DRAINAGE REPORT

Walker Center

169 Grove Street and 144 Hancock Street

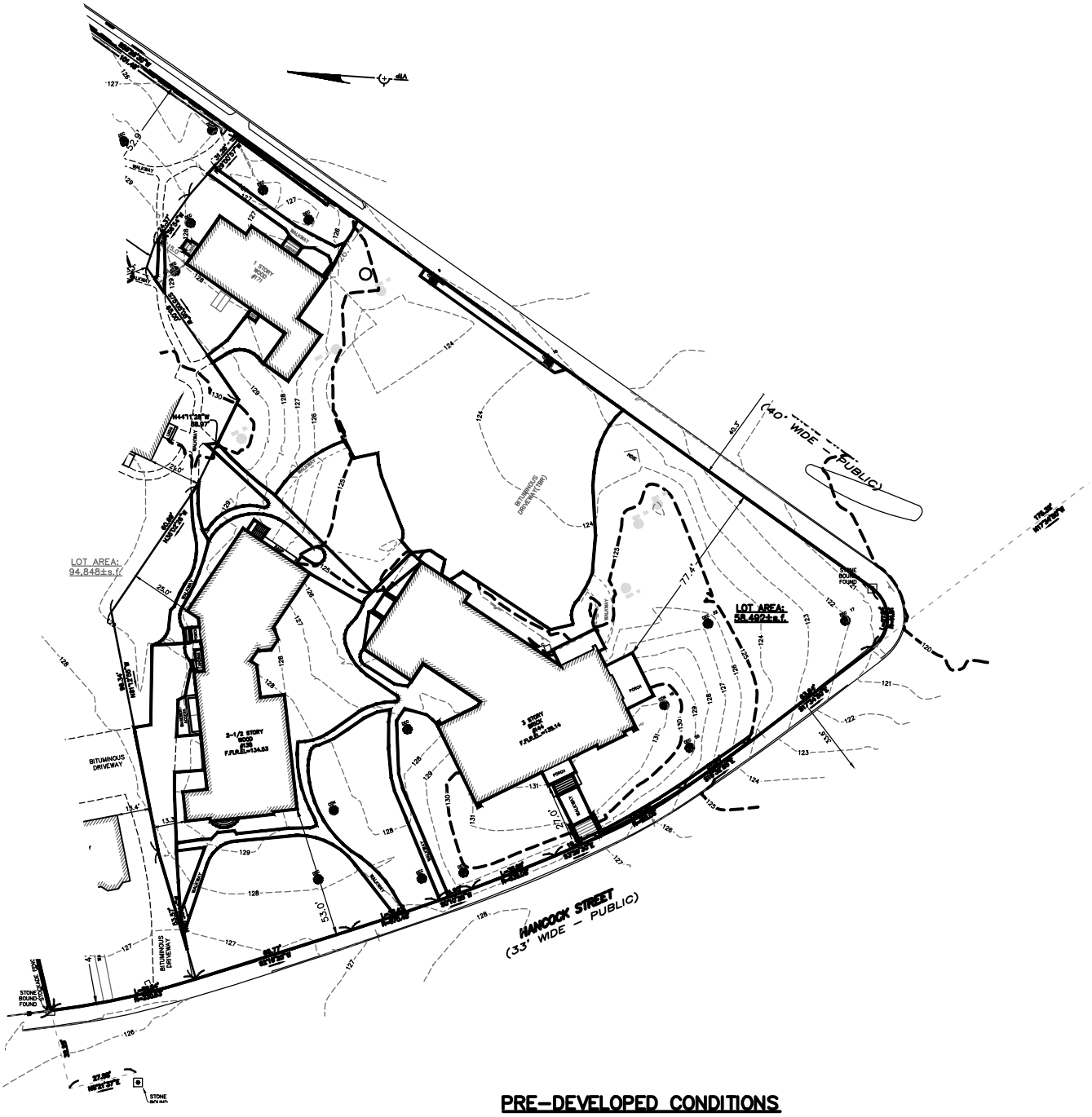
Newton, Massachusetts

Date: May 1, 2022

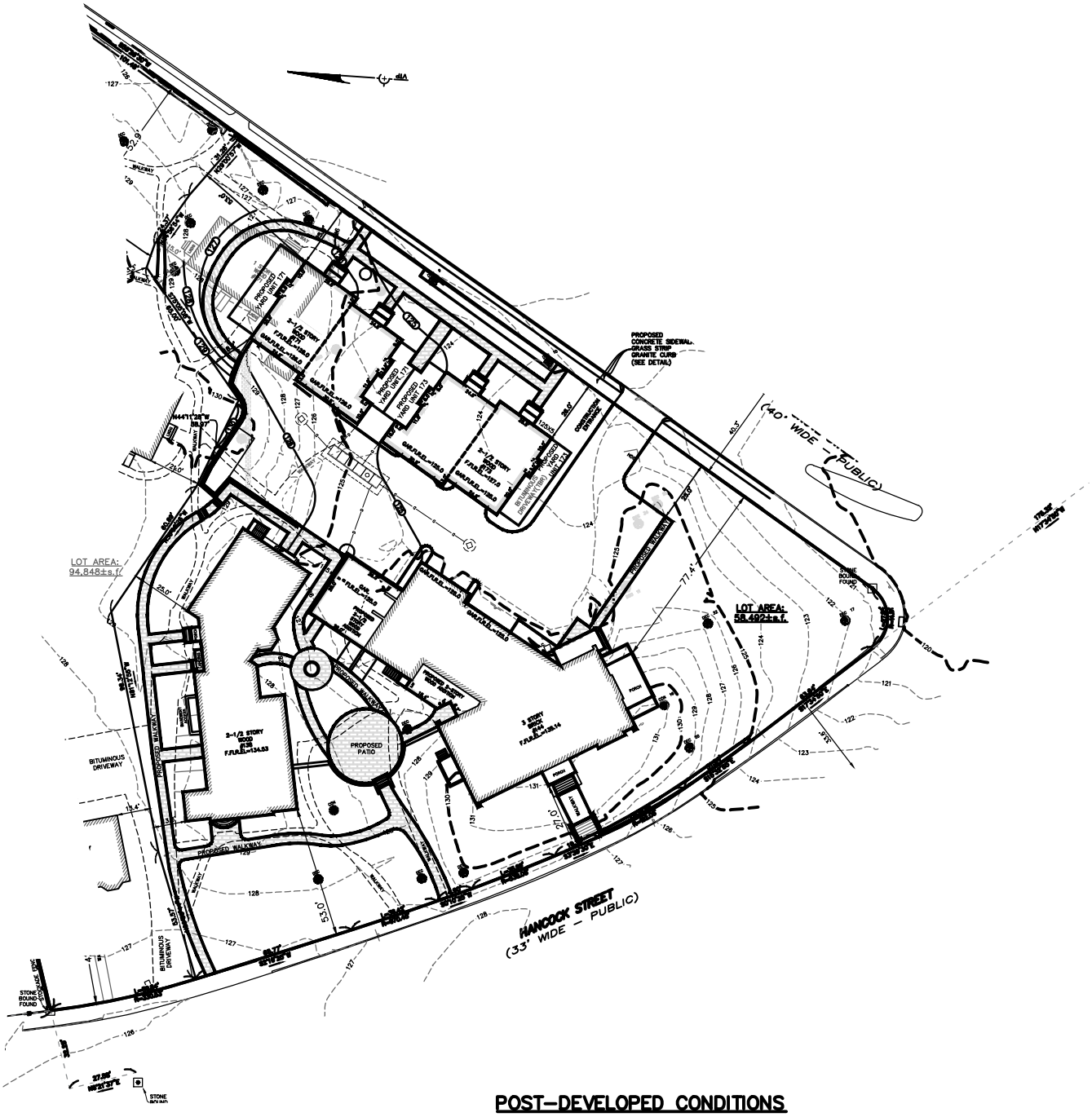
Prepared by:
Natalie Doyle

Reviewed by:
Marc Besio, PE, SIT

VTP Associates, Inc.
132 Adams Street
2nd Floor, Suite 3
Newton Massachusetts 02465
1-617-332-8271
Job # 220214



PRE-DEVELOPED CONDITIONS



POST-DEVELOPED CONDITIONS

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IMPERVIOUS AREAS

Date: Date: May 1, 2022

Address: Walker Center

Project: 220214

Impervious Areas	Existing	Proposed
Buildings #138	3,728.0 s.f.	3,728.0 s.f.
Buildings #144	5,115.0 s.f.	6,149.0 s.f.
Buildings #171	0.0 s.f.	2,006.7 s.f.
Buildings #173	1,578.0 s.f.	2,009.0 s.f.
North Driveway	1,313.0 s.f.	0.0 s.f.
South Driveway/Parking Lot	13,266.0 s.f.	8,851.0 s.f.
Walkways, patios	3,107.0 s.f.	4,732.0 s.f.
Landing, stairs	307.0 s.f.	439.0 s.f.
A.C. Unit	6.3 s.f.	6.3 s.f.
Retaining Walls	276.0 s.f.	389.0 s.f.
Total	**28,696.3 s.f.**	**28,310.0 s.f.**
	0	

Increase in Impervious Area: 28,310.0 - 28,696.3 = -386.3 s.f.

Lot area: 58,492.0 s.f.

4% of lot area: 2,339.7 s.f.

400 s.f. Max.

-386.3 s.f. < 400.0 s.f. Drainage Not Required

DRAINAGE SUMMARY

Project Location: Walker Center **Lot Area:** 58,492 sq. ft. = 1.343 acres
Project Number: 220214 **Date:** Date: May 1, 2022

IMPERVIOUS AREAS:

Existing Conditions:

Impervious Area:	28,696 sq. ft. / 43560 sq. ft. / acre		= 0.659 acres
Pervious Area:	29,796 sq. ft. / 43560 sq. ft. / acre		= 0.684 acres

Runoff Coefficient (weighted):

0.6588 acres	x 0.95 =	0.6259 acres	
0.6840 acres	x 0.35 =	0.2394 acres	
1.343 acres		**0.865 acres / 1.343 acres**	**= 0.644**

Proposed Conditions:

Impervious Area:	28,310 sq. ft. / 43560 sq. ft. / acre		= 0.650 acres
Pervious Area:	30,182 sq. ft. / 43560 sq. ft. / acre		= 0.693 acres

Runoff Coefficient (weighted):

0.6499 acres	x 0.95 =	0.6174 acres	
0.6929 acres	x 0.35 =	0.2425 acres	
1.343 acres		**0.860 acres / 1.343 acres**	**= 0.640**

VOLUME AND FLOW:

Q_{25} pre =	0.644 x	5.91 x	1.343 =	5.112 cfs	
Q_{25} post =	0.640 x	5.91 x	1.343 =	5.080 cfs	
V_{25} pre =	0.493 x	5.112 x	1.343 =	3.385 ac-ft	
V_{25} post =	0.493 x	5.080 x	1.343 =	3.363 ac-ft	
Q_{100} pre =	0.644 x	8.78 x	1.343 =	7.594 cfs	
Q_{100} post =	0.640 x	8.78 x	1.343 =	7.547 cfs	
V_{100} pre =	0.732 x	7.594 x	1.343 =	7.465 ac-ft	
V_{100} post =	0.732 x	7.547 x	1.343 =	7.419 ac-ft	
V_{100} post -	V_{100} pre =	7.419 ac-ft	- 7.465 ac-ft		**-= 0.046 ac-ft**
-0.046 ac-ft x	43560 sq. ft. / acre		-= 2003.76 cu-ft	x 7.48 gal/cf	**-= 14,988 gal**
Q_{100} post -	Q_{100} pre =	7.547 cfs	- 7.594 cfs =	-0.047 cfs	
-0.047 cfs x	60 sec/min	x 45 min	-= 126.90 cfm	x 7.48 gal/cf	**-= 949 gpm**

END GALLEY STORAGE:

Design Infiltration Rate: 7 min/inch = 0.71 ft/hr Rawls Ratio: 8.27 (Sand)

Infiltration Capacity

Bottom Area =	8.0'	x 6.0'	= 48.0 sq. ft.	
48.0 sq. ft.	x 0.71 ft/hr	= 34.1 cfh	= 818.4 cf/day	= 0.0188 ac-ft

Galley Storage

Total =	48.0 sq. ft.	x 3.25'	= 156.0 cf	
Embedded Galley Volume =	4.00'	x 4.00'	x 3.25'	= 52.0 cf
Stone Volume =	156.0 cf	- 52.0 cf	= 104.0 cf	
Storage =	stone volume x voids ratio		= 104.0 x 0.35	= 36.4 cf
Galley Volume =	3.50'	x 3.50'	x 3.25'	= 39.8 cf

Total Capacity = Galley Volume + stone void volume

39.8 + 36.4 = 76.2 cf = 0.0017 ac-ft

Total stored/infiltrated = infiltration capacity + total capacity

0.0188 ac-ft + 0.0017 ac-ft **= 0.0205 ac-ft**

MIDDLE GALLEYS STORAGE:

Design Infiltration Rate: 7 min/inch = 0.71 ft/hr Rawls Ratio: 8.27 (Sandy)

Infiltration Capacity

Bottom Area =	8.0'	x 4.0'	= 32.0 sq. ft.	
32.0 sq. ft.	x 0.71 ft/hr	= 22.7 cf/hr	= 544.8 cf/day	= 0.0125 ac-ft

Galley Storage

Total =	32.0 sq. ft.	x 3.25'	= 104.0 cf	
Embedded Galley Volume =	4.00'	x 4.00'	x 3.25'	= 52.0 cf
Stone Volume =	104.0 cf	- 52.0 cf	= 52.0 cf	
Storage =	stone volume x voids ratio		= 52.0 x 0.35	= 18.2 cf
Galley Volume =	3.50'	x 3.50'	x 3.25'	= 39.8 cf

Total Capacity = Galley Volume + stone void volume

52.0 + 18.2 = 70.2 cf = 0.0016 ac-ft

Total stored/infiltrated = infiltration capacity + total capacity

0.0125 ac-ft + 0.0016 ac-ft **= 0.0141 ac-ft**

REQUIRED SYSTEM STORAGE:

Storage required: **-0.0460 ac-ft**

Storage provided:

Unit Type	Qty.	Unit Capacity	Total		
End:	2	0.0205 ac-ft	0.0410 ac-ft		
Middle:	5	0.0141 ac-ft	0.0705 ac-ft		
Low Profile End:	0	0.0056 ac-ft	0.0000 ac-ft		
Low Profile Middle:	0	0.0038 ac-ft	0.0000 ac-ft		
Total =	**7 units**		**0.1115 ac-ft**	>	-0.0460 ac-ft

Therefore OK

Soil Map—Middlesex County, Massachusetts

Map Scale: 1:863 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	1.4	100.0%
Totals for Area of Interest		**1.4**	**100.0%**

Middlesex County, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)

Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, head slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex

Across-slope shape: Linear, convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021