during the Limited Dividend Term (as defined below) containing Excess Equity.
(n) Family : One or more individuals occupying a unit in accordance with the definition adopted by HUD for the so-called Section 8 program under the United States Housing Act of 1937, as amended, and the regulations promulgated thereunder (the "Section 8 Program"). Notwithstanding the foregoing, a household comprised of a full-time student or students shall not qualify as a Family except as permitted under the Low-Income Housing Tax Credit Program, Internal Revenue Code Section 42(i)(3)(D).
(o) Fee-Based Monitoring Period: The period commencing on the earlier of (i) prepayment of the Loan or (ii) maturity of the Loan, and continuing until the expiration of the Term.

(p) [50% AMI Unit: A unit that is rented to and occupied by, or is available for rent to and occupancy by, a Family with income at or below fifty percent (50%) of AMI.]

(q) Fiscal Year: The fiscal year of the Borrower ending _____.

(r) HUD: The United States Department of Housing and Urban Development.

(s) Lender's Limited Dividend Policy: The Lender's policy, so captioned, dated [September 2013], which is fully incorporated herein by reference. Notwithstanding anything in this Agreement to the contrary, in the event of any conflict between the terms of this Agreement and the terms of the Limited Dividend Policy, the terms of this Agreement shall control.

(t) Limited Dividend Distribution: The aggregate annual distributions permitted to be made to the Borrower from time to time as calculated pursuant to the Annual Limited Dividend Financial Report or as otherwise permitted pursuant to this Agreement.

(u) Limited Dividend Organization: Any applicant which proposes to sponsor housing under the Act and is not a public agency or non-profit corporation, and is eligible to receive a subsidy from a state or federal agency after a comprehensive permit has been issued and which, unless otherwise governed by a federal act or regulation, agrees to limit the dividend on the invested equity to no more than that allowed by the Lender's Limited Dividend Policy during the Limited Dividend Term. Lender acknowledges that Borrower qualifies as a Limited Dividend Organization by executing this Agreement and performing its obligations hereunder.

(v) Limited Dividend Term: The period commencing on the date of this Agreement and ending on the date that shall be [fifteen (15) years] from the date that the Mortgaged Property begins to generate Development Revenues, as such date shall be certified in writing by Borrower to Lender. The parties agree to execute a supplemental instrument in recordable form setting forth the precise Limited Dividend Term once the same is established. [longer of loan term or 15 years]

(w) Loan Closing Date: The date the Lender funds the Loan to the Borrower. The parties acknowledge that the deadline for the closing of the Loan is _____, unless extended by the Lender in writing.

(x) Loan Documents: As defined in the loan agreement to be entered into between Borrower and Lender (including, without limitation, this Agreement, but only during the period that the Loan is outstanding). During the period that the Loan is outstanding, in the event of any conflict between the terms of the other Loan Documents and this Agreement, the terms of the other Loan Documents shall control. Notwithstanding the use of the terms "Borrower" and "Lender" in this Agreement, the parties acknowledge and agree that this Agreement may remain in effect during the Fee-Based Monitoring Period, and at that time Lender and Borrower shall no longer have the relationship of borrower and lender, but Lender shall act solely in its capacity as the enforcer of this Agreement pursuant to 760 CMR 56.05(13).

(y) MAALD: The maximum allowable annual limited dividend as determined in accordance with Lender's Limited Dividend Policy.

(z) Mortgage: The Mortgage and Security Agreement to be recorded with respect to the Mortgaged Property.

(aa) Mortgage Debt: All sums due or required to be paid pursuant to the Loan Documents.

(bb) Municipality: The Town of _____, acting by and through its Zoning Board of Appeals.

(cc) Occupancy Requirements. As defined in Section 6(b).

(dd) Registry: The _____ Registry of Deeds [and/or the _____ County Registry of the Land Court].

(ee) Term: The period commencing on the date this Agreement is recorded at the Registry and ending on the later of (a) the date on which the Mortgage is discharged or (b) the date which is [thirty (30)] years from the Loan Closing Date, unless earlier terminated in accordance with Section 4 hereof, subject however, to the provisions hereof relative to the Limited Dividend

Term. [for new construction: 30 years][for substantial rehabilitation: loan term but minimum of 15 years]

3. Affordable Housing Restrictions. The Borrower intends, declares and covenants that, during the Term of this Agreement, this Agreement and the covenants and restrictions set forth in this Agreement regulating and restricting the use, occupancy and transfer of the Mortgaged Property (i) shall be and are covenants running with the Mortgaged Property, encumbering the Mortgaged Property for the Term of this Agreement, binding upon the Borrower, the Borrower's successors in title and all subsequent owners and operators of the Mortgaged Property; (ii) are not merely personal covenants of Borrower; and (iii) shall inure to the benefit of the Lender and its respective successors and assigns during the Term of this Agreement. The restrictions contained herein are intended to be construed as an affordable housing restriction as defined in Section 31 of Chapter 184 of the Massachusetts General Laws which has the benefit of Section 32 of said Chapter 184, such that the restrictions contained herein shall not be limited in duration by any rule or operation of law but rather shall run for the full Term hereof. Unless the covenants contained herein have been released by the Lender in writing, they shall survive and be effective for the Term of this Agreement regardless of whether any obligations owed to the Lender or to any assignees of the Lender in connection with the Loan have been fully paid and/or performed. The Borrower acknowledges that regardless of the duration of the Term of this Agreement, the Affordable Housing Units shall, pursuant to the Comprehensive Permit, remain affordable in "perpetuity", meaning for so long as the Housing Development is maintained and occupied on the Mortgaged Property as contemplated by the Comprehensive Permit. The Lender shall provide written notice to the Chief Executive Officer of the Municipality of the expiration of the Term of this Agreement at least six (6) months prior thereto.

4. Term and Effective Date.

(a) This Agreement shall become effective upon the recording of this Agreement with the Registry, and shall continue for the Term, notwithstanding any sale or refinance of the Mortgaged Property or payment or prepayment of the Loan and the obligations secured by the Mortgage. Notwithstanding the foregoing, the Lender may release and discharge this Agreement prior to the expiration of the Term if a regulatory agreement sufficient for the Mortgaged Property to comply with the requirements of the Act, its implementing regulations and DHCD guidance, as reasonably determined by Lender, is recorded in the Registry that, inter alia, provides for monitoring and enforcement of the requirements of the Comprehensive Permit and continued compliance by the Project with the Comprehensive Permit and the Act. Prior to any such release and discharge, notice of such regulatory agreement shall be sent to the Municipality, which may review any such regulatory agreement for compliance with the Act and the Comprehensive Permit. If, within twenty (20) days of receipt of any such regulatory agreement, the Municipality notifies Lender in writing that it believes such regulatory agreement does not comply with the Act or the Comprehensive Permit, Lender shall, in good faith, make all reasonable efforts to address the Municipality's concerns. Upon expiration of the Term of this Agreement, the rights and obligations of the Lender, its designee, successors and/or assigns hereunder with respect to the monitoring and enforcement of compliance with the terms hereof shall automatically terminate without the need of either party to execute or record any additional document. Notwithstanding anything to the contrary contained herein, any provision of this Agreement (the "Limited Dividend Provisions") relative to the limitation of the use or distribution of Development Revenues, and any reporting or enforcement rights with respect thereto (including without limitation, the provisions of Sections 11, 12 and 13(b) below) shall bind, and the benefits shall inure to, respectively, Borrower and Lender and their respective successors and assigns, only until the expiration of the Limited Dividend Term and the satisfaction of all obligations herein applicable during the Limited Dividend Term, upon which the Limited Dividend Provisions shall be of no further force and effect.

(b) In the event that the Loan does not close prior to the Loan Closing Date, as the same may be extended by Lender in writing, or in the event that Borrower at any time elects not to accept the Loan, but Borrower has constructed or still intends to construct the Housing Development, then (i) Borrower shall be required to obtain a replacement subsidy as may be required under the Act as expeditiously as is reasonably practical; and (ii) Borrower shall execute and record a replacement regulatory agreement with the entity providing such replacement subsidy. Simultaneously with the recording of the replacement regulatory agreement, Borrower and Lender shall execute and record a release and termination of this Agreement. The Borrower's failure to comply with this Section 4(b) shall be a default of this Agreement; provided, however that Borrower shall not be in default so long as it is using commercially reasonable efforts to obtain a replacement subsidy.

(c) In the event that Borrower or its successor in title elects not to construct the Housing Development on the Mortgaged Property pursuant to the Comprehensive Permit, then Borrower or its successor may notify Lender in writing that it intends not to exercise its rights under the Comprehensive Permit, and within thirty (30) days after receipt of such written notice, Lender shall execute, deliver and record a termination of this Agreement.

5. Priority of Agreement. This Agreement is senior to the Mortgage and to any other mortgage encumbering the Mortgage Property. In the event of foreclosure of the Mortgage or deed in lieu of foreclosure, the Lender may, at its option, unilaterally discharge this Agreement or subordinate this Agreement to the Mortgage, and the Borrower agrees to execute any documents required by Lender to so discharge or subordinate this Agreement. Furthermore, the Borrower understands and agrees that, in the event of foreclosure of the Mortgage and the exercise by the Lender of the Power of Sale therein, the Mortgaged Property will be sold subject to the restrictions imposed hereby unless the Lender exercises its rights to discharge or subordinate this Agreement prior to such sale. Notwithstanding the foregoing, the Lender shall not take any actions to discharge or terminate this Agreement if such actions would cause the units in the Housing Development to not comply with the Act or the Comprehensive Permit issued thereunder. Borrower acknowledges that any discharge or termination of this Agreement shall not affect the validity or enforceability of the Comprehensive Permit or the obligations of the Borrower to comply with the provisions thereof.

6. Restrictions. This section specifies a Family's eligibility to occupy an Affordable Housing Unit and the maximum rent that such a Family may be charged.

(a) The Borrower shall ensure that all Affordable Housing Units shall be of comparable quality to the other units in the Mortgaged Property (provided that the interior finishes of the Affordable Housing Units may differ from the market-rate units), [subject to and as further specified in the Comprehensive Permit] and shall be dispersed evenly throughout the Mortgaged Property as required by the Comprehensive Permit and as shown on the floor plans attached and incorporated into the Comprehensive Permit. If the Mortgaged Property is comprised of more than one building, each building shall have a proportionate share of Affordable Housing Units [, as required by the Comprehensive Permit]. The Affordable Housing Units shall include [_____ (__) single-room occupancy units], [_____ (__) studio apartments], [_____ (__) one-bedroom units],[_____(__) two-bedroom units], [_____(__) three-bedroom units], and [_____ (___) four-bedroom units]. The Borrower shall use commercially reasonable efforts to ensure that the Affordable Housing Units are, at all times, fully occupied and shall require that tenants occupy the Affordable Housing Units as their domiciles and principal residences.

(b) Income Restrictions. At least _____(_____) of the housing units in the Mortgaged Property shall be rented to Families whose annual incomes are equal to or less than [eighty percent (80%)][fifty percent (50%)] of AMI (the "Occupancy Requirements"). [If 80% AMI add: Notwithstanding

the foregoing, in the event that at the time the Borrower commences marketing the Affordable Housing Units for rental, the rents for such Affordable Housing Units are not at least ten percent (10%) below market rents as determined by Lender, the maximum income limit for Families renting Affordable Housing Units shall be reduced with a corresponding decrease in the initial maximum rents so that such rents are at least ten percent (10%) below market. Such maximum income limit shall become the Occupancy Requirement and remain effective for the Term.]

A Family's annual income will be the anticipated total income from all sources received by the Family head and spouse (even if temporarily absent) and by each additional member of the Family (other than children under the age of 18 years), including all net income derived from assets for the 12-month period following the effective date of certification of income. Annual income shall be determined in a manner consistent with either (i) the Section 8 Program or (ii) such other methodology approved by Lender; annual income specifically includes and excludes certain types of income as set forth in, and shall be determined in accordance with the regulations promulgated under the Section 8 Program (or any successor regulations) or in any other manner approved by Lender.

As a condition to occupancy, each potential tenant of an Affordable Housing Unit shall be required to sign and deliver to the Borrower an income certification using a form adopted for such use by the Borrower with the prior written consent of the Lender, such consent not to be unreasonably withheld or delayed.

If, after initial occupancy, the income of a tenant of an Affordable Housing Unit increases and, as a result of such increase, exceeds the maximum income permitted hereunder for such a tenant, the Borrower shall not be in default hereunder so long as either (i) the tenant income does not exceed one hundred forty percent (140%) of the maximum income permitted or (ii) the Borrower rents the next available unit at the Mortgaged Property as an Affordable Housing Unit in conformance with the Occupancy Requirements, or otherwise demonstrates compliance with the Occupancy Requirements.

(c) Rent Restrictions. The annual rental expense for each Affordable Housing Unit, including the provision of heat, electricity, water and hot water, shall not exceed thirty percent (30%) of the applicable income limit for the Affordable Housing Unit, adjusted for household size, assuming that a unit which does not have a separate bedroom is occupied by one individual, and that a unit which has one or more separate bedrooms is occupied by 1.5 individuals for each separate bedroom. However, the maximum annual rent for any Affordable Housing Unit shall not fall below the rent level set at the time that the Mortgaged Property is first occupied in accordance with this Agreement. Notwithstanding the above, if an Affordable Housing Unit has a subsidy commitment through the Section 8 Program, or any comparable rental assistance program, then the maximum rent shall be that permitted by the Section 8 Program, or the comparable program.

If, after initial occupancy, the income of a tenant in an Affordable Housing Unit increases, and as a result of such increase, exceeds one hundred forty percent (140%) of the maximum income permitted hereunder for such a tenant, at the expiration of the applicable lease term, the rent restrictions shall no longer apply to such tenant.

(d) Subsidized Housing Inventory. It is the intent of Borrower and Lender that all of the units in the Housing Development shall be included in the Subsidized Housing Inventory maintained by DHCD in accordance with current DHCD policies and DHCD regulations implementing the Act, but in no event shall Borrower be in breach or default under this Agreement due to any change in such policies or regulations which affect the counting of units.

7. Affirmative Marketing and Tenant Selection.

(a) The Borrower shall not discriminate on the basis of race, color, creed, religious creed, sex, age, handicap, marital status, sexual orientation, national origin or any other basis prohibited by law in the lease, use or occupancy of units at the Mortgaged Property, or in the employment or application for employment of persons for the operation and management of the Mortgaged Property. Prior to the Housing Development's construction loan closing and marketing any of the rental units at the Housing Development for rental the Borrower shall submit to Lender, and obtain the Lender's written approval of, an affirmative fair housing marketing and resident selection plan conforming to the requirements of the Act, its implementing regulations and applicable DHCD guidance, such approval not to be unreasonably withheld or delayed. Once approved, the affirmative fair housing marketing and resident selection plan shall be incorporated herein by reference as if fully set forth herein. Borrower shall notify Lender in writing at least thirty (30) days prior to commencing marketing of the rental units at the Housing Development. The Borrower's affirmative fair housing marketing and resident selection plan shall be implemented for the full Term of this Agreement and must at all times during the Term comply with all requirements of the Act and guidelines established by DHCD. The Borrower must, during the Term of this Agreement, demonstrate that it is qualified to implement the affirmative fair housing marketing and resident selection plan in accordance with applicable DHCD guidance. The affirmative fair housing marketing and resident selection plan shall be updated during the Term as required by applicable DHCD guidance. The Borrower shall advertise the availability of Affordable Housing Units in one or more newspapers that serve minority groups and other groups protected under fair housing laws and vacancies will be listed with fair housing organizations in such area. The Borrower shall select tenants for the Mortgaged Property in a fair and impartial manner, based on objective criteria made known to such tenants upon request. Written applications will be accepted and time stamped upon receipt, so that such applications may be considered in the order in which they were received; and a waiting list of applicants not accepted as tenants will also be established.

(b) [Consistent with the foregoing Section 7(a), the Borrower, in renting the Affordable Housing Units, will be allowed to give the maximum preference allowed by law to current residents of the Municipality, employees of the Municipality, employees of businesses located in the Municipality and households with children attending school in the Municipality (a "Local Preference"); provided that (i) Borrower shall only implement such a Local Preference in conformity with the fair housing requirements of HUD, DHCD, the Massachusetts Commission Against Discrimination, or any authority with jurisdiction and like purpose; and (ii) Municipality has provided to Borrower and Lender the information required to justify such a Local Preference in accordance with applicable laws, regulations and policies of Lender and DHCD.]

8. Management and Maintenance of the Mortgaged Property. For so long as the Loan is outstanding, the Borrower shall manage and maintain the Mortgaged Property in the condition required by the applicable provisions of the Loan Documents pertaining to management, operation and condition of the Mortgaged Property. During the Fee-Based Monitoring Period, the Borrower shall maintain the Housing Development in good physical condition in accordance with DHCD's requirements, the Comprehensive Permit and standards and the requirements of any subsequent mortgage lender, ordinary wear and tear and casualty excepted. The Borrower covenants, agrees and warrants that the Mortgaged Property and the Affordable Housing Units at all times shall be suitable for occupancy and in compliance with all applicable laws including, without limitation, health, safety and building codes. The Borrower hereby grants to the Lender and its duly authorized representatives the right to enter the Mortgaged Property and the Affordable Housing Units at reasonable times and upon reasonable notice for the purpose of inspecting the Mortgaged Property and the Affordable Housing Units to determine compliance and with this Agreement and to enforce the terms of this Agreement or to prevent, remedy or abate any violation of this Agreement.

9. Borrower's Representations, Covenants and Warranties. The Borrower hereby represents, covenants and warrants as follows:

(a) The Borrower (i) is a [corporation] [_____] duly organized under the laws of _____, and is qualified to transact business under the laws of the Commonwealth of Massachusetts; (ii) is and shall remain a sole purpose, single entity mortgagor; (iii) is and shall remain a Limited Dividend Organization during the Limited Dividend Term; (iv) has the power and authority to own its properties and assets and to carry on its business as now being conducted, and (v) has the full legal right, power and authority to execute and deliver this Agreement.

(b) The execution and performance of this Agreement by the Borrower (i) will not violate and has not violated any provision of law, rule or regulation, or any order of any court or other agency or governmental body, and (ii) will not violate and has not violated any provision of any indenture, agreement, mortgage, mortgage note, or other instrument to which the Borrower is a party or by which it or the Mortgaged Property is bound, and (iii) will not result and has not resulted in the creation or imposition of any prohibited encumbrance of any nature.

(c) The Borrower will, at the time of execution and delivery of this Agreement, have good and marketable title to the premises constituting the Mortgaged Property or an enforceable leasehold interest in the Mortgaged Property free and clear of any lien or encumbrance senior to this Agreement other than encumbrances approved by Lender in writing, such approval not to be unreasonably withheld, conditioned or delayed.

(d) There is no action, suit or proceeding at law or in equity or by or before any governmental instrumentality or other agency now pending, or, to the knowledge of the Borrower, threatened against or affecting it, or any of its properties or rights, which, if adversely determined, would materially impair its right to carry on business substantially as now conducted (and as now contemplated by this Agreement) or would materially adversely affect its financial condition.

10. Change in Composition of Borrower; Change in Use of Mortgaged Property; and Transfer of Mortgaged Property.

(a) During the period that the Loan is outstanding, the Borrower shall not, without the prior written consent of the Lender and modification to the Comprehensive Permit, change the type or number of residential units, or permit the use of the dwelling accommodations of the Mortgaged Property for any purpose except residential units and appurtenant uses, if any, permitted by the Comprehensive Permit (collectively, a "Use Change"). During the Fee-Based Monitoring Period, Borrower shall provide Lender with prompt notice of any amendment to the Comprehensive Permit effectuating a Use Change. So long as the Mortgaged Property is used for multi-family housing pursuant to the Comprehensive Permit, no Use Change shall result in the Mortgaged Property not meeting the requirements of the Act relative to the provision of Affordable Housing Units. In the case of casualty to all or a portion of the Mortgaged Property, Borrower shall not be required to restore any such casualty (except to the extent mandated by the Loan Documents), but if Borrower partially restores the Housing Development, the Borrower shall provide the appropriate percentage of Affordable Housing Units and unit mix based on the total number of units after such restoration. During the period that the Loan is outstanding, the Borrower shall not, without the prior written consent of the Lender, sell or otherwise transfer its interest or any part thereof in the Mortgaged Property, except to the extent permitted under any of the Loan Documents. In the event the Lender grants such consent when it is required, prior to any transfer of ownership of the Mortgaged Property or any portion thereof or interest therein, the Borrower agrees to secure from the transferee a written agreement stating that transferee will assume in full the Borrower's obligations and duties under this Agreement.

(b) During the Fee-Based Monitoring Period, the Borrower shall provide Lender with thirty (30) days prior written notice of the following:

(i) any change, substitution or withdrawal of any general partner, manager or agent of Borrower; or

(ii) the conveyance, assignment, transfer, or relinquishment of a majority of the Beneficial Interests (herein defined) in Borrower; or

(iii) any sale, conveyance, transfer, ground lease, exchange, pledge, assignment or mortgage of the Housing Development, whether direct or indirect, that materially affects the Borrower's obligations under this Agreement.

For purposes hereof, the term "Beneficial Interest" shall mean: (i) with respect to a partnership, any limited partnership interests or other rights to receive income, losses, or a return on equity contributions made to such partnership; (ii) with respect to a limited liability company, any interests as a member of such company or other rights to receive income, losses, or a return on equity contributions made to such company; or (iii) with respect to a company or corporation, any interests as an officer, board member or stockholder of such company or corporation to receive income, losses, or a return on equity contributions made to such company or corporation.

(c) The Mortgaged Property shall not be converted to a condominium or cooperative form of ownership, without modification of the Comprehensive Permit by the Municipality and, while the Loan is outstanding, the prior written consent of the Lender. During the Fee-Based Monitoring Period, if Borrower wishes to convert the Mortgaged Property to a condominium or cooperative form of ownership, Lender consent shall not be required, provided that Borrower obtains a replacement subsidizing agency in connection with such conversion to the extent that the Lender is unwilling to continue as the subsidizing agency upon such conversion.

11. Use of Development Revenues.

(a) During the Limited Dividend Term, all Development Revenues shall, if not held by the Lender in one of its accounts, be deposited in an account held in the name of Borrower or a nominee for Borrower in a bank or banks, whose deposits are insured by the Federal Deposit Insurance Corporation or otherwise deposited in funds and accounts established hereunder (a "Development Bank Account"). The Lender shall at all times be advised of the names of the accounts and the names of the banks. Development Revenues shall be used only in accordance with the provisions of this Agreement. Any person receiving Development Revenues other than as permitted by this Agreement shall immediately deposit such funds in a Development Bank Account, or failing to do so in violation of this Agreement, shall hold such funds in trust for the Mortgaged Property.

(b) During the Limited Dividend Term, Borrower shall apply Development Revenues in the following order of priority: (i) payment of or adequate reserve for all sums due or currently required to be paid under the terms of the Mortgage Debt; and (ii) payment of or adequate reserve for all reasonable and appropriate expenses of the Mortgaged Property as identified in Subsection (c), below. Any amounts remaining after application of Development Revenue as provided above shall be applied as provided in Section 12 below.

(c) With respect to the application of Development Revenues as described above, Borrower shall be allowed to use Development Revenues to pay for any and all taxes, impositions, services, supplies, or materials or other costs or liabilities incurred in the ownership, operation, management, maintenance and improvement of the Mortgaged Property, provided:

(i) Payment for any and all services, supplies, or materials shall not exceed the amount ordinarily and reasonably paid for such services, supplies, or materials in the area where the services are rendered or the supplies or materials furnished;

(ii) Reasonable and necessary expenses which may be payable pursuant to subsection 11(c)(i), above, shall be directly related to the operation, maintenance or management of the Mortgaged Property; and

(iii) Without the Lender's prior written consent, Borrower may not assign, transfer, create a security interest in, dispose of, or encumber any Development Revenues except as expressly permitted herein.

(d) In operating the Mortgaged Property during the Limited Dividend Term, except with regard to (i) Limited Dividend Distributions, or (ii) proceeds of any sale, financing or other capital transaction not subject to provisions of this Agreement relative to Limited Dividend Distributions, Borrower shall not use any Development Revenues to pay any liability, either direct or contingent, that is not related to the Mortgaged Property or the Housing Development.

(e) Repayment of developer's fee loaned is treated as a Limited Dividend Distribution and is subject to the limitations set forth herein.

12. Limited Dividend Distributions

(a) Timing and Conditions. Except as provided in subparagraph (h) below, during the Limited Dividend Term no distributions may be made to the Borrower other than Limited Dividend Distributions. Except as provided in subparagraphs (c), (e) and (h) below, Limited Dividend Distributions may be made: (i) only following completion of the Fiscal Year; (ii) only once all currently payable amounts as identified in Section 11 (c) above are paid as evidenced by a certificate provided by an independent accountant certifying that no such obligations are more than thirty (30) days past due and that there are no outstanding material extraordinary obligations incurred outside the ordinary course of business, even if thirty (30) or less days past due; and (iii) only after submission by Borrower of the Annual Limited Dividend Financial Report pursuant to Paragraph 13(b) below and receipt by Borrower of written notice from Lender approving said report (such approval to be given, or any alleged deficiency identified, within thirty (30) days after Lender's receipt of a complete Annual Limited Dividend Report).

(b) Restrictions on Distributions. During the Limited Dividend Term no Limited Dividend Distribution for any Fiscal Year may exceed ten percent (10%) of Borrower's Equity. For so long as the Loan is outstanding, no Limited Dividend Distributions may be made when: (i) a default or an event of default has occurred and is continuing under any Loan Document; (ii) where there has been failure to comply with the Lender's notice of any reasonable requirement for proper maintenance of the Mortgaged Property; or (iii) there is outstanding against all or any part of the Mortgaged Property any lien or security interest other than a lien securing the Loan or a lien expressly permitted under the Loan Documents. During the Fee-Based Monitoring Period, no Limited Dividend Distributions may be made when: (i) a Default or an Event of Default has occurred and is continuing under this Agreement; or (ii) where there has been failure to

comply with the Lender's notice of any reasonable requirement for proper maintenance of the Mortgaged Property.

(c) Monthly Limited Dividend Distributions. Notwithstanding anything to the contrary in this Agreement, Limited Dividend Distributions may be made to Borrower at any time during a Fiscal Year, and as often as monthly, based on an operating budget for the Housing Development prepared by Borrower and approved by Lender. In the event Borrower's Annual Limited Dividend Financial Report demonstrates that the aggregate amount so distributed to Borrower during the applicable Fiscal Year exceeds ten percent (10%) of Borrower's Equity, then not later than ten (10) business days after receipt of Lender's notification to the Borrower, Borrower shall deposit into the Excess Equity Account a sum equal to the difference between the amount actually distributed and the maximum allowable Limited Dividend Distribution for the applicable Fiscal Year.

(d) Recalculation of Borrower's Equity. For the purposes hereof the amount of "Borrower's Equity" shall be as set forth in Section 2(e) of this Agreement, as the same may be adjusted from time to time, as determined by and in accordance with Lender's Limited Dividend Policy. The parties acknowledge that Borrower's Equity is based on projected project costs and will be updated on or before the Loan Closing Date to reflect actual costs or as-complete appraised value, as Borrower shall elect. Thereafter, Borrower's Equity may be adjusted from time to time pursuant to the Lender's Limited Dividend Policy; provided, however, that if the Lender's Limited Divided Policy later is amended to allow for more frequent adjustments to Borrower's Equity, the Borrower shall be allowed to make adjustments to Borrower's Equity at such times as are allowed under the amended Limited Dividend Policy.

(e) Excess Equity. In the event that the amount available for Limited Dividend Distribution in a given Fiscal Year exceeds the Limited Dividend Distribution permitted for such Borrower's Fiscal Year pursuant to Section 12(b) above, such excess shall be deposited and administered in accordance with Section 12(f) below. Amounts deposited into the Excess Equity Account may, subject to subsections (a) through (c) above, and pursuant to the Lender's Limited Dividend Policy, be distributed by the Lender to the Borrower in amounts equal to the difference between the amount by which Limited Dividend Distributions actually made in any prior Fiscal Year were less than the amount permitted to be distributed under Section 12(b) hereof for such Fiscal Year, plus simple interest in accordance with the Lender's Limited Dividend Policy. In the event that annual net cash flow as determined in pursuant to the Annual Limited Dividend Financial Report is insufficient to allow the Borrower to take its MAALD, and there are funds in the Excess Equity Account, Lender shall distribute to Borrower an amount equal to the unpaid portion of the MAALD for such Fiscal Year, provided that, in no event shall the amount so distributed exceed the amount available in the Excess Equity Account.

(f) Excess Equity Account. Any Excess Equity shall be deposited in the Excess Equity Account. No distributions may be made to Borrower from the Excess Equity Account except those permitted pursuant to Section 12(e) hereof. For so long as the Loan is outstanding, upon the occurrence of an event of default under the Loan Documents, the Lender may apply any amounts in the Excess Equity Account to the payment of all or any portion of the Mortgage Debt. During the Fee-Based Monitoring Period, the Lender may, in its sole discretion, make amounts available from the Excess Equity Account to pay all or a portion of the annual monitoring fee that remains outstanding thirty (30) days after its due date. Upon Borrower's request, amounts may also be withdrawn from the Excess Equity Account during the Term hereof and applied for the following purposes: (i) payment of or adequate reserve for all sums due or currently required to be paid under the terms of the Mortgage, or during the Fee-Based Monitoring Period, any mortgage on the Mortgaged Property; (ii) payment of or adequate reserve for all reasonable and necessary operating expenses of the Housing Development as reasonably determined by Borrower; (iii) deposit of all amounts as may be deposited in a reserve fund for capital replacements reasonably determined by Borrower to be sufficient to

meet anticipated capital needs of the Housing Development which may be held by Lender or a lending institution reasonably acceptable to Lender and which reserves shall be used for capital expenditures for the Housing Development reasonably determined to be necessary by the Borrower; (iv) payment of operating expense loans made by the partners, managers or members of Borrower for expenses of the Housing Development, provided that Borrower shall have obtained prior written approval for such loans from the Lender (or, during the Fee-Based Monitoring Period, from the holder of the mortgage loan encumbering the Mortgaged Property and if there is no mortgage, from Lender) and shall have supplied the applicable lender with such evidence as the applicable lender may reasonably request as to the application of the proceeds of such operating expense loans to the Housing Development; or (v) for any other purposes, subject to a determination by the Lender (or during the Fee-Based Monitoring Period, from the holder of the mortgage loan encumbering the Mortgaged Property and if there is no mortgage, from Lender) that the expenditure if necessary to address the Housing Development's physical or financial needs and that no other Housing Development reserve funds are available to address such needs. Notwithstanding the foregoing, payment of the items set forth in clauses (i), (ii), (iii) and (v) above by the Borrower shall be subject to the prior written approval of Lender, which approval shall not be unreasonably withheld or delayed; it being agreed by Lender that if the Borrower can demonstrate that its proposed operating expenditures, capital expenditures and reserves are substantially consistent with those made for other comparable housing developments in the Commonwealth of Massachusetts, Lender shall approve such request. Further, in no event shall such review or approval be required by Lender to the extent such capital expenditures or reserves are mandated by the holder of any mortgage loan encumbering the Mortgaged Property during the Fee-Based Monitoring Period.

Further, Lender agrees that it shall not unreasonably withhold or delay its consent to release of any amounts held in the Excess Equity Account, upon the written request of the Borrower that: (i) provide a direct and material benefit to tenants in the Affordable Housing Units; or (ii) reduce rentals to tenants in the Affordable Housing Units.

In the event that Lender's approval is requested pursuant to this Section 12(f) for expenditures out of the Excess Equity Account, and Lender fails to respond within thirty (30) days of Lender's receipt thereof, then Lender shall be deemed to have approved the request, and Lender shall have no further rights to object to, or to place conditions upon, the same.

In any event, cash available for distribution in any year in excess of twenty percent (20%) of Borrower's Equity, subject to payment of accumulated and unpaid Limited Dividend Distributions, shall be distributed to the Municipality within fifteen (15) business days of notice and demand given by Lender as provided herein, or as otherwise directed by Lender. Upon the expiration of the Limited Dividend Term, any balance remaining in the Excess Equity Account shall, if deemed necessary by Lender to address current or future physical needs at the Housing Development, be deposited in the Housing Development's replacement reserve account or, if not deemed necessary by the Lender for such purpose, distributed to the Municipality for the purpose of developing and/or preserving affordable housing.

(g) Lender's Interest in Excess Equity. All funds in the Excess Equity Account shall be considered additional security for the performance of obligations of the Borrower under the Loan Documents and the Borrower hereby pledges and grants to Lender a continuing security interest in said funds. Furthermore, the Borrower recognizes and agrees that (i) possession of said funds by the Lender constitutes a bona fide pledge of said funds to the Lender for security purposes, (ii) to the extent required by applicable law, this Agreement, in combination, as necessary, with other documents referred to herein, constitutes a valid and binding security agreement, and (iii) the validity and effectiveness of said pledge will not be compromised if said funds are held in a bank or other financial institution. The Borrower further acknowledges and agrees that, notwithstanding any nomenclature or title given to the Excess Equity Account by the bank or other financial institution at which the Excess Equity Account is held, or the fact that the

Borrower's tax identification number is used with respect to the Excess Equity Account, the Lender, and not the Borrower, shall be the customer of the bank or other financial institution holding the Excess Equity Account; such bank or other financial institution shall comply with instructions originated by the Lender directing the disposition of funds in the Excess Equity Account, without further consent of the Borrower; and the Lender, and not the Borrower, shall have the exclusive right to withdraw funds from the Excess Equity Account.

(h) Distributions from Certain Capital Events. Notwithstanding anything to the contrary contained in this Agreement, a distribution resulting from the proceeds of a sale or refinancing of the Mortgaged Property shall not be deemed to be a Limited Dividend Distribution, and shall not be regulated by this Agreement. A sale or refinancing shall not result in a new evaluation of Borrower's Equity. In clarification of the preceding sentence, upon any refinancing, the amount of Borrower's Equity shall remain the same, notwithstanding the fact that the amount of the mortgage loan secured by the Mortgaged Property may change. Per Lender's Limited Dividend Policy, a re-evaluation of Borrower's Equity shall occur no more frequently than once every five (5) years, and only pursuant to the methodology set forth in said policy.

13. Information.

(a) The Borrower covenants and agrees to secure and maintain on file for inspection and copying by the Lender such information, reports and certifications as the Lender may reasonably require in writing in order to insure that the Occupancy Requirements contained herein are being complied with. The Borrower further covenants and agrees to submit to the Lender annually, or more frequently if required in writing by the Lender, reports detailing such facts as the Lender reasonably determines are sufficient to establish compliance with the restrictions contained hereunder, copies of leases for all Affordable Housing Units, and a certification by the Borrower that, to the best of its knowledge, the restrictions contained herein are being complied with. The Borrower further covenants and agrees promptly to notify the Lender if the Borrower discovers noncompliance with any restrictions hereunder.

(b) In addition to the financial information required to be furnished by the Borrower to the Lender pursuant to the Loan Documents and Section 13(a) above, the Borrower shall furnish to the Lender, during the Limited Dividend Term, within ninety (90) days of the end of its Fiscal Year, an audited Annual Limited Dividend Financial Report. The Lender's agreement to waive or modify the requirement of an audited Annual Limited Dividend Financial Report for a given year shall not be deemed to constitute a waiver or modification of the requirement of an audited Annual Limited Dividend Financial Report in any subsequent year. Should the Borrower fail in any given year to comply with its obligations under this subparagraph, the Borrower acknowledges and agrees that such failure constitutes a knowing waiver and relinquishment of any Limited Dividend Distributions to which it might otherwise be entitled for such year pursuant to Sections 12(c) and/or 12(e) above.

(c) Annually, during the Term, no later than September 30, the Borrower shall submit to DHCD, via the web-based annual reporting system located at https://hedhsgdevannualreport.azurewebsites.net/, or as otherwise instructed, an annual report containing the following in a form approved by DHCD and containing such supporting documentation as DHCD shall require:

(i) Data required by DHCD regulations at 760 CMR 61.00 promulgated pursuant to Chapter 334 of the Acts of 2006 (the "Data Collection Act") and all applicable DHCD directives, guidelines and forms as may be amended from time to time and such data fields as are contained in the web-based system. The Borrower shall collect said data for the express purpose of reporting to DHCD, and the collection and reporting of said data shall comply with said regulations, directives, guidelines and forms.

(ii) The Borrower shall submit such additional reports to DHCD as deemed necessary to ensure compliance with the Data Collection Act and the regulations promulgated thereunder.

(iii) A certification by the Borrower or the Borrower's managing agent that the information submitted pursuant to this Subparagraph (c) is true and accurate.

The Lender and the Borrower shall treat as confidential any of the foregoing information relating to a specific tenant or Affordable Housing Unit in compliance with all applicable state and federal statutes and regulations, including, without limitation, M.G.L c. 66A, and shall implement adequate systems and procedures for maintaining the confidentiality of such information (but the Lender and Borrower may release general statistical and other information about the Mortgaged Property, so long as the privacy rights and interests of the individual tenants are protected). The Lender and the Borrower shall not use any of the information obtained and/or furnished pursuant to Subparagraph (c) for any purpose described in the federal Fair Credit Reporting Act (15 U.S.C. §1681a(d)(1)) and Section 603(d)(1) of Public Law No. 91-508 or in any manner that would cause a lender or borrower to be considered a "consumer reporting agency" under the federal Fair Credit Reporting Act (15 U.S.C. §1681a(f) and 603(f) of Public Law No. 91-508).

14. Monitoring.

(a) For the period commencing on the date this Agreement is recorded, and continuing until the earlier of (i) the maturity of the Loan or (ii) repayment of the Loan, the Lender shall monitor the Borrower's compliance with this Agreement at no cost to the Borrower.

(b) For the duration of the Fee-Based Monitoring Period, the Lender, its designee or assignee shall continue to monitor the Borrower's compliance with all or a portion of the ongoing requirements of this Agreement. As partial compensation for its services in monitoring compliance with this Agreement, on or about commencement of the Fee-Based Monitoring Period, the Lender shall invoice the Borrower for the annual monitoring services fee (calculated in accordance with subparagraphs (c) and (d) below) due to be paid by the Borrower to the Lender for the portion of the calendar year remaining after commencement of the Fee-Based Monitoring Period. Thereafter, for each calendar year of the Fee-Based Monitoring Period, the Lender shall, after publication of the CPI-U, invoice the Borrower for the annual monitoring services fee due for such calendar year. The Borrower shall pay such invoice in full within thirty (30) days of the date of the invoice. The Borrower's failure or refusal to pay the monitoring fee to the Lender in a timely manner shall constitute an Event of Default hereunder.

(c) The base monitoring fee is $150.00 per Affordable Housing Unit per year (the "Base Fee"). The annual invoice shall state the monitoring services fee calculated by multiplying the most recent Adjusted Base Fee, defined below, by the total number of Affordable Housing Units. The Base Fee shall be adjusted annually (commencing with the year following the Loan Closing Date), following publication of the CPI-U for the immediately preceding calendar year by the Bureau of Labor Statistics yielding, for each year, an "Adjusted Base Fee". The Lender shall furnish the Borrower annually with a Notice of Adjusted Base Fee (designated, by way of example: "Adjusted Base Fee: Year 2011"), beginning in the year following the Loan Closing Date. The initial adjustment to the Base Fee shall be calculated by multiplying the Base Fee by the lesser of (a) 110% or (b) (1+ CPI-U) for the immediately preceding calendar year. Adjustments to the Adjusted Base Fee for each subsequent year shall be made by multiplying the most recent Adjusted Base Fee (as set forth in the Lender's most recent Notice of Adjusted Base Fee) by the lesser of (a) 110% or (b) (1 + CPI-U) for the immediately preceding calendar year.

(d) If the Bureau of Labor Statistics should cease to publish such the CPI-U in its present form and calculated on the present basis, a comparable price index or a price index reflecting changes in the cost of living determined in a similar manner shall be chosen at the sole discretion of the Lender, with notice to the Borrower. The level of the CPI-U or comparable price index as of any day relevant to the application of any part of this Section dealing with an "adjustment" shall be that published by the Bureau of Labor Statistics for the immediately preceding calendar year.

(e) The Borrower acknowledges that in performing its monitoring services hereunder the Lender is not acting as agent or fiduciary for the Municipality, and any waiver by the Lender of any requirement hereunder shall not be binding upon the Municipality and shall not be deemed a waiver of any obligation of the Borrower under the Comprehensive Permit.

(f) The Lender may, from time to time, and after notice to the Municipality, engage the service of a qualified third party monitoring agent for purposes of monitoring the Borrower's performance under this Agreement. If, within twenty (20) days of receipt of any such notice, the Municipality notifies Lender in writing that it believes that such proposed monitoring agent is not properly qualified, Lender shall, in good faith, make all reasonable efforts to address the Municipality's concerns. In the event a third party monitoring agent is engaged, such monitoring agent shall have authority to act in all matters relating to the Lender's obligations under this Agreement and shall apply and adhere to the standards and policies of DHCD relative to the administrative responsibilities of subsidizing agencies under the Act. Such monitoring agent shall not be held liable for any action taken or omitted under this Agreement so long as it shall have acted in good faith and without gross negligence.

15. Enforcement.

(a) If the Lender provides written notice in accordance with Section 19 hereof of any default, violation or breach of any provision of this Agreement by the Borrower ("Default") and such Default is not cured to the satisfaction of the Lender within thirty (30) days after the giving of notice to the Borrower or such a longer period of time as is necessary to cure such Default so long as Borrower is diligently and continuously pursuing a cure ("Event of Default"), the Lender may apply to any court, state or federal, for specific performance of this Agreement or an injunction against any violation of this Agreement, or for such other relief as may be appropriate, since the injury to the Lender arising from the default under any of the terms of this Agreement would be irreparable and the amount of damages cannot be ascertained and/or compensated by money alone; and the Lender may exercise any other remedy at law or in equity or take any other action as may be necessary or desirable to correct noncompliance with this Agreement; or Lender may terminate this Agreement.

(b) In the event the Lender brings an action to enforce this Agreement and prevails in any such action, the Borrower shall pay all fees and expenses, including reasonable attorneys' fees and costs of the Lender (including court costs and the time of any in-house counsel of Lender charged at the same rate as comparable outside attorneys).

(c) The Borrower hereby grants to the Lender or its designee or agent the right to enter upon the Mortgaged Property at reasonable times and upon reasonable notice for the purpose of monitoring and enforcing the terms of this Agreement or to prevent, remedy or abate any violation of this Agreement.

(d) No act or omission by the Lender other than a writing signed by it waiving a breach by the Borrower shall constitute a waiver thereof.

16. Successors and Assigns. This Agreement shall bind and the benefits shall inure to the Borrower and the Lender, and their respective successors and assigns for the Term of this Agreement. Upon a sale or other conveyance of the Mortgaged Property, the new owner shall assume and perform all of the duties and obligations of the Borrower pursuant to this Agreement arising or accruing on or after the date of such sale or other conveyance. The prior owner shall have no obligation or liability under this Agreement by reason of any action, inaction or default which occurs on or after the date of the sale or other conveyance. Any successor owner must demonstrate that it is qualified to implement the Housing Development's affirmative fair housing marketing and resident selection plan in accordance with applicable DHCD guidance.

17. Amendment and Modification. This Agreement may not be modified or amended except in a writing signed by the Lender and the Borrower or by their respective successors and assigns. Notice of such amendment shall be sent to the Municipality, which may review the form for compliance with the Act and the Comprehensive Permit. If, within twenty (20) days of receipt of any such amendment, the Municipality notifies Lender in writing that it believes such amendment does not comply with the Act or the Comprehensive Permit, Lender shall, in good faith, make all reasonable efforts to address the Municipality's concerns.

18. Limitation on Liability and Indemnification.

(a) The Lender shall not be liable for any action taken or omitted under this Agreement so long as its actions do not constitute gross negligence or willful misconduct. Subject to the foregoing, the Borrower indemnifies and holds the Lender harmless of, from and against all damages, costs, claims and liabilities, including reasonable attorneys' fees and costs, asserted against the Lender arising from, relating to or in connection with this Agreement and/or the Mortgaged Property.

(b) Notwithstanding anything in this Agreement to the contrary, upon the occurrence of any breach or default by Borrower hereunder, the Lender will look solely to the Mortgaged Property for satisfaction of any judgment against Borrower and no officer, partner, manager, member, agent or employee of Borrower shall have any personal liability hereunder or for the performance of any obligation of Borrower hereunder. Nothing in this paragraph shall affect or derogate from Lender's rights against any guarantor or any other party who may have liability under the Loan Documents while the Loan is outstanding.

19. Notices. All notices to be given pursuant to this Agreement shall be in writing and shall be hand-delivered by a reputable delivery service or sent by certified or registered mail, return receipt requested, to the parties hereto at the addresses set forth on the first page of this Agreement or to such other place as the Lender or the Borrower from time to time designate in writing in accordance with this provision. A notice shall be deemed received on the date of delivery.

20. Severability. All rights, powers and remedies provided herein may be exercised only to the extent that exercise thereof does not violate any applicable law, and are intended to be limited to the extent necessary so that they will not render this Agreement invalid, illegal, unenforceable or not entitled to be recorded, registered, or filed under applicable law. If any provision or part hereof shall be determined to be invalid, illegal or unenforceable, this Agreement shall be construed as if such invalid, illegal or unenforceable provision or part thereof has not been contained herein.

21. Governing Law. This Agreement shall be governed by the laws of the Commonwealth of Massachusetts.

22. Recording. Borrower, at its cost and expense, shall cause this Agreement to be duly recorded or filed and rerecorded or refiled at the Registry and shall pay or cause to be paid all recording, filing, or other taxes, fees and charges, and shall comply with all such statutes and regulations as may be required by law in order to establish, preserve and protect the ability of the Lender to enforce this Agreement. Borrower shall provide Lender with satisfactory evidence that there are no mortgages or other encumbrances senior to this Agreement.

23. Applicability. Notwithstanding anything to the contrary in this Agreement, Lender and Borrower agree that this Agreement shall be given effect and shall apply to the Mortgaged Property only if and to the extent that the Borrower or Borrower's successor in title constructs the Housing Development on the Mortgaged Property. Nothing in this Agreement shall require the construction of the Housing Development nor preclude the Borrower from using the Mortgaged Property for any other purpose.

IN WITNESS WHEREOF, the parties have caused this Agreement to be signed and sealed by their respective, duly authorized representatives, as of the date and year first written above.

BORROWER:

_____

By: _____

Name:_____

Title:_____
Hereunto Duly Authorized

LENDER:
MASSACHUSETTS HOUSING
PARTNERSHIP FUND BOARD

By: _____

Name:_____

Title:_____
Hereunto Duly Authorized

COMMONWEALTH OF MASSACHUSETTS

_____, ss. _____,201_

On this ____ day of _____, 201_, before me the undersigned notary public, personally appeared the above-named _____, _____ of _____, proved to me by satisfactory evidence of identification, consisting of: [circle one] (a driver's license) (a passport) (my personal knowledge) (other: _____), to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he/she signed it voluntarily for its stated purpose.

_____
Notary Public:
My Commission Expires:
SEAL

COMMONWEALTH OF MASSACHUSETTS

_____, ss. _____,201_

On this ____ day of _____, 201_, before me the undersigned notary public, personally appeared the above-named _____, _____ of the Massachusetts Housing Partnership Fund Board, proved to me by satisfactory evidence of identification, consisting of: [circle one] (a driver's license) (a passport) (my personal knowledge) (other: _____), to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he/she signed it voluntarily for its stated purpose.

_____
Notary Public:
My Commission Expires:
SEAL

[**ACKNOWLEDGEMENT OF ZONING BOARD OF APPEALS**

The undersigned duly authorized Chair of the _____ Zoning Board of Appeals hereby acknowledges that the foregoing Agreement ("Agreement") satisfies the requirements for a "Regulatory Agreement" in the Comprehensive Permit, as defined therein, and that the Comprehensive Permit is subject to M.G.L. Chapter 40B, Sections 20-23; 760 CMR 56.00; and the Comprehensive Permit Guidelines issued by the Massachusetts Department of Housing and Community Development (DHCD) (collectively, the "Comprehensive Permit Rules"). Without limiting the generality of the foregoing, the units in the Housing Development required to be affordable under the Comprehensive Permit shall be affordable if such units are rented in accordance with the Agreement; any local preference set forth in the Comprehensive Permit shall be implemented only in compliance with applicable state and federal fair housing rules and the Comprehensive Permit Rules; compliance with the Agreement shall be determined solely by the Lender during the initial thirty (30) year term in accordance with the Comprehensive Permit Rules; and the transfer of the Comprehensive Permit shall be governed exclusively by the Comprehensive Permit Rules. In addition, the Agreement shall control over the Comprehensive Permit with respect to any matter which is addressed by the Agreement.

_____

Name:
Chair, _____ Zoning Board of Appeals

COMMONWEALTH OF MASSACHUSETTS

_____, ss.

On this ___ day of _____, 2014, before me, the undersigned notary public, personally appeared _____, the Chair of the _____ Zoning Board of Appeals, proved to me through satisfactory evidence of identification, which was [a current driver's license][a current U.S. passport][my personal knowledge], to be the person whose name is signed on the preceding instrument and acknowledged the foregoing instrument to be his or her free act and deed.

_____

Notary Public
My commission expires:]

EXHIBIT A

(Mortgaged Property Description)

SECTION 9

LIST OF EXCEPTIONS TO THE ZONING BYLAWS AND
OTHER LOCAL LAND USE REQUIREMENTS

445 HARVARD
PROPOSED WAIVER LIST
L-1.0 Zoning District
March 2017

Brookline Zoning By-Laws				
Bylaw Section	**Requirement**	**Requested Waiver(s)**	**Details of Proposal Requiring Waiver**	**Waiver Number**
§4.08	Affordable Housing Requirements	Waiver to allow affordable housing requirements under Chapter 40B, rather than under 4.08.	The Development is a multi-family housing development under c.40B, so the affordable housing requirements are governed by the comprehensive permit.	A
§5.09	Design Review	Design Review requirements not applicable under M.G.L. c. 40B.	Comprehensive Permit, as may be granted by Zoning Board of Appeals shall provide all local permits per M.G.L. c. 40B § 20-23.	B
Table §5.01	Maximum Floor Area	Waiver from maximum ratio of gross floor area to lot area (1.0 in L-1.0 District)	The Development is on a 10,115± sf. lot and will have a floor area ratio of approximately 3.44	C
Table §5.01	Maximum Height of Buildings	Waiver from maximum building height limitations (40’ in L-1.0 District)	The height of the Development will be 58’ at its maximum.	D
Table 5.01	Minimum Front Yard	Waiver from 10’	The proposed front yard is 1’-5”’	E
Table 5.01	Minimum Side Yard	Waiver from 10’+L/10’	The proposed side yard is 5’	F
Table 5.01	Minimum Rear Yard	Waiver from 30’	The proposed rear yard is 5’	G
Table 5.01	Maximum Building Stories	N/A	5 stories are proposed	H
Table 5.01	Maximum Lot Coverage	Waiver from 80%	79% proposed lot coverage	I
Table 5.01	Minimum Open Space (landscaped)	Waiver from 10%	14.5% proposed	J
Table 5.01	Minimum Open Space (usable)	Waiver from 20%	0% proposed	K

Table 6.02	Parking Spaces	Waiver to from 1.5 spaces/unit	The proximity to public transportation and the parking lots nearby allow for a lower parking ratio	L
§3.17	Department of Public Works	Waiver from the Department of Public Works site plan approval process, curb cut procedure, tree removal, and construction and maintenance related parking permits.	Comprehensive Permit, as may be granted by Zoning Board of Appeals shall provide all local permits per M.G.L. c. 40B § 20-23.	M