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TOWN OF NEEDHAM
MASSACHUSETTS

500 Dedham Avenue
Needham, MA 02492
781-455-7550

PLANNING BOARD

APPLICATION FOR SITE PLAN REVIEW

Project Determination: (circle one) Major Project Minor Project

This application must be completed, signed, and submitted with the filing fee by the applicant or his representative in accordance with the Planning Board's Rules as adopted under its jurisdiction as a Special Permit Granting Authority. Section 7.4 of the By-Laws.

Location of Property 100 West Street, Needham MA
Name of Applicant Greystar Development East, LLC
Applicant's Address 1 Federal Street, Suite 1804, Boston, MA 02110
Phone Number (857) 254-1329

Applicant is: Owner _____ Tenant _____
Agent/Attorney _____ Purchaser ✓

Property Owner's Name HCRI Massachusetts Properties Trust II
Property Owner's Address 4500 Dorr Street, Toledo, OH 43615
Telephone Number _____

Characteristics of Property: Lot Area 4.3 Present Use Commercial Parcel Number: 1990630003700000
Map # 63 Parcel # __ Zoning District ASB-MF

Description of Project for Site Plan Review under Section 7.4 of the Zoning By-Law:

The Applicant is proposing to redevelop the Property by demolishing the existing building and constructing a three-story multifamily residential building containing a total of 189 residential units and associated amenities (the "Project"). The residential units will include a mix of studio, one-bedroom, two-bedroom, and three-bedroom units, and 24 units will be affordable to households earning up to 80% of the area median income ("AMI"). The Project also includes 186 surface parking spaces.

Signature of Applicant (or representative) _____
Gary Kerr, Authorized Signatory, Greystar Development East, LLC
Address if not applicant _____
Telephone # 857 254 1329
Owner's permission if other than applicant _____
DocuSigned by: Russell Simon
Russell Simon, Authorized Signatory, HCRI Massachusetts Properties Trust II

SUMMARY OF PLANNING BOARD ACTION

Received by Planning Board _____ Date _____
Hearing Date _____ Parties of Interest Notified of Public Hearing _____
Decision Required by _____ Decision/Notices of Decision sent _____
Granted _____
Denied _____ Fee Paid _____ Fee Waived_____
Withdrawn _____
NOTE: Reports on Minor Projects must be issues within 35 days of filing date.

goulston&storrs
counsellors at law

August 12, 2025

BY HAND DELIVERY, OVERNIGHT DELIVERY & ELECTRONIC MAIL

Town of Needham Planning Board Members
Public Service Administration Building
500 Dedham Avenue
Needham, MA 02492
Attn: Lee Newman, Planning Director

Re: 100 West Street, Needham Heights, Massachusetts (the "Property")

Dear Planning Board Members:

We are counsel to Greystar Development East, LLC (the "Applicant") in connection with the redevelopment of approximately 4.29 acres of land, bordered by West Street to the north, Highland Avenue to the east, the MBTA Needham Line Commuter Rail to the west, and residential properties to the south. The Property is improved by an existing building that previously operated as an assisted living facility but has been vacant since 2018.

The Applicant is proposing to redevelop the Property by demolishing the existing building and constructing a three-story multifamily residential building containing a total of 189 residential units and associated amenities (the "Project"). The residential units will include a mix of studio, one-bedroom, two-bedroom, and three-bedroom units, and 24 units will be affordable to households earning up to 80% of the area median income ("AMI"). The Project also includes 186 surface parking spaces.

As described below, zoning allows a maximum Floor Area Ratio ("FAR") of 1.30 for the Property generating a maximum build out of approximately 242,934 sq. ft. The Application (defined below) proposes an FAR of 1.12 based on a buildout of 206,625 sq. ft., 36,309 sq. ft. less than the maximum buildout.

Pursuant to the Massachusetts Zoning Act, G.L. c. 40A, the Needham Zoning By-Law (the "By-Law"), and the Board Rules, enclosed is an Application for Site Plan Review for the Project (the "Application"). In support of the Application, the Applicant is submitting the following materials and information (five (5*) copies of each are included unless otherwise indicated; one (1) reduced size copy of the Architectural Plan Set and Site Development Plan Set will be mailed directly to each Planning Board member*):

1. Site Plan Review Application Package:

    a. Site Plan Review Narrative

b. Site Plan Review Application

c. Traffic Impact Assessment prepared by MDM Transportation Consultants, Inc., dated July 9, 2025 (the "TIA")

d. Geotechnical Report

e. Drainage Report

f. Architectural Plan Set prepared by Cube 3 Studio LLC, which includes the following, all dated August 8, 2025:

   i. Floor Plans

   ii. Building Elevations

   iii. Building Elevations and Sections

g. Site Development Plan Set titled "Site Development Plans for Greystar Proposed Residential Development" (the "Plan Set"), prepared by Bohler Engineering, which includes the following, all dated August 12, 2025:

   i. Sheet C-101 – Cover Sheet

   ii. Sheet C-102 – General Notes and Legend

   iii. Sheet C-301 – Site Plan

   iv. Sheet C-401 – Grading and Drainage Plan

   v. Sheet C-501 – Utility Plan

   vi. Sheet C-801 – Erosion and Sediment Control Plan

   vii. Sheet C-802 – Erosion and Sediment Control Notes and Details

   viii. Sheets C-901 and C-902 – Construction Details

   ix. Sheet L-100 – Landscape Plan

   x. Sheet L-200 – Lighting Plan

   xi. Sheets L-300, L-301, and L-302 – Landscape Details

2. Check payable to the Town of Needham in the amount of $20,662.50, representing the filing fee for Site Plan Review, calculated at $1,000 plus $0.10 per square foot in excess

of 10,000 sq. ft for 206,625 sq. ft. of multifamily residential uses (*sent under separate cover via overnight mail*).

* * *

ZONING ANALYSIS DISCUSSION:

Background and Overview:

Pursuant to the Town of Needham Zoning Map, as amended by Article 19 of the Annual Town Meeting held on May 5, 2025 (as amended, the "Zoning Map"), the Property is located partially within the Avery Square District and partially within the Single Residence B District. In addition, a portion of the Property is located within the Avery Square Overlay District, and the entire Property is located within the ASB-MF Subdistrict of the Multi-family Overlay District ("MFOD"). The MFOD was established by an amendment to the Town of Needham Zoning By-Law adopted by Town Meeting pursuant to Article 18 of the Annual Town Meeting on May 5, 2025.

The creation of the MFOD was the result of an extensive planning effort by the Town of Needham (the "Town"), that followed multiple public information sessions, interactive workshops and public hearings. We are excited to submit this Project for review under the parameters of the MFOD zoning that reflects public input during the extensive public planning process.

The Applicant now proposes the Project to realize the goals of this re-zoning. Pursuant to By-Law Section 3.17.2, the Applicant hereby elects to develop the Project in accordance with the provisions of MFOD.

Proposed Project:

Use

As described above, the Project will demolish the existing building and construct a multifamily residential building containing a total of 189 residential units and associated amenities (including lobby, leasing office, fitness center, mail/package room, bike parking, and lounge), comprising approximately 206,625 gross square feet. The Project will also reconfigure the existing surface parking area to provide for 186 surface parking spaces. Bicycle parking will also be provided adjacent to and within the proposed building. A breakdown of proposed uses and the approximate square footage of such uses is as follows:

Uses	**Proposed**
Multi-Family Housing	206,625 sq. ft.
Accessory Vehicle Parking	186 surface vehicle parking spaces

Accessory Bicycle Parking	141 surface bicycle parking spaces 48 covered spaces Total: 189bicycle parking spaces

Pursuant to By-Law Section 3.17.4, Multi-family housing is allowed as-of-right in the MFOD. Uses accessory to Multi-family housing are also allowed as-of-right in the MFOD, including (i) surface and structured parking and (ii) any uses customarily and ordinarily incident to Multi-family housing, including, without limitation, residential amenities such as bike storage/parking, a swimming pool, fitness facilities and similar amenity uses. Given that the accessory parking on the Property and accessory lobby and amenities are incidental to the operation of the Multi-family housing use, such accessory uses are allowed as-of-right.

Parking

As noted above, the Applicant plans to construct 186 surface parking spaces for vehicles and 141 surface parking spaces for bicycles, as well as 48 covered bicycle parking spaces to be provided within the proposed building. The following chart describes the number of parking spaces required pursuant to By-Law Section 3.17.6.

Item	**Requirement**	**Proposed**	**Compliance with Zoning?**
Min. Off-Street Vehicle Parking Spaces	1.0 space/dwelling unit	0.98 spaces/dwelling unit	YES – Subject to Grant of Waiver
Min. Bicycle Parking Spaces	1.0 space/dwelling unit	1.0 space/dwelling unit	YES
Min. Bicycle Parking Spaces Integrated into Structure of Building as Covered Spaces	25%	25%	YES

In addition to the foregoing requirements, By-Law Section 3.17.6 imposes the parking requirements set forth in bold below. Each requirement is followed by the Applicant's description of how the Project complies with such requirement or why such requirement is not applicable.

(i) Parking areas shall be designed and constructed in accordance with Subsection 5.1.3 Parking Plan and Design Requirements. The remaining provisions of Section 5.1 Off Street Parking Regulations shall not apply to projects within the Multi-family Overlay District.

As further described below, the parking areas at the Project will comply with all design guidelines prescribed by By-Law Section 5.1.3.

(ii) In the ASB-MF subdistrict, the façade(s) of all parking garages, structured parking and deck/rooftop parking visible from Highland Avenue shall be designed to be generally indistinguishable from the façade(s) of the residential portion of the building(s), and shall allow no view of parked vehicles from Highland Avenue except where such view is intermittent and incidental to the operation of the parking area, such as a view afforded by the opening of an automated garage door.

The Project does not include a parking garage, structured parking, or deck/rooftop parking. Therefore, this requirement is not applicable.

(iii) Enclosed parking areas shall comply with Subsection 4.4.6 Enclosed Parking.

The Project does not include any enclosed parking areas. Therefore, this requirement is not applicable.

(iv) No parking shall be allowed within the front setback. Parking shall be on the side or to the rear of the building, or below grade.

As shown on the Plan Set, no parking is proposed within the required 10 ft. minimum front setback. All parking will be located to the side or the rear of the proposed building.

Based on the foregoing, the Project will comply with all applicable parking requirements, except the requirement to provide a minimum number of off-street vehicle parking spaces. The Applicant is requesting a waiver from this requirement, as further described below.

Dimensional Requirements

The following chart sets forth dimensional requirements applicable to the Project:

Item	Requirement	Proposed	Compliance with Zoning?
Max. FAR	1.3	1.09	YES
Min. Lot Area	10,000 SF	187,219 SF	YES
Max. Building Coverage	None	N/A	YES
Max. Dwelling Units per Acre	44	43.97	YES
Max. Multi-family Buildings per Lot	2+ buildings	1 building	YES
Max. Height (Stories)	3.0	3.0	YES
Max. Height (Feet)	40 FT	40 FT	YES

Item	Requirement	Proposed	Compliance with Zoning?
Min. Lot Frontage	80 FT	80 FT	YES
Min. Front Setback	10 FT	10.9 FT (Highland Ave.) 10.1 FT (West St.)	YES
Min. Side Setback	10 FT	11.2 FT	YES
Min. Side Setback Along MBTA Right-of-Way	20 FT	N/A	YES
Min. Rear Setback	10 FT	70.2 FT	YES
Min. Rear Setback Along MBTA Right-of-Way	20 FT	> 20 FT	YES
Single-Family Residential Setback	110 FT	> 110 FT	YES

In addition to the foregoing requirements, By-Law Section 3.17.5.1 imposes the dimensional requirements set forth in bold below. Each requirement is followed by the Applicant's description of how the Project complies with such requirement.

(i) Seventy percent (70%) of the main datum line of the front facade of the building shall be set back no more than 15 feet, except that periodic front setbacks greater than fifteen (15) feet are allowed if activated by courtyards, landscaping, drive aisles, amenity areas, or other similar site design features that enhance the streetscape. In the ASB-MF subdistrict, the Applicant may apply for a Special Permit from the Planning Board if less than seventy percent (70%) of the main datum line front facade of the building is set back 15 feet.

As shown on the Plan Set, 70% of the proposed building's front façade along Highland Avenue will be set back between 10.7 ft and 10.9 ft. The remaining 30% of the front façade along Highland Avenue will be set back more than 15 ft. but will be activated by courtyards and garden amenities, as allowed by this requirement.

Along West Street, no portion of the proposed building's front façade is set back more than 15 ft.

(ii) With respect to any lot partially within an underlying residential district [. . .] except for access driveways and sidewalks, which are permitted, any portion of the lot within said residential district shall be kept open with landscaped areas, hardscaped areas, outdoor recreation areas (e.g., swimming pool) and/or similar open areas.

As shown on the Plan Set, the portion of the Property located within the Single

Residence B District will be kept open with landscaped areas, outdoor recreation areas, and hardscaped areas.

Based on the foregoing, the Project complies with all applicable dimensional requirements.

Affordable Housing

By-Law Section 3.17.8.1 requires no fewer than 12.5% of housing units constructed within the MFOD be Affordable Housing Units as defined in By-Law Section 1.3. An Affordable Housing Unit is a dwelling unit that is affordable to and occupied by a household with income at or below 80% of the AMI.

As noted above, the Project proposes to construct 189 residential units. Pursuant to By-Law Section 3.17.8.1, 12.5% of these units, i.e., 24 units, must be affordable to households earning 80% or less than the AMI. Accordingly, 24 of the 189 residential units proposed by the Project will be made affordable to households earning 80% or less than the AMI.

Relief Requested

Pursuant to By-Law Section 3.17.9.5, the Planning Board may waive the off-street parking requirements set forth in By-Law Section 3.17.6 and Subsection 5.1.3. Accordingly, the Applicant is requesting a waiver from By-Law Section 3.17.6(a) for off-street vehicle parking space ratio of 0.98 spaces/dwelling unit rather the 1.0 space/dwelling unit and By-Law Section 5.1.3(k) to permit a reduction in the percentage of landscape area required to be located in the interior of the parking lot. In both cases, these waivers are being requested to enhance the amount of open space area at the Property. Given that the Project is a transit oriented development, the slight reduction in parking (3 spaces) still allows for a parking supply that can accommodate the parking demand of the Project while adding an additional pocket park to the Project.

Site Plan Review:

Pursuant to By-Law Section 3.17, Site Plan Review, as prescribed by By-Law Section 3.17, is required for all Multi-family housing projects within the MFOD[1]. The Planning Board is the site plan review authority for Multi-family housing projects within the MFOD.

Accordingly, the Project is subject to Site Plan Review by the Planning Board as provided in By-Law Section 3.17.

Satisfaction of Standards for Granting Site Plan Approval:

[1] Multi-family housing projects within the MFOD are not subject to the Site Plan Review provisions set forth in By-Law Section 7, except as expressly provided for in By-Law Section 3.17.

By-Law Section 3.17.9.4 provides that Site Plan Approval for uses listed in By-Law Section 3.17.3, which uses include Multi-family housing use and uses accessory thereto, shall be granted upon determination by the Planning Board that the following criteria have been satisfied:

(i) the applicant has submitted the information as set forth in Subsection 3.17.9.2, Submission Requirements; and

(ii) the project as described in the application meets the dimensional and density requirements contained in Subsection 3.17.5, Dimensional Regulations, the parking requirements contained in Subsection 3.17.6, Off-Street Parking, the development standards contained in Subsection 3.17.7, Development Standards, and Subsection 3.17.8.2, Affordable Housing Development Standards.

The following sections demonstrate that the Application and the Project comply with the foregoing criteria.

1. Submission Requirements

The Plan Set and other application materials submitted herewith include all of the information required by the submission requirements set forth in By-Section 3.17.9.2.

2. Dimensional Regulations

As described above, the Project complies with all applicable dimensional requirements as set forth in By-Law Section 3.17.5.

3. Off-Street Parking

As described above, the Project complies with all applicable parking requirements as set forth in By-Law Section 3.17.6. Pursuant to By-Law Section 3.17.6(b), the Project is also required to comply with the parking plan and design requirements set forth in By-Law Section 5.1.3. These parking plan and design requirements are provided in bold below, and each requirement is followed by the Applicant's description of how the Project complies with such requirement. As noted below, the Applicant is seeking a waiver from By-Law Section 5.1.3(k).

(a) **Parking Lot Illumination – All parking areas which are proposed to be illuminated shall provide an illumination level of an average of one foot candle. All illumination shall be shielded so as not to shine directly onto a public or private way or onto any property in a residential district.**

Lighting is designed to achieve an average of one footcandle. Glare shall be minimized with cut-off luminaires, and off-site glare will be minimized through the use of light placement, fencing, and vegetation adjacent to the parking areas.

(b) **Loading Requirements – Adequate off-street loading facilities and space with unimpeded access shall be provided for all new construction and for all building additions greater than 100 square feet of floor area. Facilities shall be so sized and arranged that no trucks shall be parked on a public way while loading, unloading, or waiting to do so.**

A dedicated loading area is proposed along the western edge of the building, adjacent to back-of-house operations and access. This configuration ensures that all loading and unloading activities occur on-site, with no trucks staged or parked within the public way.

(c) **Handicapped Parking – Parking spaces for the exclusive use of handicapped individuals shall be provided in accordance with the most recent rules and regulations of the Architectural Access Barriers Board, specifically Section 23 thereof.**

Six ADA parking space have been provided, with two of these spaces being van accessible, complying with the minimum requirement.

(d) **Driveway Openings – Ingress and egress shall be located so as to minimize conflict with traffic on streets and where good visibility and sight distances are available to observe approaching pedestrian and vehicular traffic. See Sections 4.4.5, 4.6.6 and 4.10.3 for Driveway Openings Regulations in Business, Industrial, and Industrial-1 Districts.**

The proposed driveway openings have been located to minimize conflicts with street traffic and to provide sufficient visibility and sight distance for both vehicles and pedestrians. Please refer to the Transportation Demand Management (TDM) Plan in the enclosed Site Plan Review Application Package for additional details on site access and circulation.

(e) **Compact Cars – Off-street parking areas may be designated to allow up to a maximum of 50% of the total number of parking spaces to be used by compact cars. Compact car spaces shall not be less than 8 feet by 16 feet.**

The Project proposes a total of 186 parking spaces, including 93 compact spaces measuring either 8 feet by 16 feet or 8 feet by 18 feet, which complies with the maximum 50% allowance for compact parking.

(f) **Parking Space Size – Each parking space, except for the allowable percentage for compact cars, shall measure at least 9 feet in width and 18.5 feet in length; however, parallel parking spaces shall be at least 22 feet in length. The required parking space dimensions, including those for compact car spaces, shall not be reduced by obstructions, including, but not limited to, light poles and columns.**

The proposed parking spaces, with the exception of the compact spaces, referenced above in the response to By-Law Section 5.1.3(e), have been designed at 9 feet in width and 22 feet in length.

(g) **Bumper Overhang – The minimum length requirements stated in the above two paragraphs may include no more than one foot of area beyond the curb at the front or rear of a space, used for bumper over-hang.**

The parking spaces dimensions, as listed above in the response to By-Law Section 5.1.3(f), do not include any overhang area over the curb.

(h) **Parking Space Layout – Required parking areas shall be designed so that each motor vehicle may proceed to and from its parking space without requiring the movement of any other vehicle. In no case shall spaces be so located as to require the backing or maneuvering onto the sidewalk or into a public or private way upon entering or leaving the space.**

The proposed parking layout complies with this requirement. All spaces are designed to allow vehicles to enter and exit without moving another vehicle and without backing or maneuvering into a sidewalk or public way.

(i) Width of Maneuvering Aisle – The minimum width of aisles within parking areas providing access to parking spaces for one-way traffic shall be as follows:

Angle of Parking Space	**Minimum Width of Aisle**
90 degree	**24 feet/25 feet***
60 degree	**18 feet/19 feet***
45 degree	**14 feet**
30 degree	**12 feet**
parallel	**12 feet**

*** The greater width shall be used where one foot of bumper overhang occurs.**

The minimum width of maneuvering aisles within parking areas providing access to spaces for two-way traffic shall be twenty (20) feet or the width required above, whichever is greater. The required width of all maneuvering aisles shall not be reduced by obstructions, including, but not limited to, light poles and columns.

A minimum width of 24 feet is provided for all drive aisles with 90 degree

parking spaces.

(j) Parking Setbacks – Parking spaces and maneuvering aisles shall be setback a minimum of ten (10) feet from a front lot line or street right-of-way line; except, however, that such setback shall be twenty (20) feet in a Business or Industrial District, if the conditions set forth in Subsection 4.4.4 or 4.5.2 of this By-Law apply. Such parking setback shall also be twenty (20) feet in an Industrial-1 District and Highway Commercial 1 District unless a deeper parking setback is required by Section 4.11. Parking spaces, maneuvering aisles and driveways shall be set back a minimum of four (4) feet from the rear and side lot lines. Except in an enclosed structure or in an unenclosed parking facility beneath a structure, no parking space, maneuvering aisle or driveway shall be located within five (5) feet of a building line at the first floor.

Proposed parking spaces and maneuvering aisles have been provided with a minimum 10 feet setback from the right-of-way line and 4 feet from the side and rear lot lines.

(k) Landscaped Areas – Setback areas required under the above paragraph (j) shall be maintained as landscaped areas, except where driveway openings or sidewalks occur. Landscaped areas shall include trees, shrubs, flowers and grass. Planting beds shall be at least 4 feet wide. In any parking area requiring 10 or more spaces, ten (10) percent or more of such area shall be maintained as landscaped area. In parking areas requiring 20 or more spaces, a minimum of one-quarter of this amount shall be located in the interior of the parking area. Required landscape setback areas shall count towards the minimum ten percent requirement; provided, however, that the interior landscaped area requirement shall be met.

Proposed parking spaces and maneuvering aisles have been provided with a minimum 10 feet setback from the right-of-way line and 4 feet from the side and rear lot lines. Native trees and shrubs and grass are proposed in these areas, with minimum 4-foot-wide planting beds. The total parking area is 53,869 square feet and more than ten percent (10%) is maintained as landscaped area. Given the unique layout of the parking area, the Applicant is requesting a waiver from By-Law Section 5.1.3(k) to permit a reduction in the percentage of landscape area required to be located in the interior of the parking lot.

(l) Trees – For all parking areas requiring 10 or more spaces, trees shall be required. One tree shall be provided for every 10 spaces or a fraction thereof. Such trees shall be located within or around the parking area so as to screen and soften the visual impact of parked vehicles as much as possible. They shall be at least 2” trunk diameter, with not less than 40 square feet of unpaved soil or other permeable surface area per tree. Planting beds shall be

at least 4 feet wide.

Trees are located within and adjacent to the parking areas, in excess of one tree per ten parking spaces. A mix of deciduous and evergreen trees are provided for visual interest and habitat diversity.

(**m) Location – Off-street parking required by this Section shall be located on either the same lot as the principal use or uses or on a lot within 300 feet which is under the same ownership. In the Avery Square Business District, required parking for non-residential uses shall be either on the same premises as the activity it serves, or on a separate parcel, which may be shared with other uses, if the parcel is located within five hundred (500) feet (800 feet for employees) walking distance of the building entrance to be served, is located in a zoning district permitting or allowing on special permit the activity it serves, and is permanently committed to serving the use involved. In the Avery Square Business District, no parking shall be located within 10 feet of a street line.**

All parking is located on the same lot as the principal use, with all spaces set back a minimum of 10 feet from both Highland Street and West Street.

(n) Bicycle Racks – For parking areas of forty or more spaces, bicycle racks facilitating locking shall be provided to accommodate one bicycle per twenty parking spaces required, or fraction thereof.

Outdoor bicycle parking for 141 bicycles has been provided adjacent to the building, with additional bicycle storage located within the building.

4. <u>Development Standards</u>

The Project is subject to certain development standards as set forth in By-Law Section 3.17.7. These standards are provided in bold below, and each standard is followed by the Applicant's description of how the Project complies with such standard.

(a) [Not applicable; no requirement imposed].

(b) Buildings shall be designed with due regard to their relationship to open spaces, existing buildings, and community assets in the area.

The proposed concept intends to bridge the neighborhoods along Highland Avenue with a graduated approach of a varied rhythm and texture. This concept bridges the distinct differences in the site context by breaking down the facade into smaller modules that build a rhythm with subtle angled bays on the south end of the Property that relate to the scale of the adjacent residential neighborhood. Then the building transitions to a slightly larger scale module to complement the

more commercial character of the area at the north end of the Property. Landscaped areas at the northern end of proposed design push the building inward to create street level courtyards that break the façade along Highland Avenue, providing a visual and physical relief of the streetscape opposite the urban feel of the adjacent buildings. By varying the forms, textures and building massing in this way, the Applicant believes the building will integrate into the existing context while creating a unique addition that compliments and enhances the neighborhood.

(c) Building entrances shall be available from one or more streets on which the building fronts and, if the building fronts Chestnut Street, Garden Street, Highland Avenue, Hillside Avenue, Rosemary Street, or West Street, the primary building entrance must be located on at least one such street.

The Project, located along Highland Avenue and West Street, has the main building entrance located on Highland Avenue. In addition, all ground floor residential units will have direct entrances from the surrounding streets, Highland Avenue and West Street, and the surface parking area. Building egresses are located on Highland Avenue, West Street, and in the surface parking area.

(d) The site shall be designed so that all collection and storage areas for residential refuse shall be internal to the building(s), or otherwise shall not be visible from any public way and appropriately screened from abutting properties, and adequate management and removal of refuse shall be provided for.

All areas for residential refuse are located internal to the building, with a designed pickup area along the western edge of the building.

(e) Site arrangement and driveway layout shall provide sufficient access for emergency and service vehicles, including fire, police, and rubbish removal.

The site has been designed to provide sufficient access for emergency and service vehicles, including fire, police, and rubbish removal, in compliance with this requirement. Truck turning movements have been modeled to confirm adequate circulation.

(f) Plantings shall be provided and include species that are native or adapted to the region. Plants on the Massachusetts Prohibited Plant List, as may be amended, are prohibited.

Trees and vegetation shall be native species. The use of plants on the Massachusetts Prohibited Plant List will be avoided.

(g) All construction shall be subject to the current town storm water bylaws,

regulations, and policies along with any current regulations or policies from DEP, state, and federal agencies.

All construction will comply with the current Town stormwater bylaws, regulations, and policies, as well as applicable DEP, state, and federal requirements and have been outlined as part of the site plan set and stormwater management report.

(h) Control measures shall be employed to mitigate any substantial threat to water quality or soil stability, both during and after construction.

Appropriate control measures will be implemented to mitigate any substantial threat to water quality or soil stability during and after construction and have been outlined as part of the site plan set and stormwater management report.

(i) There shall be adequate water, sewer, and utility service provided to serve the project.

Adequate water, sewer, and utility services are available to the site and have been shown on the site plan set, extending from the utility mains located in Highland Avenue and West Street.

(j) Off-site glare from headlights shall be controlled through arrangement, grading, fences, and planting. Off-site light over-spill from exterior lighting shall be controlled through luminaries selection, positioning, and mounting height so as to not add more than one foot candle to illumination levels at any point off-site.

Off-site glare will be minimized through the use of fencing and vegetation adjacent to the parking areas. Site lighting is designed to avoid illumination spill over and is not above 1 foot candle at any edge of the site. This is accomplished through the use of cut offs and positioning.

(k) Pedestrian and vehicular movement within and outside the project site shall be protected, through selection of egress points, provision for adequate sight distances, and through reasonable mitigation measures for traffic attributable to the project.

Direct pedestrian connectivity will be provided by way of paved connections linking the building entrances and parking field to the existing sidewalks along Highland Avenue and West Street. Marked crosswalks will be provided across the two Site driveways.

Vehicular access will be provided by way of the two existing driveways along the west side of Highland Avenue and the south side of West Street. The West Street

driveway will be restricted (via signage) to right-turns only for exiting motorists. Adequate sight distances are available to accommodate traffic safely based on a review of applicable standards.

The redevelopment of the Property can be accommodated with minimal impacts to the roadway network, TDM measures have been recommended and are discussed in the TIA.

(l) Site arrangements and grading shall minimize to the extent practicable the number of removed trees 8" trunk diameter or larger, and the volume of earth cut and fill.

Proposed grading will be sensitive to existing trees with trunks greater than 8" and minimize disturbance where feasible.

(m) No retaining wall shall be built within the required yard setback except a retaining wall with a face not greater than four (4) feet in height at any point and a length that does not exceed forty (40) percent of the lot's perimeter. Notwithstanding the foregoing, retaining walls may graduate in height from four (4) to seven (7) feet in height when providing access to a garage or egress entry doors at the basement level, measured from the basement or garage floor to the top of the wall. In such cases, the wall is limited to seven (7) feet in height for not more than 25% of the length of the wall.

No retaining walls are proposed as part of the Project. Therefore, this requirement is not applicable.

(n) Retaining walls with a face greater than twelve (12) feet in height are prohibited unless the Applicant's engineer certifies in writing to the Building Commissioner that the retaining wall will not cause an increase in water flow off the Property and will not adversely impact adjacent property or the public.

No retaining walls are proposed as part of the Project. Therefore, this requirement is not applicable.

(n) Construction activity shall be consistent with Section 3.8 of the General By-Laws and any reasonable conditions on construction activity that are warranted at a particular site and included in the applicable site plan approval, including but not limited to hours during which construction activity may take place, the movement of trucks or heavy equipment on or off the site, measures to control dirt, dust, and erosion and to protect existing vegetation to be preserved on the site.

Construction activity has been proposed to be consistent with By-Law Section

3.8.

The Project is also subject to a special development standard applicable only in the ASB-MF Subdistrict, which standard is provided below in bold, followed by the Applicant's description of how the Project complies with such standard.

(a) Multi-family housing in the ASB-MF subdistrict shall employ existing curb cuts on Highland Avenue and West Street to the extent feasible. Existing curb cuts may be improved, reconstructed and modified. Additional curb cuts may be added subject to site plan review.

The Project proposes to maintain the existing curb cuts. No additional curb cuts are proposed.

5. <u>Affordable Housing Development Standards</u>

The Project is subject to certain affordable housing development standards as set forth in By-Law Section 3.17.8.2. These standards are provided in bold below, and the list of standards is followed by the Applicant's description of how the Project complies with such standards.

Affordable units shall be:

(a) Integrated with the rest of the development and shall be compatible in design, appearance, construction, and quality of exterior and interior materials with the other units and/or lots;

(b) Dispersed throughout the development;

(c) Located such that the units have equal access to shared amenities, including light and air, and utilities (including any bicycle storage and/or Electric Vehicle charging stations) within the development;

(d) Located such that the units have equal avoidance of any potential nuisances as market-rate units within the development;

(e) Distributed proportionately among unit sizes; and

(f) Distributed proportionately across each phase of a phased development.

(g) Occupancy permits may be issued for market-rate units prior to the end of construction of the entire development provided that occupancy permits for Affordable Units are issued simultaneously on a pro rata basis.

All affordable units will be integrated into the Project and will not differ from any other units located within the building. Affordable units will be equally dispersed,

located and distributed throughout the Project.

As detailed above and in the materials submitted herewith, the Project satisfies each of the applicable criteria for Site Plan Approval.

As required by G.L. 40A and the By-Law, the Applicant has submitted a copy of this Application to the Town Clerk.

We appreciate your attention to this matter. The Applicant and the entire Project team look forward to meeting with you and discussing the Project on September 16, 2025 or such earlier date that is convenient for the Board.

Very truly yours,

Timothy W. Sullivan
Attorney for Applicant

Enclosures

SITE PLAN REVIEW APPLICATION PACKAGE

For

PROPOSED RESIDENTIAL DEVELOPMENT

100 West Street
Needham, Massachusetts

Submitted to:

Town of Needham
Planning and Community Development
500 Dedham Avenue
Needham, MA 02492
Attn: Lee Newman

Applicant:
Greystar Development East, LLC
c/o Timothy Beinert
1 Federal Street, Suite 1804
Boston, MA 02110

Prepared by:
BOHLER
45 Franklin Street, 5th Floor
Boston, MA 02110

In Association With:
CUBE3
56 High Street
North Andover, MA 01845

August 12, 2025

#MAB250036.00

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SECTION 1:
SITE PLAN REVIEW NARRATIVE

1. Introduction

Greystar (the “Applicant”) hereby submits this narrative in support of its application for Site Plan Review pursuant to Section 3.17.9 of the Town of Needham Zoning By Law. The site is approximately 4.3 acre bounded by West Street to the north, the MBTA Commuter Rail Train Tracks to the west, residential properties to the south and Highland Ave to the east. The project entails construction of a new 3-story building with a total of 189 apartment units, a total of 186 parking spaces, associated utilities, stormwater, site amenities and landscaping (the “Project”). The entirety of the Site is located within the Multi-Family Overlay District (MFOD).

2. Parking and Loading

Parking will be provided on-site within the proposed surface lot, which includes a total of 186 spaces. Vehicular access will be provided through two curb cuts, one on West Street and one on Highland Avenue. Both are located in approximately the same locations as the existing curb cuts, and each will support two-way circulation. All proposed parking is located within the portion of the site zoned Avery Square Business.

A designated loading zone is proposed along the western edge of the building, adjacent to the back-of-house operations and elevator access. This area includes a striped loading space and an accessible ramp to support deliveries, access and tenant move-in.

Bicycle storage will be provided externally and internally to the building for use by residents and visitors. This amenity is intended to encourage bicycle use and reduce reliance on personal vehicles.

The site is located in close proximity to the Needham Heights Commuter Rail Station and is supported by a well-connected sidewalk network that encourages pedestrian access. The Applicant is committed to promoting a balanced, multimodal transportation strategy. A Transportation Demand Management (TDM) Plan has been included in this submission.

3. Traffic Flow and Circulation

A full Traffic Impact Assessment (TIA) has been prepared for the Project and is included with this application. The existing site, formerly developed with a 142-bed senior care facility, will be redeveloped as a 189-unit multifamily residential community. Vehicle access will continue to be provided via two existing, modified, driveways: the full-access driveway along Highland Avenue opposite Morton Street and a limited-access (full entering; right-turn only exiting) driveway along West Street opposite Avery Square. An active loading area is proposed along the west side of Highland Avenue, opposite Mellen Street.

Trip generation was estimated using ITE methodology. The Project is anticipated to generate approximately 81 vehicle trips (19 entering and 62 exiting) during the weekday morning peak hour, and 102 vehicle trips (64 entering and 38 exiting) during the weekday evening peak hour. Daily trips are estimated at approximately 1,284 vehicles. These estimates are considered conservative, as no reduction was applied for the site’s proximity to public transit and pedestrian infrastructure.

The site is located across from the Needham Heights MBTA Commuter Rail station and is within walking distance of multiple MBTA bus stops, including Route 59. U.S. Census data indicates that a significant portion of local residents utilize alternative modes of transportation, including public transit, walking, and bicycling.

Intersection capacity analyses show that the project will not degrade level of service at surrounding intersections, with all approaches expected to continue operating at LOS D or better during peak hours. No off-site mitigation is required. A Transportation Demand Management (TDM) program is proposed to further

reduce single-occupancy vehicle use and promote sustainable transportation options. A full Traffic Impact Assessment (TIA) has been prepared for the Project and is included with this application.

4. External Lighting

Discrete lighting elements will be provided on building facades to accent architecture features. Lights will be placed to minimize off-site lighting impacts, illuminate arrival points, open space walkways and sidewalks, and enhance the proposed architecture and landscape. The light fixtures on the Project will utilize an LED energy efficient light source. The lightshades will minimize up-lighting.

Any exterior Site lighting for the Project will be dark-sky friendly and encompass LED driveway lighting, pedestrian pole fixtures, accent catenary lights, discrete spot lights for sign lighting and special features, and lighting at entry points to the building. There are existing street lights located along West Street and Highland Avenue and we anticipate sufficient lighting in the area such that the Project will not be required to provide additional street lighting. The lighting that is installed will be placed in locations to minimize off-Site lighting impacts, illuminate arrival points, amenity areas, walkways and sidewalks, and enhance the proposed architecture and landscape.

5. Landscaping and Screening

The Project includes streetscapes along Highland Avenue and West Street, three courtyard areas, and a large open space area a large open space on the southern side. The streetscapes incorporate native street trees and plantings. The open space on ground level will include site perimeter plantings that will provide year-round visual interest, screening, and improve the public right of way. The proposed outdoor amenity space on ground level will include a dog park, children's play area, open lawn, patio lounge and outdoor kitchen area with grills and a shade structure.

6. Sanitary Sewer

The Project team will work with the Town of Needham Department of Public Works (DPW) and Engineering Department to review existing and proposed sewer infrastructure in the Project Vicinity. There are existing 15" sewer mains that run down Highland Avenue and West Street. The project anticipate tying into the existing main in Highland Avenue with the proposed sewer service(s).

Estimated sewer flows have been calculated using the Title 5 System Sewage Flow Design Criteria and are outlined below:

Existing				
Use/Unit Type	Quantity	Bedroom Quantity	Unit Flow (GPD)	Total Flow (GPD)
Assisted Living Facilities	142	142	150	21,300
			Total	**21,300**
Proposed				
Use/Unit Type	Quantity	Bedroom Quantity	Unit Flow (GPD)	Total Flow (GPD)
Studio	30	30	110	3,300
One Bed	84	84	110	9,240
Two Bed	58	116	220	12,760
Three Bed	17	51	330	5,610
			Total	**30,910**
Net Increase				***9,610***

7. Stormwater Management

Existing Conditions

The site is approximately 4.3 acres and currently developed with a three-story senior housing building oriented north–south along Highland Avenue, with paved parking areas to the south and west. Under existing conditions, stormwater from the parking areas drains via overland flow to catch basins, which discharge to three design points through an underground drainage network. Roof runoff is collected along the Highland Avenue frontage and conveyed north via subsurface piping. Site grades range from 173 feet near the MBTA tracks to 180 feet along the northeasterly edge.

Proposed Conditions

The proposed stormwater management controls will be designed in accordance with the Town of Needham requirements and the methodologies promoted in the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook. The Site's stormwater management system has been designed to drain to deep-sump, hooded catch basins, area drains, and water quality inlets. The drain inlets will capture and convey stormwater runoff, via an underground pipe system, to one of the three (3) stormwater Best Management Practices (BMP) included as part of the stormwater management system. Water quality treatment of stormwater runoff will be provided through a combination of deep-sumps and hoods within catch basins, hydrodynamic separators, and a proprietary filtration unit. The water quality units and proprietary filtration unit address Total Suspended Solids (TSS). Rooftop runoff will also receive treatment to remove TP. The peak rate of runoff will be attenuated predominately by one of the three (3) stormwater system located in the parking lot and front courtyard area, which will control the release of stormwater to the municipal drain network in West Street and along the MBTA right of way tracks.

Since the Project will disturb more than one acre of land, construction will require the submittal of a Notice of Intent (NOI) for coverage under the Construction General Permit (CGP) as part of the EPA's National Pollutant Discharge Elimination System (NPDES). Conformance with NPDES will require the preparation of a Stormwater Pollution Prevention Plan (SWPPP) for the Project's construction and performance of applicable SWPPP site inspections. As part of conformance with the SWPPP and NPDES, appropriate erosion and sedimentation (E&S) controls will be installed to prevent sediment laden stormwater runoff from leaving the site and entering the city drainage system. E&S controls may include structural methods such as catch basin inlet controls, silt fence, and silt socks as well as non-structural methods such as minimizing the extent and duration of exposed soils. E&S controls will be maintained as necessary until all disturbed areas have been stabilized through the placement of pavement, structure, or established vegetative cover.

Additionally, an Operation and Maintenance (O&M) Plan will be prepared for the Project's proposed stormwater management system. The O&M Plan will outline procedures and timetables for the long-term operation and maintenance of the proposed stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M will include a list of responsible parties, and the stormwater management system will be maintained by the owner and/or the owner's representative.

8. Water Service

Water service for the proposed development is anticipated to be looped between the existing 10-inch water main in Highland Avenue and the 12-inch water main in West Street. The final size and location of the building connections will be coordinated with the Department of Public Works, Engineering and Fire Department. A hydrant flow test will also be coordinated with DPW and the results will be incorporated into the design as the Project progresses. Existing hydrant coverage is anticipated to be suitable to serve the proposed project.

9. Electric and Telecommunication Utilities

The Project proposes to tie into the existing private utility infrastructure immediately adjacent to the project site. It is anticipated that electrical infrastructure will be proposed within one of the courtyard areas and is served by an electric manhole on Highland Avenue via underground conduits. Final locations and sizes will be coordinated with appropriate utility providers.

10. Snow Removal

The Project proposes snow to be stored off the southwestern corner of the site. During larger snow events, excess snow may be trucked off site. De-icing methods include salt, sand, and other measures will be implemented as needed.

11. Architecture Compatibility

The proposed 189-unit multifamily development is designed to respond thoughtfully to its surroundings along Highland Avenue and West Street. The building massing is broken into smaller modules with varied textures and angled bays at the southern end to reflect the scale of the adjacent residential neighborhood, transitioning to a more commercial expression toward the north. Landscaped courtyards along Highland Avenue create visual breaks in the façade and provide relief to the streetscape, enhancing the pedestrian experience and integrating the project into the existing urban fabric.

The main entrance is located along Highland Avenue, with additional residential entrances and egresses provided along both frontages and the internal parking area. Ground-floor units feature individual entries to further activate the street edge and reinforce a neighborhood feel.

SECTION 2:
SITE PLAN REVIEW APPLICATION

Docusign Envelope ID: 1CF78778-2E54-4375-91D5-DBA3BFAC7D1B

TOWN OF NEEDHAM
MASSACHUSETTS

500 Dedham Avenue
Needham, MA 02492
781-455-7550

PLANNING BOARD

APPLICATION FOR SITE PLAN REVIEW

Project Determination: (circle one) Major Project Minor Project

This application must be completed, signed, and submitted with the filing fee by the applicant or his representative in accordance with the Planning Board's Rules as adopted under its jurisdiction as a Special Permit Granting Authority. Section 7.4 of the By-Laws.

Location of Property 100 West Street, Needham MA
Name of Applicant Greystar Development East, LLC
Applicant's Address 1 Federal Street, Suite 1804, Boston, MA 02110
Phone Number (857) 254-1329

Applicant is: Owner _____ Tenant _____
Agent/Attorney _____ Purchaser ✓

Property Owner's Name HCRI Massachusetts Properties Trust II
Property Owner's Address 4500 Dorr Street, Toledo, OH 43615
Telephone Number _____

Characteristics of Property: Lot Area 4.3 Present Use Commercial
Map # 63 Parcel # __ Zoning District ASB-MF

Description of Project for Site Plan Review under Section 7.4 of the Zoning By-Law:

Signature of Applicant (or representative) _____
Address if not applicant _____
Telephone # 857 254 1329
Owner's permission if other than applicant DocuSigned by: Russell Simon 985ECC807F8C448...

SUMMARY OF PLANNING BOARD ACTION

Received by Planning Board _____ Date _____
Hearing Date _____ Parties of Interest Notified of Public Hearing _____
Decision Required by _____ Decision/Notices of Decision sent _____
Granted _____
Denied _____ Fee Paid _____ Fee Waived _____
Withdrawn _____
NOTE: Reports on Minor Projects must be issues within 35 days of filing date.

SECTION 3:
TRAFFIC REPORT

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

PRINCIPALS
Robert J. Michaud, P.E.
Daniel J. Mills, P.E., PTOE

M E M O R A N D U M

DATE: August 7, 2025

TO: Tim Beinert
Greystar
One Federal Street, Suite 1804
Boston, MA 02110

FROM: Robert J. Michaud, P.E. – Managing Principal
Andrew J. Arseneault – Project Manager

RE: **Proposed Multifamily Residential Community**
100 West Street – Needham, MA

MDM Transportation Consultants, Inc. (MDM) has prepared this Traffic Impact Assessment (TIA) for a proposed multifamily residential community to be located at 100 West Street in Needham, Massachusetts. The location of the Site relative to the adjacent roadway network is shown in **Figure 1.** This TIA provides a primary summary of the baseline traffic conditions at the Site and adjacent roadways/intersections, evaluates historical and projected trip generation, site access/egress, and provides an operational analysis of project impact.

PROJECT DESCRIPTION

The Site consists of approximately 4.31± acres of land bordered by Highland Avenue, West Street, railroad track operated by the Massachusetts Bay Transportation Authority (MBTA), and residential properties. The Site is improved by an existing 187,310± square foot (sf) commercial building that formerly housed an approximate 142-bed senior adult continuing care facility.

Under the proposed Site programming, the existing structures will be razed, and a multifamily residential community of up to 189 dwelling units will be constructed. On-site vehicular parking is planned for a minimum of 186 spaces, with additional areas of on-street permit parking available along Highland Avenue in the immediate vicinity of the Site. Secure bicycle parking will be provided for up to 189 bicycles, with approximately 47 bicycle storage spaces provided in an interior bicycle room and 142 short-term storage spaces provided by way of exterior bicycle racks. Site access is envisioned to continue to be provided by way of the two existing driveways serving the Site along Highland Avenue and West Street. The Highland Avenue driveway is envisioned to provided full-access and will require the elimination of two on-street parking spaces. The West Street driveway will limit (by way of signage) exiting vehicles to right-turns only, reducing potential conflict points with the adjacent at-grade MBTA rail crossing. Further,

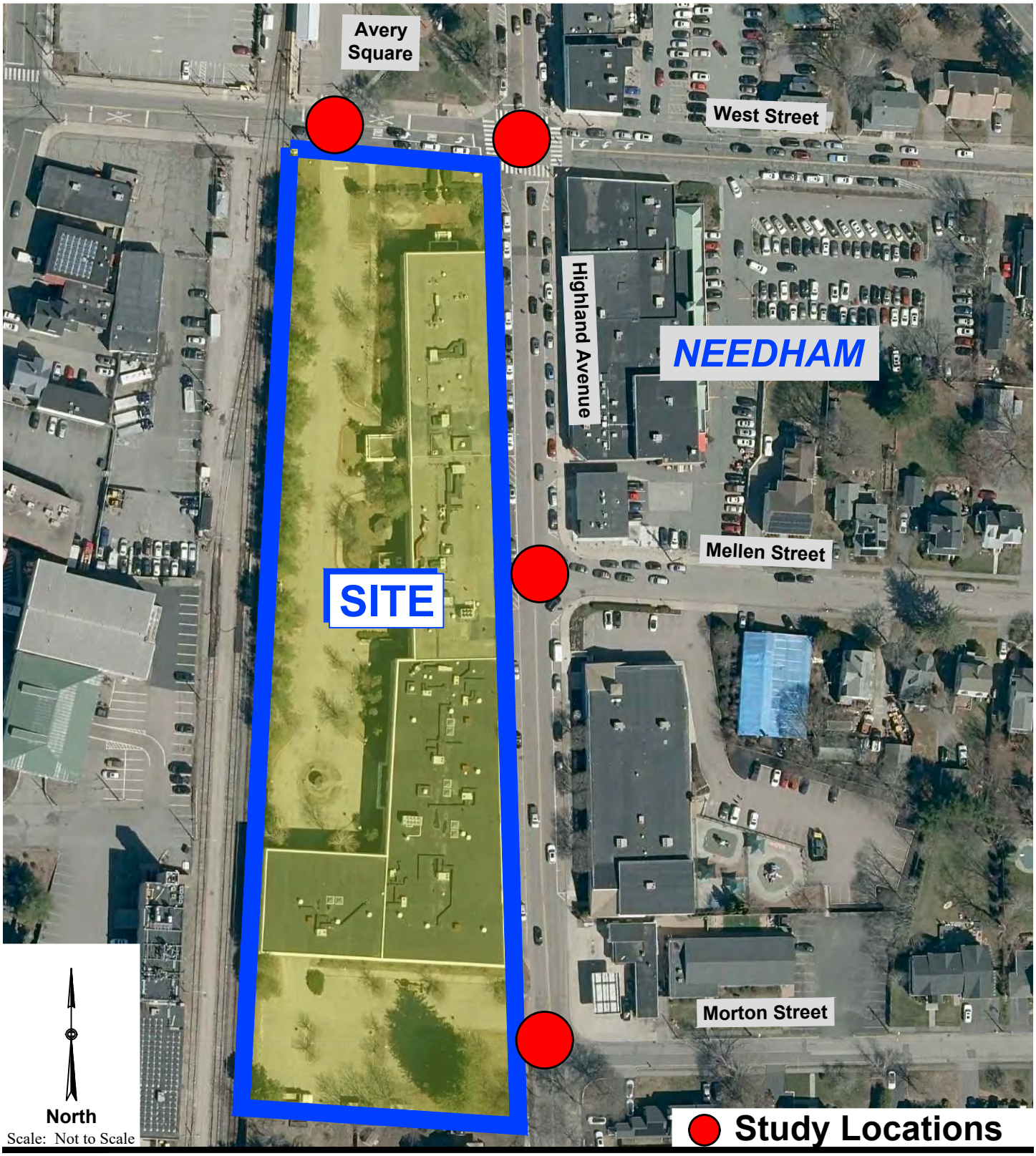

Figure 1

Site Location

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: July 2025
Dwg No. 1424 TIA01.dwg
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G:\Projects\1424 - Needham (100 West Street)\Dwg\1424 TIA01.dwg, Figure 1, 7/9/2025 11:55:20 AM

an active loading area is proposed along the west side of Highland Avenue, approximately opposite Mellen Street. The preliminary Site layout prepared by Bohler is presented in **Figure 2**.

BASELINE TRAFFIC AND SAFETY CHARATERISTICS

An overview of roadway classification and geometric characteristics is provided below for the adjacent study roadways.

Highland Avenue

Highland Avenue is generally a north-south roadway under local jurisdiction within the study area. Highland Avenue is classified by MassDOT as a principal arterial roadway and provides a direct connection to Interstate 95 to the north. Highland Avenue provides a single travel lane in each direction. Sidewalks and on-street parking are provided along both sides of Highland Avenue. Land use along Highland Avenue in the study area include the Site, Needham Heights Common, and commercial and residential properties.

West Street

West Street is generally an east-west roadway under local jurisdiction within the study area. West Street is classified by MassDOT as a major collector roadway and provides a connection between Webster Street in the east and Central Avenue to the west. West Street provides a single travel lane in each direction, with additional turning lanes provided at the Highland Avenue intersection. Sidewalks are provided along both sides of West Street. Land use along West Street in the study area include the Site, Needham Heights Common, the Needham Heights MBTA station and commercial and residential properties.

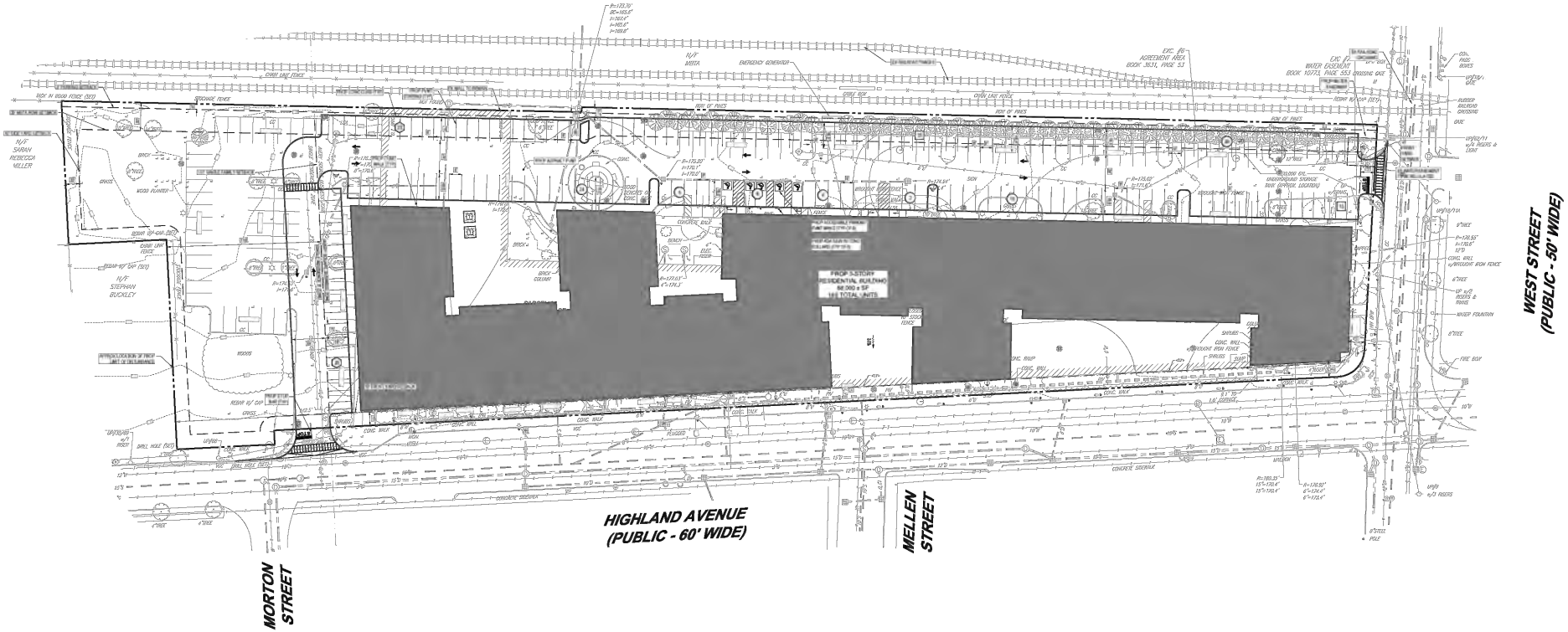
Intersections

The following intersections provide a primary means of access to the Site and are likely to sustain a measurable level of traffic impact from the development of the Site.

- Highland Avenue at West Street – Signalized
- Highland Avenue at Mellen Street – Unsignalized
- Highland Avenue at Morton Street and the Site driveway – Unsignalized
- West Street at Avery Square and the Site driveway – Unsignalized

Baseline Traffic Data

Traffic volume data was collected at the study intersections in April 2025 during the weekday morning (7:00 AM - 9:00 AM) and weekday evening (4:00 PM – 6:00 PM) periods to coincide with peak traffic activity of the proposed uses and the adjacent streets. A review of MassDOT permanent count station data indicates that April is representative of an average traffic month.



North

Scale: Not to Scale

Site Plan Source: Bohler

Figure 2

Preliminary Site Plan

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: August 2025
Dwg No. 1424 TIA01.dwg
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Therefore, no adjustment (reduction) for seasonal fluctuations needed to be made to the traffic volume data. The weekday morning and weekday evening peak hour traffic volumes for the study intersections are shown in **Figure 3** and **Figure 4**. Traffic count data and MassDOT permanent count station data are provided in the **Attachments**.

Daily Traffic Counts

In addition to TMC data described above, daily traffic volumes were obtained along Highland Avenue to the south of Morton Street in April 2025 which is summarized in **Table 1** without adjustment.

TABLE 1
ROADWAY TRAFFIC-VOLUME SUMMARY

Time Period	Daily Volume (vpd)[1]	Percent Daily Traffic[2]	Peak Hour Volume (vph)[3]	Peak Flow Direction[4]	Peak Hour Directional Volume (vph)
Highland Avenue, south of Morton Street					
Weekday Morning Peak Hour	11,540	7.4%	859	52.8% NB	454
Weekday Evening Peak Hour	11,540	7.8%	904	51.7% SB	467

[1]Two-way daily traffic expressed in vehicles per day.
[2]The percent of daily traffic that occurs during the peak hour.
[3]Two-way peak-hour volume expressed in vehicles per hour.
[4]NB = northbound, SB = southbound

As summarized in **Table 1**, Highland Avenue carries approximately 11,540 vehicles per day (vpd) on weekdays. Peak hour traffic flow on Highland Avenue ranges from approximately 859 to 904 vehicles per hour (vph) which represents 7 to 8 percent of daily traffic flow with the peak flow direction slightly heavier northbound during the weekday morning peak hour and slightly heavier southbound during the weekday evening peak hour.

Measured Travel Speeds

Vehicle speeds were obtained for Highland Avenue. These measured travel speeds provide a basis for determining sight line requirements at the site driveway intersection with Highland Avenue. **Table 2** presents a summary of the travel speed data collected along Highland Avenue. Detailed speed data is provided in the **Attachments**.

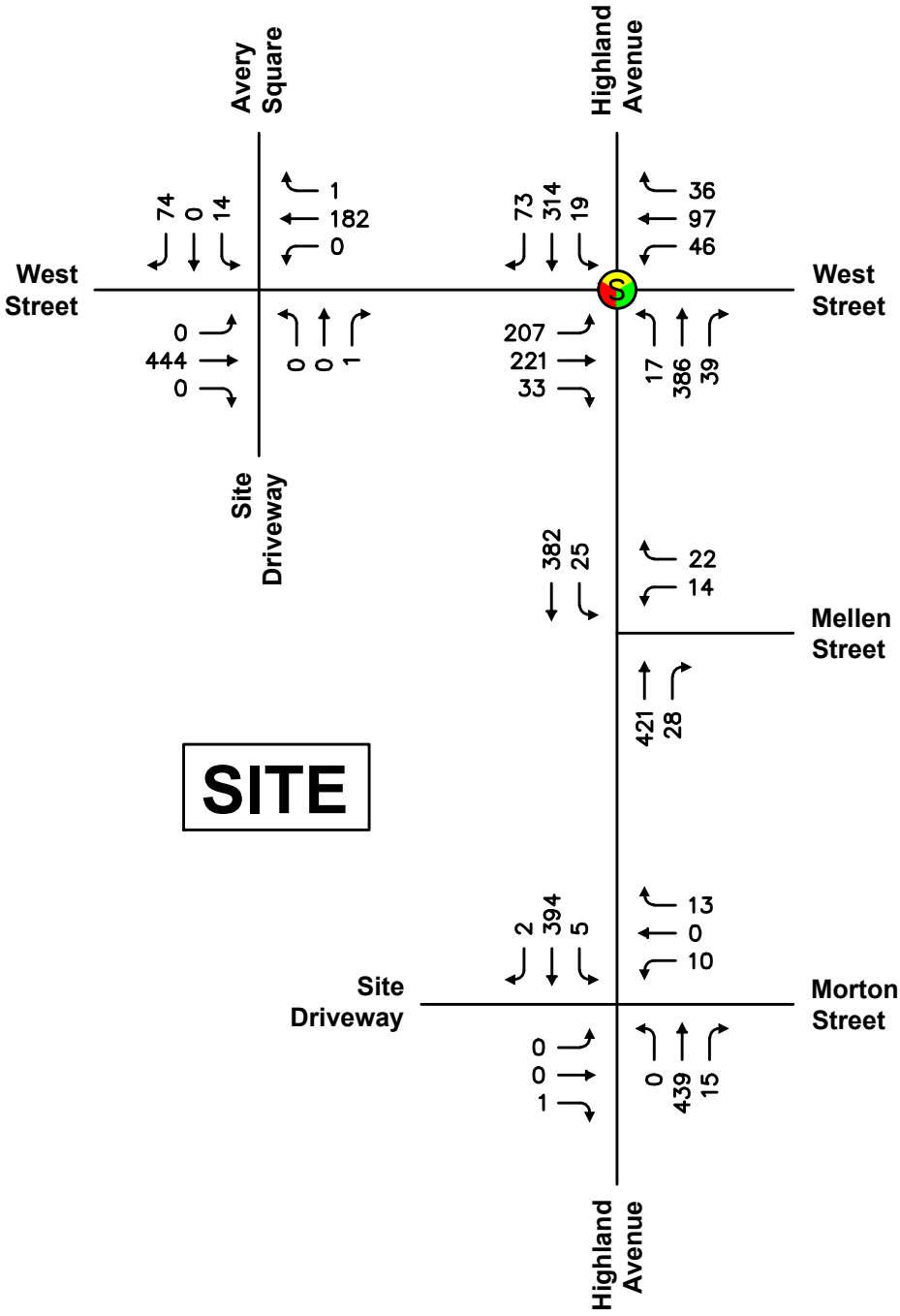

Figure 3

2025 Baseline Condition
Morning Peak Hour Traffic Volumes

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: July 2025
Dwg No. 1424 TIA01.dwg
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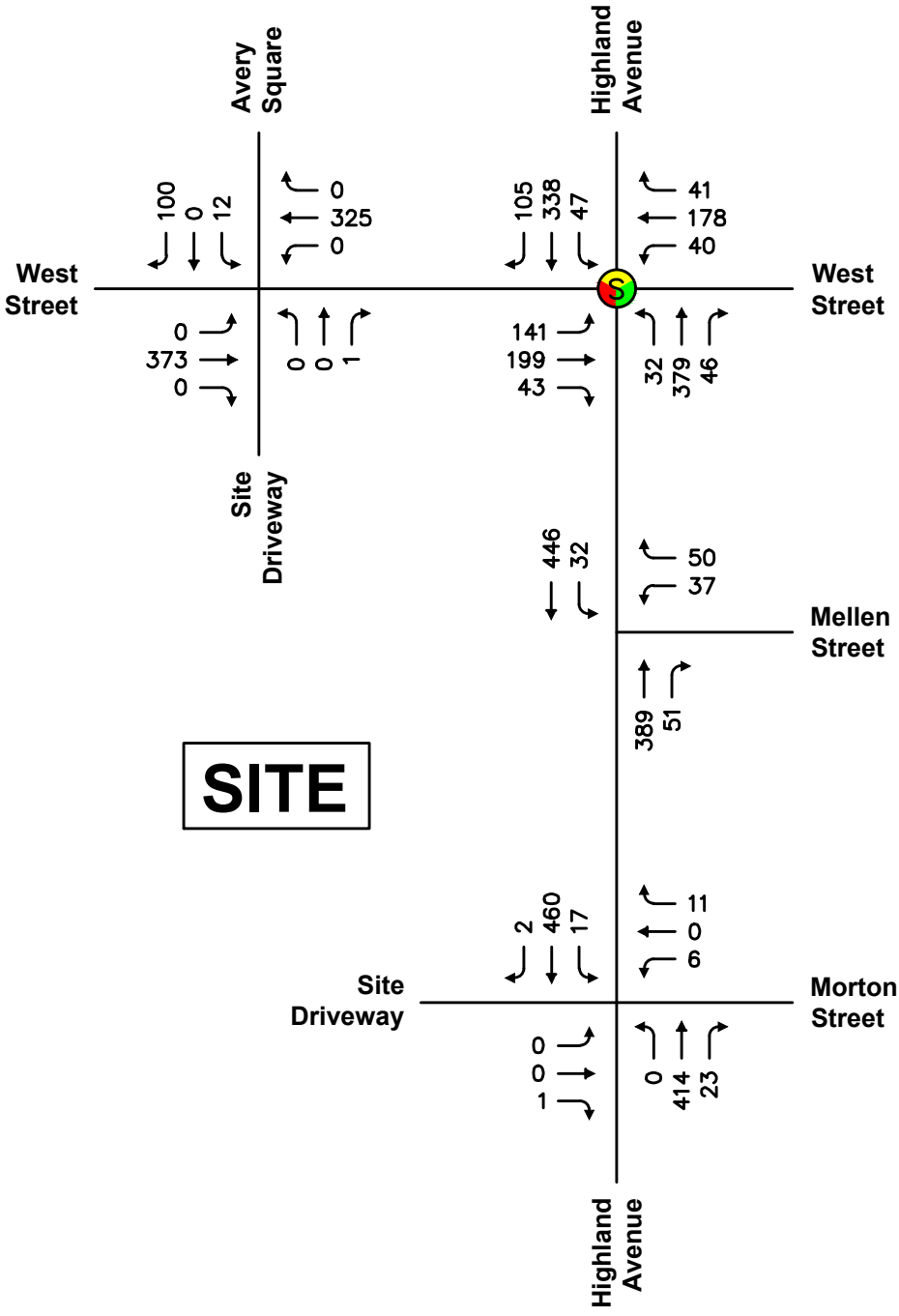

Scale: Not to Scale

Figure 4

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

2025 Baseline Condition
Evening Peak Hour Traffic Volumes

Date: July 2025
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TABLE 2
SPEED STUDY RESULTS

Travel Direction	Statutory Speed Limit[1]	Travel Speed	
		Mean[2]	85th Percentile[3]
Highland Avenue			
Northbound	30	28	32
Southbound	30	30	34

[1]Statutory speed limit in mph.
[2]Arithmetic mean in mph.
[3]The speed at or below which 85 percent of the vehicles are traveling in mph.

As summarized in **Table 2**, the mean (average) travel speed on Highland Avenue was observed to be 28 mph for the northbound direction and 30 mph in the southbound direction; the 85th percentile travel speed was observed to be 32 mph in the northbound direction and 34 mph in the southbound direction.

Public Transportation Facilities

The MBTA provides commuter rail and fixed-route bus services in the immediate vicinity of the Site. Commuter rail service along the Needham Line is provided at the Needham Heights station, located opposite the Site along West Street. Fixed-route bus service provided by way of Route 59 – Needham Junction – Watertown Square, travelling along Highland Avenue with the closest stop provided at the Highland Avenue at Avery Square and Mark Lee Road intersection, approximately 500 feet north of the Site. The Needham Line of the MBTA Commuter Rail provides direct service to South Station in Boston, with Needham Heights station serving as the terminus of the line. Bus Route 59 provides service to several multimodal stations, including Newton Highlands Station, which provides a connection to the Green Line of the MBTA Subway system. The public transit schedules and fare information is provided in the **Attachments**.

Intersection Crash History

In order to identify crash trends and safety characteristics for study area intersections, crash data were obtained from MassDOT for the Town of Needham for the five-year period covering 2020-2024 (the most recent full year of data currently available from MassDOT). A summary of the crash data with crash rates for the study intersections with reported crashes is provided in **Table 3** with detailed data provided in the **Attachments.**

Crash rates were calculated for the study intersections as reported in **Table 3**. These rates quantify the number of crashes per million entering vehicles. MassDOT has determined the official District 6 (which includes the Town of Needham) crash rate to be 0.71 for signalized intersections and 0.52 for unsignalized intersections. This rate represents MassDOT's "average" crash experience for District 6 communities and serves as a basis for comparing reported crash rates for the study intersections. Where calculated crash rates notably exceed the district average, some form of safety countermeasures may be beneficial. A review of Highway Safety Improvement Project (HSIP) locations was also conducted.

TABLE 3
INTERSECTION CRASH SUMMARY
2020 THROUGH 2024[1]

	INTERSECTIONS			
Data Category	Highland Ave. at West St.	Highland Ave. at Mellen St.	Highland Ave. at Morton St. and the Site driveway	West St. at Avery Sq. and the Site driveway
Traffic Control	Signalized	Unsignalized	Unsignalized	Unsignalized
Crash Rate[2]	**0.89**	**0.55**	**0.05**	**0.16**
MassDOT Avg. Rate[3]	0.71	0.52	0.52	0.52
Above Avg. Rate?	**Yes**	**Yes**	**No**	**No**
Year:				
2020	4	1	0	1
2021	7	0	0	0
2022	9	1	0	0
2023	7	8	0	1
2024	6	3	1	1
Total	**33**	**13**	**1**	**3**
Type:				
Angle	13	5	1	0
Rear-End	7	1	0	1
Head-On	0	0	0	0
Sideswipe	10	3	0	1
Fixed-Object	3	4	0	1
Pedestrian/Bicyclist	0	0	0	0
Other	0	0	0	0
Severity:				
P. Damage Only	32	12	1	2
Personal Injury	1	1	0	0
Fatality	0	0	0	0
Unknown	0	0	0	1
Conditions:				
Dry	27	11	1	2
Wet	6	1	0	1
Snow/Ice	0	1	0	0
Unknown/Other	0	0	0	0
Time:				
7:00 AM to 9:00 AM[4]	2	0	0	0
4:00 PM to 6:00 PM[4]	3	1	0	0
Rest of Day/Weekend	28	12	1	3

[1]Source: MassDOT Crash Database
[2]Crashes per million entering vehicles.
[3]District 6 Average Crash Rates: 0.71 (Signalized) and 0.52 (Unsignalized)
[4]On Weekdays.

As summarized in **Table 3**:

- *Highland Avenue at West Street.* There were 33 crashes reported at the signalized study intersection during the five-year study period, resulting in a crash rate of 0.89, which is above the District 6 average. The reported crashes included 13 angle-type collisions, seven rear-end collisions, 10 sideswipe-type collisions, and three collisions with fixed-objects. Ninety-seven percent (97%) of the crashes resulted in property damage only, generally indicative of low-speed crashes. Fifteen percent (15%) occurred during the peak period travel times and eighty-two percent (82%) occurred under dry roadway conditions.

- *Highland Avenue at Mellen Street.* There were 13 crashes reported at the unsignalized study intersection during the five-year study period, resulting in a crash rate of 0.55, which is generally consistent with the District 6 average. The reported crashes included five angle-type collisions, one rear-end collision, three sideswipe-type collisions, and four collisions with fixed-objects. Ninety-two percent (92%) of the crashes resulted in property damage only, generally indicative of low-speed crashes. Eight percent (8%) occurred during the peak period travel times and eighty-five percent (85%) occurred under dry roadway conditions.

- *Highland Avenue at Morton Street and the Site driveway.* There was one crash reported at the unsignalized study intersection during the five-year study period, resulting in a crash rate of 0.05, which is well below the District 6 average. The reported crash involved an angle-type collision that resulted in property damage only, outside of the peak period travel times and under dry roadway conditions.

- *Highland Avenue at Avery Square and the Site driveway.* There were three crashes reported at the unsignalized study intersection during the five-year study period, resulting in a crash rate of 0.16, which is well below the District 6 average. The reported crashes included one rear-end collision, one sideswipe-type collision, and one collision with a fixed-object. Sixty-seven (67%) of the crashes resulted in property damage only, generally indicative of low-speed crashes. No (0%) crashes occurred during the peak period travel times and sixty-seven (67%) occurred under dry roadway conditions.

In summary, based on an extensive review of MassDOT crash data, none of the intersections are classified as high crash locations (HSIP eligible) by MassDOT, and no fatalities or pedestrian-related incidents were reported over the five-year period at the study area intersections. As noted, the intersection of Highland Avenue at West Street was noted to have a crash rate that was higher than the average crash rate for signalized intersections located in District 6. The Town of Needham and MassDOT are in the process of developing a long-term corridor improvement plan that will include this intersection to address safety needs as discussed in more detail in the *Planned Area Roadway Improvements* section of this report.

SIGHT LINE EVALUATION

An evaluation of sight lines in accordance with the standards published by the American Association of State Highway and Transportation Officials' (AASHTO) [1] was conducted at the Site driveway intersections with Highland Avenue to ensure that minimum recommended sight lines are available to safely exit onto the aforementioned roadway.

Stopping Sight Distance

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the applicable Highland Avenue and West Street approaches to the Site driveways. **Table 4** presents a summary of the available SSD as it relates to Highland Avenue and West Street and AASHTO's recommended SSD.

TABLE 4
STOPPING SIGHT DISTANCE SUMMARY

Approach/ Travel Direction	Available SSD	AASHTO Recommended[1]	
		Regulatory Speed[2]	85th Percentile Speed[3]
Highland Avenue at the Site driveway			
Northbound	>500 Feet	200 Feet	220 Feet
Southbound	>500 Feet	200 Feet	240 Feet
West Street at the Site driveway			
Eastbound	>400 Feet	200 Feet	250 Feet
Westbound	>400 Feet	200 Feet	250 Feet

[1] Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet and adjustments for roadway grade.
[2] The Statutory Speed Limit is 30 mph along Highland Avenue and West Street.
[3] The 85th Percentile travel speed is 32 mph NB and 34 mph SB on Highland Avenue. An 85th percentile speed of up to 35 mph was assumed along West Street, which is 5 mph above the statutory speed limit.

Intersection Sight Distance

Available ISD was estimated in the field using AASHTO standards for driver's eye (3.5 feet), object height (3.5 feet) and decision point (10 feet from the edge of the travel way) looking along Highland Avenue and West Street from the Site driveway. **Table 5** presents a summary of the

[1] *A policy on Geometric Design of Highways and Streets,* American Association of State Highway and Transportation Officials (AASHTO), 2018.

available ISD for the departure from the aforementioned Site driveway and AASHTO's minimum (safe) and recommended (efficient) ISDs.

TABLE 5
INTERSECTION SIGHT DISTANCE SUMMARY

Approach/ Travel Direction	Available ISD	AASHTO Minimum[1] 85th Percentile Speed[2]	AASHTO Ideal[1] 85th Percentile Speed[2]
The Site driveway at Highland Avenue			
Looking North	245 Feet	240 Feet	325 Feet
Looking South	>500 Feet	220 Feet	355 Feet
The Site driveway at West Street			
Looking West	350 Feet	250 Feet	335 Feet

[1] Recommended minimum and ideal sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet. The minimum value as noted represents ISD per AASHTO guidance.
[2] The 85th Percentile travel speed is 32 mph NB and 34 mph SB on Highland Avenue. An 85th percentile speed of up to 35 mph was assumed along West Street, which is 5 mph above the statutory speed limit.

As summarized in **Table 4 and Table 5**, the analysis results indicate that the available sight lines exceed AASHTO's recommended SSD and ISD criteria for safe operations based on both the posted speed limit and observed 85th percentile design speeds. MDM recommends that any new plantings (shrubs, bushes) or physical landscape features to be located within the Highland Avenue and West Street sight line triangles should also be maintained at a height of 2 feet or less above the adjacent existing roadway grade to ensure unobstructed lines of sight.

PROJECTED TRAFFIC CONDITIONS

Evaluation of the proposed development impacts requires the establishment of a future baseline analysis condition. This section estimates future roadway and traffic conditions with and without the proposed development of the Site. For planning purposes, a seven-year planning horizon (year 2032) was selected, consistent with standard industry practice.

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to a future year condition. Traffic volumes on the roadway network at that time, in the absence of the development (that is, the No-Build condition), includes existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others that are currently under review at the local and/or state level. Consideration of these factors resulted in the development of

No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic-flow networks to develop future Build conditions.

The following sections provide an overview of the future No-Build and Build traffic volumes.

Planned Area Roadway Improvements

MassDOT and the Town of Needham are in the design and development stage of a corridor improvement project along Highland Avenue, including segments of roadway and intersections in the immediate vicinity of the Site. Conceptually the project is envisioned to include geometric alterations to the Highland Avenue at West Street intersection, widening the southbound approach from one general purpose travel lane to a shared left-turn/through lane and a right-turn lane. Currently, this project is in the preliminary design phase, and is actively soliciting public feedback for any potential design revisions. Given the preliminary nature of this project, no improvements associated with this potential roadway improvement project were assumed in the future conditions analysis in this report. Should this project be advanced it would represent a general improvement to the analysis presented herein.

No other major roadway improvements have been identified at this time.

Background Traffic Growth

Background traffic includes demand generated by other planned developments in the area as well as demand increases caused by external factors. External factors are general increases in traffic not attributable to a specific development and are determined using historical data.

Historical Area Growth

Nearby permanent count station data published by MassDOT indicates a 0.45 percent per year growth rate. For purposes of this evaluation, a 1.0 percent growth rate was used (7.2 percent increase over a 7-year horizon). This growth rate is higher than historic rates, and, as such, is also expected to account for any small fluctuation in hourly traffic that may occur from time to time in the study area and traffic associated with other potential small developments or vacancies in the area. MassDOT permanent count station data and background growth calculations are provided in the **Attachments**.

Background Development-Related Growth

The development of future No-Build traffic volumes also considers traffic generated through the study area from other specific area developments. Based on a consultation with the Town of Needham Department of Planning and Community Development and a review of Massachusetts

Environmental Policy Act (MEPA) filings, there are no pending or approved projects in the immediate area that were reviewed as they may increase traffic volumes through the study area.

To account for future traffic growth in the study area, the one percent annual growth rate was applied to the Baseline traffic volumes over a five-year period. The resulting 2032 No-Build traffic volumes for the weekday morning and evening peak hours are displayed in **Figure 5** and **Figure 6**.

Trip Generation

The trip generation estimates for the proposed multifamily residential community were estimated using trip rates published in the ITE *Trip Generation*[2] manual for Land Use Code (LUC) 220 – Multifamily Housing (Low-Rise). **Table 6** presents the trip-generation summary for the proposed multifamily residential community based on ITE methodology.

TABLE 6
TRIP-GENERATION SUMMARY – ITE BASIS
MULTIFAMILY RESIDENTIAL[1]

Period/Direction	Total Vehicle Trips
Weekday Morning Peak Hour:	
Entering	19
Exiting	62
Total	81
Weekday Evening Peak Hour:	
Entering	64
Exiting	38
Total	102
Daily	1,286

[1]Source: ITE Trip Generation, 11th Edition; 2021.
[2]Based on ITE trip rates for LUC 220 – Multifamily Housing (Low-Rise) applied to 189 Units.

As summarized in **Table 6**, based on industry-standard trip rates, the proposed multifamily residential community is estimated to generate approximately 81 trips during the weekday morning peak hour (19 entering and 62 exiting) and 111 trips during the weekday evening peak hour (64 entering and 38 exiting). On a daily basis, the proposed multifamily residential community is estimated to generate approximately 1,286 trips on a weekday.

The US Census publishes mode split rates for Needham and the immediate Census tract containing the Site, including estimates of vehicular, transit, and walking/bicycling mode split rates. The Site is located within a highly public transportation-oriented area of the Town with

[2]*Trip Generation, 11th ed.*; Institute of Transportation Engineers (ITE), 2021.

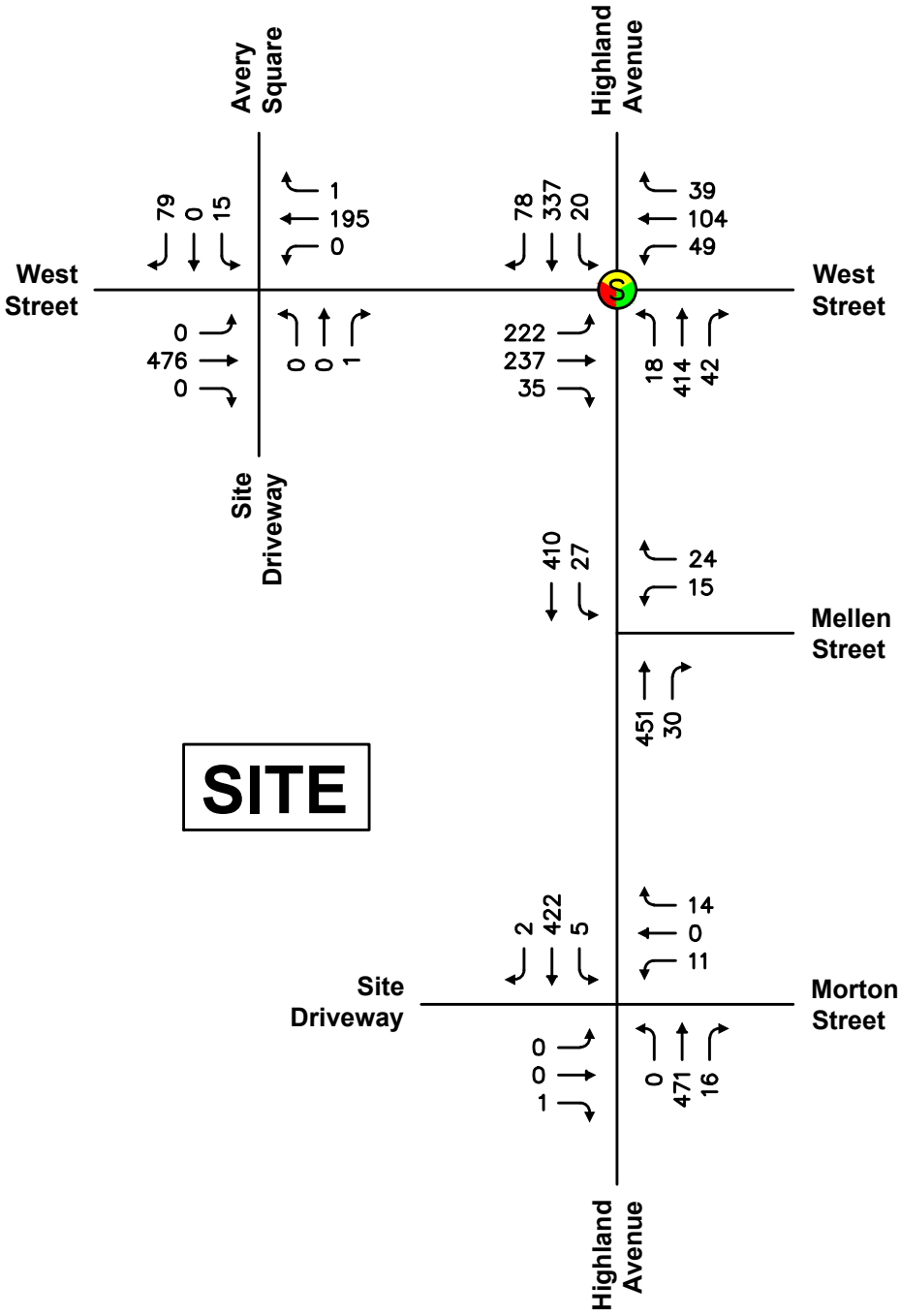

Figure 5

2032 No-Build Condition
Morning Peak Hour Traffic Volumes

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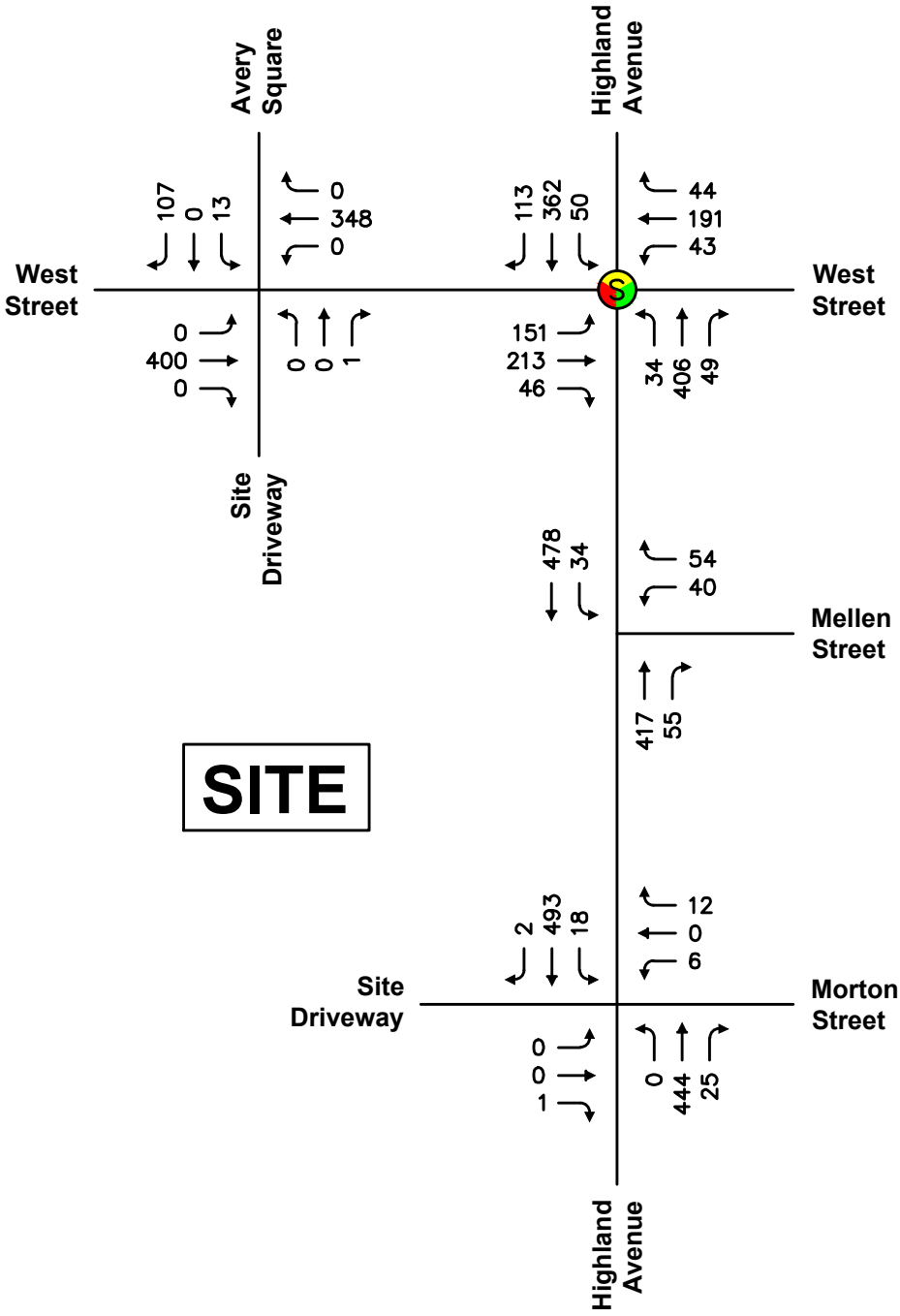

Figure 6

2032 No-Build Condition
Evening Peak Hour Traffic Volumes

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excellent access to an extensive sidewalk system, public transit services (MBTA), commuter rail line (Needham Heights Station), and walking and bicycling opportunities. A summary of the current (2023) and pre-covid (2019) five-year estimates for US Census Tract 4572 mode share data for the immediate study area is summarized in **Table 7**.

TABLE 7
AREA TRAVEL MODE STATISTICS[1]

Travel Mode	Current Percentages	Historic Percentages
Single Occupant Vehicle (SOV)	57%	73%
Auto (Carpool)	6%	2%
Public Transportation	5%	13%
Taxicab/Motorcycle/Other	0%	0%
Bike/Walk	4%	4%
Work From Home	28%	8%
Total	**100%**	**100%**

[1]Includes data from Census Tract 4752, Norfolk County, Massachusetts.

As summarized in **Table 7**, a review of current census data for the census tract indicates non-auto travel modes account for approximately 9% of the trips generated throughout the immediate study area, of which public transportation is the largest share (5%) followed by pedestrians and bicyclists (4%). Carpooling also accounts for 6% of automobile trips made in the immediate area. MDM notes the relatively high percentage of employees working from home within the tract, which appears to be elevated in response to external conditions resulting from general COVID-19 responses.

Historic data in the five-year period ending in 2019 indicated that non-auto travel modes within the tract accounted for approximately 17% of the trips, of which public transportation commuters represented the largest share (13%) followed by pedestrians and bicyclists (4%). Historically, carpooling accounted for 2% of the automobile trips made. Detailed Census tract information is provided in the **Attachments**.

Despite the relative proximity of the transit opportunities and pedestrian facilities, a credit to account for the use of non-motorized travel *was not applied* to the projected traffic volumes. This will result in a conservative (i.e., "worst-case") analysis of Site related traffic impacts.

Trip Distribution

The directional distribution of development-generated trips on the roadway network is a function of a number of variables including local area populations and the efficiency of the roadways leading to the Site. Journey-to-work census data serves as the basis for determining the trip distribution pattern for the proposed multifamily residential community. The distribution of the site generated trips is displayed in **Figure 7**. Journey-to-work trip distribution calculations are provided in the **Attachments**.

Development-related trips for the proposed multifamily residential community are assigned to the roadway network using the trip-generation estimates shown in Table 6 and the distribution patterns presented in Figure 7. Development-related trips at each intersection approach for the weekday morning and weekday evening peak hours are quantified in **Figure 8** and **Figure 9**, respectively.

Build Traffic Volumes

2032 Build condition traffic volumes are derived by: i) removing the incidental traffic associated with the existing vacant Site, and ii) adding development-specific traffic volumes to the 2032 No-Build conditions. The 2032 Build condition traffic-volume networks for the weekday morning and weekday evening peak hours are displayed in **Figure 10** and **Figure 11**, respectively. Volume networks depicting the removal of the incidental existing Site trips are provided in the **Attachments**.

OPERATIONS ANALYSIS

This section provides an overview of operational analysis methodology, and an assessment of intersection operations.

Analysis Methodology

Intersection capacity analyses are presented in this section for the 2025 Baseline, 2032 No-Build, and 2032 Build traffic-volume conditions. Capacity analyses, conducted in accordance with EEA/MassDOT guidelines and by using the Synchro® computer software, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The results of the intersection capacity are summarized below in **Table 9** and **Table 10** for the weekday morning and weekday evening peak hours, respectively.

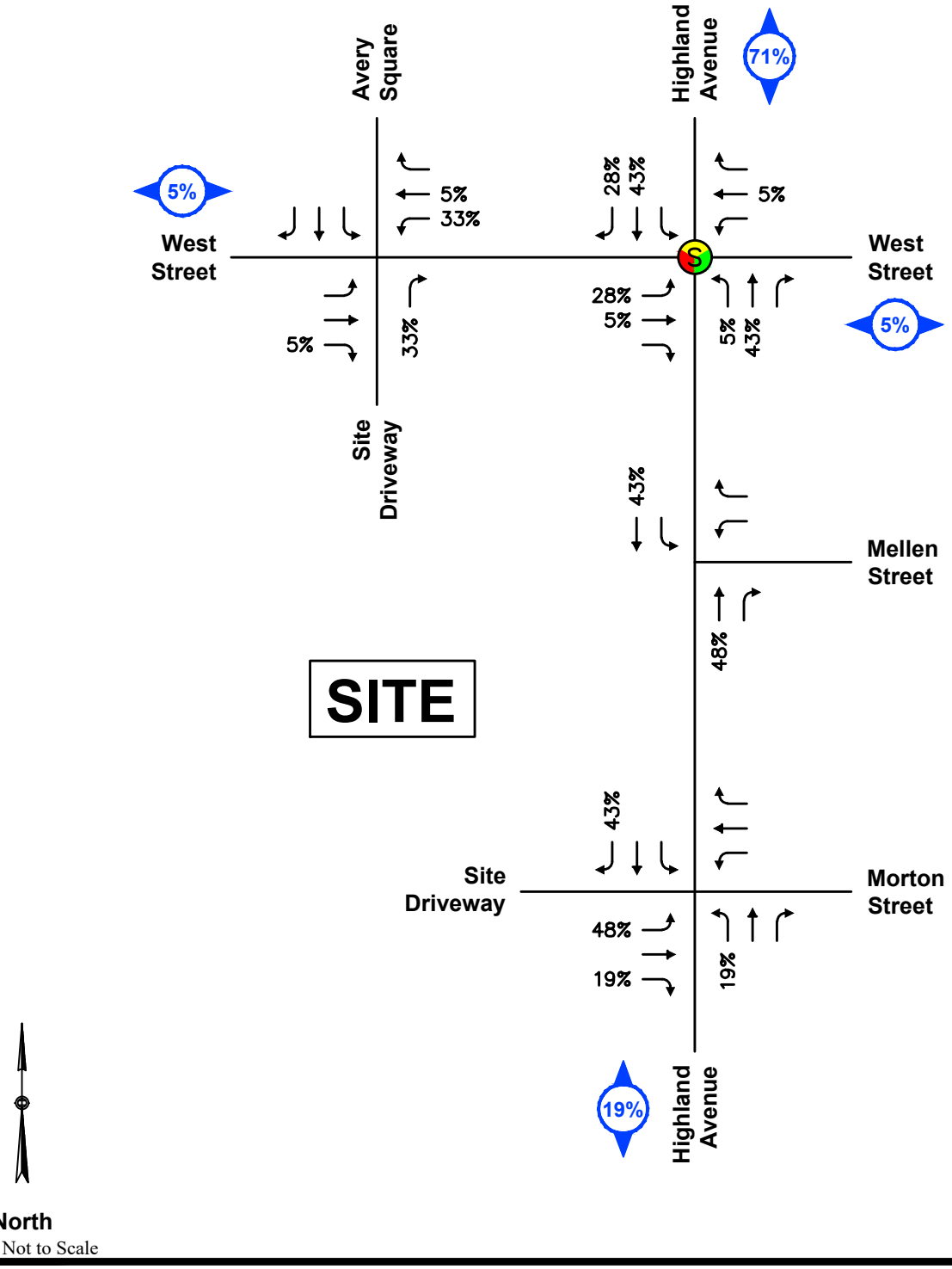

Figure 7

Site Generated Trips
Morning Peak Hour Traffic Volumes

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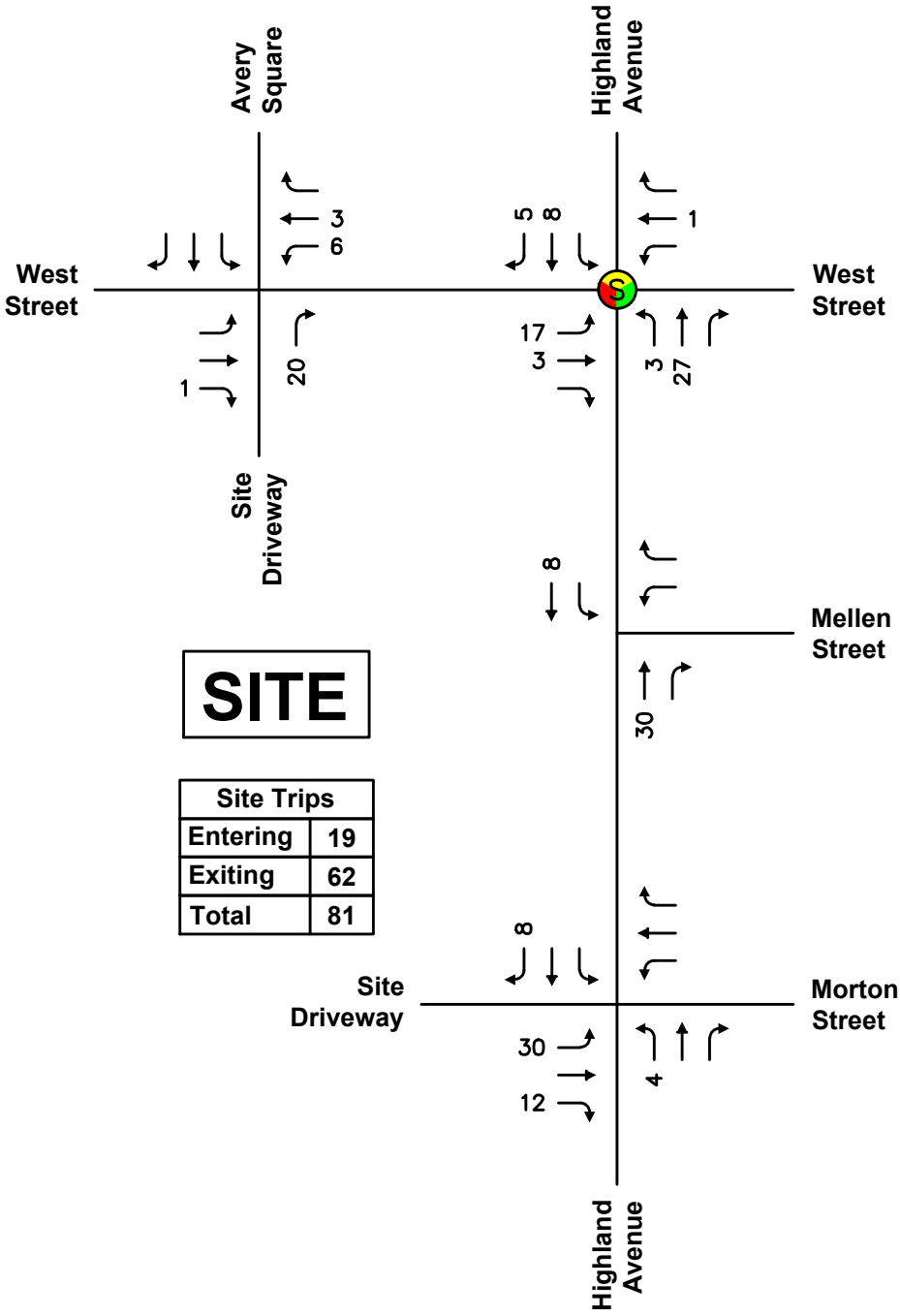

North
Scale: Not to Scale

Figure 8

Site Generated Trips
Morning Peak Hour Traffic Volumes

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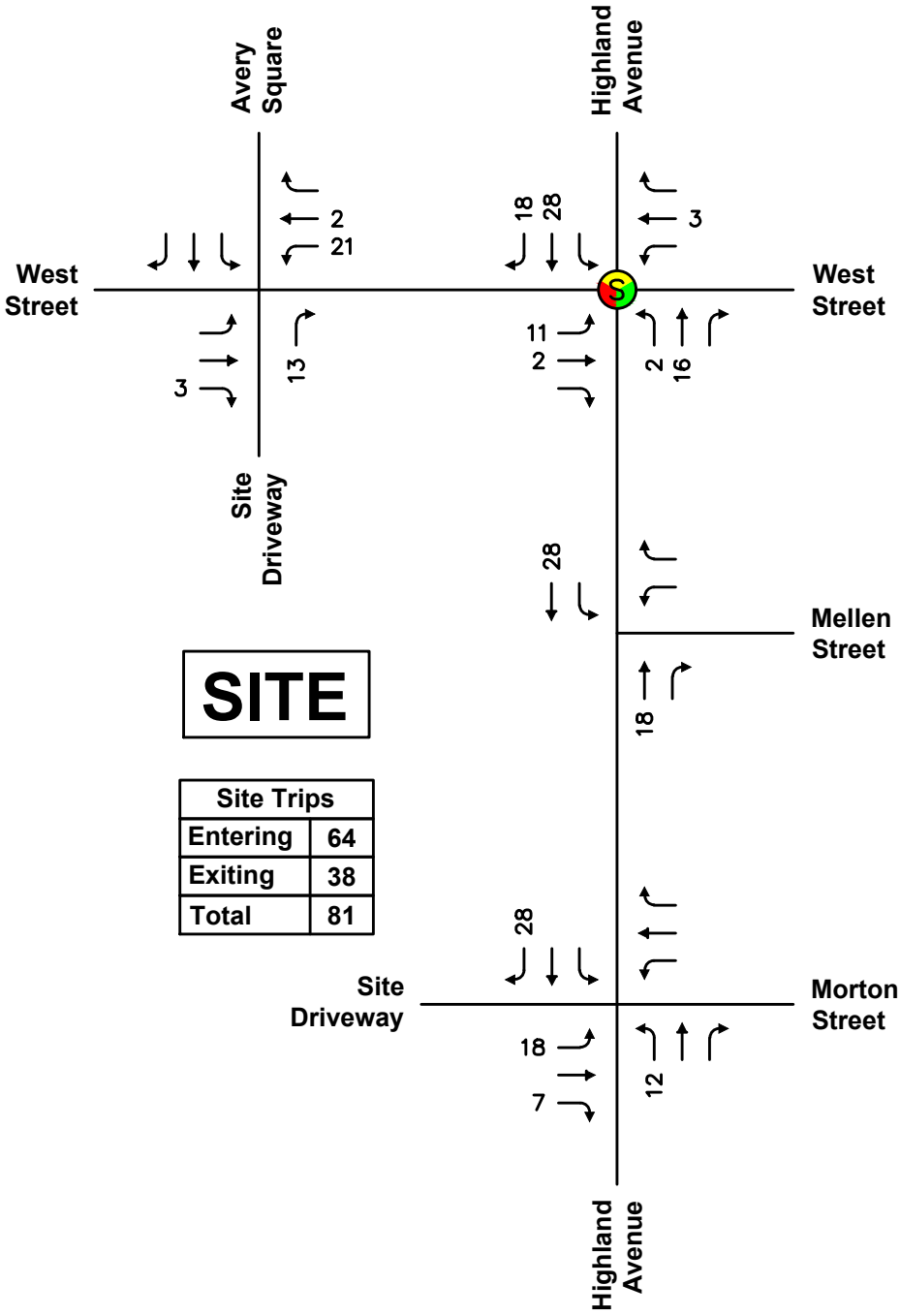

Figure 9

Site Generated Trips
Evening Peak Hour Traffic Volumes

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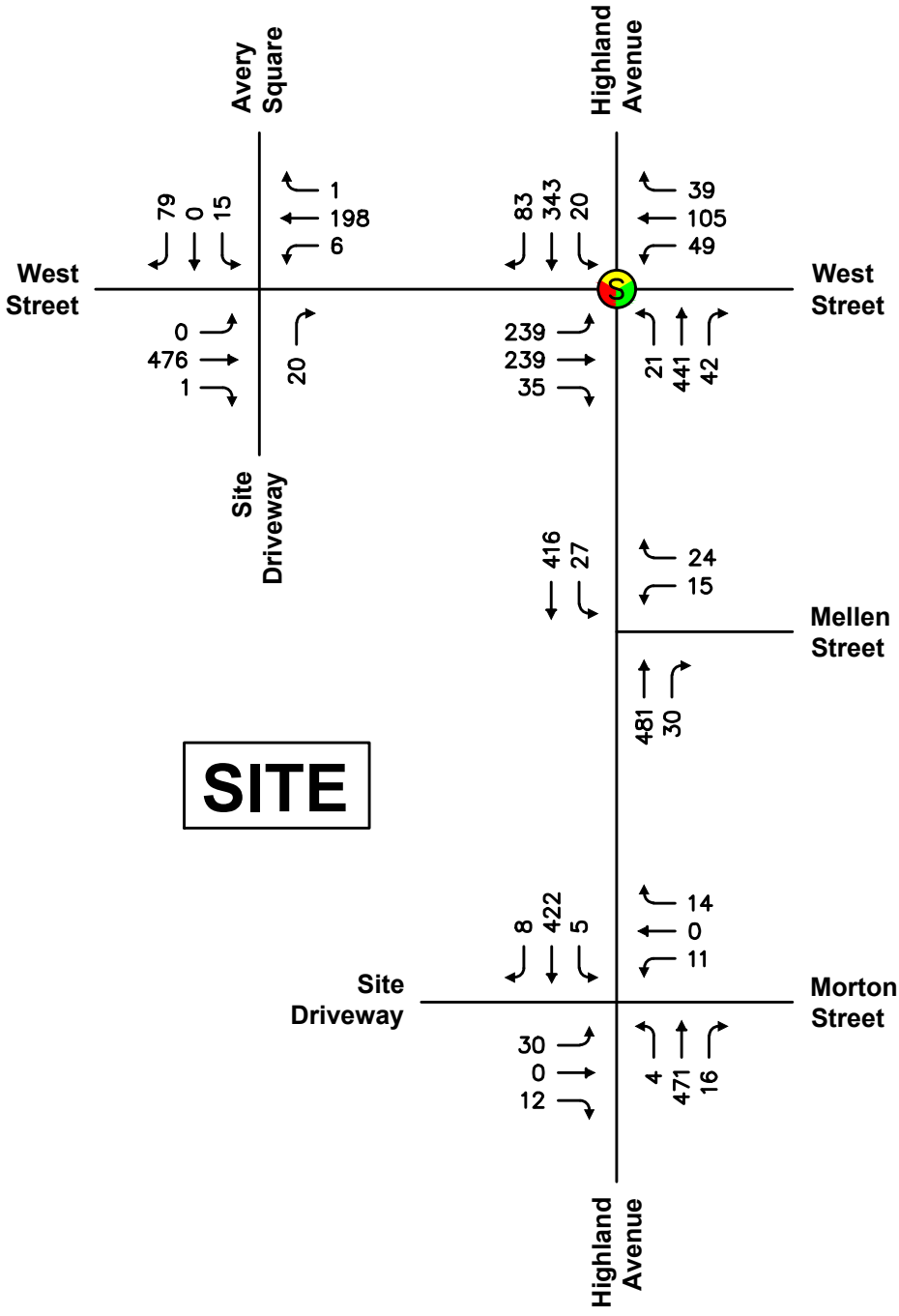

Figure 10

2032 Build Condition
Morning Peak Hour Traffic Volumes

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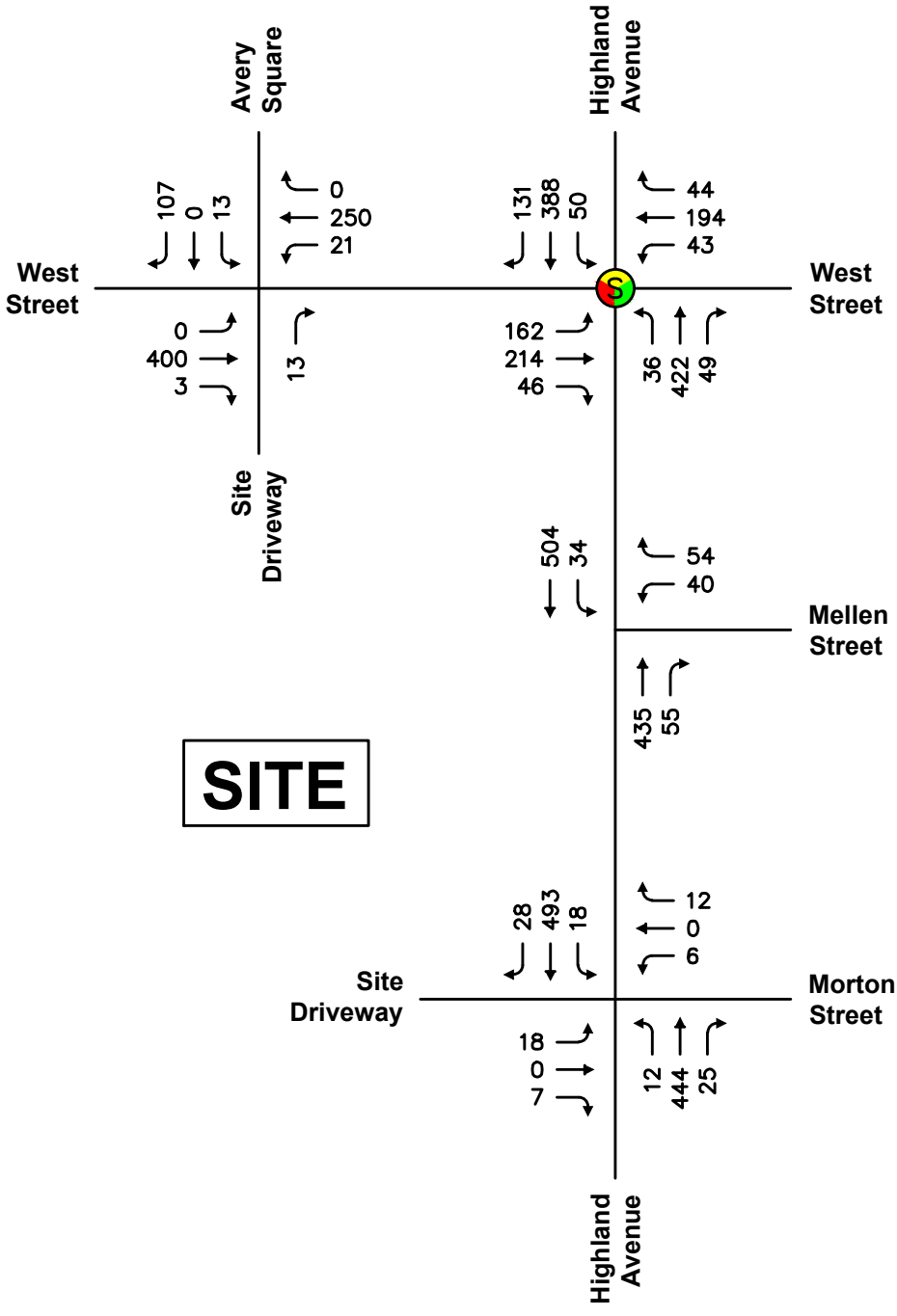

Figure 11

MDM TRANSPORTATION CONSULTANTS, INC.
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2032 Build Condition
Evening Peak Hour Traffic Volumes

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TABLE 9
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY MORNING PEAK HOUR

Intersection	Approach	2025 Baseline			2032 No-Build			2032 Build		
		v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Highland Avenue at	Eastbound	0.32	12	B	0.36	13	B	0.39	15	B
West Street	Westbound	0.38	28	C	0.41	31	C	0.43	34	C
	Northbound	0.69	24	C	0.72	26	C	0.75	27	C
	Southbound	0.65	22	C	0.67	24	C	0.67	24	C
	OVERALL	**0.69**	**20**	**C**	**0.72**	**22**	**C**	**0.75**	**23**	**C**
Highland Avenue at	Westbound	0.10	15	C	0.12	16	C	0.12	17	C
Mellen Street	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.03	<5	A	0.03	<5	A	0.03	<5	A
Highland Avenue at	Eastbound	0.00	11	B	0.00	11	B	0.20	24	C
Morton Street and the	Westbound	0.08	16	C	0.09	18	C	0.10	18	C
Site driveway	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.01	<5	A	0.01	<5	A	0.01	<5	A
West Street at	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Avery Square and the	Westbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Site driveway	Northbound	0.00	11	B	0.00	11	B	0.04	12	B
	Southbound	0.13	11	B	0.14	11	B	0.15	11	B

[1]Volume-to-capacity ratio
[2]Average control delay per vehicle (in seconds)
[3]Level of service

TABLE 10
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY EVENING PEAK HOUR

Intersection	Approach	2025 Baseline			2032 No-Build			2032 Build		
		v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Highland Avenue at	Eastbound	0.27	13	B	0.30	14	B	0.32	16	B
West Street	Westbound	0.50	29	C	0.54	32	C	0.57	36	D
	Northbound	0.63	21	C	0.66	22	C	0.65	22	C
	Southbound	0.70	23	C	0.74	25	C	0.76	26	C
	OVERALL	**0.70**	**21**	**C**	**0.74**	**23**	**C**	**0.76**	**24**	**C**
Highland Avenue at	Westbound	0.23	17	C	0.27	18	C	0.28	19	C
Mellen Street	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.03	<5	A	0.03	<5	A	0.04	<5	A
Highland Avenue at	Eastbound	0.00	11	B	0.00	12	B	0.12	24	C
Morton Street and the	Westbound	0.05	15	C	0.06	16	C	0.06	16	C
Site driveway	Northbound	0.00	<5	A	0.00	<5	A	0.01	<5	A
	Southbound	0.02	<5	A	0.02	<5	A	0.02	<5	A
West Street at	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Avery Square and the	Westbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Site driveway	Northbound	0.00	10	B	0.00	11	B	0.02	11	B
	Southbound	0.19	12	B	0.22	13	B	0.21	12	B

[1]Volume-to-capacity ratio
[2]Average control delay per vehicle (in seconds)
[3]Level of service

As summarized in **Tables 9** and **Table 10**, the proposed multifamily residential community is expected to have minimal impact on the study area intersections and will not result in any notable changes in traffic operations in the study area relative to No-Build conditions. Specifically, all movements at the study intersections will continue to operate below capacity at LOS C or better during the peak hours with the development of the Site. Based on the analysis no off-site mitigation is required.

Vehicle Queue Analysis Results

Vehicle queue results are presented for the signalized intersections. These vehicle queues are compared to available storage lengths, which are defined as lengths of exclusive turn lanes or the distance to the nearest major intersection for through lanes. Vehicle queue results from the capacity analysis are summarized in **Table 11**. Detailed worksheets of the queuing analysis are provided in the **Attachments**.

TABLE 11
VEHICLE QUEUE ANALYSIS SUMMARY
HIGHLAND AVENUE AT WEST STREET

Approach	Storage Length (feet)	2025 Baseline Average Queue Length[1]	2025 Baseline 95th Percentile Queue Length[1]	2032 No-Build Average Queue Length	2032 No-Build 95th Percentile Queue Length	2032 Build Average Queue Length	2032 Build 95th Percentile Queue Length
Weekday Morning Peak Hour							
Eastbound L	95	48	120	56	144	67	169
Eastbound T/R	>1,000	58	143	70	173	76	189
Westbound L	75	17	59	20	68	21	72
Westbound T/R	>1,000	46	126	54	148	59	160
Northbound L/T/R	>1,000	153	330	179	388	207	434
Southbound L/T/R	>1,000	135	296	157	346	173	368
Weekday Evening Peak Hour							
Eastbound L	95	33	86	39	102	47	120
Eastbound T/R	>1,000	57	138	68	164	76	182
Westbound L	75	14	49	16	56	18	59
Westbound T/R	>1,000	82	193	96	223	106	242
Northbound L/T/R	>1,000	154	298	183	329	203	347
Southbound L/T/R	>1,000	169	330	203	368	241	417

[1] Average and 95th percentile queue lengths are reported in feet per lane.

As summarized in **Table 11,** the average vehicle queues at the signalized study intersection will generally be contained within available storage lanes during peak hours. The project will not significantly change queue lengths compared to No-Build conditions and will generally result in minor changes (increases or decreases) of up to two (2) vehicles on all approaches in comparison to No-Build conditions.

RECCOMENDATIONS

In summary, adequate capacity is available at the study intersections to accommodate the traffic associated with the proposed multifamily residential community. The proposed multifamily residential community is estimated to generate a trip increase on area roadways ranging from approximately 81 vehicle trips during the weekday morning peak hour to 102 vehicle trips during the weekday evening peak hour, without the application of a credit to account for the use of transit users (up to 13%) or pedestrians/bicyclists (approximately 4%). While no specific off-site mitigation measures are required, MDM recommends the following access/egress improvements, pedestrian and bicycle accommodations, off-site, and TDM elements to enhancements operations, safety, and traffic flow:

Access/Egress Improvements

- *Driveway Design.* The final driveway alignments, widths and curb radii shall be designed to achieve (a) approximate perpendicular orientation with Highland Avenue and

West Street; and (b) curb radii as required to accommodate emergency vehicles as defined by the Town of Needham Fire Department. In all cases, the final driveway grading and orientation will meet or exceed the minimum recommended stopping sight distance presented herein.

- *Signs and Pavement Markings.* A STOP sign (R1-1) and STOP line pavement marking should be installed on the Site driveway approaches to Highland Avenue and West Street. Marked crosswalks should be provided where applicable on-site and at the site driveway approaches to Highland Avenue and West Street. The signs and pavement markings shall conform to MUTCD[3] standards. In addition, a NO LEFT TURN (Graphic) sign (R3-2) should be installed on the West Street Site driveway approach to reinforce the envisioned operation.

- *Maintain Clear Sight Lines.* New plantings (shrubs, bushes) and structures (walls, fences, etc.) should be designed and maintained at a height of 2 feet or less above the finished driveway elevation within the sight triangle areas to provide unobstructed visibility to oncoming vehicles. In addition, the existing curb extension provided along the north side of the Highland Avenue Site driveway should be extended approximately 40 feet north, which would require the elimination of approximately two existing on-street parking spaces.

Pedestrian and Bicycle Accommodations

- *Pedestrian Accommodation.* The design should incorporate an internal sidewalk network that connects the proposed building entrances with the proposed parking fields and to the existing sidewalks along Highland Avenue and West Street.

- *Bicycle Amenities*. The Proponent will incorporate secure and weather-protected bicycle racks to encourage and facilitate this mode of transportation to/from the Site by residents. Additional bike racks will also be provided on-site for visitors.

TDM Program

The Proponent is committed to reducing Site trip generation by residents by implementing a Transportation Demand Management (TDM) program. These elements are consistent with the Massachusetts Department of Environmental Protection (MADEP) directive to use all reasonable and feasible mitigation actions to reduce auto emissions. A preliminary list of potential TDM program elements may include the following, subject to refinement of the development program:

- *On-Site Transportation Coordinator*
- *Public Transportation Information & Promotion*

[3] *Manual on Uniform Traffic Control Devices*, Federal Highway Administration (FHWA), 2023.

- *Unbundling Parking from Residential Leases*
- *Preferential Parking for Low-Emission Vehicles*
- *Pedestrian Infrastructure*
- *Bicycle Racks*
- *Secure Covered Bike Parking*
- *On-Site Support Services/Amenities (mail room, laundry, fitness center, communal office space to supplement remote work, etc.)*

CONCLUSIONS

In summary, MDM finds that the development of the Site as a 189-unit multifamily residential community will be accommodated well within the capacity of the study area roadways and intersections with no discernable impact to traffic flow compared to No-Build conditions. The study area intersections are projected to operate below capacity at an acceptable LOS C or better operation during the peak hours. Proposed access/egress along Highland Avenue and West Street will be designed to ensure adequate maneuverability for the design vehicles and that adequate sight lines are provided in accordance with AASHTO criteria based on ambient and regulatory travel speeds.

ATTACHMENTS

- □ Traffic Volume Data
- □ Seasonal/Yearly Growth Data
- □ Speed Data
- □ Transit Schedules and Fare Information
- □ MassDOT Crash Records and Mapping
- □ Sight Distance Calculations
- □ Trip Generation
- □ Census Information and Journey-to-Work Data
- □ Existing Site Trips Removed
- □ Capacity Analysis

- Traffic Volume Data

MDM TRANSPORTATION CONSULTANTS, INC.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Highland Street
Just south of Dana Plaza
Needham, MA

Site Code: 1424
Station ID:

Latitude: 0' 0.0000 Undefined

Start Time	10-Apr-25 Thu	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		7	86			4	148				
12:15		1	93			2	111				
12:30		3	95			1	96				
12:45		1	104	12	378	3	99	10	454	22	832
01:00		3	93			2	96				
01:15		1	103			3	101				
01:30		1	84			1	124				
01:45		0	93	5	373	1	106	7	427	12	800
02:00		2	93			0	95				
02:15		1	104			1	111				
02:30		0	119			0	128				
02:45		0	94	3	410	0	139	1	473	4	883
03:00		1	118			0	103				
03:15		1	123			1	101				
03:30		0	120			1	117				
03:45		5	128	7	489	1	105	3	426	10	915
04:00		3	108			0	115				
04:15		1	144			4	115				
04:30		4	117			4	109				
04:45		3	95	11	464	1	129	9	468	20	932
05:00		7	92			8	115				
05:15		20	97			9	116				
05:30		10	119			13	106				
05:45		18	106	55	414	8	76	38	413	93	827
06:00		28	117			25	108				
06:15		31	102			20	111				
06:30		38	93			29	85				
06:45		49	70	146	382	43	90	117	394	263	776
07:00		52	74			58	78				
07:15		73	78			89	72				
07:30		99	55			89	86				
07:45		115	55	339	262	140	75	376	311	715	573
08:00		105	44			132	60				
08:15		85	39			105	53				
08:30		87	42			97	64				
08:45		80	34	357	159	80	69	414	246	771	405
09:00		89	21			90	60				
09:15		87	30			103	30				
09:30		87	35			103	20				
09:45		96	24	359	110	92	24	388	134	747	244
10:00		66	11			87	26				
10:15		83	16			99	22				
10:30		112	18			79	15				
10:45		95	7	356	52	86	10	351	73	707	125
11:00		80	4			101	11				
11:15		93	9			110	5				
11:30		78	6			123	9				
11:45		93	4	344	23	140	1	474	26	818	49
Total		1994	3516			2188	3845			4182	7361
Percent		36.2%	63.8%			36.3%	63.7%			36.2%	63.8%
Combined Total		5510				6033				11543	

MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
E/W: West Street
Needham, MA

File Name : 1424_Highland_Avenue_at_West_Street_1286645_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Highland Avenue From North					West Street From East					Highland Avenue From South					West Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	18	44	1	4	67	6	11	1	3	21	3	43	1	0	47	7	31	32	1	71	206
07:15 AM	9	70	0	3	82	3	24	4	3	34	6	86	3	3	98	5	39	42	1	87	301
07:30 AM	21	81	6	6	114	7	18	6	6	37	11	78	2	1	92	11	60	53	0	124	367
07:45 AM	18	90	5	6	119	11	23	10	5	49	8	106	0	1	115	8	61	46	2	117	400
Total	66	285	12	19	382	27	76	21	17	141	28	313	6	5	352	31	191	173	4	399	1274
08:00 AM	20	83	6	6	115	9	30	12	9	60	10	113	6	2	131	5	52	54	1	112	418
08:15 AM	14	60	2	2	78	9	26	18	5	58	10	89	9	3	111	9	48	54	0	111	358
08:30 AM	17	79	6	2	104	9	41	10	6	66	9	86	3	0	98	4	39	33	0	76	344
08:45 AM	26	83	12	3	124	7	33	2	7	49	10	63	3	2	78	6	36	43	0	85	336
Total	77	305	26	13	421	34	130	42	27	233	39	351	21	7	418	24	175	184	1	384	1456
04:00 PM	14	79	11	11	115	13	30	18	12	73	10	89	11	3	113	15	50	25	6	96	397
04:15 PM	17	111	14	2	144	7	35	20	6	68	25	85	4	3	117	12	37	34	0	83	412
04:30 PM	17	90	9	4	120	12	30	12	11	65	12	80	4	3	99	9	49	28	1	87	371
04:45 PM	18	77	13	6	114	13	39	16	4	72	13	101	6	3	123	13	52	37	4	106	415
Total	66	357	47	23	493	45	134	66	33	278	60	355	25	12	452	49	188	124	11	372	1595
05:00 PM	28	79	10	1	118	5	45	6	11	67	12	98	7	7	124	11	56	40	0	107	416
05:15 PM	28	79	13	4	124	12	45	9	14	80	12	97	8	7	124	10	51	38	2	101	429
05:30 PM	31	103	11	4	149	11	49	9	4	73	9	83	11	0	103	9	40	26	4	79	404
05:45 PM	25	92	14	9	140	12	40	9	10	71	9	68	12	11	100	13	44	41	5	103	414
Total	112	353	48	18	531	40	179	33	39	291	42	346	38	25	451	43	191	145	11	390	1663
Grand Total	321	1300	133	73	1827	146	519	162	116	943	169	1365	90	49	1673	147	745	626	27	1545	5988
Apprch %	17.6	71.2	7.3	4		15.5	55	17.2	12.3		10.1	81.6	5.4	2.9		9.5	48.2	40.5	1.7		
Total %	5.4	21.7	2.2	1.2	30.5	2.4	8.7	2.7	1.9	15.7	2.8	22.8	1.5	0.8	27.9	2.5	12.4	10.5	0.5	25.8	
Lights	306	1267	128	73	1774	146	508	160	116	930	167	1318	89	49	1623	143	732	616	27	1518	5845
% Lights	95.3	97.5	96.2	100	97.1	100	97.9	98.8	100	98.6	98.8	96.6	98.9	100	97	97.3	98.3	98.4	100	98.3	97.6
Mediums	12	25	3	0	40	0	9	2	0	11	2	31	1	0	34	4	13	9	0	26	111
% Mediums	3.7	1.9	2.3	0	2.2	0	1.7	1.2	0	1.2	1.2	2.3	1.1	0	2	2.7	1.7	1.4	0	1.7	1.9
Articulated Trucks																					
% Articulated Trucks	0.9	0.6	1.5	0	0.7	0	0.4	0	0	0.2	0	1.2	0	0	1	0	0	0.2	0	0.1	0.5

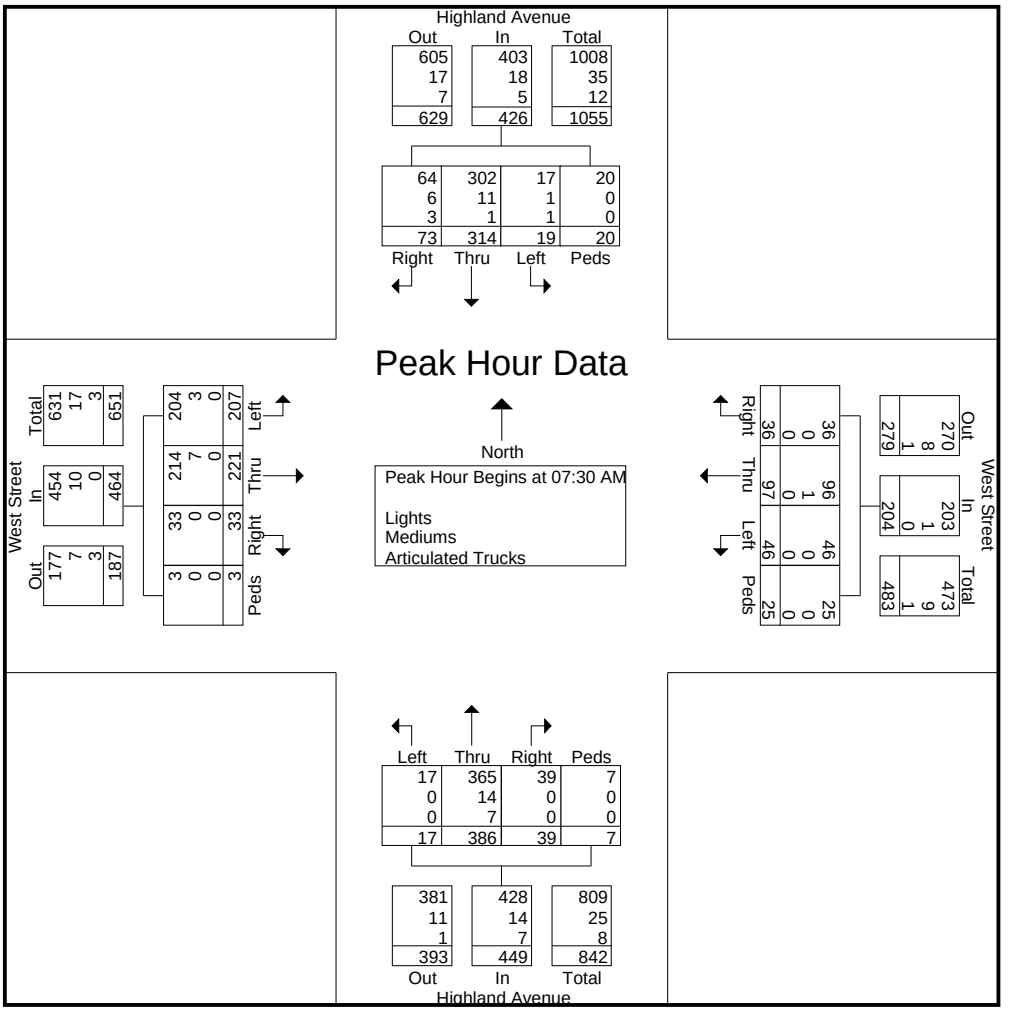
MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
E/W: West Street
Needham, MA

File Name : 1424_Highland_Avenue_at_West_Street_1286645_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 2

	Highland Avenue From North					West Street From East					Highland Avenue From South					West Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**21**	81	**6**	**6**	114	7	18	6	6	37	**11**	78	2	1	92	**11**	60	53	0	**124**	367
07:45 AM	18	**90**	5	6	**119**	**11**	23	10	5	49	8	106	0	1	115	8	**61**	46	**2**	117	400
08:00 AM	20	83	6	6	115	9	**30**	12	**9**	**60**	10	**113**	6	2	**131**	5	52	**54**	1	112	**418**
08:15 AM	14	60	2	2	78	9	26	**18**	5	58	10	89	**9**	**3**	111	9	48	54	0	111	358
Total Volume	73	314	19	20	426	36	97	46	25	204	39	386	17	7	449	33	221	207	3	464	1543
% App. Total	17.1	73.7	4.5	4.7		17.6	47.5	22.5	12.3		8.7	86	3.8	1.6		7.1	47.6	44.6	0.6		
PHF	.869	.872	.792	.833	.895	.818	.808	.639	.694	.850	.886	.854	.472	.583	.857	.750	.906	.958	.375	.935	.923
Lights	64	302	17	20	403	36	96	46	25	203	39	365	17	7	428	33	214	204	3	454	1488
% Lights	87.7	96.2	89.5	100	94.6	100	99.0	100	100	99.5	100	94.6	100	100	95.3	100	96.8	98.6	100	97.8	96.4
Mediums	6	11	1	0	18	0	1	0	0	1	0	14	0	0	14	0	7	3	0	10	43
% Mediums	8.2	3.5	5.3	0	4.2	0	1.0	0	0	0.5	0	3.6	0	0	3.1	0	3.2	1.4	0	2.2	2.8
Articulated Trucks	3	1	1	0	5	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	12
% Articulated Trucks	4.1	0.3	5.3	0	1.2	0	0	0	0	0	0	1.8	0	0	1.6	0	0	0	0	0	0.8



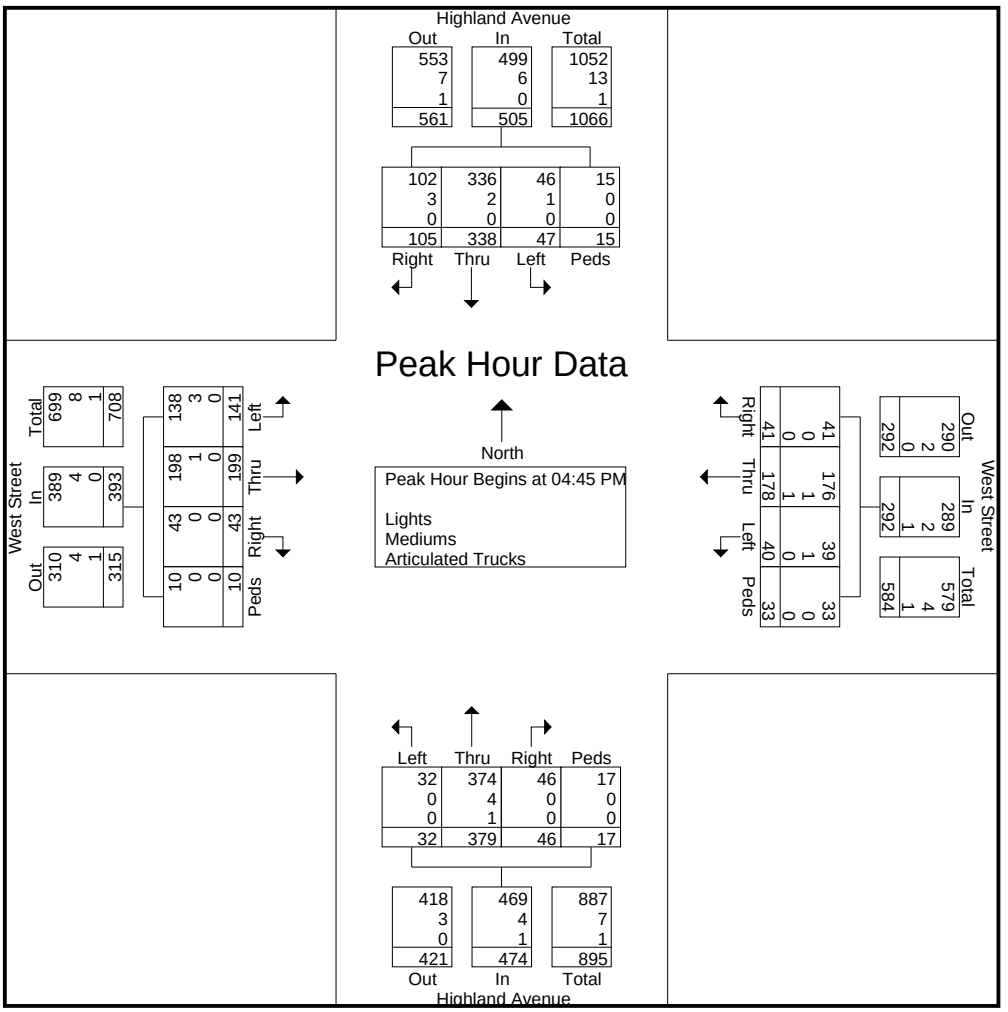
MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
E/W: West Street
Needham, MA

File Name : 1424_Highland_Avenue_at_West_Street_1286645_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 3

	Highland Avenue From North					West Street From East					Highland Avenue From South					West Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	18	77	**13**	**6**	114	**13**	39	**16**	4	72	**13**	**101**	6	3	123	**13**	52	37	**4**	106	415
05:00 PM	28	79	10	1	118	5	45	6	11	67	12	98	7	**7**	**124**	11	**56**	**40**	0	**107**	416
05:15 PM	28	79	13	4	124	12	45	9	**14**	**80**	12	97	8	7	124	10	51	38	2	101	**429**
05:30 PM	**31**	**103**	11	4	**149**	11	**49**	9	4	73	9	83	**11**	0	103	9	40	26	4	79	404
Total Volume	105	338	47	15	505	41	178	40	33	292	46	379	32	17	474	43	199	141	10	393	1664
% App. Total	20.8	66.9	9.3	3		14	61	13.7	11.3		9.7	80	6.8	3.6		10.9	50.6	35.9	2.5		
PHF	.847	.820	.904	.625	.847	.788	.908	.625	.589	.913	.885	.938	.727	.607	.956	.827	.888	.881	.625	.918	.970
Lights	102	336	46	15	499	41	176	39	33	289	46	374	32	17	469	43	198	138	10	389	1646
% Lights	97.1	99.4	97.9	100	98.8	100	98.9	97.5	100	99.0	100	98.7	100	100	98.9	100	99.5	97.9	100	99.0	98.9
Mediums	3	2	1	0	6	0	1	1	0	2	0	4	0	0	4	0	1	3	0	4	16
% Mediums	2.9	0.6	2.1	0	1.2	0	0.6	2.5	0	0.7	0	1.1	0	0	0.8	0	0.5	2.1	0	1.0	1.0
Articulated Trucks	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	2
% Articulated Trucks	0	0	0	0	0	0	0.6	0	0	0.3	0	0.3	0	0	0.2	0	0	0	0	0	0.1



MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
East: Mellen Street
Needham, MA

File Name : 1424_Highland_Avenue_at_Mellen_Street_1286637_04-10-2025
Site Code : 1424
Start Date : 4/10/2025

Groups Printed- Lights - Mediums - Articulated Trucks

	Highland Avenue From North				Mellen Street From East				Highland Avenue From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	51	2	0	53	1	0	0	1	2	48	0	50	104
07:15 AM	74	5	0	79	5	1	0	6	3	78	0	81	166
07:30 AM	85	5	0	90	3	2	2	7	1	97	0	98	195
07:45 AM	107	4	0	111	6	8	5	19	12	100	0	112	242
Total	317	16	0	333	15	11	7	33	18	323	0	341	707
08:00 AM	101	6	0	107	8	3	4	15	6	123	0	129	251
08:15 AM	87	7	0	94	3	2	2	7	4	101	0	105	206
08:30 AM	87	8	0	95	5	1	3	9	6	97	0	103	207
08:45 AM	75	9	1	85	6	2	5	13	5	62	0	67	165
Total	350	30	1	381	22	8	14	44	21	383	0	404	829
04:00 PM	112	9	0	121	14	7	7	28	14	101	0	115	264
04:15 PM	126	6	1	133	13	9	11	33	12	96	0	108	274
04:30 PM	114	6	1	121	11	11	10	32	12	88	0	100	253
04:45 PM	94	11	0	105	12	10	6	28	13	104	0	117	250
Total	446	32	2	480	50	37	34	121	51	389	0	440	1041
05:00 PM	84	11	0	95	11	8	7	26	15	96	1	112	233
05:15 PM	95	9	0	104	13	3	13	29	12	104	0	116	249
05:30 PM	115	10	0	125	10	9	6	25	10	96	0	106	256
05:45 PM	102	7	0	109	9	6	13	28	7	75	0	82	219
Total	396	37	0	433	43	26	39	108	44	371	1	416	957
Grand Total	1509	115	3	1627	130	82	94	306	134	1466	1	1601	3534
Apprch %	92.7	7.1	0.2		42.5	26.8	30.7		8.4	91.6	0.1		
Total %	42.7	3.3	0.1	46	3.7	2.3	2.7	8.7	3.8	41.5	0	45.3	
Lights	1473	113	3	1589	130	80	94	304	133	1420	1	1554	3447
% Lights	97.6	98.3	100	97.7	100	97.6	100	99.3	99.3	96.9	100	97.1	97.5
Mediums	29	1	0	30	0	2	0	2	1	33	0	34	66
% Mediums	1.9	0.9	0	1.8	0	2.4	0	0.7	0.7	2.3	0	2.1	1.9
Articulated Trucks	7	1	0	8	0	0	0	0	0	13	0	13	21
% Articulated Trucks	0.5	0.9	0	0.5	0	0	0	0	0	0.9	0	0.8	0.6

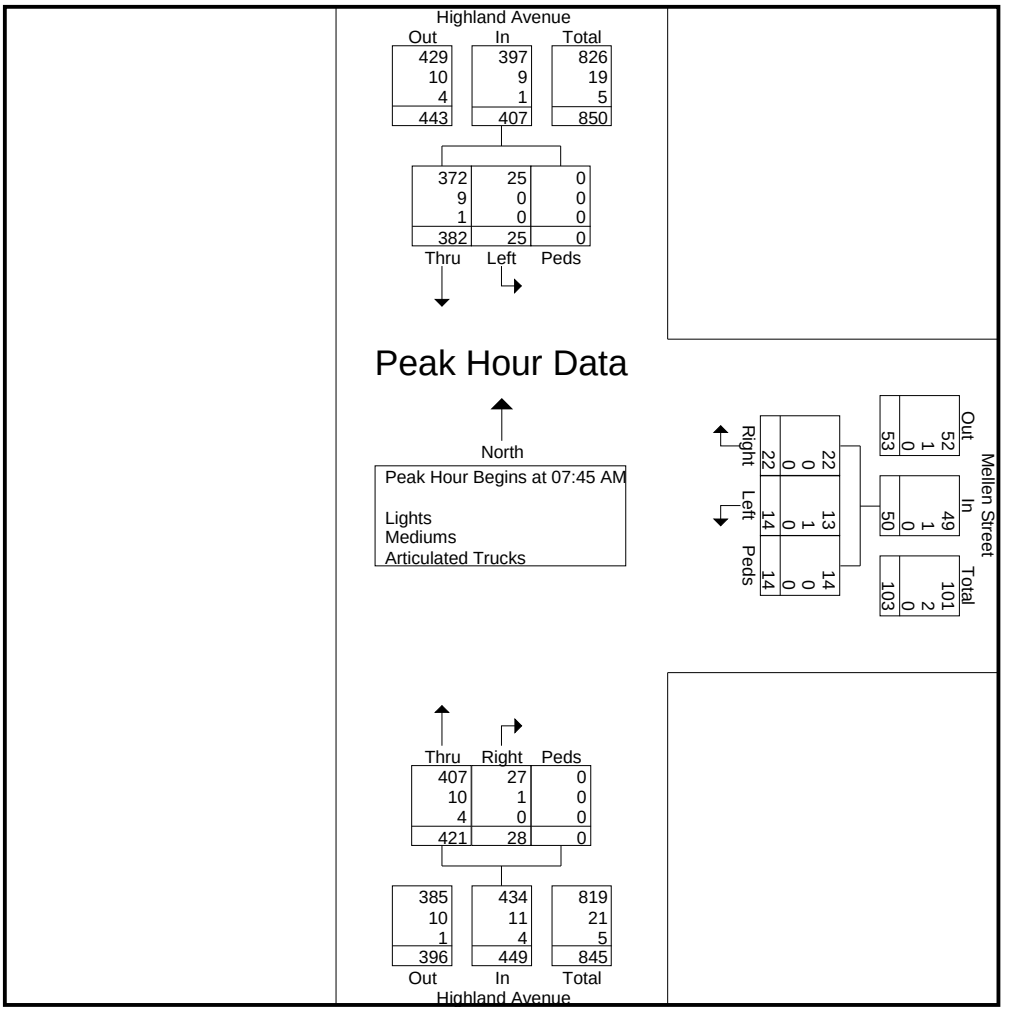
MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
East: Mellen Street
Needham, MA

File Name : 1424_Highland_Avenue_at_Mellen_Street_1286637_04-10-2025
Site Code : 1424
Start Date : 4/10/2025

	Highland Avenue From North				Mellen Street From East				Highland Avenue From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	**107**	4	0	**111**	6	**8**	**5**	**19**	**12**	100	0	112	242
08:00 AM	101	6	0	107	**8**	3	4	15	6	**123**	0	**129**	**251**
08:15 AM	87	7	0	94	3	2	2	7	4	101	0	105	206
08:30 AM	87	**8**	0	95	5	1	3	9	6	97	0	103	207
Total Volume	382	25	0	407	22	14	14	50	28	421	0	449	906
% App. Total	93.9	6.1	0		44	28	28		6.2	93.8	0		
PHF	.893	.781	.000	.917	.688	.438	.700	.658	.583	.856	.000	.870	.902
Lights	372	25	0	397	22	13	14	49	27	407	0	434	880
% Lights	97.4	100	0	97.5	100	92.9	100	98.0	96.4	96.7	0	96.7	97.1
Mediums	9	0	0	9	0	1	0	1	1	10	0	11	21
% Mediums	2.4	0	0	2.2	0	7.1	0	2.0	3.6	2.4	0	2.4	2.3
Articulated Trucks	1	0	0	1	0	0	0	0	0	4	0	4	5
% Articulated Trucks	0.3	0	0	0.2	0	0	0	0	0	1.0	0	0.9	0.6



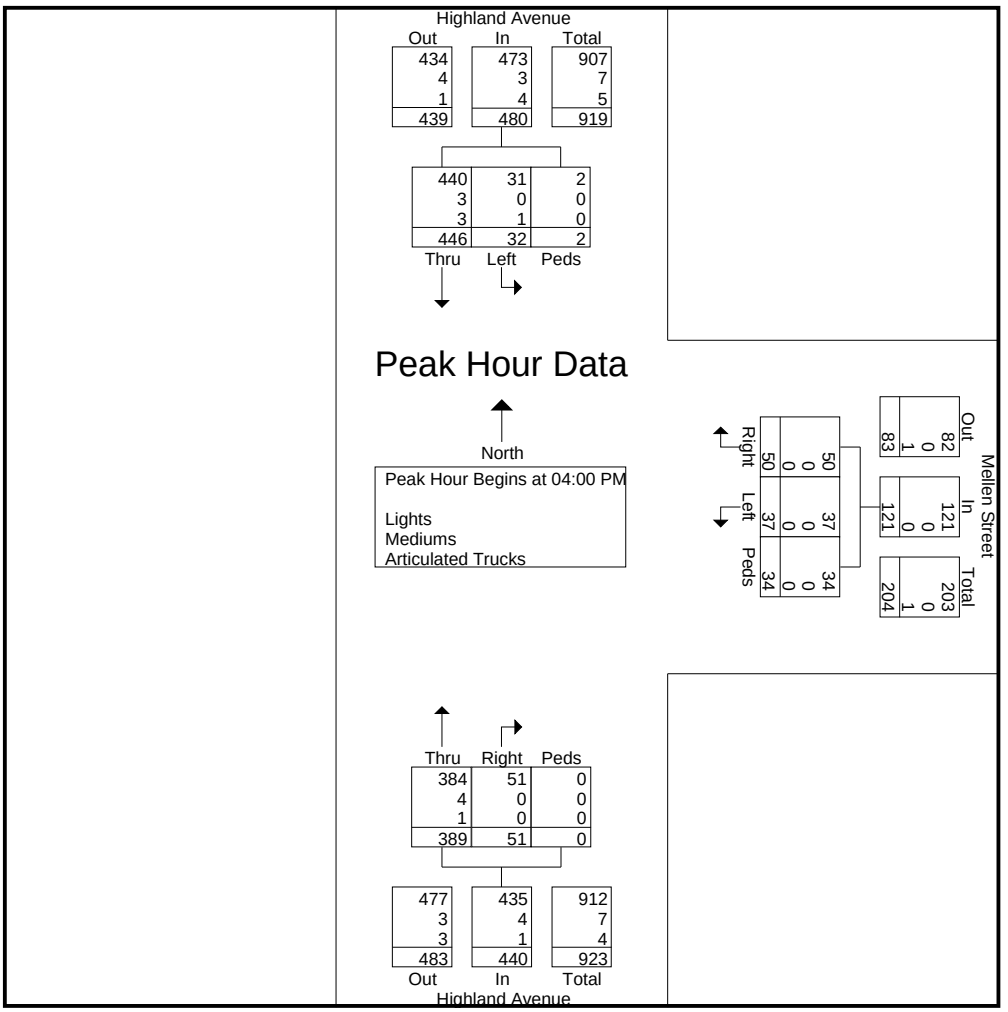
MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
East: Mellen Street
Needham, MA

File Name : 1424_Highland_Avenue_at_Mellen_Street_1286637_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 3

	Highland Avenue From North				Mellen Street From East				Highland Avenue From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:00 PM													
04:00 PM	112	9	0	121	**14**	7	7	28	**14**	101	0	115	264
04:15 PM	**126**	6	**1**	**133**	13	9	**11**	**33**	12	96	0	108	**274**
04:30 PM	114	6	1	121	11	**11**	10	32	12	88	0	100	253
04:45 PM	94	**11**	0	105	12	10	6	28	13	**104**	0	**117**	250
Total Volume	446	32	2	480	50	37	34	121	51	389	0	440	1041
% App. Total	92.9	6.7	0.4		41.3	30.6	28.1		11.6	88.4	0		
PHF	.885	.727	.500	.902	.893	.841	.773	.917	.911	.935	.000	.940	.950
Lights	440	31	2	473	50	37	34	121	51	384	0	435	1029
% Lights	98.7	96.9	100	98.5	100	100	100	100	100	98.7	0	98.9	98.8
Mediums	3	0	0	3	0	0	0	0	0	4	0	4	7
% Mediums	0.7	0	0	0.6	0	0	0	0	0	1.0	0	0.9	0.7
Articulated Trucks	3	1	0	4	0	0	0	0	0	1	0	1	5
% Articulated Trucks	0.7	3.1	0	0.8	0	0	0	0	0	0.3	0	0.2	0.5



MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue File Name : 1424_Highland_Avenue_at_Morton_Street_Site_Driveway_1286642_04-10-2025
East: Morton Street Site Code : 1424
West: Site Driveway Start Date : 4/10/2025
Needham, MA Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Highland Avenue From North					Morton Street From East					Highland Avenue From South					Site Driveway From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	53	1	0	54	1	0	1	0	2	1	57	0	0	58	0	0	0	0	0	114
07:15 AM	0	73	1	0	74	3	0	1	1	5	3	88	1	0	92	0	0	0	3	3	174
07:30 AM	1	105	1	0	107	2	0	2	3	7	2	90	0	0	92	0	0	0	2	2	208
07:45 AM	0	111	2	1	114	3	0	5	4	12	5	123	0	0	128	1	0	0	2	3	257
Total	1	342	5	1	349	9	0	9	8	26	11	358	1	0	370	1	0	0	7	8	753
08:00 AM	0	93	0	0	93	4	0	3	2	9	5	120	0	0	125	0	0	0	0	0	227
08:15 AM	1	85	2	0	88	4	0	0	3	7	3	106	0	0	109	0	0	0	1	1	205
08:30 AM	1	88	0	0	89	3	0	0	1	4	2	86	1	1	90	1	0	0	0	1	184
08:45 AM	0	79	1	0	80	1	0	1	6	8	6	68	0	0	74	1	0	0	1	2	164
Total	2	345	3	0	350	12	0	4	12	28	16	380	1	1	398	2	0	0	2	4	780
04:00 PM	1	112	6	0	119	4	0	3	5	12	6	106	0	0	112	0	0	0	2	2	245
04:15 PM	0	135	3	0	138	2	0	1	6	9	3	106	0	0	109	1	0	0	4	5	261
04:30 PM	0	127	4	0	131	1	0	1	7	9	7	92	0	0	99	0	0	0	2	2	241
04:45 PM	1	86	4	0	91	4	0	1	1	6	7	110	0	0	117	0	0	0	6	6	220
Total	2	460	17	0	479	11	0	6	19	36	23	414	0	0	437	1	0	0	14	15	967
05:00 PM	0	91	5	0	96	5	0	4	2	11	10	120	0	0	130	0	0	0	6	6	243
05:15 PM	0	100	3	2	105	6	0	2	5	13	8	90	0	0	98	0	0	0	3	3	219
05:30 PM	0	116	2	0	118	0	0	0	1	1	7	110	0	0	117	1	0	0	6	7	243
05:45 PM	0	107	4	1	112	0	0	1	6	7	4	68	0	1	73	0	0	0	1	1	193
Total	0	414	14	3	431	11	0	7	14	32	29	388	0	1	418	1	0	0	16	17	898
Grand Total	5	1561	39	4	1609	43	0	26	53	122	79	1540	2	2	1623	5	0	0	39	44	3398
Apprch %	0.3	97	2.4	0.2		35.2	0	21.3	43.4		4.9	94.9	0.1	0.1		11.4	0	0	88.6		
Total %	0.1	45.9	1.1	0.1	47.4	1.3	0	0.8	1.6	3.6	2.3	45.3	0.1	0.1	47.8	0.1	0	0	1.1	1.3	
Lights	5	1517	38	4	1564	43	0	26	53	122	78	1488	2	2	1570	5	0	0	39	44	3300
% Lights	100	97.2	97.4	100	97.2	100	0	100	100	100	98.7	96.6	100	100	96.7	100	0	0	100	100	97.1
Mediums	0	38	1	0	39	0	0	0	0	0	1	37	0	0	38	0	0	0	0	0	77
% Mediums	0	2.4	2.6	0	2.4	0	0	0	0	0	1.3	2.4	0	0	2.3	0	0	0	0	0	2.3
Articulated Trucks																					
% Articulated Trucks	0	0.4	0	0	0.4	0	0	0	0	0	0	1	0	0	0.9	0	0	0	0	0	0.6

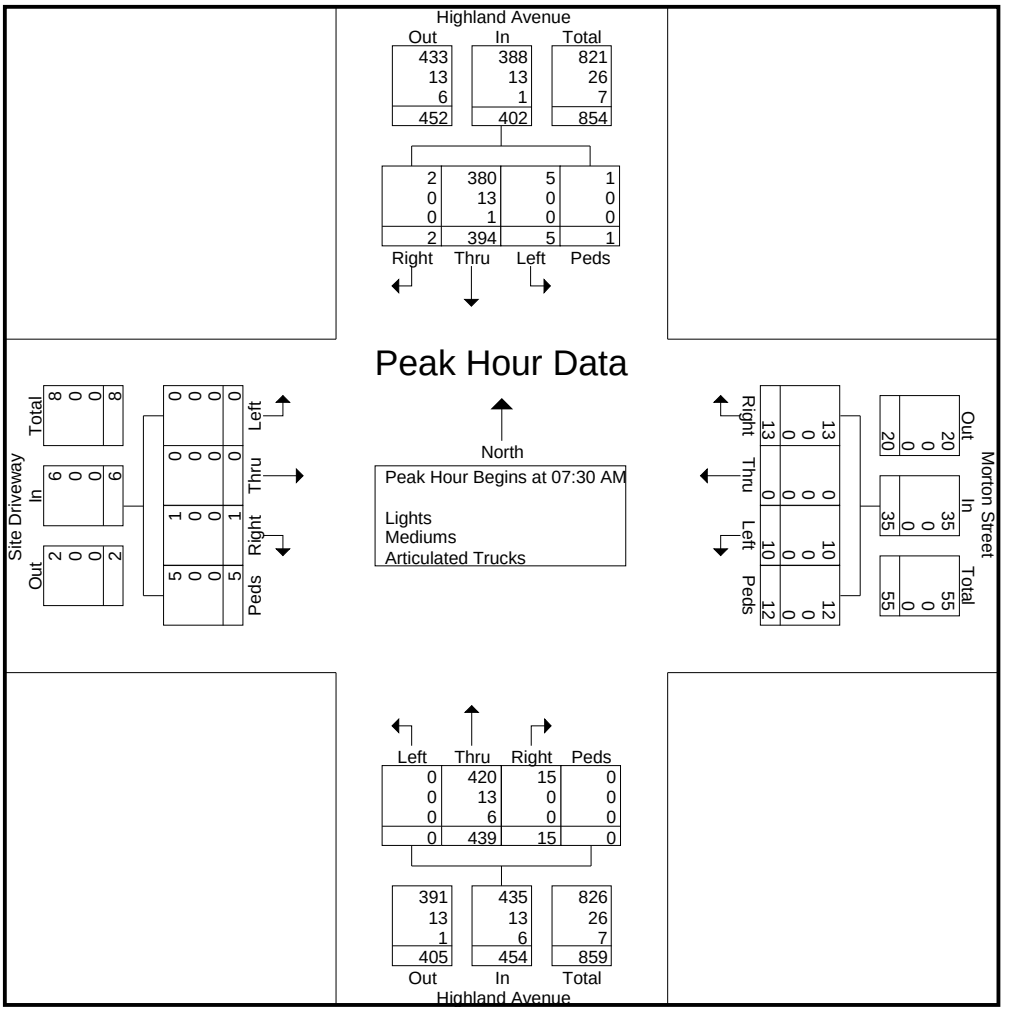
MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue (First Name)
East: Morton Street (Site Code)
West: Site Driveway (Start Date)
Needham, MA (Page No)

1424_Highland_Avenue_at_Morton_Street_Site_Driveway_1286642_04-10-2025
: 1424
: 4/10/2025
: 2

	Highland Avenue From North					Morton Street From East					Highland Avenue From South					Site Driveway From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**1**	105	1	0	107	2	0	2	3	7	2	90	0	0	92	0	0	0	**2**	2	208
07:45 AM	0	**111**	**2**	**1**	**114**	3	0	**5**	**4**	**12**	**5**	**123**	0	0	**128**	**1**	0	0	2	**3**	**257**
08:00 AM	0	93	0	0	93	**4**	0	3	2	9	5	120	0	0	125	0	0	0	0	0	227
08:15 AM	1	85	2	0	88	4	0	0	3	7	3	106	0	0	109	0	0	0	1	1	205
Total Volume	2	394	5	1	402	13	0	10	12	35	15	439	0	0	454	1	0	0	5	6	897
% App. Total	0.5	98	1.2	0.2		37.1	0	28.6	34.3		3.3	96.7	0	0		16.7	0	0	83.3		
PHF	.500	.887	.625	.250	.882	.813	.000	.500	.750	.729	.750	.892	.000	.000	.887	.250	.000	.000	.625	.500	.873
Lights	2	380	5	1	388	13	0	10	12	35	15	420	0	0	435	1	0	0	5	6	864
% Lights	100	96.4	100	100	96.5	100	0	100	100	100	100	95.7	0	0	95.8	100	0	0	100	100	96.3
Mediums	0	13	0	0	13	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	26
% Mediums	0	3.3	0	0	3.2	0	0	0	0	0	0	3.0	0	0	2.9	0	0	0	0	0	2.9
Articulated Trucks	0	1	0	0	1	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	7
% Articulated Trucks	0	0.3	0	0	0.2	0	0	0	0	0	0	1.4	0	0	1.3	0	0	0	0	0	0.8



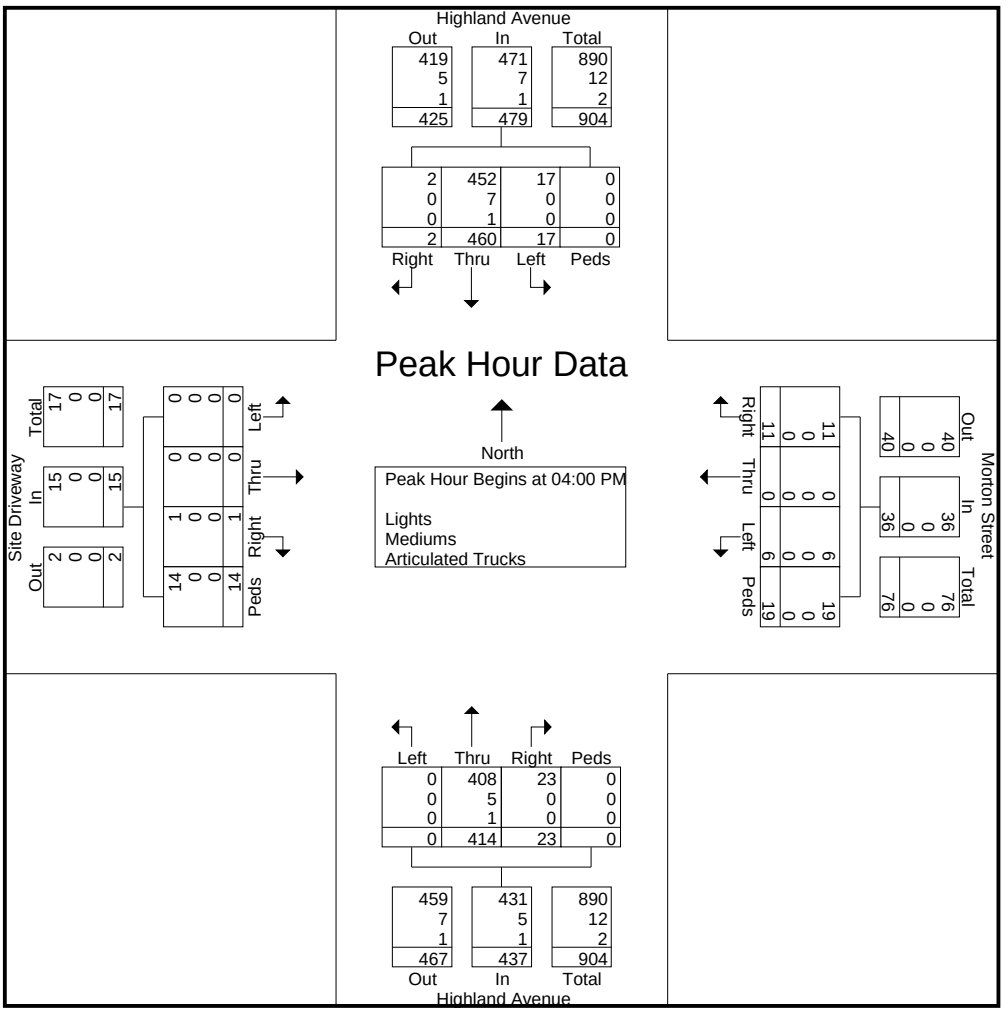
MDM Transportation Consultants, Inc.

28 Lord Rd, Suite 280
Marlborough, MA, 01752

N/S: Highland Avenue
East: Morton Street
West: Site Driveway
Needham, MA

File Name : 1424_Highland_Avenue_at_Morton_Street_Site_Driveway_1286642_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 3

	Highland Avenue From North					Morton Street From East					Highland Avenue From South					Site Driveway From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	**1**	112	**6**	0	119	**4**	0	**3**	5	**12**	6	106	0	0	112	0	0	0	2	2	245
04:15 PM	0	**135**	3	0	**138**	2	0	1	6	9	3	106	0	0	109	**1**	0	0	4	5	**261**
04:30 PM	0	127	4	0	131	1	0	1	**7**	9	**7**	92	0	0	99	0	0	0	2	2	241
04:45 PM	1	86	4	0	91	4	0	1	1	6	7	**110**	0	0	**117**	0	0	0	**6**	**6**	220
Total Volume	2	460	17	0	479	11	0	6	19	36	23	414	0	0	437	1	0	0	14	15	967
% App. Total	0.4	96	3.5	0		30.6	0	16.7	52.8		5.3	94.7	0	0		6.7	0	0	93.3		
PHF	.500	.852	.708	.000	.868	.688	.000	.500	.679	.750	.821	.941	.000	.000	.934	.250	.000	.000	.583	.625	.926
Lights	2	452	17	0	471	11	0	6	19	36	23	408	0	0	431	1	0	0	14	15	953
% Lights	100	98.3	100	0	98.3	100	0	100	100	100	100	98.6	0	0	98.6	100	0	0	100	100	98.6
Mediums	0	7	0	0	7	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	12
% Mediums	0	1.5	0	0	1.5	0	0	0	0	0	0	1.2	0	0	1.1	0	0	0	0	0	1.2
Articulated Trucks	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
% Articulated Trucks	0	0.2	0	0	0.2	0	0	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0	0.2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Avery Square
NB: Site Driveway
E/W: West Street
Needham, MA

File Name : 1424_West_Street_at_Avery_Square_Site_Driveway_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Avery Square From North					West Street From East					Site Driveway From South					West Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	10	0	3	0	13	0	26	0	0	26	0	0	0	0	0	0	63	0	0	63	102
07:15 AM	12	0	0	0	12	0	38	0	0	38	0	0	0	0	0	0	90	0	0	90	140
07:30 AM	13	0	1	0	14	0	44	0	0	44	1	0	0	0	1	0	112	0	0	112	171
07:45 AM	22	0	8	0	30	0	39	0	0	39	0	0	0	0	0	0	118	0	0	118	187
Total	57	0	12	0	69	0	147	0	0	147	1	0	0	0	1	0	383	0	0	383	600
08:00 AM	19	0	2	0	21	0	55	0	0	55	0	0	0	0	0	0	103	0	0	103	179
08:15 AM	20	0	3	0	23	1	44	0	0	45	0	0	0	0	0	0	111	0	0	111	179
08:30 AM	16	0	2	0	18	0	67	0	0	67	0	0	0	0	0	0	73	0	0	73	158
08:45 AM	22	0	5	0	27	0	63	0	0	63	0	0	0	0	0	0	83	0	0	83	173
Total	77	0	12	0	89	1	229	0	0	230	0	0	0	0	0	0	370	0	0	370	689
04:00 PM	23	0	2	0	25	0	58	0	0	58	0	0	0	0	0	0	87	1	0	88	171
04:15 PM	15	0	2	0	17	0	62	0	0	62	0	0	0	0	0	0	85	0	0	85	164
04:30 PM	20	0	4	0	24	0	58	0	0	58	0	0	0	0	0	0	76	0	0	76	158
04:45 PM	16	0	5	0	21	0	58	0	0	58	0	0	0	0	0	0	96	0	0	96	175
Total	74	0	13	0	87	0	236	0	0	236	0	0	0	0	0	0	344	1	0	345	668
05:00 PM	24	0	4	0	28	0	77	0	0	77	0	0	0	0	0	0	112	0	0	112	217
05:15 PM	26	0	0	0	26	0	84	0	0	84	1	0	0	0	1	0	87	0	0	87	198
05:30 PM	20	0	3	0	23	0	84	0	0	84	0	0	0	0	0	0	72	0	0	72	179
05:45 PM	30	0	5	0	35	0	80	0	0	80	0	0	0	0	0	0	102	0	0	102	217
Total	100	0	12	0	112	0	325	0	0	325	1	0	0	0	1	0	373	0	0	373	811
Grand Total	308	0	49	0	357	1	937	0	0	938	2	0	0	0	2	0	1470	1	0	1471	2768
Apprch %	86.3	0	13.7	0		0.1	99.9	0	0		100	0	0	0		0	99.9	0.1	0		
Total %	11.1	0	1.8	0	12.9	0	33.9	0	0	33.9	0.1	0	0	0	0.1	0	53.1	0	0	53.1	
Lights	307	0	47	0	354	1	913	0	0	914	2	0	0	0	2	0	1443	1	0	1444	2714
% Lights	99.7	0	95.9	0	99.2	100	97.4	0	0	97.4	100	0	0	0	100	0	98.2	100	0	98.2	98
Mediums	1	0	2	0	3	0	20	0	0	20	0	0	0	0	0	0	26	0	0	26	49
% Mediums	0.3	0	4.1	0	0.8	0	2.1	0	0	2.1	0	0	0	0	0	0	1.8	0	0	1.8	1.8
Articulated Trucks	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5
% Articulated Trucks	0	0	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0	0.1	0	0	0.1	0.2

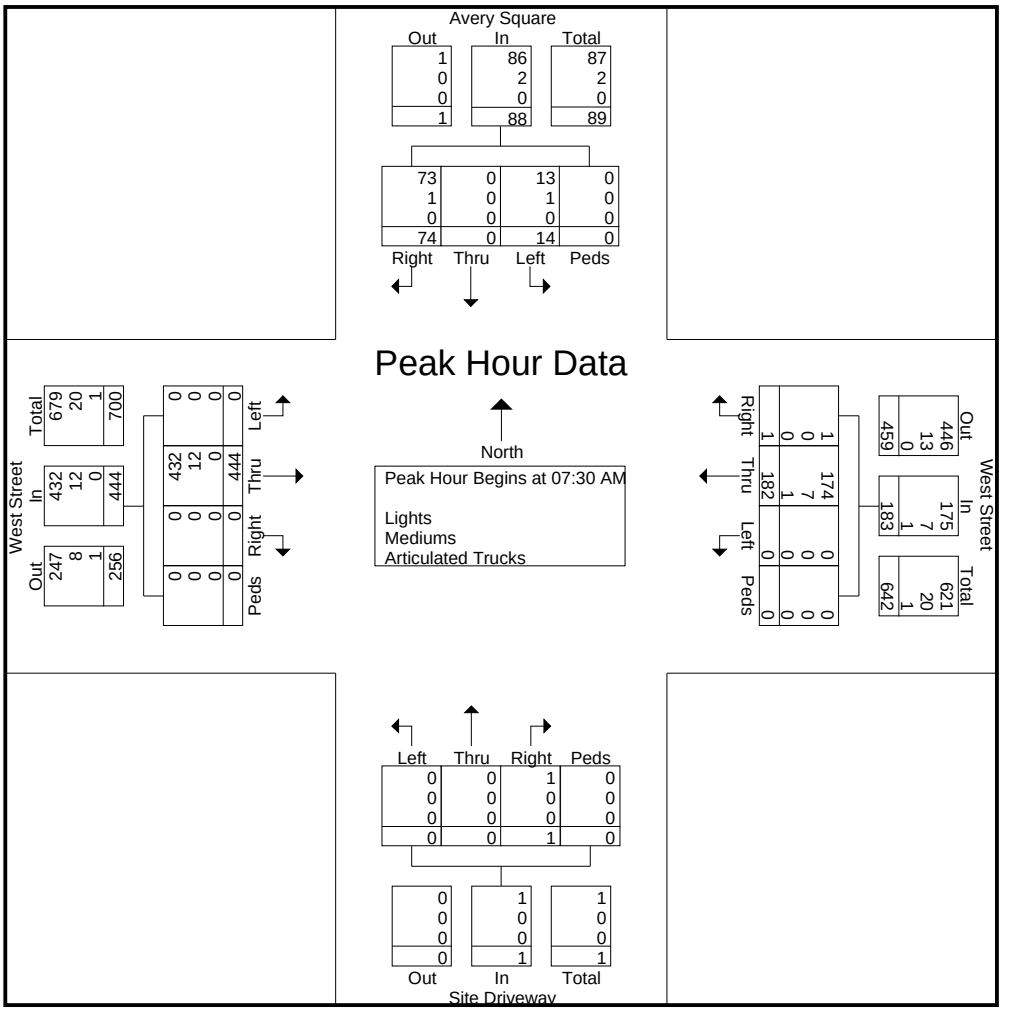
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Avery Square
NB: Site Driveway
E/W: West Street
Needham, MA

File Name : 1424_West_Street_at_Avery_Square_Site_Driveway_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 2

	Avery Square From North					West Street From East					Site Driveway From South					West Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	13	0	1	0	14	0	44	0	0	44	**1**	0	0	0	**1**	0	112	0	0	112	171
07:45 AM	**22**	0	**8**	0	**30**	0	39	0	0	39	0	0	0	0	0	0	**118**	0	0	**118**	**187**
08:00 AM	19	0	2	0	21	0	**55**	0	0	**55**	0	0	0	0	0	0	103	0	0	103	179
08:15 AM	20	0	3	0	23	**1**	44	0	0	45	0	0	0	0	0	0	111	0	0	111	179
Total Volume	74	0	14	0	88	1	182	0	0	183	1	0	0	0	1	0	444	0	0	444	716
% App. Total	84.1	0	15.9	0		0.5	99.5	0	0		100	0	0	0		0	100	0	0		
PHF	.841	.000	.438	.000	.733	.250	.827	.000	.000	.832	.250	.000	.000	.000	.250	.000	.941	.000	.000	.941	.957
Lights	73	0	13	0	86	1	174	0	0	175	1	0	0	0	1	0	432	0	0	432	694
% Lights	98.6	0	92.9	0	97.7	100	95.6	0	0	95.6	100	0	0	0	100	0	97.3	0	0	97.3	96.9
Mediums	1	0	1	0	2	0	7	0	0	7	0	0	0	0	0	0	12	0	0	12	21
% Mediums	1.4	0	7.1	0	2.3	0	3.8	0	0	3.8	0	0	0	0	0	0	2.7	0	0	2.7	2.9
Articulated Trucks	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0.1



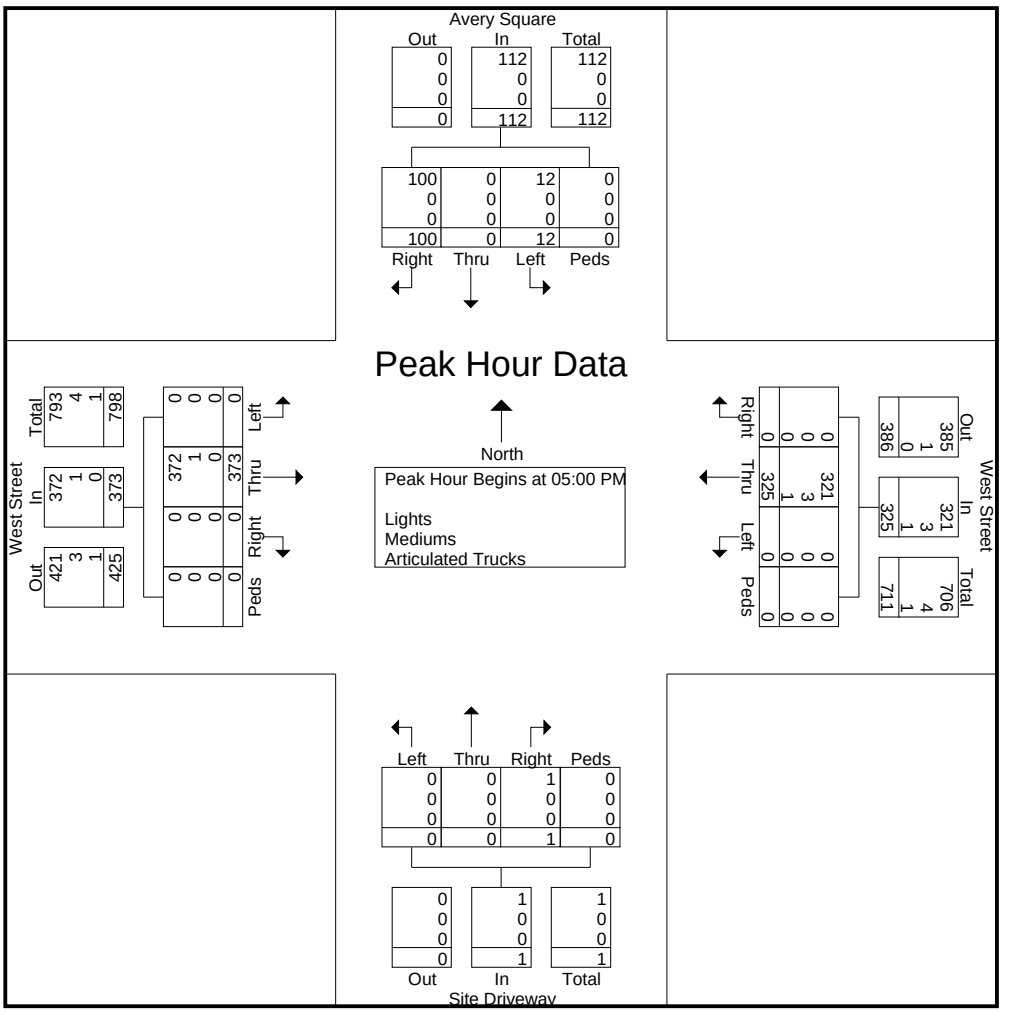
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Avery Square
NB: Site Driveway
E/W: West Street
Needham, MA

File Name : 1424_West_Street_at_Avery_Square_Site_Driveway_04-10-2025
Site Code : 1424
Start Date : 4/10/2025
Page No : 3

	Avery Square From North					West Street From East					Site Driveway From South					West Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	24	0	4	0	28	0	77	0	0	77	0	0	0	0	0	0	**112**	0	0	**112**	**217**
05:15 PM	26	0	0	0	26	0	**84**	0	0	**84**	**1**	0	0	0	**1**	0	87	0	0	87	198
05:30 PM	20	0	3	0	23	0	84	0	0	84	0	0	0	0	0	0	72	0	0	72	179
05:45 PM	**30**	0	**5**	0	**35**	0	80	0	0	80	0	0	0	0	0	0	102	0	0	102	217
Total Volume	100	0	12	0	112	0	325	0	0	325	1	0	0	0	1	0	373	0	0	373	811
% App. Total	89.3	0	10.7	0		0	100	0	0		100	0	0	0		0	100	0	0		
PHF	.833	.000	.600	.000	.800	.000	.967	.000	.000	.967	.250	.000	.000	.000	.250	.000	.833	.000	.000	.833	.934
Lights	100	0	12	0	112	0	321	0	0	321	1	0	0	0	1	0	372	0	0	372	806
% Lights	100	0	100	0	100	0	98.8	0	0	98.8	100	0	0	0	100	0	99.7	0	0	99.7	99.4
Mediums	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4
% Mediums	0	0	0	0	0	0	0.9	0	0	0.9	0	0	0	0	0	0	0.3	0	0	0.3	0.5
Articulated Trucks	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0.3	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0.1



□ Seasonal/Yearly Growth Data

SECTION I - CONTINUOUS COUNTING STATION MONTHLY AVERAGE DAILY TRAFFIC

STATION 4165 - NEWTON - INTERSTATE 95 - NORTH OF RTE. 16

YR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
2015		127,134	142,024	150,125	151,576	153,916	144,679	149,503	151,538	152,148	141,875	137,826	145,668
		2%	4%	-1%	2%	2%	2%	1%	0%	2%	4%	0%	1%
2016	139,436	130,154	148,054	149,295	153,957	156,496	147,414	151,081	152,186	154,663	146,935	137,768	147,287
			-12%	-3%	0%	0%	0%	-1%	1%	1%	1%	7%	1%
2017			129,731	144,492	153,434	156,333	147,884	149,113	154,281	155,618	149,129	147,141	148,716
	-17%	-7%	7%	0%	-2%	0%	0%	2%	-3%	-1%	-3%	-8%	-4%
2022	115,828	121,108	138,526	144,552	150,707	155,828	148,340	152,075	150,400	153,927	144,591	136,092	142,665
	12%	11%	3%	-4%	-5%	-5%	-6%	-6%	3%	4%	4%	5%	1%
2023	129,233	134,612	142,230	139,270	143,285	147,525	139,039	142,697	155,446	159,681	150,987	142,723	143,894
	5%	7%	6%	9%	9%	5%	8%	9%	-3%	-6%	-4%	-1%	3%
2024	135,522	143,677	150,733	151,651	156,316	155,328	150,130	156,118	150,488	149,319	144,609	141,165	148,755
Seasonal Adjustment Factor (to average month)	1.12	1.11	1.03	1.00	0.96	0.95	1.00	0.97	0.96	0.95	1.00	1.04	
												Growth	**0.45%**

Average Yearly Growth Calculated 0.5%

Yearly Growth Factor Used 1.0%

ITALICS = ESTIMATED DATA

MADT

- Speed Data

MDM TRANSPORTATION CONSULTANTS, INC.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Highland Street
Just south of Dana Plaza
Needham, MA

Site Code: 1424
Station ID:

Latitude: 0' 0.0000 Undefined

Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
04/10/25	0	0	0	3	4	4	1	0	0	0	0	0	0	0	12	38
01:00	0	0	0	0	3	2	0	0	0	0	0	0	0	0	5	38
02:00	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3	32
03:00	0	0	0	3	2	2	0	0	0	0	0	0	0	0	7	37
04:00	1	1	0	4	3	1	0	0	1	0	0	0	0	0	11	36
05:00	0	0	1	13	25	14	2	0	0	0	0	0	0	0	55	37
06:00	0	0	5	42	65	27	7	0	0	0	0	0	0	0	146	37
07:00	1	3	36	136	130	29	4	0	0	0	0	0	0	0	339	34
08:00	5	8	24	135	129	48	7	1	0	0	0	0	0	0	357	35
09:00	7	7	27	134	151	32	1	0	0	0	0	0	0	0	359	34
10:00	1	3	57	146	127	21	1	0	0	0	0	0	0	0	356	33
11:00	0	5	20	143	142	31	3	0	0	0	0	0	0	0	344	34
12 PM	0	7	38	156	151	25	1	0	0	0	0	0	0	0	378	33
13:00	0	1	15	142	173	38	3	1	0	0	0	0	0	0	373	34
14:00	2	7	32	179	158	26	6	0	0	0	0	0	0	0	410	34
15:00	0	7	46	222	173	40	0	1	0	0	0	0	0	0	489	34
16:00	0	1	78	208	143	33	1	0	0	0	0	0	0	0	464	33
17:00	1	0	43	203	139	28	0	0	0	0	0	0	0	0	414	33
18:00	1	1	16	173	151	36	3	1	0	0	0	0	0	0	382	34
19:00	1	1	24	112	103	20	1	0	0	0	0	0	0	0	262	34
20:00	0	0	12	60	68	18	1	0	0	0	0	0	0	0	159	34
21:00	0	0	13	35	51	9	1	1	0	0	0	0	0	0	110	34
22:00	0	0	9	17	19	5	2	0	0	0	0	0	0	0	52	34
23:00	0	0	1	7	9	1	4	1	0	0	0	0	0	0	23	41
Total	20	52	497	2275	2120	490	49	6	1	0	0	0	0	0	5510	

Statistics		
	10 MPH Pace Speed :	26-35 MPH
	85th Percentile :	34 MPH
	95th Percentile :	37 MPH
	Number of Vehicles > 30 MPH :	2666
	Percent of Vehicles > 30 MPH :	48.4%
	Mean Speed(Average) :	30 MPH

Stats		
	Mean Speed(Average) :	30 MPH
	85th Percentile :	34 MPH
	95th Percentile :	37 MPH
	Number of Vehicles > 30 MPH :	2666
	Percent of Vehicles > 30 MPH :	48.4%

MDM TRANSPORTATION CONSULTANTS, INC.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Highland Street
Just south of Dana Plaza
Needham, MA

Site Code: 1424
Station ID:

Latitude: 0' 0.0000 Undefined

Northbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
04/10/25	0	1	0	4	5	0	0	0	0	0	0	0	0	0	10	33
01:00	0	0	1	2	2	0	2	0	0	0	0	0	0	0	7	42
02:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	29
03:00	0	0	1	0	1	1	0	0	0	0	0	0	0	0	3	37
04:00	0	1	0	5	1	0	1	1	0	0	0	0	0	0	9	43
05:00	0	1	3	12	16	6	0	0	0	0	0	0	0	0	38	35
06:00	1	0	6	49	53	8	0	0	0	0	0	0	0	0	117	34
07:00	9	16	77	161	93	18	1	0	1	0	0	0	0	0	376	33
08:00	3	21	112	175	90	10	3	0	0	0	0	0	0	0	414	32
09:00	0	2	70	207	96	13	0	0	0	0	0	0	0	0	388	32
10:00	2	9	58	176	90	14	2	0	0	0	0	0	0	0	351	32
11:00	2	10	139	241	77	5	0	0	0	0	0	0	0	0	474	30
12 PM	3	16	102	236	86	11	0	0	0	0	0	0	0	0	454	31
13:00	0	5	82	232	100	8	0	0	0	0	0	0	0	0	427	32
14:00	10	10	129	228	86	10	0	0	0	0	0	0	0	0	473	31
15:00	0	16	118	211	68	13	0	0	0	0	0	0	0	0	426	31
16:00	5	10	144	235	69	5	0	0	0	0	0	0	0	0	468	30
17:00	1	18	119	201	69	5	0	0	0	0	0	0	0	0	413	30
18:00	0	5	76	230	73	10	0	0	0	0	0	0	0	0	394	31
19:00	1	4	52	153	87	14	0	0	0	0	0	0	0	0	311	33
20:00	0	8	61	128	45	4	0	0	0	0	0	0	0	0	246	31
21:00	0	0	17	74	37	5	1	0	0	0	0	0	0	0	134	33
22:00	0	3	9	39	16	6	0	0	0	0	0	0	0	0	73	33
23:00	0	0	3	7	11	5	0	0	0	0	0	0	0	0	26	36
Total	37	156	1379	3007	1271	171	10	1	1	0	0	0	0	0	6033	

Statistics		
	10 MPH Pace Speed :	21-30 MPH
	85th Percentile :	32 MPH
	95th Percentile :	34 MPH
	Number of Vehicles > 30 MPH :	1454
	Percent of Vehicles > 30 MPH :	24.1%
	Mean Speed(Average) :	28 MPH

Stats		
	Mean Speed(Average) :	28 MPH
	85th Percentile :	32 MPH
	95th Percentile :	34 MPH
	Number of Vehicles > 30 MPH :	1454
	Percent of Vehicles > 30 MPH :	24.1%

- Transit Schedules and Fare Information

NEEDHAM LINE

SPRING/SUMMER SCHEDULE
Effective March 24, 2025

Monday to Friday

Inbound to Boston

ZONE	STATION	TRAIN #	AM							PM									
			602	608	614	620	626	630	634	638	642	646	650	654	660	666	672	680	686
		Bikes Allowed	🚲					🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲
2	Needham Heights	♿	5:05	6:05	7:05	8:05	9:05	10:05	11:05	12:05	1:05	2:05	3:05	4:05	5:07	6:05	7:05	8:50	10:15
2	Needham Center	♿	5:09	6:09	7:09	8:09	9:09	10:09	11:09	12:09	1:09	2:09	3:09	4:09	5:11	6:09	7:09	8:54	10:19
2	Needham Junction	♿	5:13	6:13	7:13	8:13	9:13	10:13	11:13	12:13	1:13	2:13	3:13	4:13	5:15	6:13	7:13	8:58	10:23
2	Hersey	♿	5:16	6:16	7:16	8:16	9:16	10:16	11:16	12:16	1:16	2:16	3:16	4:16	5:18	6:16	7:16	9:01	10:26
1	West Roxbury	♿	5:21	6:22	7:22	8:22	9:21	10:21	11:21	12:21	1:21	2:26	3:26	4:26	5:28	6:26	7:26	9:06	10:31
1	Highland	♿	5:23	6:24	7:24	8:24	9:23	10:23	11:23	12:23	1:23	2:28	3:28	4:28	5:30	6:28	7:28	9:08	10:33
1	Bellevue	♿	5:25	6:27	7:27	8:27	9:25	10:25	11:25	12:25	1:25	2:30	3:30	4:30	5:32	6:30	7:30	9:10	10:35
1	Roslindale Village	♿	5:28	6:30	7:30	8:30	9:28	10:28	11:28	12:28	1:28	2:33	3:33	4:33	5:35	6:33	7:33	9:13	10:38
1A	Forest Hills	♿	5:31	6:34	7:34	8:34	9:31	10:31	11:31	12:31	1:31	2:36	3:36	4:36	5:38	6:36	7:36	9:16	10:42
1A	Ruggles	♿	L 5:37	L 6:40	L 7:40	L 8:40	L 9:37	L 10:37	L 11:37	L 12:37	L 1:37	L 2:42	L 3:42	L 4:42	L 5:45	L 6:42	L 7:42	L 9:22	-
1A	Back Bay	♿	L 5:41	L 6:44	L 7:44	L 8:44	L 9:40	L 10:40	L 11:40	L 12:40	L 1:40	L 2:45	L 3:45	L 4:45	L 5:49	L 6:45	L 7:45	L 9:25	-
1A	South Station	♿	5:47	6:50	7:50	8:50	9:46	10:45	11:45	12:45	1:45	2:50	3:50	4:50	5:55	6:50	7:50	9:30	-

Monday to Friday

Outbound from Boston

ZONE	STATION	TRAIN #	AM							PM											AM
			617	621	625	629	633	637	641	645	649	655	661	667	673	677	683	Providence 889	689	Providence 893	693
		Bikes Allowed	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲					🚲	🚲	🚲	🚲	🚲	🚲
1A	South Station	♿	6:50	7:50	8:50	9:50	10:50	11:50	12:50	1:55	2:55	3:55	4:55	5:55	6:55	7:55	9:20	10:45	Board Providence 889 & change train at Forest Hills for a Needham connection	11:55	Board Providence 893 & change train at Forest Hills for a Needham connection
1A	Back Bay	♿	6:55	7:55	8:55	9:55	10:55	11:55	12:55	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:25	10:50		12:00	
1A	Ruggles	♿	6:58	7:58	8:58	9:58	10:58	11:58	12:58	2:03	3:03	4:03	5:03	6:03	7:03	8:03	9:28	10:53		12:03	
1A	Forest Hills	♿	7:03	8:03	9:03	10:03	11:03	12:03	1:03	2:08	3:08	4:08	5:08	6:08	7:08	8:08	9:33	10:58 →	11:03	12:08 →	12:13
1	Roslindale Village	♿	7:06	8:06	9:06	10:06	11:06	12:06	1:06	2:11	3:11	4:11	5:12	6:11	7:11	8:11	9:36	-	11:06	-	12:16
1	Bellevue	♿	7:09	8:09	9:09	10:09	11:09	12:09	1:09	2:14	3:14	4:14	5:15	6:14	7:14	8:14	9:39	-	11:09	-	12:19
1	Highland	♿	7:11	8:11	9:11	10:11	11:11	12:11	1:11	2:16	3:16	4:16	5:18	6:16	7:16	8:16	9:41	-	11:11	-	12:21
1	West Roxbury	♿	7:13	8:13	9:13	10:13	11:13	12:13	1:13	2:18	3:18	4:18	5:20	6:18	7:18	8:18	9:43	-	11:13	-	12:23
2	Hersey	♿	7:23	8:23	9:23	10:23	11:23	12:23	1:23	2:23	3:23	4:24	5:26	6:24	7:23	8:23	9:48	-	11:18	-	12:28
2	Needham Junction	♿	7:26	8:26	9:26	10:26	11:26	12:26	1:26	2:26	3:26	4:27	5:29	6:27	7:26	8:26	9:51	-	11:21	-	12:31
2	Needham Center	♿	7:29	8:29	9:29	10:29	11:29	12:29	1:29	2:29	3:29	4:31	5:33	6:31	7:29	8:29	9:54	-	11:24	-	12:34
2	Needham Heights	♿	7:35	8:35	9:35	10:35	11:35	12:35	1:35	2:35	3:35	4:38	5:41	6:38	7:35	8:35	10:00	-	11:29	-	12:39

Weekend

Inbound to Boston

ZONE	STATION	TRAIN #	AM			PM				
			5608	5620	5630	5638	5646	5654	5666	5678
		Bikes Allowed	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲
2	Needham Heights	♿	6:10	8:10	10:10	12:10	2:10	4:10	6:10	8:10
2	Needham Center	♿	6:14	8:14	10:14	12:14	2:14	4:14	6:14	8:14
2	Needham Junction	♿	6:18	8:18	10:18	12:18	2:18	4:18	6:18	8:18
2	Hersey	♿	6:21	8:21	10:21	12:21	2:21	4:21	6:21	8:21
1	West Roxbury	♿	6:26	8:26	10:26	12:26	2:26	4:26	6:26	8:26
1	Highland	♿	6:28	8:28	10:28	12:28	2:28	4:28	6:28	8:28
1	Bellevue	♿	6:30	8:30	10:30	12:30	2:30	4:30	6:30	8:30
1	Roslindale Village	♿	6:33	8:33	10:33	12:33	2:33	4:33	6:33	8:33
1A	Forest Hills	♿	6:36	8:36	10:36	12:36	2:36	4:36	6:36	8:36
1A	Ruggles	♿	L 6:41	L 8:41	L 10:41	L 12:41	L 2:41	L 4:41	L 6:41	L 8:41
1A	Back Bay	♿	L 6:45	L 8:45	L 10:45	L 12:45	L 2:45	L 4:45	L 6:45	L 8:45
1A	South Station	♿	6:50	8:50	10:50	12:50	2:50	4:50	6:50	8:50

Weekend

Outbound from Boston

ZONE	STATION	TRAIN #	AM			PM				
			5617	5627	5635	5643	5651	5663	5675	5687
		Bikes Allowed	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲
1A	South Station	♿	7:15	9:13	11:15	1:15	3:15	5:13	7:15	10:15
1A	Back Bay	♿	7:20	9:18	11:20	1:20	3:20	5:18	7:20	10:20
1A	Ruggles	♿	7:23	9:21	11:23	1:23	3:23	5:21	7:23	10:23
1A	Forest Hills	♿	7:28	9:26	11:28	1:28	3:28	5:26	7:28	10:28
1	Roslindale Village	♿	7:31	9:29	11:31	1:31	3:31	5:29	7:31	10:31
1	Bellevue	♿	7:34	9:32	11:34	1:34	3:34	5:32	7:34	10:34
1	Highland	♿	7:36	9:34	11:36	1:36	3:36	5:34	7:36	10:36
1	West Roxbury	♿	7:38	9:36	11:38	1:38	3:38	5:36	7:38	10:38
2	Hersey	♿	7:43	9:41	11:43	1:43	3:43	5:41	7:43	10:43
2	Needham Junction	♿	7:46	9:44	11:46	1:46	3:46	5:44	7:46	10:46
2	Needham Center	♿	7:50	9:48	11:50	1:50	3:50	5:48	7:50	10:50
2	Needham Heights	♿	7:55	9:53	11:55	1:55	3:55	5:53	7:55	10:55

Keep in Mind:
This schedule will be effective from March 24, 2025 and will replace the schedule of November 18, 2024.

HOLIDAY SERVICE:
The following holidays will operate on a WEEKEND Schedule:

- **MEMORIAL DAY** - Monday, May 26, 2025
- **INDEPENDENCE DAY** - Friday, July 4, 2025
- **LABOR DAY** - Monday, September 1, 2025

WEEKDAY SERVICE:
The following holidays will operate on a WEEKDAY schedule:

- **PATRIOTS' DAY** - Monday, April 21, 2025
- **JUNETEENTH** - Thursday, June 19, 2025
- **COLUMBUS DAY** - Monday, October 13, 2025

For all holiday schedules, please check mbta.com/holidays or call 617-222-3200.

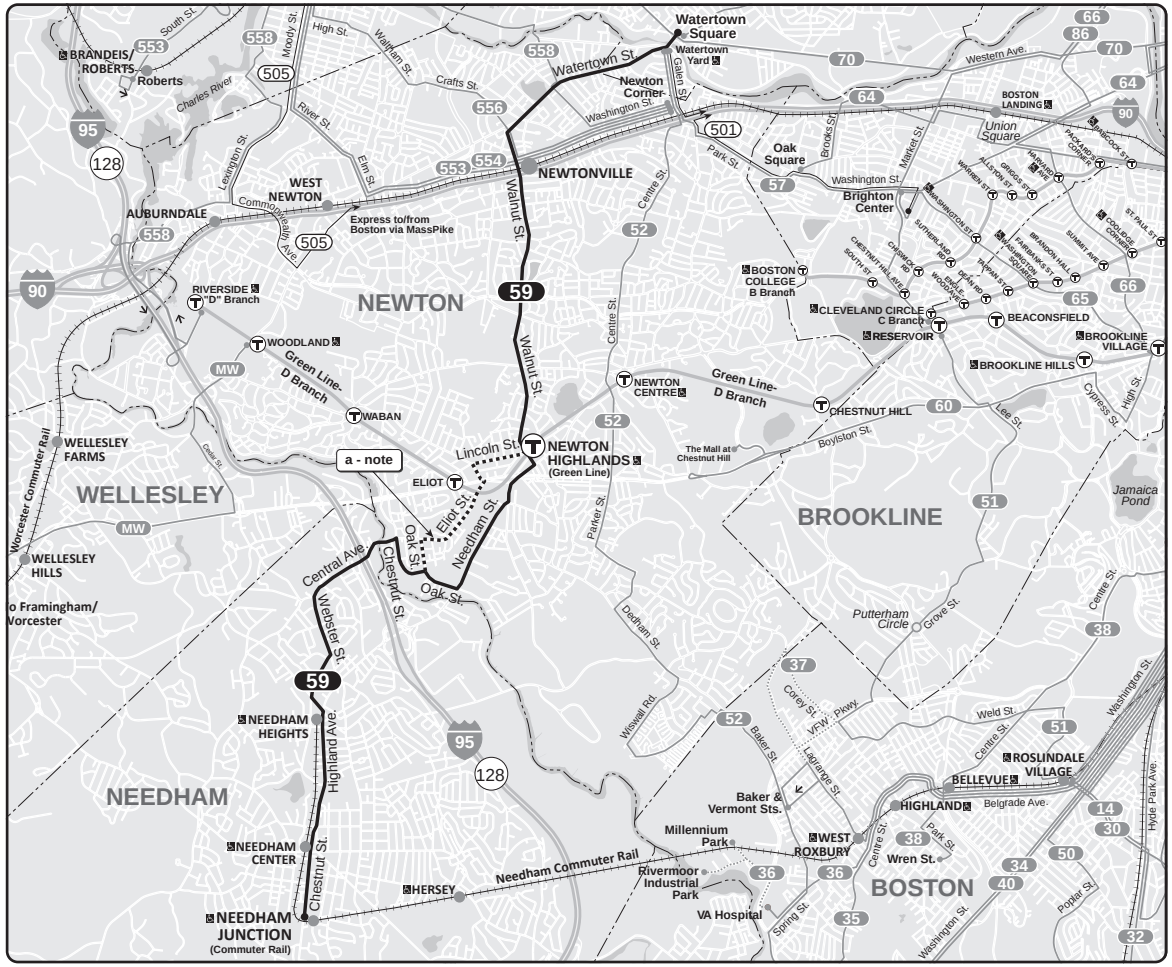
Times in blue indicate an early departure (L stop): The train may leave ahead of schedule at these stops.

Bikes: Bicycles are allowed on trains with the bicycle symbol shown below the train number.

High level platform and bridge plate available. Visit **mbta.com/accessibility** for more information.

Effective **April 6, 2025** Replaces December 2024

59 Needham Jct – Watertown Sq



Connections

GREEN LINE | D | NEEDHAM LINE

FRAMINGHAM/WORCESTER LINE

- Transfer to bus/subway available on CharlieCard and contactless—good for 2 hours, pay fare difference.
- Children 11 & under ride free.

All MBTA buses are accessible to people with disabilities.

	CharlieCard & Contactless	Cash on board	Reduced fare
Local Bus	**$1.70**	**$1.70**	**$0.85**
Bus + Subway	**$2.40**	**$4.10**	**$1.10**

Complete fare/pass rules and free/reduced fare eligibility:
mbta.com/fares or call **617-222-3200**

Information **617-222-3200**
Lost and Found **617-222-1450**
TTY **617-222-5146**

Realtime arrival information, maps, and more
mbta.com

A123-3-22.01

Weekday 59

Inbound

	Needham Junction	Newton Highlands Station	Watertown Square
	6:20	6:38	6:55
	6:50	7:09	7:30
A	7:20	7:41	8:02
	7:55	8:17	8:39
A	8:25	8:51	9:10
	9:00	9:19	9:36
	9:35	9:54	10:11
	10:10	10:29	10:46
	10:55	11:14	11:31
	11:45	**12:04**	**12:21**
	12:35	**12:54**	**1:11**
	1:25	**1:44**	**2:01**
	2:15	**2:34**	**2:51**
	3:10	**3:33**	**3:56**
	4:00	**4:22**	**4:44**
	4:50	**5:13**	**5:33**
	5:35	**5:58**	**6:18**
	6:10	**6:33**	**6:51**
	6:45	**7:03**	**7:21**
	7:20	**7:37**	**7:52**
	7:50	**8:07**	**8:22**

Outbound

	Watertown Square	Newton Highlands Station	Needham Junction
	6:05	6:18	6:37
	6:35	6:48	7:07
	7:05	7:25	7:44
	7:35	7:55	8:15
	8:10	8:30	8:50
	8:45	9:04	9:24
	9:25	9:44	10:04
	10:05	10:22	10:42
	10:55	11:12	11:33
	11:45	**12:02**	**12:23**
	12:35	**12:52**	**1:13**
	1:25	**1:42**	**2:03**
	2:10	**2:27**	**2:52**
	3:00	**3:20**	**3:45**
	3:50	**4:10**	**4:35**
A	**4:30**	**4:50**	**5:14**
	5:05	**5:28**	**5:53**
A	**5:45**	**6:08**	**6:32**
	6:25	**6:42**	**7:05**
	7:00	**7:16**	**7:39**

Saturday 59

Inbound

Needham Junction	Newton Highlands Station	Watertown Square
7:05	7:23	7:36
8:35	8:55	9:10
10:05	10:28	10:45
11:36	**12:01**	**12:18**
1:10	**1:35**	**1:50**
2:40	**3:02**	**3:17**
4:10	**4:31**	**4:46**
5:40	**6:01**	**6:15**
7:05	**7:25**	**7:39**

Outbound

Watertown Square	Newton Highlands Station	Needham Junction
6:20	6:35	6:49
7:50	8:05	8:22
9:20	9:35	9:56
10:50	11:05	11:30
12:22	**12:37**	**1:02**
1:55	**2:10**	**2:31**
3:25	**3:40**	**3:59**
4:55	**5:10**	**5:29**
6:25	**6:40**	**6:57**

Sunday 59

Inbound

Needham Junction	Newton Highlands Station	Watertown Square
7:50	8:07	8:20
9:20	9:39	9:53
10:50	11:09	11:23
12:20	**12:40**	**12:56**
1:50	**2:08**	**2:24**
3:20	**3:39**	**3:56**
4:50	**5:09**	**5:25**
6:20	**6:39**	**6:55**

Outbound

Watertown Square	Newton Highlands Station	Needham Junction
7:05	7:17	7:33
8:35	8:47	9:05
10:05	10:18	10:38
11:35	11:48	**12:08**
1:05	**1:18**	**1:38**
2:35	**2:48**	**3:08**
4:05	**4:18**	**4:38**
5:35	**5:49**	**6:09**

A via Eliot Street

PM times are **bold**

Information in this timetable is subject to change without notice. Traffic and weather may affect running times.

Always check bus destination signs before boarding. Some buses may only serve a part, or skip portions of this route.

Holidays

- SUN New Year's Day
- SAT MLK Jr. Day
- SAT Presidents Day
- SAT Patriots' Day
- SUN Memorial Day
- SUN Independence Day
- SUN Labor Day
- SAT Columbus/Indigenous Peoples Day
- SUN Thanksgiving
- SUN Christmas Day

- MassDOT Crash Records and Mapping

Crash Number	City Town Name	Crash Date	Crash Severity	Crash Time	Crash Year	Max Injury Severity Reported	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	First Harmful Event	Light Conditions	Manner of Collision	RMV Document Numbers	Road Surface Condition	Roadway Junction Type	Total Fatalities	Total Non-Fatal Injuries	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Emergency Use (All Vehicles)	Vehicle Towed From Scene (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Crash Report IDs	First Harmful Event Location	Most Harmful Event (All Vehicles)	Road Contributing Circumstance	Traffic Control Device Function	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway
Highland Avenue at West Street																															
4825289	NEEDHAM	02/18/2020	Property damage only (none injured)	4:31 PM	2020	No injury	2	D2: (Visibility obstructed)	D2: Not Distracted	Collision with parked motor vehicle	Daylight	Sideswipe, same direction	PW2020065001 34	Wet	Not at junction	0	0	V1: Parked / V2: Turning left	V1:(Passenger car) / V2:(Truck/trailer)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: S	Rain	20NEE-60-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with parked motor vehicle)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with parked motor vehicle)	53	WEST STREET
4834275	NEEDHAM	03/05/2020	Property damage only (none injured)	9:52 AM	2020	No injury	3	D1: (Unknown) / D2: (Unknown) / D3: (No improper driving)	D3: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2020097002 08	Dry	Not at junction	0	0	V1: Travelling straight ahead / V2: Backing / V3: Parked	V1:(Passenger car) / V2:(Passenger car) / V3:(Passenger car)	V1:(No) / V2:(No) / V3:(No)	V1:(No) / V2:(Yes, vehicle or trailer disabled) / V3:(No)	V1: E / V2: E / V3: E	Clear	20NEE-74-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic) / V3:(Collision with motor vehicle in traffic)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with parked motor vehicle) V3:(Collision with motor vehicle in traffic)	896	HIGHLAND AVE
4900758	NEEDHAM	11/05/2020	Property damage only (none injured)	8:20 AM	2020	No Apparent Injury (O)	1	D1: (Inattention),(Distracted)	D1: External distraction (outside the vehicle)	Collision with utility pole	Daylight	Fixed-Object	PW2020344004 01	Dry	Driveway	0	0	V1: Turning left	V1:(Passenger car)	V1:(No)	V1:(Yes, vehicle or trailer disabled)	V1: N	Clear/Cloudy	20NEE-238-AC	Roadside	V1:(Collision with utility pole)	None	Not reported	V1:(Collision with utility pole)	910	HIGHLAND AVE
4916538	NEEDHAM	12/27/2020	Property damage only (none injured)	2:44 PM	2020	No Apparent Injury (O)	2	D1: (Made an improper turn) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2021007002 36	Dry	Four-way intersection	0	0	V1: Turning right / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: S	Clear	20NEE-293-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	100	WEST ST
4988432	NEEDHAM	05/12/2021	Property damage only (none injured)	8:01 AM	2021	No Apparent Injury (O)	2	D1: (Inattention) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2021210003 12	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear	21NEE-126-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5014396	NEEDHAM	07/03/2021	Property damage only (none injured)	9:29 AM	2021	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Failed to yield right of way)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2021273001 33	Wet	Not at junction	0	0	V1: Travelling straight ahead / V2: Entering traffic lane	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Rain	21NEE-186-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	896	HIGHLAND AVE
5014428	NEEDHAM	08/12/2021	Property damage only (none injured)	2:56 PM	2021	No Apparent Injury (O)	2	D1: (Unknown) / D2: (No improper driving)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2021273003 03	Dry	Not at junction	0	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear	21NEE-223-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, device not functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		WEST ST / HIGHLAND AVE
5014433	NEEDHAM	08/22/2021	Property damage only (none injured)	8:16 PM	2021	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Unknown)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Dark - lighted roadway	Angle	PW2021273002 16	Wet	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(Yes, vehicle or trailer disabled) / V2:(Yes, vehicle or trailer disabled)	V1: E / V2: N	Rain	21NEE-229-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5014434	NEEDHAM	08/23/2021	Property damage only (none injured)	8:06 PM	2021	No Apparent Injury (O)	2	D1: (Unknown) / D2: (Unknown)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Dark - lighted roadway	Angle	PW2021273002 17	Wet	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(Yes, vehicle or trailer disabled) / V2:(No)	V1: E / V2: S	Rain	21NEE-230-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic),(Collision with utility pole) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5031216	NEEDHAM	09/02/2021	Property damage only (none injured)	9:14 AM	2021	No Apparent Injury (O)	2	D1: (Failed to yield right of way) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2021315002 31	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(Yes, vehicle or trailer disabled)	V1: S / V2: W	Cloudy	21NEE-241-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5067475	NEEDHAM	12/06/2021	Property damage only (none injured)	3:32 PM	2021	No Apparent Injury (O)	1	D1: (Inattention)		Collision with unknown fixed object	Daylight	Fixed-Object	PW2022040002 17	Dry	Not at junction	0	0	V1: Backing	V1:(Passenger car)	V1:(No)	V1:(No)	V1: N	Clear	21NEE-357-AC	Roadside	V1:(Collision with other fixed object (wall, building, tunnel, etc.))	None	Not reported	V1:(Collision with other fixed object(wall, building, tunnel, etc.))		HIGHLAND AVE / WEST ST
5087594	NEEDHAM	01/15/2022	Property damage only (none injured)	8:00 PM	2022	No Apparent Injury (O)	2	D1: (Unknown) / D2: (Unknown)		Collision with motor vehicle in traffic	Dark - lighted roadway	Sideswipe, same direction	PW2022092002 16	Dry	Four-way intersection	0	0	V1: Turning right / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear	22NEE-24-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5087639	NEEDHAM	01/24/2022	Property damage only (none injured)	9:05 AM	2022	No Apparent Injury (O)	2	D1: (Disregarded traffic signs, signals, road markings) / D2: (No improper driving)	D1: Other activity, electronic device	Collision with motor vehicle in traffic	Daylight	Angle	PW2022092004 04	Wet	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(Yes, vehicle or trailer disabled) / V2:(No)	V1: S / V2: E	Clear/Cloudy	22NEE-29-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5098856	NEEDHAM	03/18/2022	Property damage only (none injured)	1:20 PM	2022	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Inattention)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2022124003 21	Dry	Not at junction	0	0	V1: Travelling straight ahead / V2: Backing	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	22NEE-93-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	892	HIGHLAND AVE
5128752	NEEDHAM	04/06/2022	Property damage only (none injured)	12:12 PM	2022	No Apparent Injury (O)	1	D1: (Made an improper turn)		Collision with utility pole	Daylight	Fixed-Object	PW2022203003 30	Wet	Not at junction	0	0	V1: Turning right	V1:(Tractor/semi-trailer)	V1:(No)	V1:(No)	V1: E	Rain	22NEE-116-AC	Roadway	V1:(Collision with light pole or other post/support)	Traffic congestion related	Yes, device functioning	V1:(Collision with light pole or other post/support)		HIGHLAND AVE / WEST ST
5118511	NEEDHAM	05/26/2022	Property damage only (none injured)	9:34 AM	2022	No Apparent Injury (O)	2	D1: (Distracted) / D2: (No improper driving)	D1: Other activity (searching, eating, personal hygiene, etc.) / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2022176002 44	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Other) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear	22NEE-183-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		WEST ST / HIGHLAND AVE
5147984	NEEDHAM	08/04/2022	Property damage only (none injured)	9:16 AM	2022	No Apparent Injury (O)	2	D1: (Inattention),(No improper driving) / D2: (No improper driving)	D1: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2022253008 12	Dry	Four-way intersection	0	0	V1: Turning left / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear/Cloudy	22NEE-265-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	Other	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5194315	NEEDHAM	11/21/2022	Property damage only (none injured)	2:27 PM	2022	No Apparent Injury (O)	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2022363001 40	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear	22NEE-410-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5207356	NEEDHAM	12/14/2022	Property damage only (none injured)	3:29 PM	2022	No Apparent Injury (O)	2	D1: (Other improper action) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2023028002 18	Dry	Not at junction	0	0	V1: Overtaking/passing / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear	22NEE-443-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		WEST ST
5207360	NEEDHAM	12/21/2022	Non-fatal injury	11:35 AM	2022	Suspected Minor Injury (B)	2	D1: (No improper driving) / D2: (Illness) D1: (Failure to keep in proper lane or running off road),(Disregarded traffic signs, signals, road markings) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2023028002 22	Dry	Not at junction	0	1	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear	22NEE-452-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / WEST ST
5282976	NEEDHAM	05/13/2023	Property damage only (none injured)	6:00 PM	2023	No Apparent Injury (O)	2	D1: (Failed to yield right of way) / D2: (No improper driving)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2023429749 1	Dry	Four-way intersection	0	0	V1: Changing lanes / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear	23NEE-148-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		WEST ST Rte / HIGHLAND AVE Rte
5283019	NEEDHAM	05/30/2023	Property damage only (none injured)	4:44 PM	2023	No Apparent Injury (O)	2	D1: (Failed to yield right of way) / D2: (No improper driving) D1: (Failure to keep in proper lane or running off road),(Disregarded traffic signs, signals, road markings) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2023429754 7	Dry	Not at junction	0	0	V1: Entering traffic lane / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	23NEE-175-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
5282997	NEEDHAM	06/08/2023	Property damage only (none injured)	1:04 PM	2023	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Inattention)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2023429751 6	Dry	Four-way intersection	0	0	V1: Changing lanes / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	23NEE-196-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		WEST ST Rte / HIGHLAND AVE Rte
5283038	NEEDHAM	06/11/2023	Property damage only (none injured)	5:45 PM	2023	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Inattention) D1: (Swerving or avoiding due to wind, slippery surface, vehicle, object, vulnerable user in roadway) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with parked motor vehicle	Daylight	Sideswipe, same direction	PW2023429756 6	Dry	Not at junction	0	0	V1: Parked / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	23NEE-205-AC	Outside roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with parked motor vehicle)	None	No, device not functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with parked motor vehicle)	910	HIGHLAND AVE Rte
5303101	NEEDHAM	07/05/2023	Property damage only (none injured)	4:20 PM	2023	No Apparent Injury (O)	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2023431909 8	Dry	Not at junction	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: S	Clear	23NEE-236-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
5325158	NEEDHAM	10/16/2023	Property damage only (none injured)	2:22 PM	2023	No Apparent Injury (O)	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2023434260 4	Dry	Not at junction	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear	23NEE-352-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	Traffic congestion related	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	910	HIGHLAND AVE Rte
5325148	NEEDHAM	10/27/2023	Property damage only (none injured)	6:32 PM	2023	No Apparent Injury (O)	2	D1: (Unknown) / D2: (Unknown)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Dark - lighted roadway	Angle	PW2023434264 2	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Backing	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	23NEE-371-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	Traffic congestion related	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
5372659	NEEDHAM	02/26/2024	Property damage only (none injured)	11:51 AM	2024	No Apparent Injury (O)	2	D1: (Unknown) / D2: (No improper driving)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2024439684 6	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear	24NEE-82-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		WEST ST Rte / HIGHLAND AVE Rte
5398005	NEEDHAM	03/06/2024	Property damage only (none injured)	1:11 PM	2024	No Apparent Injury (O)	2	D1: (Other improper action) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2024442411 1	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Turning right	V1:(MOPED) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: E	Clear	24NEE-94-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
5397992	NEEDHAM	04/29/2024	Property damage only (none injured)	12:56 PM	2024	No Apparent Injury (O)	2	D1: (Made an improper turn),(Disregarded traffic signs, signals, road markings) / D2: (No improper driving)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	PW2024442409 5	Dry	Four-way intersection	0	0	V1: Turning right / V2: Turning right	V1:(Passenger car) / V2:(Single-unit truck (2-axle, 6-tires))	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear	24NEE-157-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
5427304	NEEDHAM	06/19/2024	Property damage only (none injured)	11:59 AM	2024	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Inattention)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Rear-end	PW2024445691 7	Dry	Not at junction	0	0	V1: Backing / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	24NEE-238-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, device not functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	910	HIGHLAND AVE Rte
5463724	NEEDHAM	08/02/2024	Property damage only (none injured)	12:03 PM	2024	No Apparent Injury (O)	2	D1: (Unknown) / D2: (No improper driving)	D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2024449794 2	Dry	Four-way intersection	0	0	V1: Turning left / V2: Turning right	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear/Rain	24NEE-284-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
5490398	NEEDHAM	12/02/2024	Property damage only (none injured)	6:39 PM	2024	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Failed to yield right of way)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2024452685 7	Dry	Four-way intersection	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(Yes, vehicle or trailer disabled) / V2:(No)	V1: W / V2: N	Clear	24NEE-455-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, device not functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE Rte / WEST ST Rte
Highland Avenue at Mellen Street																															
4905822	NEEDHAM	08/18/2020	Property damage only (none injured)	6:43 PM	2020	No injury	2	D1: (No improper driving) / D2: (Over-correcting/over-steering)	D1: Not Distracted / D2: Not Distracted	Collision with parked motor vehicle	Dusk	Sideswipe, same direction	PW2020344001 23	Dry	Not at junction	0	0	V1: Parked / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: N / V2: N	Clear	20NEE-173-AC	Roadway	V1:(Collision with parked motor vehicle) / V2:(Collision with parked motor vehicle)	None	Not reported	V1:(Collision with parked motor vehicle) V2:(Collision with parked motor vehicle)	958	HIGHLAND AVE
5169619	NEEDHAM	09/27/2022	Property damage only (none injured)	12:44 PM	2022	No Apparent Injury (O)	2	D2: (No improper driving)	D2: Not Distracted	Collision with parked motor vehicle	Daylight	Fixed-Object	PW2022305004 21	Dry	Not at junction	0	0	V1: Not reported / V2: Parked	V2:(Passenger car)	V1:(No) / V2:(No)	V2:(No)	V1: N / V2: N	Clear	22NEE-329-AC	Outside roadway	V2:(Collision with motor vehicle in traffic)	None	Not reported	V2:(Collision with motor vehicle in traffic)	958	HIGHLAND AVE
5282987	NEEDHAM	05/19/2023	Property damage only (none injured)	5:35 PM	2023	No Apparent Injury (O)	2	D1: (Distracted),(Disregarded traffic signs, signals, road markings) / D2: (No improper driving)	D1: External distraction (outside the vehicle) / D2: Not Distracted	Collision with parked motor vehicle	Daylight	Angle	PW2023429750 4	Dry	Not at junction	0	0	V1: Travelling straight ahead / V2: Parked	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(Yes, vehicle or trailer disabled) / V2:(Yes, vehicle or trailer disabled)	V1: S / V2: S	Clear	23NEE-158-AC	Roadway	V1:(Collision with parked motor vehicle) / V2:(Collision with motor vehicle in traffic)	None	Not reported	V1:(Collision with parked motor vehicle) V2:(Collision with motor vehicle in traffic)	958	HIGHLAND AVE Rte
5282985	NEEDHAM	05/22/2023	Property damage only (none injured)	1:56 AM	2023	No Apparent Injury (O)	1	D1: (Swerving or avoiding due to wind, slippery surface, vehicle, object, vulnerable user in roadway)	D1: Not Distracted	Collision with utility pole	Dark - lighted roadway	Fixed-Object	PW2023429749 8	Dry	T-intersection	0	0	V1: Turning right	V1:(Passenger car)	V1:(No)	V1:(No)	V1: E	Clear	23NEE-161-AC	Roadside	V1:(Collision with utility pole)	None	Not reported	V1:(Collision with utility pole)		HIGHLAND AVE Rte / MELLEN ST Rte
5283007	NEEDHAM	05/26/2023	Property damage only (none injured)	1:30 PM	2023	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Over-correcting/over-steering)	D1: Not Distracted / D2: Not Distracted	Collision with parked motor vehicle	Daylight	Sideswipe, same direction	PW2023429753 2	Dry	Not at junction	0	0	V1: Parked / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: S	Clear	23NEE-170-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with parked motor vehicle)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with parked motor vehicle)	958	HIGHLAND AVE Rte
5283035	NEEDHAM	06/09/2023	Property damage only (none injured)	3:38 PM	2023	Unknown	1	D1: (Unknown)		Collision with unknown fixed object	Daylight	Fixed-Object	PW2023429756 3	Dry	Not at junction	0	0	V1: Travelling straight ahead	V1:(Passenger car)	V1:(No)	V1:(No)	V1: S	Cloudy	23NEE-200-AC	Outside roadway	V1:(Collision with other fixed object (wall, building, tunnel, etc.))	None	No, device not functioning	V1:(Collision with other fixed object(wall, building, tunnel, etc.))	958	HIGHLAND AVE Rte
5303130	NEEDHAM	08/12/2023	Property damage only (none injured)	4:59 PM	2023	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Unknown)	D1: Not Distracted	Collision with parked motor vehicle	Daylight	Angle	PW2023431912 4	Dry	Not at junction	0	0	V1: Parked / V2: Backing	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: S	Clear/Cloudy	23NEE-277-AC	Outside roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with parked motor vehicle)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with parked motor vehicle)	958	HIGHLAND AVE Rte
5303131	NEEDHAM	08/21/2023	Property damage only (none injured)	2:55 PM	2023	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Failed to yield right of way)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Angle	PW2023431914 9	Dry	Not at junction	0	0	V1: Travelling straight ahead / V2: Making U-turn	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: N	Clear	23NEE-286-AC	Roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	958	HIGHLAND AVE Rte
5312179	NEEDHAM	09/25/2023	Property damage only (none injured)	12:54 PM	2023	No Apparent Injury (O)	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Daylight	Sideswipe, opposite direction	PW2023432881 3	Wet	Driveway	0	0	V1: Backing / V2: Parked	V1:(Passenger car) / V2:(Passenger car)	V2:(No)	V1:(No) / V2:(No)	V1: / V2: S	Rain	23NEE-329-AC	Outside roadway	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham, MA COUNT DATE : Apr-25

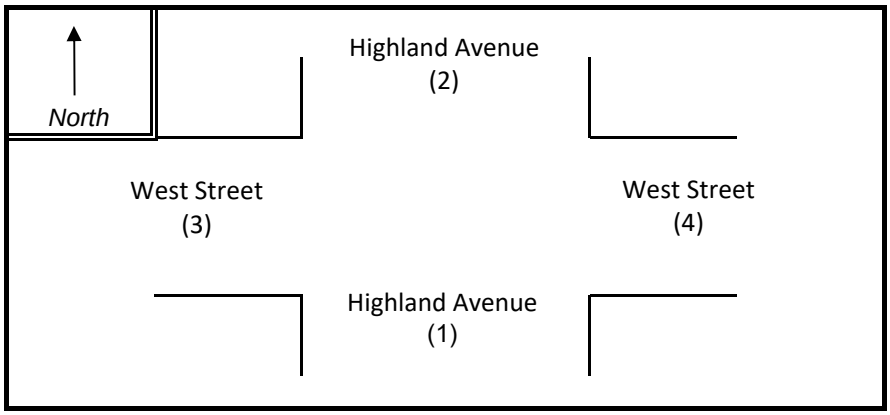
DISTRICT : 6 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Highland Avenue

MINOR STREET(S) : West Street

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	457	490	383	259		1,589

" K " FACTOR : **0.078**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **20,372**

TOTAL # OF CRASHES : 33

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **6.60**

CRASH RATE CALCULATION : **0.89**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : MassDOT District 6 Avg: Signalized = 0.71; Unsignalized = 0.52

Project Title & Date: 1424 - Needham

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham, MA COUNT DATE : Apr-25

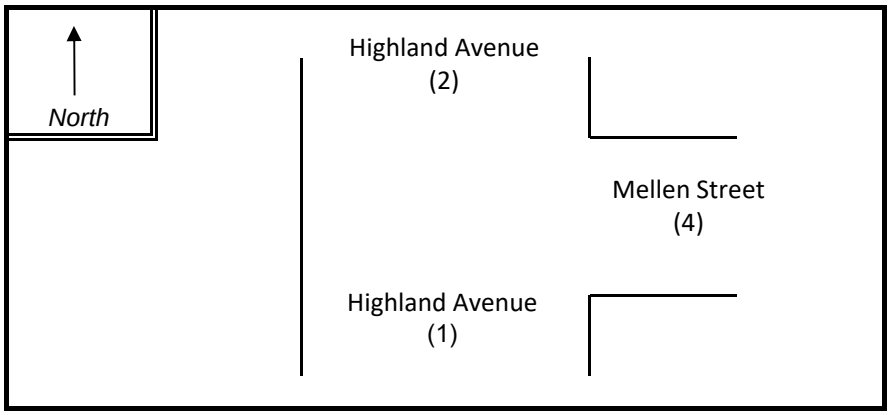
DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Highland Avenue

MINOR STREET(S) : Mellen Street

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	440	478	0	87		**1,005**

" K " FACTOR : **0.078** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **12,885**

TOTAL # OF CRASHES : 13 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **2.60**

CRASH RATE CALCULATION : **0.55** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 6 Avg: Signalized = 0.71; Unsignalized = 0.52

Project Title & Date: 1424 - Needham

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham, MA COUNT DATE : Apr-25

DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

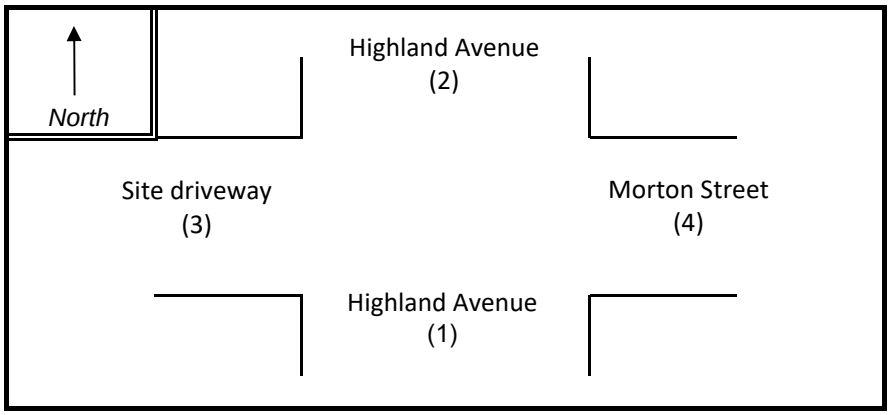
~ INTERSECTION DATA ~

MAJOR STREET : Highland Avenue

MINOR STREET(S) : Morton Street

Site driveway

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	437	479	1	17		**934**

" K " FACTOR : **0.078** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **11,974**

TOTAL # OF CRASHES : 1 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.20**

CRASH RATE CALCULATION : **0.05** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 6 Avg: Signalized = 0.71; Unsignalized = 0.52

Project Title & Date: 1424 - Needham

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham, MA COUNT DATE : Apr-25

DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

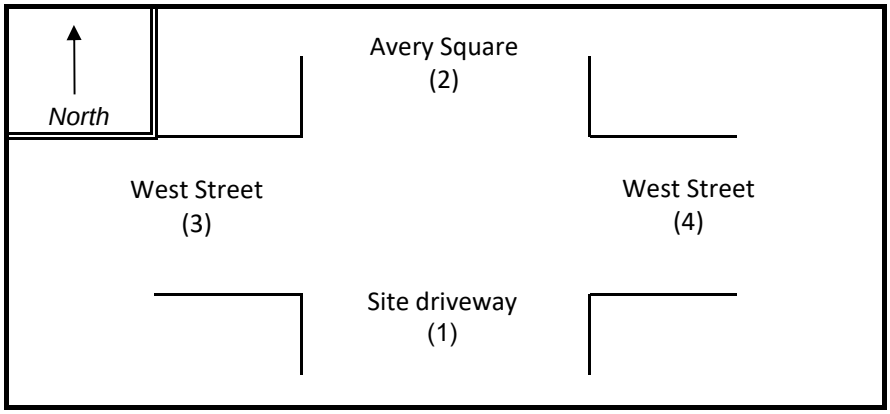
~ INTERSECTION DATA ~

MAJOR STREET : West Street

MINOR STREET(S) : Avery Square

Site driveway

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	1	112	373	325		811

" K " FACTOR : **0.078**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **10,397**

TOTAL # OF CRASHES : 3

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **0.60**

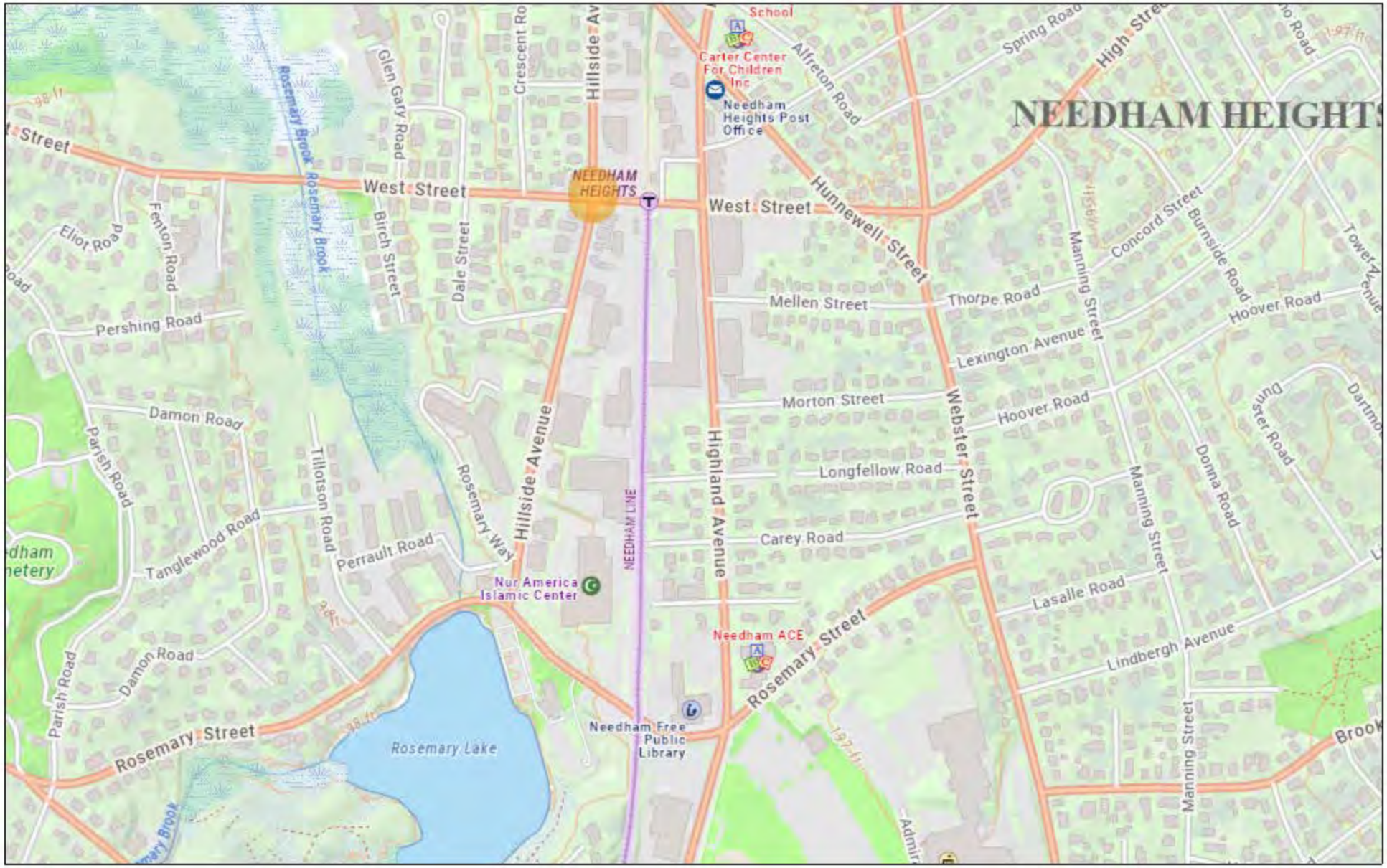
CRASH RATE CALCULATION : **0.16**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : MassDOT District 6 Avg: Signalized = 0.71; Unsignalized = 0.52

Project Title & Date: 1424 - Needham

ArcGIS Web Map



April 8, 2025

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

MassGIS

□ Sight Distance Calculations

Stopping Sight Distance - 85th Percentile

Highland Avenue approaches to the Site driveway

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
Direction 1	NB	32	117.6	98.1	220.0
Direction 2	SB	34	124.95	110.8	240.0

INPUTS	Direction 1	Direction 2
Travel Direction	NB	SB
Speed	32	34
Grade	0	0
t	2.5	2.5
a	11.2	11.2

Stopping Sight Distance (SSD) - Source: AASHTO

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance = V^2 / (30 x ((a/32.2)+G))

Where:
t = reaction time (sec)
V = travel speed (mph)
G= roadway grade
a - deceleration rate (ft/sec^2)

Intersection Sight Distance Calculations

Source: *A Policy on Geometric Design of Highways and Street, 6th Edition;* AASHTO; 2011.

Passenger Car

ISD = 1.47 * V * t

V = speed
t = time gap

t = 7.5 s for a passenger car for Left Turn from a Stop
t = 6.5 s for a passenger car for Right Turn from a Stop

Highland Avenue

		Speed Limit		Ideal ISD	SAY
Site Driveway (left-turn from a stop)	ISD = 1.47*	32	* 7.5 =	352.8	**355 feet**
		Speed Limit		Ideal ISD	SAY
Site Driveway (right-turn from a stop)	ISD = 1.47*	34	* 6.5 =	324.87	**325 feet**

- Trip Generation

Institute of Transportation Engineers (ITE) 11th Edition
Land Use Code (LUC) 220 - Multifamily Housing (Low-Rise)

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 189

AVERAGE WEEKDAY DAILY

T = 6.41 * X + 75.31
T = 6.41 * 189 + 75.31
T = 1286.80
T = 1,286 vehicle trips
with 50% (**643** vpd) entering and 50% (**643** vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.31 * X + 22.85
T = 0.31 * 189 + 22.85
T = 81.44
T = 81 vehicle trips
with 24% (**19** vph) entering and 76% (**62** vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.43 * X + 20.55
T = 0.43 * 189 + 20.55
T = 101.82
T = 102 vehicle trips
with 63% (**64** vph) entering and 37% (**38** vph) exiting.

□ Census Information and Journey-to-Work Data

Commuting Characteristics by Sex

United States® Census Bureau

Note: The table shown may have been modified by user selections. Some information may be missing.

DATA NOTES	
TABLE ID:	S0801
SURVEY/PROGRAM:	American Community Survey
VINTAGE:	2023
DATASET:	ACSST5Y2023
PRODUCT:	ACS 5-Year Estimates Subject Tables
UNIVERSE:	None
MLA:	U.S. Census Bureau, U.S. Department of Commerce. "Commuting Characteristics by Sex." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S0801, 2023, https://data.census.gov/table/ACSST5Y2023.S0801?q=s0801&g=060XX00US2502144105_1400000US25021457200&moe=f
FTP URL:	None
API URL:	https://api.census.gov/data/2023/acs/acs5/subject
USER SELECTIONS	
TABLES	S0801
GEOS	Census Tract 4572; Norfolk County; Massachusetts; Needham town, Norfolk County, Massachusetts
EXCLUDED COLUMNS	Needham town, Norfolk County, Massachusetts!!Total!!Margin of Error
	Needham town, Norfolk County, Massachusetts!!Male!!Margin of Error
	Needham town, Norfolk County, Massachusetts!!Female!!Margin of Error
	Census Tract 4572; Norfolk County; Massachusetts!!Total!!Margin of Error
	Census Tract 4572; Norfolk County; Massachusetts!!Male!!Margin of Error
	Census Tract 4572; Norfolk County; Massachusetts!!Female!!Margin of Error
APPLIED FILTERS	None
APPLIED SORTS	None
PIVOT & GROUPING	
PIVOT COLUMNS	None
PIVOT MODE	Off
ROW GROUPS	None
VALUE COLUMNS	None
WEB ADDRESS	https://data.census.gov/table/ACSST5Y2023.S0801?q=s0801&g=060XX00US2502144105_1400000US25021457200&moe=f
TABLE NOTES	
	Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, the decennial census is the official source of population totals for April 1st of each decennial year. In between censuses, the Census Bureau's Population Estimates Program produces and disseminates the official estimates of the population for the nation, states, counties, cities, and towns and estimates of housing units and the group quarters population for states and
	Information about the American Community Survey (ACS) can be found on the ACS website. Supporting documentation including code lists, subject definitions, data accuracy, and statistical testing, and a full list of ACS tables and table shells (without estimates) can be found on the Technical Documentation section of the ACS website. Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.
	Source: U.S. Census Bureau, 2019-2023 American Community Survey 5-Year Estimates
	ACS data generally reflect the geographic boundaries of legal and statistical areas as of January 1 of the estimate year. For
	Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a
	Users must consider potential differences in geographic boundaries, questionnaire content or coding, or other methodological issues when comparing ACS data from different years. Statistically significant differences shown in ACS Comparison Profiles, or in data users' own analysis, may be the result of these differences and thus might not necessarily reflect changes to the social, economic, housing, or demographic characteristics being compared. For more information
	The 12 selected states are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New
	Workers include members of the Armed Forces and civilians who were at work last week.
	When information is missing or inconsistent, the Census Bureau logically assigns an acceptable value using the response to a related question or questions. If a logical assignment is not possible, data are filled using a statistical process called allocation, which uses a similar individual or household to provide a donor value. The "Allocated" section is the number of respondents who received an allocated value for a particular subject.
	Estimates of urban and rural populations, housing units, and characteristics reflect boundaries of urban areas defined based on 2020 Census data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of
	Explanation of Symbols:- The estimate could not be computed because there were an insufficient number of sample observations. For a ratio of medians estimate, one or both of the median estimates falls in the lowest interval or highest interval of an open-ended distribution. For a 5-year median estimate, the margin of error associated with a median was larger than the median itself.N The estimate or margin of error cannot be displayed because there were an insufficient number of sample cases in the selected geographic area. (X) The estimate or margin of error is not applicable or not available.median- The median falls in the lowest interval of an open-ended distribution (for example "2,500-")median+ The median falls in the highest interval of an open-ended distribution (for example "250,000+").** The margin of error could not be computed because there were an insufficient number of sample observations.*** The margin of error could not be computed because the median falls in the lowest interval or highest interval of an open-ended distribution.***** A margin
COLUMN NOTES	None

	Census Tract 4572; Norfolk County; Massachusetts		
	Total	Male	Female
Label	Estimate	Estimate	Estimate
Workers 16 years and over	3,147	1,803	1,344
MEANS OF TRANSPORTATION TO WORK			
Car, truck, or van	63.2%	63.8%	62.4%
Drove alone	57.6%	54.0%	62.4%
Carpooled	5.6%	9.8%	0.0%
In 2-person	4.4%	7.7%	0.0%
In 3-person	0.0%	0.0%	0.0%
In 4-or-more person carpool	1.2%	2.2%	0.0%
Workers per car, truck,	1.05	1.10	1.00
Public transportation (excluding taxicab)	5.1%	8.2%	0.9%
Walked	3.9%	2.1%	6.5%
Bicycle	0.0%	0.0%	0.0%
Taxicab, motorcycle, or other means	0.0%	0.0%	0.0%
Worked from home	27.8%	25.9%	30.3%
PLACE OF WORK			
Worked in state of	97.8%	97.9%	97.6%
Worked in county of residence	59.2%	50.1%	71.4%
Worked outside county of residence	38.6%	47.8%	26.3%
Worked outside state of residence	2.2%	2.1%	2.4%
Living in a place	100.0%	100.0%	100.0%
Worked in place of	47.4%	40.8%	56.3%
Worked outside place of residence	52.6%	59.2%	43.8%
Not living in a place	0.0%	0.0%	0.0%
Living in 12 selected states	100.0%	100.0%	100.0%
Worked in minor civil division of residence	47.4%	40.8%	56.3%
Worked outside minor civil division of	52.6%	59.2%	43.8%
Not living in 12 selected	0.0%	0.0%	0.0%
Workers 16 years and over who did not work from home	2,273	1,336	937
TIME OF DEPARTURE TO GO TO WORK			
12:00 a.m. to 4:59 a.m.	4.4%	7.4%	0.0%
5:00 a.m. to 5:29 a.m.	0.8%	1.3%	0.0%
5:30 a.m. to 5:59 a.m.	0.0%	0.0%	0.0%
6:00 a.m. to 6:29 a.m.	3.7%	5.2%	1.6%
6:30 a.m. to 6:59 a.m.	8.7%	12.6%	3.1%
7:00 a.m. to 7:29 a.m.	10.0%	10.3%	9.6%
7:30 a.m. to 7:59 a.m.	20.9%	15.0%	29.3%
8:00 a.m. to 8:29 a.m.	20.2%	21.3%	18.7%
8:30 a.m. to 8:59 a.m.	14.6%	10.9%	20.0%
9:00 a.m. to 11:59 p.m.	16.7%	16.0%	17.7%
TRAVEL TIME TO WORK			
Less than 10 minutes	26.7%	21.0%	34.8%
10 to 14 minutes	13.7%	14.5%	12.5%
15 to 19 minutes	10.3%	11.5%	8.5%
20 to 24 minutes	7.9%	3.2%	14.5%
25 to 29 minutes	0.5%	0.0%	1.2%
30 to 34 minutes	7.3%	9.1%	4.8%
35 to 44 minutes	10.1%	7.3%	14.1%
45 to 59 minutes	17.9%	25.4%	7.2%
60 or more minutes	5.7%	8.0%	2.5%
Mean travel time to work (minutes)	24.7	28.5	19.2
VEHICLES AVAILABLE			
Workers 16 years and over in households	3,142	1,798	1,344
No vehicle available	1.1%	1.7%	0.3%
1 vehicle available	9.4%	9.7%	9.0%
2 vehicles available	59.0%	57.1%	61.6%
3 or more vehicles available	30.5%	31.5%	29.1%
PERCENT ALLOCATED			
Means of transportation to	12.3%	(X)	(X)
Private vehicle occupancy	15.7%	(X)	(X)
Place of work	14.5%	(X)	(X)
Time of departure to go to work	25.3%	(X)	(X)
Travel time to work	18.9%	(X)	(X)
Vehicles available	2.9%	(X)	(X)

COMMUTING CHARACTERISTICS BY SEX

United States Census Bureau

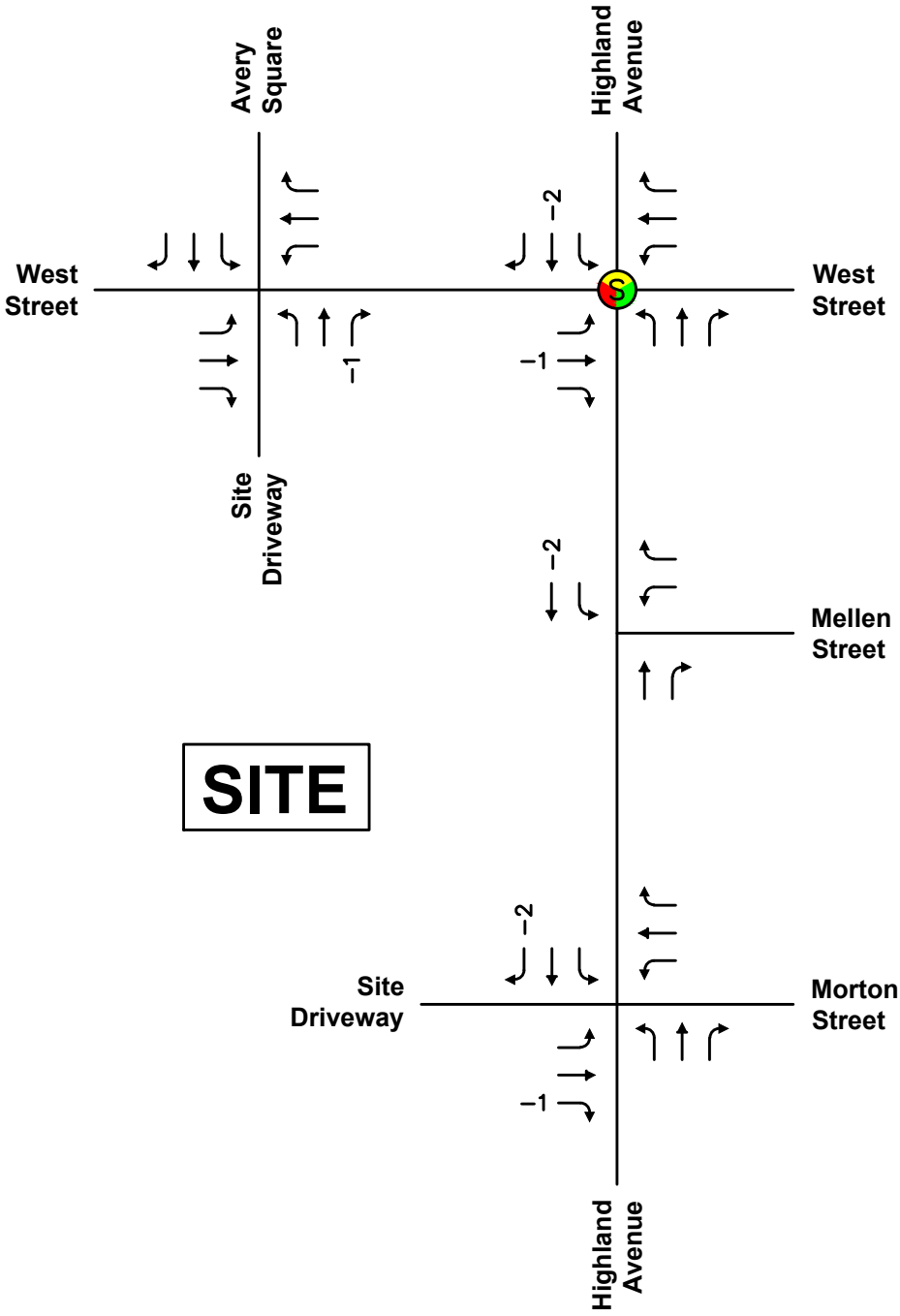
Note: The table shown may have been modified by user selections. Some information may be missing.

DATA NOTES	
TABLE ID:	S0801
SURVEY/PROGRAM:	American Community Survey
VINTAGE:	2019
DATASET:	ACSST5Y2019
PRODUCT:	ACS 5-Year Estimates Subject Tables
UNIVERSE:	None
MLA:	U.S. Census Bureau. "COMMUTING CHARACTERISTICS BY SEX." American Community Survey, ACS 5-Year Estimates Subject Tables, Table S0801, 2019, https://data.census.gov/table/ACSST5Y2019.S0801?q=s0801&g=1400000US25021457200.
FTP URL:	None
API URL:	https://api.census.gov/data/2019/acs/acs5/subject
USER SELECTIONS	
TABLES	S0801
GEOS	Census Tract 4572; Norfolk County; Massachusetts
EXCLUDED COLUMNS	None
APPLIED FILTERS	None
APPLIED SORTS	None
PIVOT & GROUPING	
PIVOT COLUMNS	None
PIVOT MODE	Off
ROW GROUPS	None
VALUE COLUMNS	None
WEB ADDRESS	https://data.census.gov/table/ACSST5Y2019.S0801?q=s0801&g=1400000US25021457200
TABLE NOTES	
	Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities, and towns and estimates of housing units for states and counties.
	Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Technical Documentation section. Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.
	Source: U.S. Census Bureau, 2015-2019 American Community Survey 5-Year Estimates
	Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a
	The 12 selected states are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York,
	Workers include members of the Armed Forces and civilians who were at work last week.
	When information is missing or inconsistent, the Census Bureau logically assigns an acceptable value using the response to a related question or questions. If a logical assignment is not possible, data are filled using a statistical process called allocation, which uses a similar individual or household to provide a donor value. The "Allocated" section is the number of respondents who received an allocated value for a particular subject.
	2019 ACS data products include updates to several categories of the existing means of transportation question. For more
	The 2015-2019 American Community Survey (ACS) data generally reflect the September 2018 Office of Management and Budget (OMB) delineations of metropolitan and micropolitan statistical areas. In certain instances, the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB delineation lists due to differences in the
	Estimates of urban and rural populations, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2010 data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing
	Explanation of Symbols: * An "**" entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate. * An "-" entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution, or the margin of error associated with a median was larger than the median itself. * An "-" following a median estimate means the median falls in the lowest interval of an open-ended distribution. * An "+" following a median estimate means the median falls in the upper interval of an open-ended distribution. * An "***" entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate. * An "*****" entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate. * An "N" entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
COLUMN NOTES	None

	Census Tract 4572, Norfolk County, Massachusetts		
	Total	Male	Female
Label	Estimate	Estimate	Estimate
Workers 16 years and over	2,934	1,592	1,342
MEANS OF TRANSPORTATION TO WORK			
Car, truck, or van	75.4%	75.9%	74.7%
Drove alone	73.2%	73.1%	73.5%
Carpooled	2.1%	2.8%	1.3%
In 2-person	2.1%	2.8%	1.3%
In 3-person	0.0%	0.0%	0.0%
In 4-or-more person carpool	0.0%	0.0%	0.0%
Workers per car, truck,	1.01	1.02	1.01
Public transportation (excluding taxicab)	13.4%	15.1%	11.3%
Walked	1.7%	1.0%	2.6%
Bicycle	1.7%	1.9%	1.5%
Taxicab, motorcycle, or other means	0.0%	0.0%	0.0%
Worked from home	7.8%	6.2%	9.8%
PLACE OF WORK			
Worked in state of	100.0%	100.0%	100.0%
Worked in county of residence	41.5%	32.7%	52.0%
Worked outside county of residence	58.5%	67.3%	48.0%
Worked outside state of residence	0.0%	0.0%	0.0%
Living in a place	100.0%	100.0%	100.0%
Worked in place of	20.8%	16.2%	26.2%
Worked outside place of residence	79.2%	83.8%	73.8%
Not living in a place	0.0%	0.0%	0.0%
Living in 12 selected states	100.0%	100.0%	100.0%
Worked in minor civil division of residence	20.8%	16.2%	26.2%
Worked outside minor civil division of	79.2%	83.8%	73.8%
Not living in 12 selected	0.0%	0.0%	0.0%
Workers 16 years and over who did not work from home	2,704	1,494	1,210
TIME OF DEPARTURE TO GO TO WORK			
12:00 a.m. to 4:59 a.m.	1.8%	2.2%	1.2%
5:00 a.m. to 5:29 a.m.	0.6%	1.1%	0.0%
5:30 a.m. to 5:59 a.m.	0.0%	0.0%	0.0%
6:00 a.m. to 6:29 a.m.	5.8%	6.6%	5.0%
6:30 a.m. to 6:59 a.m.	10.8%	14.3%	6.4%
7:00 a.m. to 7:29 a.m.	16.5%	20.3%	11.9%
7:30 a.m. to 7:59 a.m.	17.4%	17.7%	16.9%
8:00 a.m. to 8:29 a.m.	18.6%	15.0%	23.1%
8:30 a.m. to 8:59 a.m.	10.5%	5.7%	16.4%
9:00 a.m. to 11:59 p.m.	17.9%	17.1%	18.9%
TRAVEL TIME TO WORK			
Less than 10 minutes	14.3%	13.2%	15.6%
10 to 14 minutes	7.3%	3.1%	12.5%
15 to 19 minutes	10.6%	10.4%	10.9%
20 to 24 minutes	8.5%	3.5%	14.8%
25 to 29 minutes	4.8%	3.5%	6.3%
30 to 34 minutes	9.8%	14.6%	3.8%
35 to 44 minutes	14.5%	17.5%	10.8%
45 to 59 minutes	15.8%	19.0%	11.9%
60 or more minutes	14.4%	15.2%	13.4%
Mean travel time to work (minutes)	32.2	34.8	29.0
VEHICLES AVAILABLE			
Workers 16 years and over in households	2,932	1,591	1,341
No vehicle available	1.8%	1.6%	2.0%
1 vehicle available	16.3%	15.3%	17.4%
2 vehicles available	57.5%	61.2%	53.2%
3 or more vehicles available	24.4%	21.8%	27.4%
PERCENT ALLOCATED			
Means of transportation to	11.2%	(X)	(X)
Private vehicle occupancy	13.8%	(X)	(X)
Place of work	14.2%	(X)	(X)
Time of departure to go to work	14.5%	(X)	(X)
Travel time to work	14.2%	(X)	(X)
Vehicles available	1.0%	(X)	(X)

Workplace		Residence		Population	To/From Routes							
					Highland Avenue (North)		Highland Avenue (South)		West Street (East)		West Street (West)	
Boston	MA	Needham	MA	5,123	90%	4611	10%	512		0		0
Needham	MA	Needham	MA	1,591	20%	318	45%	716	30%	477	5%	80
Cambridge	MA	Needham	MA	1,079	100%	1079		0		0		0
Newton	MA	Needham	MA	971	100%	971		0		0		0
Waltham	MA	Needham	MA	592	100%	592		0		0		0
Wellesley	MA	Needham	MA	461	50%	230		0		0	50%	231
Framingham	MA	Needham	MA	236	50%	118		0		0	50%	118
Burlington	MA	Needham	MA	228	100%	228		0		0		0
Brookline	MA	Needham	MA	211	25%	53		0	75%	158		0
Dedham	MA	Needham	MA	190		0	100%	190		0		0
Quincy	MA	Needham	MA	182		0	100%	182		0		0
Natick	MA	Needham	MA	179		0		0		0	100%	179
Watertown	MA	Needham	MA	145	100%	145		0		0		0
Lexington	MA	Needham	MA	142	100%	142		0		0		0
Norwood	MA	Needham	MA	140		0	100%	140		0		0
Somerville	MA	Needham	MA	137	100%	137		0		0		0
Woburn	MA	Needham	MA	134	100%	134		0		0		0
Canton	MA	Needham	MA	128		0	100%	128		0		0
Westwood	MA	Needham	MA	118		0	100%	118		0		0
Marlborough	MA	Needham	MA	117	100%	117		0		0		0
Braintree	MA	Needham	MA	105		0	100%	105		0		0
Worcester	MA	Needham	MA	85	100%	85		0		0		0
Medford	MA	Needham	MA	84	100%	84		0		0		0
Weston	MA	Needham	MA	77	100%	77		0		0		0
Manhattan Borough	NY	Needham	MA	76		0	100%	76		0		0
Westborough	MA	Needham	MA	72	100%	72		0		0		0
Bedford	MA	Needham	MA	71	100%	71		0		0		0
Brockton	MA	Needham	MA	70		0	100%	70		0		0
Billerica	MA	Needham	MA	65	100%	65		0		0		0
Andover	MA	Needham	MA	58	100%	58		0		0		0
Hingham	MA	Needham	MA	56		0	100%	56		0		0
Stoughton	MA	Needham	MA	56		0	100%	56		0		0
Weymouth	MA	Needham	MA	56		0	100%	56		0		0
Providence	RI	Needham	MA	52		0	100%	52		0		0
Franklin	MA	Needham	MA	46		0	50%	23		0	50%	23
Wilmington	MA	Needham	MA	44	100%	44		0		0		0
Hopkinton	MA	Needham	MA	42	50%	21		0		0	50%	21
Medfield	MA	Needham	MA	42		0	50%	21		0	50%	21
Arlington	MA	Needham	MA	41	100%	41		0		0		0
Mansfield	MA	Needham	MA	41		0	100%	41		0		0
Southborough	MA	Needham	MA	41	100%	41		0		0		0
Belmont	MA	Needham	MA	40	100%	40		0		0		0
Total				**13,424**		9574		2542		635		673
						71.3%		18.9%		4.7%		5.0%
				SAY		***71%***		***19%***		***5%***		***5%***

□ Existing Site Trips Removed



North
Scale: Not to Scale

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Attachments

Existing Site Trips Removed
Morning Peak Hour Traffic Volumes

Date: July 2025
Dwg No. 1424 TIA01.dwg
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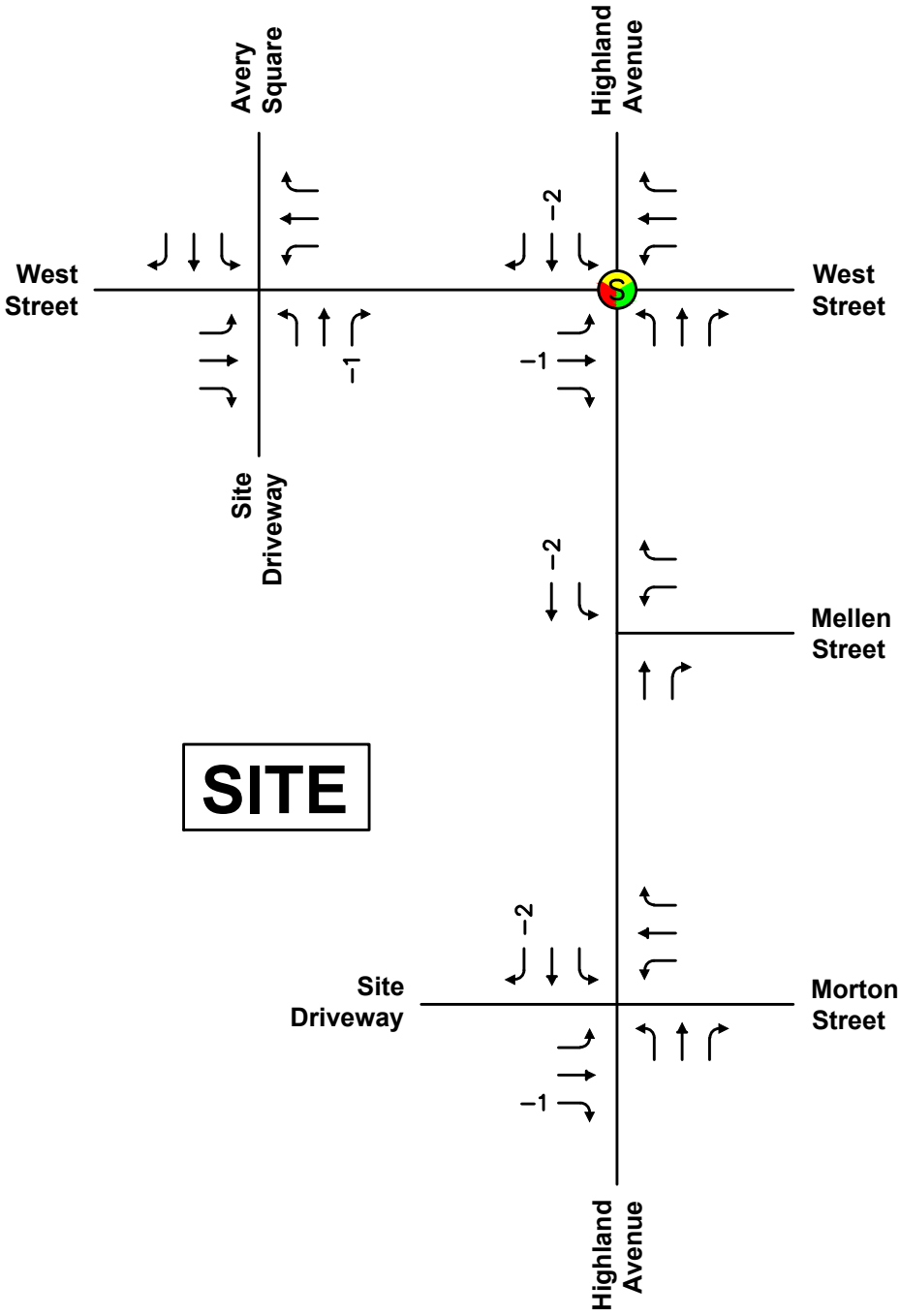
G:\Projects\1424 - Needham (100 West Street)\Dwg\1424 TIA01.dwg, Attachment 1, 7/9/2025 11:56:13 AM



North
Scale: Not to Scale

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Attachments

Existing Site Trips Removed
Evening Peak Hour Traffic Volumes

Date: July 2025
Dwg No. 1424 TIA01.dwg
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G:\Projects\1424 - Needham (100 West Street)\Dwg\1424 TIA01.dwg, Attachment 2, 7/9/2025 11:56:18 AM

□ Capacity Analysis

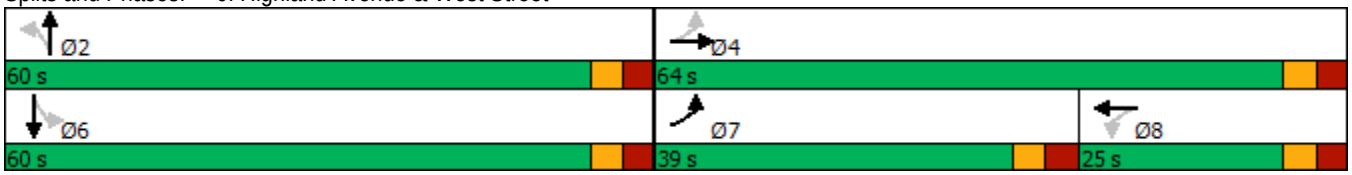
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	207	221	33	46	97	36	17	386	39	19	314	73
Future Volume (vph)	207	221	33	46	97	36	17	386	39	19	314	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	60		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980			0.959			0.988			0.976	
Flt Protected	0.950			0.950				0.998			0.998	
Satd. Flow (prot)	1787	1815	0	1805	1809	0	0	1795	0	0	1757	0
Flt Permitted	0.486			0.590				0.977			0.970	
Satd. Flow (perm)	914	1815	0	1121	1809	0	0	1757	0	0	1707	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			13			5			12	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		638			234			597			158	
Travel Time (s)		14.5			5.3			13.6			3.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	3%	0%	0%	1%	0%	0%	5%	0%	10%	4%	10%
Adj. Flow (vph)	225	240	36	50	105	39	18	420	42	21	341	79
Shared Lane Traffic (%)												
Lane Group Flow (vph)	225	276	0	50	144	0	0	480	0	0	441	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.0	26.0		13.0	13.0		25.0	25.0		25.0	25.0	
Total Split (s)	39.0	64.0		25.0	25.0		60.0	60.0		60.0	60.0	
Total Split (%)	31.5%	51.6%		20.2%	20.2%		48.4%	48.4%		48.4%	48.4%	
Maximum Green (s)	33.0	58.0		19.0	19.0		54.0	54.0		54.0	54.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-3.0			-3.0			-3.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	35.1	35.1		14.2	14.2			27.1			27.1	
Actuated g/C Ratio	0.51	0.51		0.21	0.21			0.40			0.40	
v/c Ratio	0.32	0.30		0.22	0.38			0.69			0.65	
Control Delay	12.1	11.5		29.7	27.9			23.8			22.3	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	12.1	11.5		29.7	27.9			23.8			22.3	
LOS	B	B		C	C			C			C	
Approach Delay		11.8			28.3			23.8			22.3	
Approach LOS		B			C			C			C	
90th %ile Green (s)	22.8	45.8		17.0	17.0		38.4	38.4		38.4	38.4	
90th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
70th %ile Green (s)	17.2	36.0		12.8	12.8		28.8	28.8		28.8	28.8	
70th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
50th %ile Green (s)	14.1	30.7		10.6	10.6		23.6	23.6		23.6	23.6	
50th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
30th %ile Green (s)	11.5	26.3		8.8	8.8		18.3	18.3		18.3	18.3	
30th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
10th %ile Green (s)	8.7	21.5		6.8	6.8		13.8	13.8		13.8	13.8	
10th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
Queue Length 50th (ft)	48	58		17	46			153			135	
Queue Length 95th (ft)	120	143		59	126			330			296	
Internal Link Dist (ft)		558			154			517			78	
Turn Bay Length (ft)	150			60								
Base Capacity (vph)	1026	1579		381	623			1475			1434	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.22	0.17		0.13	0.23			0.33			0.31	

Intersection Summary	
Area Type:	Other
Cycle Length: 124	
Actuated Cycle Length: 68.6	

Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 20.2	Intersection LOS: C
Intersection Capacity Utilization 57.4%	ICU Level of Service B
Analysis Period (min) 15	
90th %ile Actuated Cycle: 96.2	
70th %ile Actuated Cycle: 76.8	
50th %ile Actuated Cycle: 66.3	
30th %ile Actuated Cycle: 56.6	
10th %ile Actuated Cycle: 47.3	

Splits and Phases: 6: Highland Avenue & West Street



Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	444	0	0	182	1	0	0	1	14	0	74
Future Vol, veh/h	0	444	0	0	182	1	0	0	1	14	0	74
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	4	0	0	0	0	7	0	1
Mvmt Flow	0	463	0	0	190	1	0	0	1	15	0	77

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	191	0	0	463	0	0	692	654	463	655	654	191
Stage 1	-	-	-	-	-	-	463	463	-	191	191	-
Stage 2	-	-	-	-	-	-	229	191	-	464	463	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.17	6.5	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.17	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.17	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.563	4	3.309
Pot Cap-1 Maneuver	1395	-	-	1109	-	-	361	389	603	372	389	853
Stage 1	-	-	-	-	-	-	583	568	-	799	746	-
Stage 2	-	-	-	-	-	-	778	746	-	569	568	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1395	-	-	1109	-	-	329	389	603	371	389	853
Mov Cap-2 Maneuver	-	-	-	-	-	-	329	389	-	371	389	-
Stage 1	-	-	-	-	-	-	583	568	-	799	746	-
Stage 2	-	-	-	-	-	-	708	746	-	568	568	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	11	10.8
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	603	1395	-	-	1109	-	-	707
HCM Lane V/C Ratio	0.002	-	-	-	-	-	-	0.13
HCM Control Delay (s)	11	0	-	-	0	-	-	10.8
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.4

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	22	421	28	25	382
Future Vol, veh/h	14	22	421	28	25	382
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	7	0	3	4	0	3
Mvmt Flow	16	24	468	31	28	424

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	964	484	0	0	499	0
Stage 1	484	-	-	-	-	-
Stage 2	480	-	-	-	-	-
Critical Hdwy	6.47	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	277	587	-	-	1075	-
Stage 1	610	-	-	-	-	-
Stage 2	612	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	268	587	-	-	1075	-
Mov Cap-2 Maneuver	268	-	-	-	-	-
Stage 1	610	-	-	-	-	-
Stage 2	591	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	401	1075	-
HCM Lane V/C Ratio	-	-	0.1	0.026	-
HCM Control Delay (s)	-	-	15	8.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

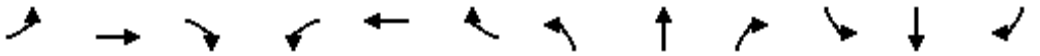
Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	1	10	0	13	0	439	15	5	394	2
Future Vol, veh/h	0	0	1	10	0	13	0	439	15	5	394	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	87	87	87	87	87	87	87	87	87
Heavy Vehicles, %	0	0	0	0	0	0	0	4	0	0	4	0
Mvmt Flow	0	0	1	11	0	15	0	505	17	6	453	2

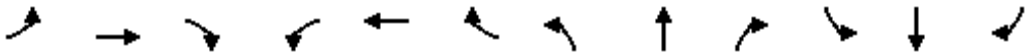
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	987	988	454	981	981	514	455	0	0	522	0	0
Stage 1	466	466	-	514	514	-	-	-	-	-	-	-
Stage 2	521	522	-	467	467	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	228	249	610	231	251	564	1116	-	-	1055	-	-
Stage 1	581	566	-	547	539	-	-	-	-	-	-	-
Stage 2	542	534	-	580	565	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	221	247	610	229	249	564	1116	-	-	1055	-	-
Mov Cap-2 Maneuver	221	247	-	229	249	-	-	-	-	-	-	-
Stage 1	581	561	-	547	539	-	-	-	-	-	-	-
Stage 2	528	534	-	574	560	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.9	16.3	0	0.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1116	-	-	610	345	1055	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.077	0.005	-	-
HCM Control Delay (s)	0	-	-	10.9	16.3	8.4	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0	-	-



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	141	199	43	40	178	41	32	379	46	47	338	105
Future Volume (vph)	141	199	43	40	178	41	32	379	46	47	338	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	60		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.973			0.972			0.987			0.971	
Flt Protected	0.950			0.950				0.997			0.995	
Satd. Flow (prot)	1770	1834	0	1752	1832	0	0	1854	0	0	1808	0
Flt Permitted	0.386			0.605				0.952			0.931	
Satd. Flow (perm)	719	1834	0	1116	1832	0	0	1771	0	0	1692	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			8			6			15	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		638			234			597			158	
Travel Time (s)		14.5			5.3			13.6			3.6	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	1%	0%	3%	1%	0%	0%	1%	0%	2%	1%	3%
Adj. Flow (vph)	145	205	44	41	184	42	33	391	47	48	348	108
Shared Lane Traffic (%)												
Lane Group Flow (vph)	145	249	0	41	226	0	0	471	0	0	504	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	

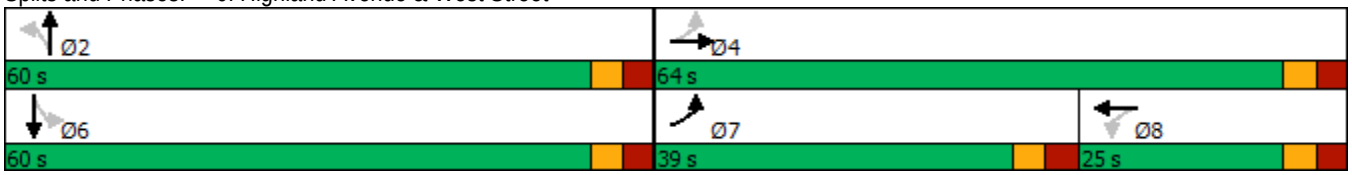


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.0	26.0		13.0	13.0		25.0	25.0		25.0	25.0	
Total Split (s)	39.0	64.0		25.0	25.0		60.0	60.0		60.0	60.0	
Total Split (%)	31.5%	51.6%		20.2%	20.2%		48.4%	48.4%		48.4%	48.4%	
Maximum Green (s)	33.0	58.0		19.0	19.0		54.0	54.0		54.0	54.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-3.0			-3.0			-3.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	35.4	35.4		17.4	17.4			30.0			30.0	
Actuated g/C Ratio	0.49	0.49		0.24	0.24			0.42			0.42	
v/c Ratio	0.25	0.27		0.15	0.50			0.63			0.70	
Control Delay	13.1	12.5		27.2	29.7			21.3			23.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.1	12.5		27.2	29.7			21.3			23.4	
LOS	B	B		C	C			C			C	
Approach Delay		12.7			29.3			21.3			23.4	
Approach LOS		B			C			C			C	
90th %ile Green (s)	17.4	42.4		19.0	19.0		42.0	42.0		42.0	42.0	
90th %ile Term Code	Gap	Hold		Max	Max		Hold	Hold		Gap	Gap	
70th %ile Green (s)	13.6	37.5		17.9	17.9		31.9	31.9		31.9	31.9	
70th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
50th %ile Green (s)	11.5	32.0		14.5	14.5		27.0	27.0		27.0	27.0	
50th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
30th %ile Green (s)	9.4	27.1		11.7	11.7		21.2	21.2		21.2	21.2	
30th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
10th %ile Green (s)	7.3	22.1		8.8	8.8		15.5	15.5		15.5	15.5	
10th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
Queue Length 50th (ft)	33	57		14	82			154			169	
Queue Length 95th (ft)	86	138		49	193			298			330	
Internal Link Dist (ft)		558			154			517			78	
Turn Bay Length (ft)	150			60								
Base Capacity (vph)	958	1557		360	597			1431			1370	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.15	0.16		0.11	0.38			0.33			0.37	

Intersection Summary	
Area Type:	Other
Cycle Length: 124	
Actuated Cycle Length: 71.7	

Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 21.2	Intersection LOS: C
Intersection Capacity Utilization 67.7%	ICU Level of Service C
Analysis Period (min) 15	
90th %ile Actuated Cycle: 96.4	
70th %ile Actuated Cycle: 81.4	
50th %ile Actuated Cycle: 71	
30th %ile Actuated Cycle: 60.3	
10th %ile Actuated Cycle: 49.6	

Splits and Phases: 6: Highland Avenue & West Street



Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	373	0	0	325	0	0	0	1	12	0	100
Future Vol, veh/h	0	373	0	0	325	0	0	0	1	12	0	100
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	401	0	0	349	0	0	0	1	13	0	108

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	349	0	0	401	0	0	804	750	401	751	750	349
Stage 1	-	-	-	-	-	-	401	401	-	349	349	-
Stage 2	-	-	-	-	-	-	403	349	-	402	401	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1221	-	-	1169	-	-	304	342	653	330	342	699
Stage 1	-	-	-	-	-	-	630	604	-	671	637	-
Stage 2	-	-	-	-	-	-	628	637	-	629	604	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1221	-	-	1169	-	-	257	342	653	329	342	699
Mov Cap-2 Maneuver	-	-	-	-	-	-	257	342	-	329	342	-
Stage 1	-	-	-	-	-	-	630	604	-	671	637	-
Stage 2	-	-	-	-	-	-	531	637	-	628	604	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.5	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	653	1221	-	-	1169	-	-	624
HCM Lane V/C Ratio	0.002	-	-	-	-	-	-	0.193
HCM Control Delay (s)	10.5	0	-	-	0	-	-	12.1
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.7

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	37	50	389	51	32	446
Future Vol, veh/h	37	50	389	51	32	446
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	1	0	3	1
Mvmt Flow	39	53	409	54	34	469

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	973	436	0	0	463	0
Stage 1	436	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	282	625	-	-	1093	-
Stage 1	656	-	-	-	-	-
Stage 2	590	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	270	625	-	-	1093	-
Mov Cap-2 Maneuver	270	-	-	-	-	-
Stage 1	656	-	-	-	-	-
Stage 2	565	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0	0.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	401	1093	-
HCM Lane V/C Ratio	-	-	0.228	0.031	-
HCM Control Delay (s)	-	-	16.6	8.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.9	0.1	-

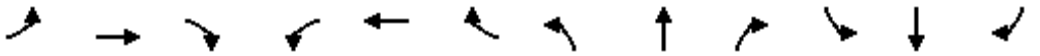
Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	1	6	0	11	0	414	23	17	460	2
Future Vol, veh/h	0	0	1	6	0	11	0	414	23	17	460	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	0	0	1	6	0	12	0	445	25	18	495	2

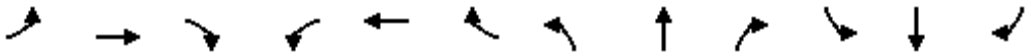
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	996	1002	496	991	991	458	497	0	0	470	0	0
Stage 1	532	532	-	458	458	-	-	-	-	-	-	-
Stage 2	464	470	-	533	533	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	225	244	578	227	248	607	1077	-	-	1102	-	-
Stage 1	535	529	-	587	570	-	-	-	-	-	-	-
Stage 2	582	563	-	534	528	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	217	238	578	223	242	607	1077	-	-	1102	-	-
Mov Cap-2 Maneuver	217	238	-	223	242	-	-	-	-	-	-	-
Stage 1	535	517	-	587	570	-	-	-	-	-	-	-
Stage 2	571	563	-	521	516	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.2	15	0	0.3
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1077	-	-	578	378	1102	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.048	0.017	-	-
HCM Control Delay (s)	0	-	-	11.2	15	8.3	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0.1	-	-



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	222	237	35	49	104	39	18	414	42	20	337	78
Future Volume (vph)	222	237	35	49	104	39	18	414	42	20	337	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	60		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.981			0.959			0.988			0.976	
Flt Protected	0.950			0.950				0.998			0.998	
Satd. Flow (prot)	1787	1816	0	1805	1809	0	0	1795	0	0	1757	0
Flt Permitted	0.463			0.579				0.975			0.970	
Satd. Flow (perm)	871	1816	0	1100	1809	0	0	1754	0	0	1707	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			13			5			12	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		638			234			597			158	
Travel Time (s)		14.5			5.3			13.6			3.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	3%	0%	0%	1%	0%	0%	5%	0%	10%	4%	10%
Adj. Flow (vph)	241	258	38	53	113	42	20	450	46	22	366	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	241	296	0	53	155	0	0	516	0	0	473	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	

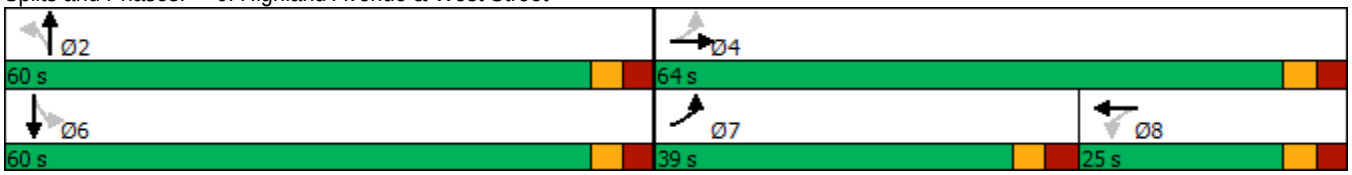


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.0	26.0		13.0	13.0		25.0	25.0		25.0	25.0	
Total Split (s)	39.0	64.0		25.0	25.0		60.0	60.0		60.0	60.0	
Total Split (%)	31.5%	51.6%		20.2%	20.2%		48.4%	48.4%		48.4%	48.4%	
Maximum Green (s)	33.0	58.0		19.0	19.0		54.0	54.0		54.0	54.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-3.0			-3.0			-3.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	37.4	37.4		15.1	15.1			30.1			30.1	
Actuated g/C Ratio	0.51	0.51		0.20	0.20			0.41			0.41	
v/c Ratio	0.36	0.32		0.24	0.41			0.72			0.67	
Control Delay	13.6	13.0		32.7	30.7			25.7			23.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.6	13.0		32.7	30.7			25.7			23.8	
LOS	B	B		C	C			C			C	
Approach Delay		13.3			31.2			25.7			23.8	
Approach LOS		B			C			C			C	
90th %ile Green (s)	25.2	50.2		19.0	19.0		44.5	44.5		44.5	44.5	
90th %ile Term Code	Gap	Hold		Max	Max		Gap	Gap		Hold	Hold	
70th %ile Green (s)	18.9	38.8		13.9	13.9		32.4	32.4		32.4	32.4	
70th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
50th %ile Green (s)	15.3	32.7		11.4	11.4		26.2	26.2		26.2	26.2	
50th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
30th %ile Green (s)	12.4	27.7		9.3	9.3		20.3	20.3		20.3	20.3	
30th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
10th %ile Green (s)	9.2	22.3		7.1	7.1		15.0	15.0		15.0	15.0	
10th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
Queue Length 50th (ft)	56	70		20	54			179			157	
Queue Length 95th (ft)	144	173		68	148			388			346	
Internal Link Dist (ft)		558			154			517			78	
Turn Bay Length (ft)	150			60								
Base Capacity (vph)	972	1514		350	585			1412			1376	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.25	0.20		0.15	0.26			0.37			0.34	

Intersection Summary	
Area Type:	Other
Cycle Length: 124	
Actuated Cycle Length: 74	

Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 22.0	Intersection LOS: C
Intersection Capacity Utilization 60.8%	ICU Level of Service B
Analysis Period (min) 15	
90th %ile Actuated Cycle: 106.7	
70th %ile Actuated Cycle: 83.2	
50th %ile Actuated Cycle: 70.9	
30th %ile Actuated Cycle: 60	
10th %ile Actuated Cycle: 49.3	

Splits and Phases: 6: Highland Avenue & West Street



Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	476	0	0	195	1	0	0	1	15	0	79
Future Vol, veh/h	0	476	0	0	195	1	0	0	1	15	0	79
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	4	0	0	0	0	7	0	1
Mvmt Flow	0	496	0	0	203	1	0	0	1	16	0	82

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	204	0	0	496	0	0	741	700	496	701	700	204
Stage 1	-	-	-	-	-	-	496	496	-	204	204	-
Stage 2	-	-	-	-	-	-	245	204	-	497	496	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.17	6.5	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.17	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.17	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.563	4	3.309
Pot Cap-1 Maneuver	1380	-	-	1078	-	-	335	366	578	347	366	839
Stage 1	-	-	-	-	-	-	559	549	-	787	737	-
Stage 2	-	-	-	-	-	-	763	737	-	546	549	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1380	-	-	1078	-	-	302	366	578	346	366	839
Mov Cap-2 Maneuver	-	-	-	-	-	-	302	366	-	346	366	-
Stage 1	-	-	-	-	-	-	559	549	-	787	737	-
Stage 2	-	-	-	-	-	-	688	737	-	545	549	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	11.2	11.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	578	1380	-	-	1078	-	-	684
HCM Lane V/C Ratio	0.002	-	-	-	-	-	-	0.143
HCM Control Delay (s)	11.2	0	-	-	0	-	-	11.1
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.5

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	24	451	30	27	410
Future Vol, veh/h	15	24	451	30	27	410
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	7	0	3	4	0	3
Mvmt Flow	17	27	501	33	30	456

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1034	518	0	0	534	0
Stage 1	518	-	-	-	-	-
Stage 2	516	-	-	-	-	-
Critical Hdwy	6.47	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	252	562	-	-	1044	-
Stage 1	588	-	-	-	-	-
Stage 2	589	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	242	562	-	-	1044	-
Mov Cap-2 Maneuver	242	-	-	-	-	-
Stage 1	588	-	-	-	-	-
Stage 2	567	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.9	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	373	1044	-
HCM Lane V/C Ratio	-	-	0.116	0.029	-
HCM Control Delay (s)	-	-	15.9	8.6	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

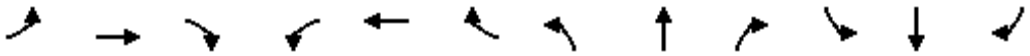
Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	1	11	0	14	0	471	16	5	422	2
Future Vol, veh/h	0	0	1	11	0	14	0	471	16	5	422	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	87	87	87	87	87	87	87	87	87
Heavy Vehicles, %	0	0	0	0	0	0	0	4	0	0	4	0
Mvmt Flow	0	0	1	13	0	16	0	541	18	6	485	2

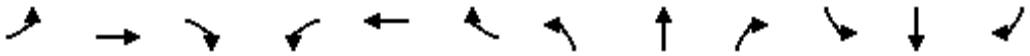
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1056	1057	486	1049	1049	550	487	0	0	559	0	0
Stage 1	498	498	-	550	550	-	-	-	-	-	-	-
Stage 2	558	559	-	499	499	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	205	227	585	207	229	539	1086	-	-	1022	-	-
Stage 1	558	548	-	523	519	-	-	-	-	-	-	-
Stage 2	518	514	-	557	547	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	198	225	585	205	227	539	1086	-	-	1022	-	-
Mov Cap-2 Maneuver	198	225	-	205	227	-	-	-	-	-	-	-
Stage 1	558	544	-	523	519	-	-	-	-	-	-	-
Stage 2	503	514	-	551	543	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.2	17.6	0	0.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1086	-	-	585	314	1022	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.092	0.006	-	-
HCM Control Delay (s)	0	-	-	11.2	17.6	8.5	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0	-	-



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	151	213	46	43	191	44	34	406	49	50	362	113
Future Volume (vph)	151	213	46	43	191	44	34	406	49	50	362	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	60		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.974			0.972			0.986			0.971	
Flt Protected	0.950			0.950				0.997			0.995	
Satd. Flow (prot)	1770	1835	0	1752	1832	0	0	1852	0	0	1808	0
Flt Permitted	0.357			0.595				0.949			0.921	
Satd. Flow (perm)	665	1835	0	1098	1832	0	0	1763	0	0	1674	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			8			6			15	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		638			234			597			158	
Travel Time (s)		14.5			5.3			13.6			3.6	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	1%	0%	3%	1%	0%	0%	1%	0%	2%	1%	3%
Adj. Flow (vph)	156	220	47	44	197	45	35	419	51	52	373	116
Shared Lane Traffic (%)												
Lane Group Flow (vph)	156	267	0	44	242	0	0	505	0	0	541	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	

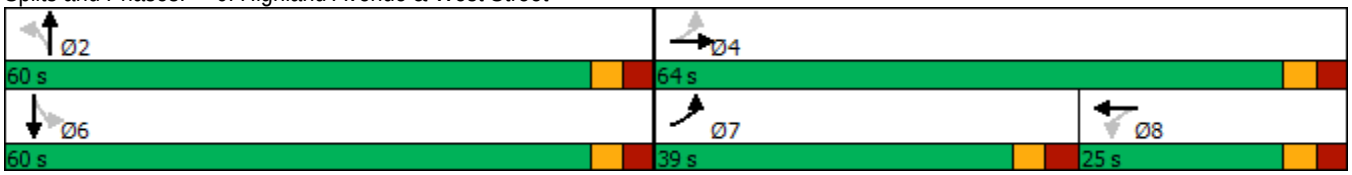


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.0	26.0		13.0	13.0		25.0	25.0		25.0	25.0	
Total Split (s)	39.0	64.0		25.0	25.0		60.0	60.0		60.0	60.0	
Total Split (%)	31.5%	51.6%		20.2%	20.2%		48.4%	48.4%		48.4%	48.4%	
Maximum Green (s)	33.0	58.0		19.0	19.0		54.0	54.0		54.0	54.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-3.0			-3.0			-3.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	37.4	37.4		18.6	18.6			33.6			33.6	
Actuated g/C Ratio	0.48	0.48		0.24	0.24			0.43			0.43	
v/c Ratio	0.29	0.30		0.17	0.54			0.66			0.74	
Control Delay	14.9	14.3		29.8	32.9			22.2			24.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	14.9	14.3		29.8	32.9			22.2			24.9	
LOS	B	B		C	C			C			C	
Approach Delay		14.5			32.4			22.2			24.9	
Approach LOS		B			C			C			C	
90th %ile Green (s)	18.2	43.2		19.0	19.0		47.4	47.4		47.4	47.4	
90th %ile Term Code	Gap	Hold		Max	Max		Hold	Hold		Gap	Gap	
70th %ile Green (s)	14.7	39.7		19.0	19.0		36.0	36.0		36.0	36.0	
70th %ile Term Code	Gap	Hold		Max	Max		Hold	Hold		Gap	Gap	
50th %ile Green (s)	12.3	34.7		16.4	16.4		30.2	30.2		30.2	30.2	
50th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
30th %ile Green (s)	10.2	29.5		13.3	13.3		25.1	25.1		25.1	25.1	
30th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
10th %ile Green (s)	7.6	23.4		9.8	9.8		17.3	17.3		17.3	17.3	
10th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
Queue Length 50th (ft)	39	68		16	96			183			203	
Queue Length 95th (ft)	102	164		56	223			329			368	
Internal Link Dist (ft)		558			154			517			78	
Turn Bay Length (ft)	150			60								
Base Capacity (vph)	894	1470		329	554			1342			1276	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.17	0.18		0.13	0.44			0.38			0.42	

Intersection Summary	
Area Type:	Other
Cycle Length: 124	
Actuated Cycle Length: 77.3	

Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 22.8	Intersection LOS: C
Intersection Capacity Utilization 71.8%	ICU Level of Service C
Analysis Period (min) 15	
90th %ile Actuated Cycle: 102.6	
70th %ile Actuated Cycle: 87.7	
50th %ile Actuated Cycle: 76.9	
30th %ile Actuated Cycle: 66.6	
10th %ile Actuated Cycle: 52.7	

Splits and Phases: 6: Highland Avenue & West Street



Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	400	0	0	348	0	0	0	1	13	0	107
Future Vol, veh/h	0	400	0	0	348	0	0	0	1	13	0	107
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	430	0	0	374	0	0	0	1	14	0	115

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	374	0	0	430	0	0	862	804	430	805	804	374
Stage 1	-	-	-	-	-	-	430	430	-	374	374	-
Stage 2	-	-	-	-	-	-	432	374	-	431	430	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1196	-	-	1140	-	-	277	319	629	303	319	677
Stage 1	-	-	-	-	-	-	607	587	-	651	621	-
Stage 2	-	-	-	-	-	-	606	621	-	607	587	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1196	-	-	1140	-	-	230	319	629	302	319	677
Mov Cap-2 Maneuver	-	-	-	-	-	-	230	319	-	302	319	-
Stage 1	-	-	-	-	-	-	607	587	-	651	621	-
Stage 2	-	-	-	-	-	-	503	621	-	606	587	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.7	12.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	629	1196	-	-	1140	-	-	597
HCM Lane V/C Ratio	0.002	-	-	-	-	-	-	0.216
HCM Control Delay (s)	10.7	0	-	-	0	-	-	12.7
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.8

Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	40	54	417	55	34	478
Future Vol, veh/h	40	54	417	55	34	478
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	1	0	3	1
Mvmt Flow	42	57	439	58	36	503

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1043	468	0	0	497	0
Stage 1	468	-	-	-	-	-
Stage 2	575	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	256	599	-	-	1062	-
Stage 1	634	-	-	-	-	-
Stage 2	567	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	244	599	-	-	1062	-
Mov Cap-2 Maneuver	244	-	-	-	-	-
Stage 1	634	-	-	-	-	-
Stage 2	540	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.2	0	0.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	370	1062	-
HCM Lane V/C Ratio	-	-	0.267	0.034	-
HCM Control Delay (s)	-	-	18.2	8.5	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0.1	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	1	6	0	12	0	444	25	18	493	2
Future Vol, veh/h	0	0	1	6	0	12	0	444	25	18	493	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	0	0	1	6	0	13	0	477	27	19	530	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1066	1073	531	1061	1061	491	532	0	0	504	0	0
Stage 1	569	569	-	491	491	-	-	-	-	-	-	-
Stage 2	497	504	-	570	570	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	202	222	552	203	226	582	1046	-	-	1071	-	-
Stage 1	511	509	-	563	552	-	-	-	-	-	-	-
Stage 2	559	544	-	510	509	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	194	216	552	199	220	582	1046	-	-	1071	-	-
Mov Cap-2 Maneuver	194	216	-	199	220	-	-	-	-	-	-	-
Stage 1	511	496	-	563	552	-	-	-	-	-	-	-
Stage 2	547	544	-	496	496	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.5	15.7	0	0.3
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1046	-	-	552	355	1071	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.055	0.018	-	-
HCM Control Delay (s)	0	-	-	11.5	15.7	8.4	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0.1	-	-

Intersection	
Int Delay, s/veh	1.7

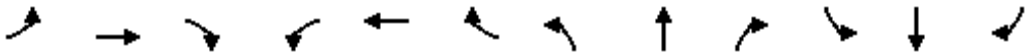
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	476	1	6	198	1	0	0	20	15	0	79
Future Vol, veh/h	0	476	1	6	198	1	0	0	20	15	0	79
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	4	0	0	0	0	7	0	1
Mvmt Flow	0	496	1	6	206	1	0	0	21	16	0	82

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	207	0	0	497	0	0	757	716	497	726	716	207
Stage 1	-	-	-	-	-	-	497	497	-	219	219	-
Stage 2	-	-	-	-	-	-	260	219	-	507	497	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.17	6.5	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.17	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.17	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.563	4	3.309
Pot Cap-1 Maneuver	1376	-	-	1077	-	-	327	358	577	334	358	836
Stage 1	-	-	-	-	-	-	559	548	-	772	726	-
Stage 2	-	-	-	-	-	-	749	726	-	539	548	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1376	-	-	1077	-	-	293	356	577	320	356	836
Mov Cap-2 Maneuver	-	-	-	-	-	-	293	356	-	320	356	-
Stage 1	-	-	-	-	-	-	559	548	-	772	722	-
Stage 2	-	-	-	-	-	-	671	722	-	520	548	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	11.5	11.3
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	577	1376	-	-	1077	-	-	665
HCM Lane V/C Ratio	0.036	-	-	-	0.006	-	-	0.147
HCM Control Delay (s)	11.5	0	-	-	8.4	0	-	11.3
HCM Lane LOS	B	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	239	239	35	49	105	39	21	441	42	20	343	83
Future Volume (vph)	239	239	35	49	105	39	21	441	42	20	343	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	60		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.981			0.960			0.989			0.975	
Flt Protected	0.950			0.950				0.998			0.998	
Satd. Flow (prot)	1787	1816	0	1805	1811	0	0	1797	0	0	1754	0
Flt Permitted	0.451			0.578				0.971			0.969	
Satd. Flow (perm)	848	1816	0	1098	1811	0	0	1748	0	0	1703	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			13			5			12	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		638			234			597			158	
Travel Time (s)		14.5			5.3			13.6			3.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	3%	0%	0%	1%	0%	0%	5%	0%	10%	4%	10%
Adj. Flow (vph)	260	260	38	53	114	42	23	479	46	22	373	90
Shared Lane Traffic (%)												
Lane Group Flow (vph)	260	298	0	53	156	0	0	548	0	0	485	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	

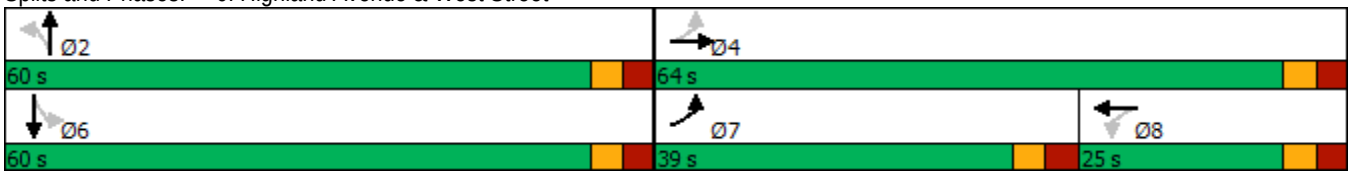


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.0	26.0		13.0	13.0		25.0	25.0		25.0	25.0	
Total Split (s)	39.0	64.0		25.0	25.0		60.0	60.0		60.0	60.0	
Total Split (%)	31.5%	51.6%		20.2%	20.2%		48.4%	48.4%		48.4%	48.4%	
Maximum Green (s)	33.0	58.0		19.0	19.0		54.0	54.0		54.0	54.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-3.0			-3.0			-3.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	39.4	39.4		15.5	15.5			33.0			33.0	
Actuated g/C Ratio	0.50	0.50		0.20	0.20			0.42			0.42	
v/c Ratio	0.39	0.33		0.25	0.43			0.75			0.67	
Control Delay	15.1	14.2		35.7	33.6			27.3			24.3	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	15.1	14.2		35.7	33.6			27.3			24.3	
LOS	B	B		D	C			C			C	
Approach Delay		14.6			34.1			27.3			24.3	
Approach LOS		B			C			C			C	
90th %ile Green (s)	27.6	52.6		19.0	19.0		49.3	49.3		49.3	49.3	
90th %ile Term Code	Gap	Hold		Max	Max		Gap	Gap		Hold	Hold	
70th %ile Green (s)	21.0	41.5		14.5	14.5		35.8	35.8		35.8	35.8	
70th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
50th %ile Green (s)	16.9	34.7		11.8	11.8		28.6	28.6		28.6	28.6	
50th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
30th %ile Green (s)	13.5	29.1		9.6	9.6		23.1	23.1		23.1	23.1	
30th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
10th %ile Green (s)	9.9	23.1		7.2	7.2		16.1	16.1		16.1	16.1	
10th %ile Term Code	Gap	Hold		Gap	Gap		Gap	Gap		Hold	Hold	
Queue Length 50th (ft)	67	76		21	59			207			173	
Queue Length 95th (ft)	169	189		72	160			434			368	
Internal Link Dist (ft)		558			154			517			78	
Turn Bay Length (ft)	150			60								
Base Capacity (vph)	928	1446		330	553			1324			1291	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.28	0.21		0.16	0.28			0.41			0.38	

Intersection Summary	
Area Type:	Other
Cycle Length: 124	
Actuated Cycle Length: 78.8	

Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 23.4	Intersection LOS: C
Intersection Capacity Utilization 64.4%	ICU Level of Service C
Analysis Period (min) 15	
90th %ile Actuated Cycle: 113.9	
70th %ile Actuated Cycle: 89.3	
50th %ile Actuated Cycle: 75.3	
30th %ile Actuated Cycle: 64.2	
10th %ile Actuated Cycle: 51.2	

Splits and Phases: 6: Highland Avenue & West Street



Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	24	481	30	27	416
Future Vol, veh/h	15	24	481	30	27	416
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	7	0	3	4	0	3
Mvmt Flow	17	27	534	33	30	462

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1073	551	0	0	567	0
Stage 1	551	-	-	-	-	-
Stage 2	522	-	-	-	-	-
Critical Hdwy	6.47	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	238	538	-	-	1015	-
Stage 1	567	-	-	-	-	-
Stage 2	585	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	228	538	-	-	1015	-
Mov Cap-2 Maneuver	228	-	-	-	-	-
Stage 1	567	-	-	-	-	-
Stage 2	562	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	353	1015	-
HCM Lane V/C Ratio	-	-	0.123	0.03	-
HCM Control Delay (s)	-	-	16.6	8.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	30	0	12	11	0	14	4	471	16	5	422	8
Future Vol, veh/h	30	0	12	11	0	14	4	471	16	5	422	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	87	87	87	87	87	87	87	87	87
Heavy Vehicles, %	0	0	0	0	0	0	0	4	0	0	4	0
Mvmt Flow	34	0	14	13	0	16	5	541	18	6	485	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1070	1071	490	1069	1066	550	494	0	0	559	0	0
Stage 1	502	502	-	560	560	-	-	-	-	-	-	-
Stage 2	568	569	-	509	506	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	201	223	582	201	224	539	1080	-	-	1022	-	-
Stage 1	555	545	-	516	514	-	-	-	-	-	-	-
Stage 2	511	509	-	550	543	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	193	220	582	194	221	539	1080	-	-	1022	-	-
Mov Cap-2 Maneuver	193	220	-	194	221	-	-	-	-	-	-	-
Stage 1	551	541	-	512	510	-	-	-	-	-	-	-
Stage 2	492	505	-	533	539	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	23.8	18.2	0.1	0.1
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1080	-	-	239	302	1022	-	-
HCM Lane V/C Ratio	0.004	-	-	0.202	0.095	0.006	-	-
HCM Control Delay (s)	8.3	0	-	23.8	18.2	8.5	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.7	0.3	0	-	-

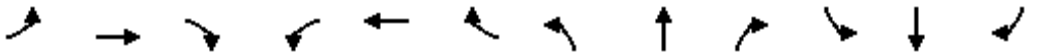
Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	400	3	21	250	0	0	0	13	13	0	107
Future Vol, veh/h	0	400	3	21	250	0	0	0	13	13	0	107
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	430	3	23	269	0	0	0	14	14	0	115

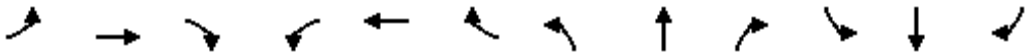
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	269	0	0	433	0	0	805	747	432	754	748	269
Stage 1	-	-	-	-	-	-	432	432	-	315	315	-
Stage 2	-	-	-	-	-	-	373	315	-	439	433	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1306	-	-	1137	-	-	303	344	628	328	343	775
Stage 1	-	-	-	-	-	-	606	586	-	700	659	-
Stage 2	-	-	-	-	-	-	652	659	-	601	585	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1306	-	-	1137	-	-	253	336	628	315	335	775
Mov Cap-2 Maneuver	-	-	-	-	-	-	253	336	-	315	335	-
Stage 1	-	-	-	-	-	-	606	586	-	700	643	-
Stage 2	-	-	-	-	-	-	542	643	-	588	585	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.6	10.9	11.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	628	1306	-	-	1137	-	-	669
HCM Lane V/C Ratio	0.022	-	-	-	0.02	-	-	0.193
HCM Control Delay (s)	10.9	0	-	-	8.2	0	-	11.7
HCM Lane LOS	B	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.7



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	162	214	46	43	194	44	36	422	49	50	388	131
Future Volume (vph)	162	214	46	43	194	44	36	422	49	50	388	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	60		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.974			0.972			0.987			0.969	
Flt Protected	0.950			0.950				0.996			0.996	
Satd. Flow (prot)	1770	1835	0	1752	1832	0	0	1852	0	0	1806	0
Flt Permitted	0.339			0.594				0.942			0.926	
Satd. Flow (perm)	631	1835	0	1096	1832	0	0	1752	0	0	1679	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			8			6			16	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		638			234			597			158	
Travel Time (s)		14.5			5.3			13.6			3.6	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	1%	0%	3%	1%	0%	0%	1%	0%	2%	1%	3%
Adj. Flow (vph)	167	221	47	44	200	45	37	435	51	52	400	135
Shared Lane Traffic (%)												
Lane Group Flow (vph)	167	268	0	44	245	0	0	523	0	0	587	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	

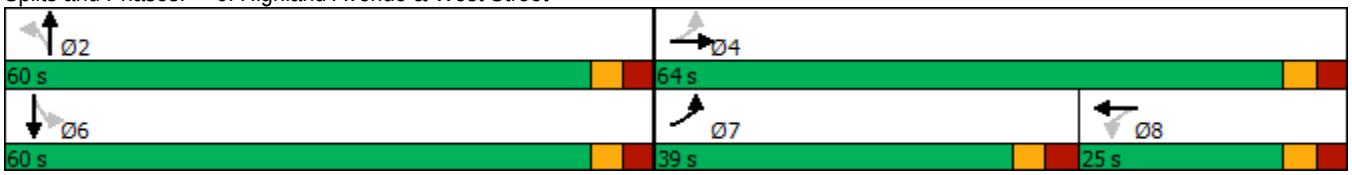


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.0	26.0		13.0	13.0		25.0	25.0		25.0	25.0	
Total Split (s)	39.0	64.0		25.0	25.0		60.0	60.0		60.0	60.0	
Total Split (%)	31.5%	51.6%		20.2%	20.2%		48.4%	48.4%		48.4%	48.4%	
Maximum Green (s)	33.0	58.0		19.0	19.0		54.0	54.0		54.0	54.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-3.0	-3.0		-3.0	-3.0			-3.0			-3.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	38.8	38.8		19.2	19.2			37.6			37.6	
Actuated g/C Ratio	0.47	0.47		0.23	0.23			0.45			0.45	
v/c Ratio	0.32	0.31		0.17	0.57			0.65			0.76	
Control Delay	17.1	16.2		33.0	36.7			22.1			26.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	17.1	16.2		33.0	36.7			22.1			26.0	
LOS	B	B		C	D			C			C	
Approach Delay		16.5			36.1			22.1			26.0	
Approach LOS		B			D			C			C	
90th %ile Green (s)	19.2	44.2		19.0	19.0		53.6	53.6		53.6	53.6	
90th %ile Term Code	Gap	Hold		Max	Max		Hold	Hold		Gap	Gap	
70th %ile Green (s)	16.2	41.2		19.0	19.0		41.9	41.9		41.9	41.9	
70th %ile Term Code	Gap	Hold		Max	Max		Hold	Hold		Gap	Gap	
50th %ile Green (s)	13.3	36.7		17.4	17.4		33.8	33.8		33.8	33.8	
50th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
30th %ile Green (s)	10.9	30.9		14.0	14.0		28.0	28.0		28.0	28.0	
30th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
10th %ile Green (s)	8.1	24.3		10.2	10.2		19.2	19.2		19.2	19.2	
10th %ile Term Code	Gap	Hold		Gap	Gap		Hold	Hold		Gap	Gap	
Queue Length 50th (ft)	47	76		18	106			203			241	
Queue Length 95th (ft)	120	182		59	242			347			417	
Internal Link Dist (ft)		558			154			517			78	
Turn Bay Length (ft)	150			60								
Base Capacity (vph)	843	1396		308	520			1267			1217	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.20	0.19		0.14	0.47			0.41			0.48	

Intersection Summary	
Area Type:	Other
Cycle Length: 124	
Actuated Cycle Length: 82.8	

Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 24.2	Intersection LOS: C
Intersection Capacity Utilization 74.8%	ICU Level of Service D
Analysis Period (min) 15	
90th %ile Actuated Cycle: 109.8	
70th %ile Actuated Cycle: 95.1	
50th %ile Actuated Cycle: 82.5	
30th %ile Actuated Cycle: 70.9	
10th %ile Actuated Cycle: 55.5	

Splits and Phases: 6: Highland Avenue & West Street



Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	40	54	435	55	34	504
Future Vol, veh/h	40	54	435	55	34	504
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	1	0	3	1
Mvmt Flow	42	57	458	58	36	531

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1090	487	0	0	516	0
Stage 1	487	-	-	-	-	-
Stage 2	603	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	240	585	-	-	1045	-
Stage 1	622	-	-	-	-	-
Stage 2	550	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	228	585	-	-	1045	-
Mov Cap-2 Maneuver	228	-	-	-	-	-
Stage 1	622	-	-	-	-	-
Stage 2	523	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.2	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	351	1045	-
HCM Lane V/C Ratio	-	-	0.282	0.034	-
HCM Control Delay (s)	-	-	19.2	8.6	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0.1	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	18	0	7	6	0	12	12	444	25	18	493	28
Future Vol, veh/h	18	0	7	6	0	12	12	444	25	18	493	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	19	0	8	6	0	13	13	477	27	19	530	30

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1106	1113	545	1104	1115	491	560	0	0	504	0	0
Stage 1	583	583	-	517	517	-	-	-	-	-	-	-
Stage 2	523	530	-	587	598	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	190	210	542	190	210	582	1021	-	-	1071	-	-
Stage 1	502	502	-	545	537	-	-	-	-	-	-	-
Stage 2	541	530	-	499	494	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	180	201	542	181	201	582	1021	-	-	1071	-	-
Mov Cap-2 Maneuver	180	201	-	181	201	-	-	-	-	-	-	-
Stage 1	493	489	-	535	527	-	-	-	-	-	-	-
Stage 2	519	520	-	479	481	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	23.5	16.4	0.2	0.3
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1021	-	-	221	335	1071	-	-
HCM Lane V/C Ratio	0.013	-	-	0.122	0.058	0.018	-	-
HCM Control Delay (s)	8.6	0	-	23.5	16.4	8.4	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0.2	0.1	-	-

SECTION 4:
GEOTECHNICAL REPORT

GeoEngineers USA

Memorandum

239 Causeway Street, Suite 400, Boston, Massachusetts 02114, Telephone: 617.749.9220 www.geoengineers.com

To:	Mr. Timothy Beinert ~ Greystar Development East, LLC
From:	Amy Blomeke, PE, Stan Sadkowski, PE GeoEngineers USA, PC
Date:	July 17, 2025
File:	20449-018-01
Subject:	Geotechnical Summary Memorandum 100 West Street Needham, Massachusetts

GeoEngineers USA, PC (GeoEngineers) is pleased to provide this geotechnical summary memorandum to Greystar Development East, LLC (Greystar, Client) to convey our preliminary geotechnical recommendations for the demolition of the existing building in support of the proposed redevelopment project at 100 West Street in Needham, Massachusetts (the Site). This memorandum is subject to the Limitations herein.

Site Description and Project Understanding

The Site consists of approximately 4.3-acres of developed land occupied by a former nursing home, which is now vacant. The existing 3-story L-shaped building, which was constructed in 1955 has a footprint of approximately 63,700 square feet (SF) with a basement across the full footprint. The Site is bounded by West Street to the north, Highland Avenue to the east, private residential properties to the south, and Massachusetts Bay Transportation Authority (MBTA) Commuter Rail train tracks to the west. The subject property is shown relative to surrounding physical features in Figure 1.

Historical buildings have been built and demolished across the Site since the Site was first developed (c. 1864 as a children's clothing manufacturer). The approximate limits of the former (now demolished) buildings are shown in Figure 2. Please note that remnants of the former buildings – such as slabs and foundations, as well as other buried debris – may still be present below the ground surface.

The proposed redevelopment includes the construction of a residential structure along with associated stormwater management areas, paved parking areas, and drive aisles. Elevations noted in this report are referenced to the North American Vertical Datum of 1988 (NAVD88).

Subsurface Investigation

GEOTECHNICAL SUBSURFACE EXPLORATION PROGRAM

Between May 13 and 14, 2025, six (6) soil borings, designated as GEO-1 through GEO-6W, were advanced by Geologic Earth Exploration, Inc. (Geologic) of Norfolk, Massachusetts, and six (6) test pits, designated as TP-1 through TP-6, were excavated by Machine Time, LLC (Machine Time) of Hudson, New Hampshire. Two (2) soil borings (GEO-4W and GEO-6W) were completed as 2-inch-diameter polyvinyl chloride (PVC) monitoring wells with well screens set to span the groundwater table. The locations of the explorations are shown in Figure 2.

The subsurface conditions encountered during the exploration program are noted in the logs in Attachment A. In general, the explorations encountered 2 to 10 feet of granular fill overlying natural deposits of granular soils consisting of sand overlying glacial till. The fill contains non-soil constituents, including, but not limited to: concrete, asphalt, brick, ash, and ceramic pieces. In addition, numerous obstructions were encountered in the borings and test pits.

Groundwater was measured in the monitoring wells, including wells by others (B-9 (OW) and B-304 (OW)) at depths ranging from approximately 4.9 to 8.7 feet below ground surface as noted in the well logs. The locations of the wells are shown in Figure 2. It should be noted that groundwater levels will vary depending on seasonal variations in temperature and precipitation, and can also be influenced by subsurface utilities, construction activities, and other factors.

Geotechnical Recommendations

Listed below are our geotechnical recommendations based on our preliminary subsurface exploration program and our understanding of the Site.

FOUNDATIONS

- We anticipate the proposed buildings could be supported by conventional, shallow spread footings, and a slab-on-grade bearing directly on natural, inorganic, granular soils or on compacted structural fill bearing directly on natural, inorganic, granular soils. Buried foundation remnants (i.e., slabs and/or footings), if encountered, should be removed from within the limits of the proposed building pads in their entirety. Similarly, subsurface utilities, if encountered, should be removed from within the proposed building in their entirety. Foundations outside the limits of the building pad and where they are not in conflict with proposed conditions can remain in place.
- For preliminary design purposes, the structural engineer should assume the following:
  - Footings should be proportioned based on preliminary net allowable bearing pressure of four (4) kips per square foot (KSF).
  - The slab-on-grade should be designed based on a modulus of subgrade reaction of 150 pounds per cubic inch (pci) using a base course layer consisting of 12-inches of MassDOT Item M2.07.1-1.
  - The Site seismic site class is Site Class D. In our opinion, the Site soils are not susceptible to liquefaction.
  - Upon finalization of conceptual grades and column loads, a settlement analysis should be performed to confirm these preliminary recommendations. If final concepts include below grade levels, or large site cuts, the recommendations herein will need to be re-evaluated.

GENERAL EARTHWORK AND TEMPORARY SUPPORT OF EXCAVATION

- When evaluating project sequence and Site demolition, we recommend the following considerations as described below.
  - The existing building has a basement that extends across the full footprint of the existing building. The basement extends to the property limits along Highland Avenue and adjacent to the MBTA railroad property line, with an approximate height of 6 to 8 feet. To provide stability during

demolition and construction, we recommend that the basement foundation walls should remain where they abut Highland Ave and the MBTA property line.

- We recommend that the foundation walls in these areas be supported (i.e. shored) by a soil berm. The soil will provide passive resistance against movement and stabilize the walls during demolition and post-demolition activities until such point that the limits can be fully backfilled with soil or future structure.
- The proposed demolition of the building sequencing has been evaluated by the project team and includes the following steps
  - Removal of the exterior brick façade as needed and with the intent of keeping Site material off of MBTA property, saw-cutting the first-floor slab to create an access point into the basement for equipment and material, sequentially saw-cutting the basement floor (to remain) to allow for drainage, and placing and compacting a structural fill soil berm within the basement against the shared wall.
- The soil berm will be engineered to determine the geometry (height and width) required to stabilize the wall during site activities. The analysis of the berm requirement will be performed prior to demolition activities. following supplemental investigations within the basement.

Limitations

We have prepared this memorandum for the exclusive use of Greystar Development East, LLC (Client) for the 100 West Street property located in Needham, Massachusetts. This memorandum is not intended for use by others and the information contained herein is not applicable to other sites. No other party may rely on the product of our services unless we agree in advance, and in writing, to such reliance. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Any electronic form, facsimile, or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments, are only a copy of the original document. The original document is stored by GeoEngineers USA, PC and will serve as the official document of record.

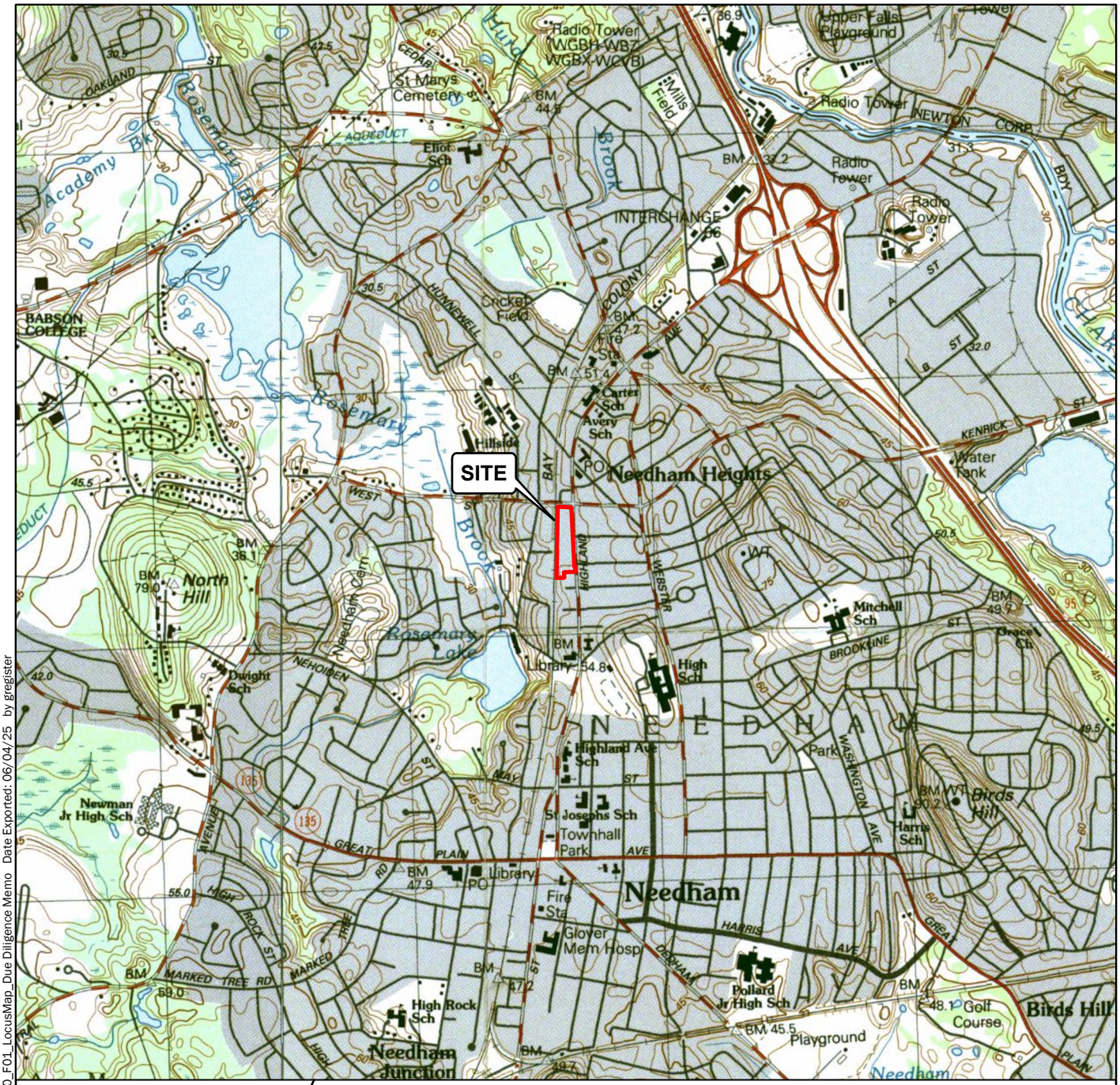
We trust this memorandum meets the project needs at this time. Please contact us at 617.749.9220 if you have any questions regarding the information contained herein.

Attachments:
Figure 1. Locus Plan
Figure 2. Exploration Location Plan
Attachment A. Subsurface Exploration Logs
Attachment B. Demolition Concept Plan
Attachment C. Limitations and Guidelines for Use

ACB:SSS:dt

Disclaimer: Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers USA, PC. and will serve as the official document of record.

Figures



N

0 2,000

Feet

Source(s):

- ESRI/MassGIS & USGS Quadrangle Maps:
  Natick ,Newton, Massachusetts REV: 1987

Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
Vertical Units: Meters

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Locus Map

Due Diligence Memorandum
100 West Street
Needham, Massachusetts

GeoEngineers USA

Figure 1

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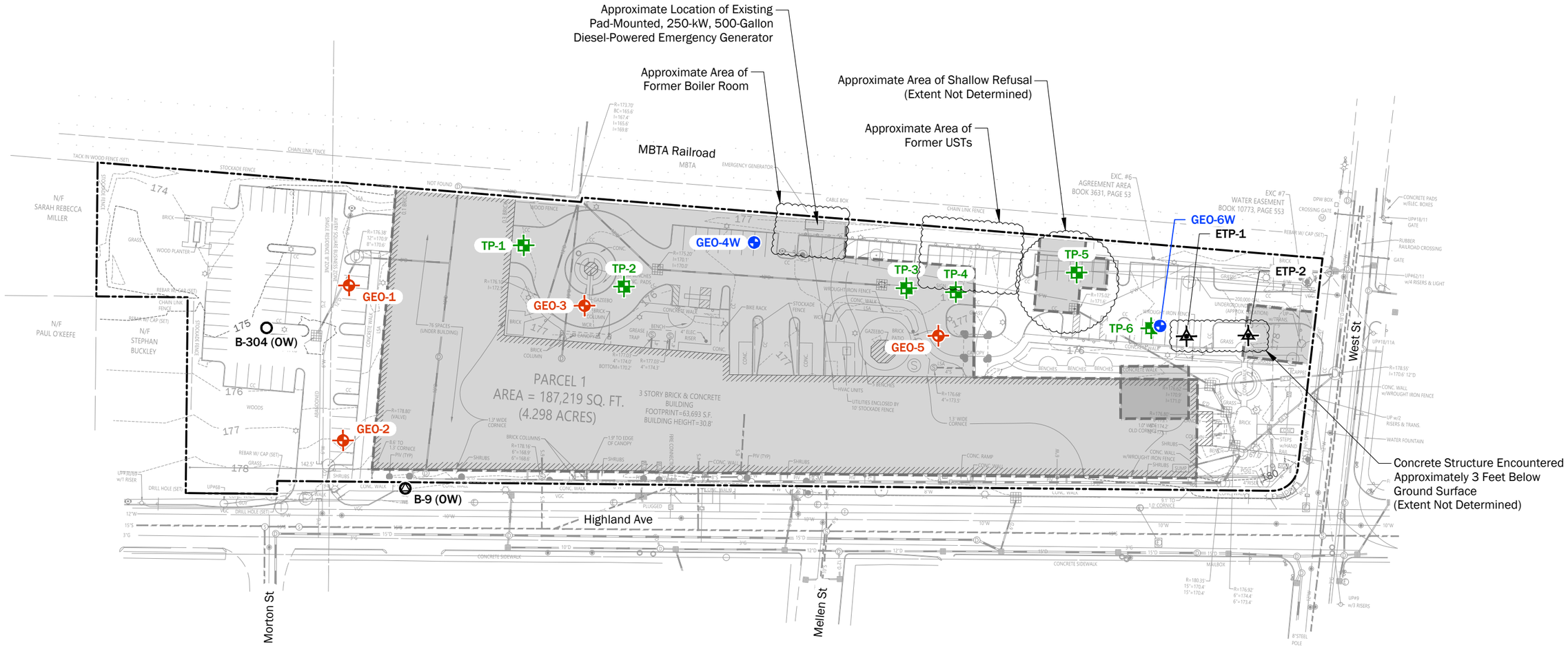

Note(s):

1. Historical site features were extrapolated from aerial imagery and should be considered approximate.

Source(s):

- Survey from Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024
- Historical explorations by others were taken from the "Phase II Comprehensive Site Investigation and RAM Completion Report, RTN 3-3480 and 3-16536" prepared by McPhail Associates, Inc., dated 05/30/2003. Locations should be considered approximate.

Coordinate System: Massachusetts State Plane, Mainland Zone, NAD83, US Foot

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Legend

- Parcel Boundary
- Former Building
- GEO-1 — Boring by GeoEngineers, May 2025
- GEO-4W — Boring Completed as Monitoring Well by GeoEngineers, May 2025
- TP-1 — Stormwater Test Pit by GeoEngineers and Bohler, May 2025
- ETP-1 — Exploratory Test Pit by GeoEngineers, May 2025
- B-9 (OW) — Monitoring Well by Carr-Dee Corp., January 2003
- B-304 (OW) — Monitoring Well by Carr-Dee Corp., April 2003

N

0 80
Feet

Exploration Location Plan

Due Diligence Memorandum
100 West Street
Needham, Massachusetts

GeoEngineers USA

Figure 2

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Attachments

Attachment A
Subsurface Exploration Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

Modified California Sampler (6-inch sleeve) or Dames & Moore

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers USA

Figure A-1

Drilled: Start 5/14/2025 End 5/14/2025	Total Depth (ft): 21	Logged By: CMC Checked By: ACB	Driller: Geologic Earth Exploration, Inc	Drilling Method: 4-inch Drive and Wash	
Surface Elevation (ft): 175 Vertical Datum: NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: CME 55 Truck-mounted Drill Rig	
Easting (X): 727660 Northing (Y): 2931202		System Datum: Massachusetts State Plane Mainland NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes: Soil samples were field screened for total VOCs using a PID with a 10.6eV lamp, calibrated to 100 ppmv isobutylene standard with a response factor of 1.0. All readings were below 1.0 ppmv.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	0	19	12-20-18-13 (38)	S-1		AC	Approximately 2 inches of asphalt concrete			
						SP	Light to dark brown fine to coarse sand with gravel, trace silt and trace ash (dense, moist) (fill)			
		7	6-9-3-3 (12)	S-2		SP-SM	Light-dark brown fine to coarse sand with silt, gravel and trace ash, mortar and brick (medium dense, moist) (fill)			
170	5	14	7-8-9-17 (17)	S-3		SP-SM	Light brown-orange fine sand with silt and trace gravel (medium dense, wet)			
		20	10-12-12-10 (24)	S-4		SM	Light brown silty fine to medium sand with trace gravel (medium dense, wet) (till)			Groundwater encountered at approximately 5½ feet
165	10									
160	15	20	18-49-47-28 (96)	S-5			Light brown-gray silty fine to medium sand with trace gravel (very dense, wet) (till)			
155	20	18	4-21-26-19 (47)	S-6			Light brown silty fine to medium sand with gravel (dense, wet) (till)			
							Boring terminated at approximately 21 feet bgs			

Notes: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Log of Boring GEO-1

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-2
Sheet 1 of 1

Drilled Start 5/14/2025 End 5/14/2025	Total Depth (ft) 15	Logged By CMC Checked By ACB	Driller Geologic Earth Exploration, Inc	Drilling Method 4-inch Drive and Wash	
Surface Elevation (ft) 177 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment CME 55 Truck-mounted Drill Rig	
Easting (X) 727779 Northing (Y) 2931204		System Datum Massachusetts State Plane Mainland NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes: Soil samples were field screened for total VOCs using a PID with a 10.6eV lamp, calibrated to 100 ppmv isobutylene standard with a response factor of 1.0. All readings were below 1.0 ppmv.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0	12	12-28-22-10 (50)	S-1		AC	Approximately 2 inches of asphalt concrete			
						SP	Brown fine to coarse sand with gravel, trace silt and trace ash (very dense, moist) (fill)			
175		12	7-8-12-6 (20)	S-2		SM	Light brown-orange silty fine to coarse sand with trace gravel (medium dense, moist) (till)			
	5									Groundwater encountered at approximately 6 feet
170										
	10	12	10-12-12-14 (24)	S-3			Light brown silty fine to medium sand with trace gravel (medium dense, wet) (till)			
165										
	15	2	16->50 (>50)	S-4			Becomes very dense and with gravel			
							Boring terminated at approximately 14.9 feet bgs			

Notes: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Log of Boring GEO-2

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-3
Sheet 1 of 1

Drilled	Start 5/13/2025	End 5/13/2025	Total Depth (ft) 21	Logged By CMC / Checked By ACB	Driller Geologic Earth Exploration, Inc	Drilling Method 4-inch Drive and Wash
Surface Elevation (ft) / Vertical Datum	176 NAVD88		Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME 55 Truck-mounted Drill Rig
Easting (X) / Northing (Y)	727664 2931383		System Datum	Massachusetts State Plane Mainland NAD83 (feet)	See "Remarks" section for groundwater observed	

Notes: Soil samples were field screened for total VOCs using a PID with a 10.6eV lamp, calibrated to 100 ppmv isobutylene standard with a response factor of 1.0. All readings were below 1.0 ppmv.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	0		12	5-5-6-5 (11)	S-1		AC	Approximately 1-inch of asphalt concrete			
							SM	Brown silty fine to medium sand with trace gravel (medium dense, moist) (fill)			
			10	4-2-1-WOH (3)	S-2			Becomes very loose (fill)			
			6	2-2-1-1 (3)	S-3		SP	Brown fine to coarse sand with gravel and trace silt (very loose, moist)			
170	5		24	8-24-36-35 (50)	S-4A			Brown fine to coarse sand with gravel and trace silt (dense, wet)			Groundwater encountered at approximately 6 feet
					S-4B		SM	Light brown silty fine to coarse sand and gravel (dense, wet) (till)			
			10	18-13-21-22 (34)	S-5			Becomes dense			
165	10										
			18	24-38-16-19 (54)	S-6			Becomes very dense			
160	15										
			16	18-62-53 (>50)	S-7						
155	20										
								Boring terminated at approximately 21 feet bgs			

Notes: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Log of Boring GEO-3

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-4
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	5/13/2025	5/13/2025	21	CMC	ACB	Geologic Earth Exploration, Inc	4-inch Drive and Wash

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME 55 Truck-mounted Drill Rig
Surface Elevation (ft) Vertical Datum	176 NAVD88	Top of Casing Elevation (ft)	176.00
Easting (X) Northing (Y)	727608 2931510	Horizontal Datum	Massachusetts State Plane Mainland NAD83 (feet)

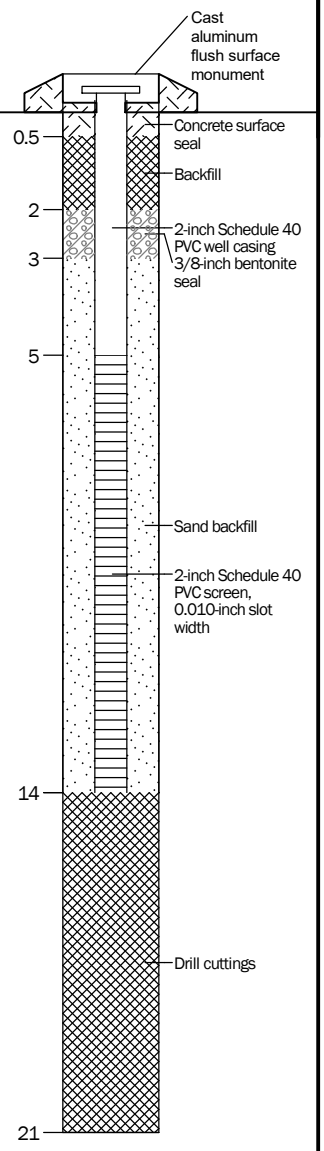
A 2-in well was installed on 5/13/2025 to a depth of 14 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
5/16/2025	7.00	169.00

Notes: Soil samples were field screened for total VOCs using a PID with a 10.6eV lamp, calibrated to 100 ppmv isobutylene standard with a response factor of 1.0. All readings were below 1.0 ppmv.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
175	0		17	5-6-12-17 (18)	S-1			AC	Approximately 2 inches of asphalt concrete		
								SP-SM	Brown fine to medium sand with silt and gravel, trace brick, wood and ash (medium dense, moist) (fill)		
			12	16-33-27-21 (60)	S-2				Dark brown fine to coarse sand with silt and gravel, trace brick and wood (very dense, moist) (fill)		
			16	10-18-27-44 (45)	S-3A			GP	Brick and mortar (dense) (fill)		
170	5				S-3B	▼		SP-SM	Light brown-gray fine to medium sand with silt and gravel (dense, moist) (fill)		
			6	14-20-22-24 (42)	S-4			SP-SM	Light brown fine to coarse sand with silt and gravel (dense, wet) (till)		
165	10										
			13	26-24-32-27 (56)	S-5			SM	Light brown silty fine to medium sand with trace gravel (very dense, wet) (till)		
160	15										
			19	9-24-30-40 (54)	S-6						
155	20								Boring terminated at approximately 21 feet bgs		

WELL LOG



Notes: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Log of Boring with Monitoring Well GEO-4W

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-5
Sheet 1 of 1

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_WELL_%F_4BC

Drilled: Start 5/13/2025 End 5/13/2025	Total Depth (ft): 21	Logged By: CMC Checked By: ACB	Driller: Geologic Earth Exploration, Inc	Drilling Method: 4-inch Drive and Wash	
Surface Elevation (ft): 176 Vertical Datum: NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: CME 55 Truck-mounted Drill Rig	
Easting (X): 727671 Northing (Y): 2931655		System Datum: Massachusetts State Plane Mainland NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes: Soil samples were field screened for total VOCs using a PID with a 10.6eV lamp, calibrated to 100 ppmv isobutylene standard with a response factor of 1.0. All readings were below 1.0 ppmv.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	0	18	7-5-2-6 (7)	S-1		AC	Approximately 2 inches of asphalt concrete			
						SP	Light gray fine to coarse sand with gravel, trace silt, and trace wood, ash and ceramic (loose, moist) (fill)			
		18	10-6-4-4 (10)	S-2			Light gray fine to coarse sand with gravel, trace silt, trace ash, wood, concrete and plastic (loose, moist) (fill)			
		6	6-2-2-2 (4)	S-3		GP	Brown-gray gravel with fine to coarse sand with trace silt and trace wood (loose, moist) (fill)			
170	5	6	1-1-6-5 (7)	S-4						Groundwater encountered at approximately 6¼ feet
		12	12-8-7-9 (15)	S-5A			Gray gravel with fine to coarse sand, trace silt trace metal and brick (medium dense, wet) (fill)			
165	10			S-5B		SM	Light brown silty fine to medium sand with gravel (medium dense, wet) (till)			
		20	15-18-34-22 (52)	S-6			Light brown to gray silty fine to medium sand with gravel (very dense, wet) (till)			
160	15									
			12-20-24-31 (44)	S-7			Becomes dense			
155	20									
							Boring terminated at approximately 21 feet bgs			

Notes: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Log of Boring GEO-5

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-6
Sheet 1 of 1

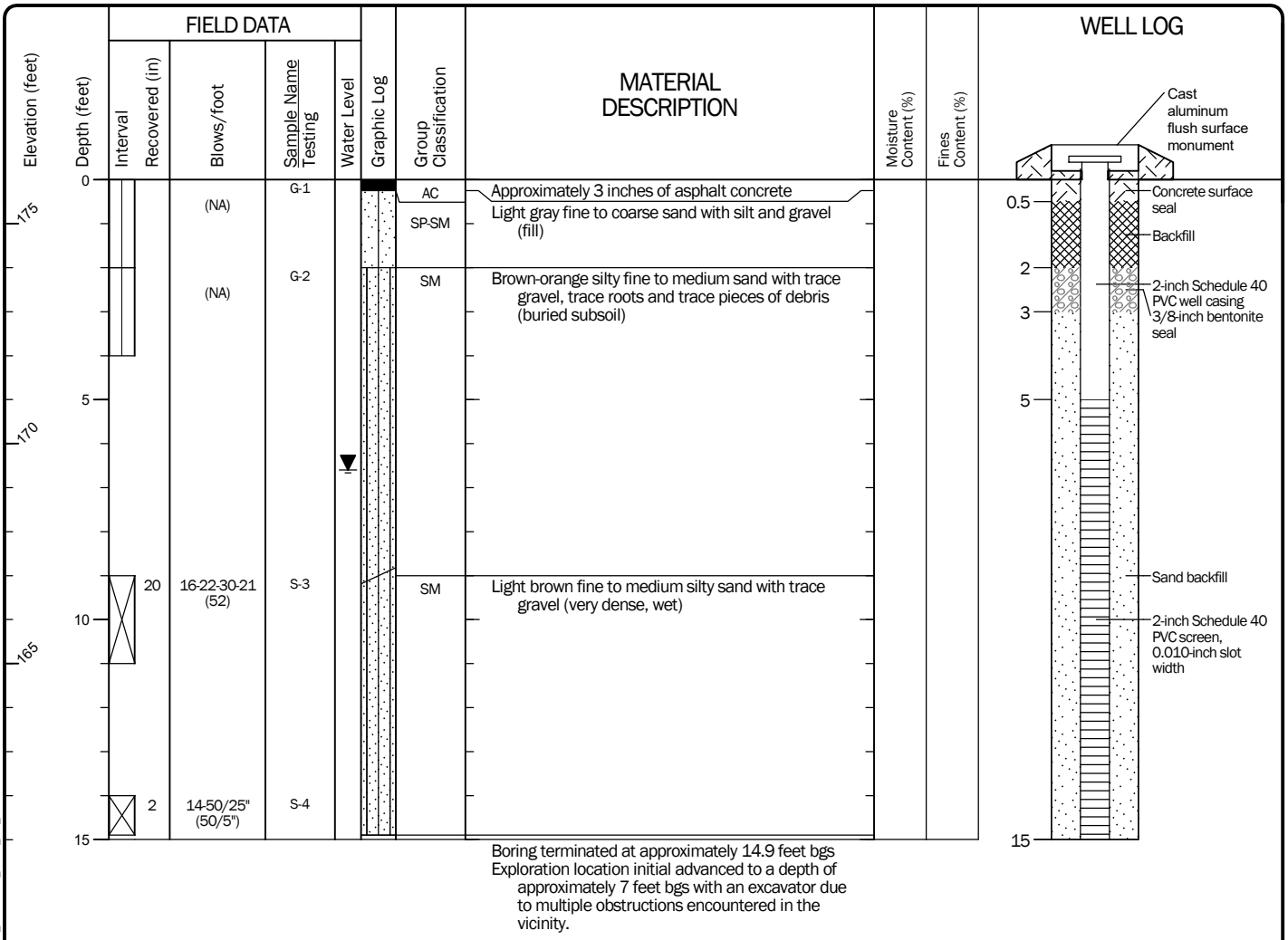
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	5/13/2025	5/13/2025	15	CMC	ACB	Geologic Earth Exploration, Inc / Machine Time LLC	

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Doosan DX140 LC Excavator 0' - 7' / 7' - 15' CME 55 Truck-mounted Drill Rig
Surface Elevation (ft) Vertical Datum	176 NAVD88	Top of Casing Elevation (ft)	176.00
Easting (X) Northing (Y)	727653 2931824	Horizontal Datum	Massachusetts State Plane Mainland NAD83 (feet)

A 2-in well was installed on 5/14/2025 to a depth of 15 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
5/16/2025	6.60	169.40

Notes: Soil samples were field screened for total VOCs using a PID with a 10.6eV lamp, calibrated to 100 ppmv isobutylene standard with a response factor of 1.0. All readings were below 1.0 ppmv.



Notes: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_WELL_%F_4BC

Log of Boring with Monitoring Well GEO-6W

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-7
Sheet 1 of 1

Date Excavated	5/14/2025	Total Depth (ft)	13.5	Logged By / Checked By	NDW / ACB
Excavator	Machine Time LLC	Equipment	Doosan DX140 LC Excavator	See "Remarks" section for groundwater observed	Caving not observed
Surface Elevation (ft) / Vertical Datum	177 / NAVD88	Easting (X) / Northing (Y)	727621 / 2931334	Coordinate System / Horizontal Datum	Massachusetts State Plane Mainland / NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
176	0				AC	Approximately 3 inches of asphalt			
175	1				SP-SM	Brown fine to coarse sand with silt, gravel, concrete, rebar and plastic (moist) (fill)			
174	2								Brick and concrete debris encountered from 2 to 5 feet bgs
173	3								
172	4								Concrete block encountered on east side wall from approximately 3½ to 5½ feet bgs
171	5								
170	6								
169	7								
168	8				SP	Brown silty fine to coarse sand, gravel and trace silt (moist to wet)			Groundwater seepage observed at approximately 8 feet bgs
167	9								
166	10								
165	11								
164	12		S-1						
	13								Standing groundwater observed at approximately 13.3 feet bgs

Test pit terminated at approximately 13.3 feet bgs

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Log of Test Pit TP-1

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-8
Sheet 1 of 1

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Date Excavated 5/14/2025	Total Depth (ft) 13	Logged By NDW Checked By ACB	Excavator Machine Time LLC Equipment Doosan DX140 LC Excavator	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) 176 Vertical Datum NAVD88		Easting (X) 727648 Northing (Y) 2931412	Coordinate System Massachusetts State Plane Mainland Horizontal Datum NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	1				AC	Approximately 6 inches of asphalt			
174	2		S-1		SP-SM	Light brown fine to coarse sand with silt and gravel, trace brick, wood, fabric and plastic (moist) (fill)			Irrigation line (2-inch PVC) encountered at approximately 28 inches bgs
173	3								
172	4								
171	5				SP	Brown fine to coarse sand with gravel, trace silt and trace cobbles (moist to wet)			
170	6								Redoximorphic features observed at approximately 6 feet
169	7								Cobbles approxiamtely 2-feet wide in diameter
168	8								
167	9								Groundwater seepage observed at approximately 9 feet bgs
166	10		S-2						
165	11								
164	12								Standing groundwater observed at approximately 12.8 feet bgs
163	13					Test pit terminated at approximately 12.8 feet bgs			

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Log of Test Pit TP-2

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-9
Sheet 1 of 1

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Date Excavated 5/14/2025	Total Depth (ft) 7	Logged By NDW Checked By ACB	Excavator Machine Time LLC Equipment Doosan DX140 LC Excavator	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) 176 Vertical Datum NAVD88		Easting (X) 727636 Northing (Y) 2931628	Coordinate System Massachusetts State Plane Mainland Horizontal Datum NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	1				AC	Approximately 3 inches of asphalt			
174	2				SP-SM	Brown fine to coarse sand with silt and gravel with concrete, brick, trace plastic, metal (rebar), and wood (moist to wet) (fill)			
173	3		S-1						Brick and concrete layer encountered from approximately 3 to 4 feet bgs
172	4								Abandoned manhole structure observed at approximately 4 feet bgs
171	5								
170	6		S-2						
169	7					Test pit terminated at approximately 7 feet bgs			Groundwater seepage observed at approximately 7 feet bgs

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Log of Test Pit TP-3

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-10
Sheet 1 of 1

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Date Excavated	5/14/2025	Total Depth (ft)	7.75	Logged By NDW Checked By ACB	Excavator Machine Time LLC Equipment Doosan DX140 LC Excavator	See "Remarks" section for groundwater observed See "Remarks" section for caving observed

Surface Elevation (ft) Vertical Datum	176 NAVD88	Easting (X) Northing (Y)	727637 2931666	Coordinate System Horizontal Datum	Massachusetts State Plane Mainland NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	0				AC	Approximately 4 inches of asphalt			
174	1				SP-SM	Light brown fine to coarse sand with silt and gravel, concrete bricks, plastic, metal, rebar, trace wood (moist to wet) (fill)			
173	2		S-1						Concrete block removed from approximately 2 feet bgs
172	3								
171	4								Metal pipe encountered at approximately 4 feet Concrete piece 4 to 5 feet in size encountered and removed from approximately 4 to 5 feet bgs
170	5								Slight caving observed at approximately 5 feet bgs
169	6		S-2						
	7					Test pit terminated at approximately 7¾ feet bgs due to groundwater			Standing groundwater observed at approximately 7¾ feet bgs

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Log of Test Pit TP-4

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-11

Date Excavated 5/14/2025	Total Depth (ft) 3	Logged By NDW Checked By ACB	Excavator Machine Time LLC Equipment Doosan DX140 LC Excavator	Groundwater not observed Caving not observed
Surface Elevation (ft) 176 Vertical Datum NAVD88		Easting (X) 727616 Northing (Y) 2931758		Coordinate System Massachusetts State Plane Mainland Horizontal Datum NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	1				AC	Approximately 3 inches of asphalt			
					SP-SM	Light brown fine to coarse sand with silt and gravel, trace brick, concrete and plastic (moist) (fill)			
174	2								
173	3								Concrete piece encountered at approximately 2.8 feet bgs
						Test pit terminated at approximately 2.8 feet bgs due to refusal			

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Log of Test Pit TP-5

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-12
Sheet 1 of 1

Date:6/10/25 Path:P:\20\20449\018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Date Excavated	5/14/2025	Total Depth (ft)	14.25	Logged By / Checked By	NDW / ACB
Excavator / Equipment	Machine Time LLC / Doosan DX140 LC Excavator	See "Remarks" section for groundwater observed / Caving not observed			
Surface Elevation (ft) / Vertical Datum	176 / NAVD88	Easting (X) / Northing (Y)	727655 / 2931817	Coordinate System / Horizontal Datum	Massachusetts State Plane Mainland / NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
175	0				AC	Approximately 4 inches of asphalt			
174	1				SM	Brown fine to coarse sand with silt, gravel and trace roots (moist) (fill)			Roots observed to extend approximately 0.8 feet bgs
173	2		S-1		SM	Light brown fine to coarse sand with silt, trace gravel and trace roots (moist) (buried subsoil)			
172	3								
171	4								
170	5				SP-SM	Gray brown silty fine to coarse sand with gravel, trace cobbles and boulders (moist)			
169	6		S-2						
168	7								
167	8								
166	9								
165	10								
164	11								
163	12								
162	13								
	14					Test pit terminated at approximately 14¼ feet bgs			Standing groundwater observed at approximately 14.2 feet bgs

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on the ALTA/NSPS Land Title Survey prepared by Vanasse, Hangen, Brustlin, Inc. (VHB), dated 06/10/2024 (the Survey). Vertical approximated based on the Survey.

Date:6/10/25 Path:P:\20\20449018\GINT\20449018OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Log of Test Pit TP-6

GeoEngineers USA

Project: 100 West Street Needham
Project Location: Needham, Massachusetts
Project Number: 20449-018-00

Figure A-13
Sheet 1 of 1

Attachment B

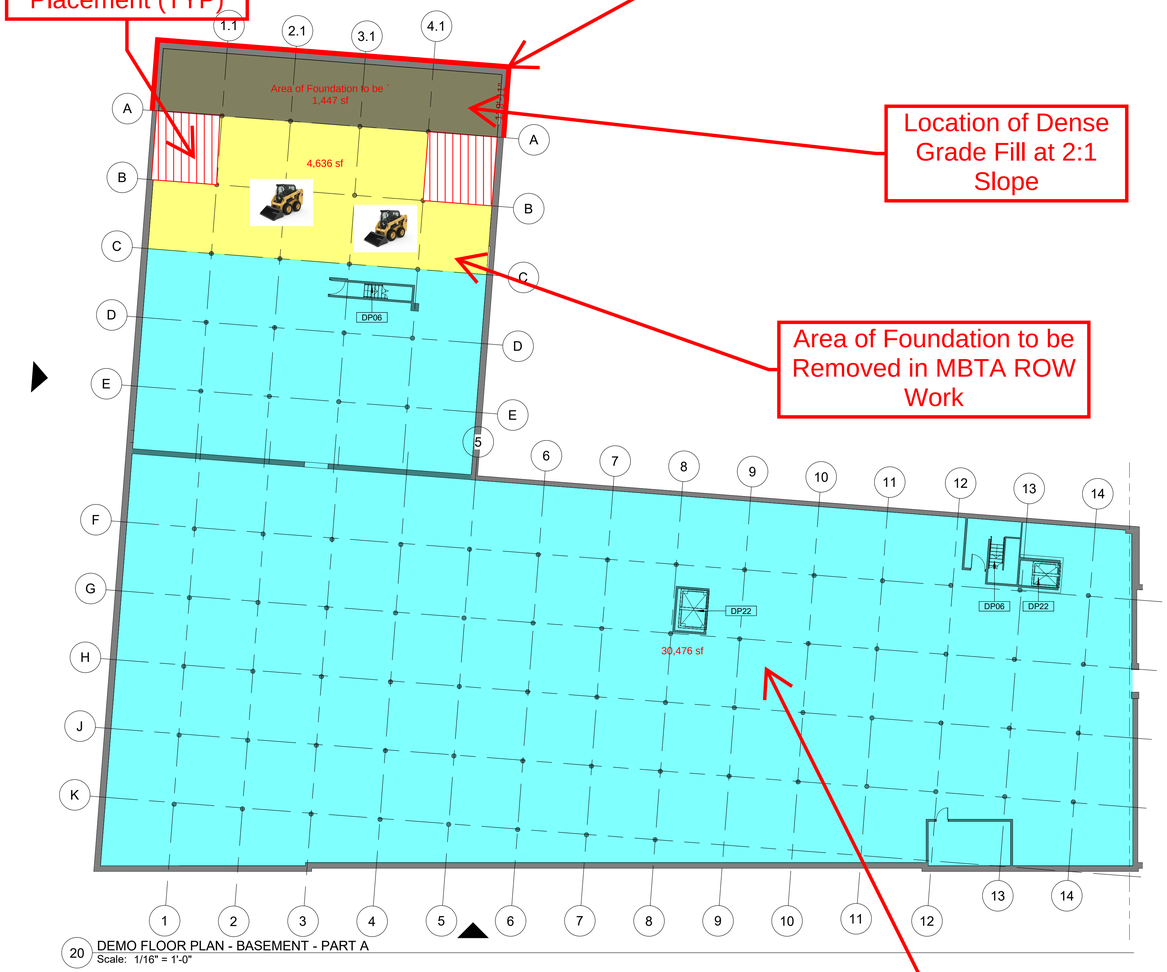
Demolition Concept Plans

Proposed Locations of Openings in First Floor Slab for Fill Placement (TYP)

Area of Foundation to be Retained

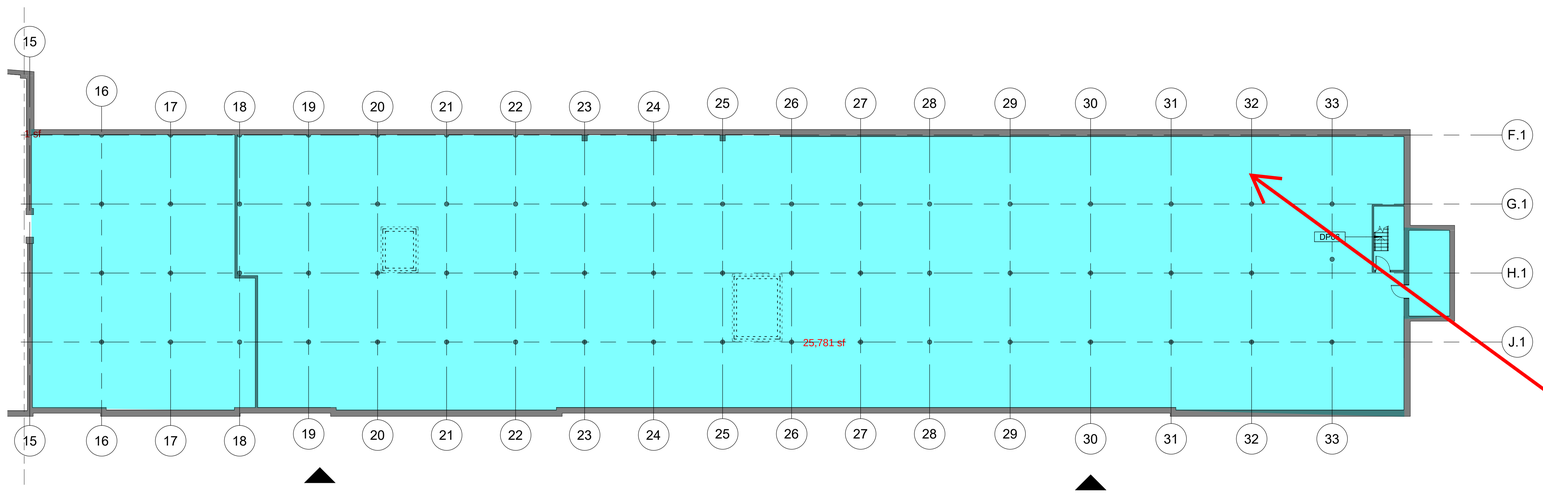
Location of Dense Grade Fill at 2:1 Slope

Area of Foundation to be Removed in MBTA ROW Work



20 DEMO FLOOR PLAN - BASEMENT - PART A
Scale: 1/16" = 1'-0"

Area of Foundation to be Removed in Phase 1



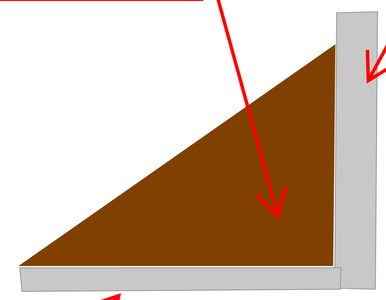
10 DEMO FLOOR PLAN - BASEMENT - PART B
Scale: 1/16" = 1'-0"

Proposed Foundation Wall Retention Sequence:

1. Remove exterior brick facade as required.
2. Saw-cut and create openings in the first floor slab beam to beam to allow for fill installation
3. Fracture holes in the the slab on grade 10' OC to allow for proper drainage
4. Lower fill into openings in the first floor slab by excavator or conveyor.
5. Utilize Skid steer loaders to push fill against the foundation wall to be retained.
6. Fill and compact CL A with approved fill materials.
7. Upon completion of foundation wall retention, raze the building from CL A to C

Foundation to Remain

Dense Graded Fill Berm



Typical Section at Foundation to Remain

Slab to Remain and to be Fractured for Drainage

Area of Foundation to be Removed in Phase 1

Consultant:

Revision:

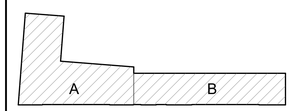
Architect of Record:

Drawn:

Checked:

Scale: As indicated

Key Plan:



Project Name:

100-110 WEST STREET, NEEDHAM, MA

Sheet Name:

DEMOLITION FLOOR PLAN - BASEMENT

Project Number:

Issue Date:
July 14, 2025

Sheet Number:
5

5/6/2021 6:33:05 PM
C:_Revit Local 2019\18017_R19_Avery Crossing_mhobbsLT4MP.rvt

Attachment C
Limitations and Guidelines for Use

Attachment C
Limitations and Guidelines For Use[1]

This attachment provides information to help you manage your risks with respect to the use of this report.

READ THESE PROVISIONS CLOSELY

It is important to recognize that the geoscience practices (geotechnical engineering, geology, and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS, AND PROJECTS

This report has been prepared for Greystar Development East, LLC and for the 100 West Street redevelopment in Needham, Massachusetts specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with Greystar Development East, LLC dated April 4, 2025 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This report has been prepared for the 100 West Street redevelopment in Needham, Massachusetts. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

1 Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation, or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers

cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to conduct additional study to obtain the specific types of information they need or prefer.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule, or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

BIOLOGICAL POLLUTANTS

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

INFORMATION PROVIDED BY OTHERS

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

SECTION 5:

STORMWATER REPORT

(UNDER SEPARATE COVER)

SECTION 6:

ARCHITECTURAL PLANS

(UNDER SEPARATE COVER)

SECTION 7:

SITE DEVELOPMENT PLANS

(UNDER SEPARATE COVER)

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED

RESIDENTIAL DEVELOPMENT

LOCATION OF SITE:

100 WEST STREET, TOWN OF NEEDHAM

NORFOLK COUNTY, MASSACHUSETTS

PARCEL ID: 199/063.0-0037-0000.0

REFERENCES AND CONTACTS

REFERENCES

♦BOUNDARY & TOPOGRAPHIC SURVEY:
VANASSE HANGEN BRUSTLIN
99 HIGH STREET, 13TH FLOOR
BOSTON, MA 02110
JOB # / SURVEY JOB # 14817.00
MASS GRID NAD 1983

♦ARCHITECTURAL PLAN:
CUBES
56 HIGH STREET
NORTH ANDOVER, MA 01845
DATED: 08/12/25

GOVERNING AGENCIES

♦PLANNING BOARD
NEEDHAM TOWN HALL
1471 HIGHLAND AVENUE
NEEDHAM, MA 02492
PHONE: (781) 455-7500

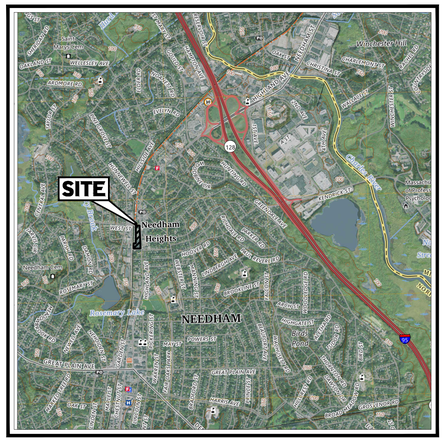
♦BUILDING DEPARTMENT
500 DEDHAM AVENUE
NEEDHAM, MASSACHUSETTS 02492
PHONE: (781) 455-7550, EXT. 1

♦FIRE DEPARTMENT
88 CHESTNUT STREET
NEEDHAM, MASSACHUSETTS 02492
PHONE: (781) 455-7580
FAX: (781) 444-2174

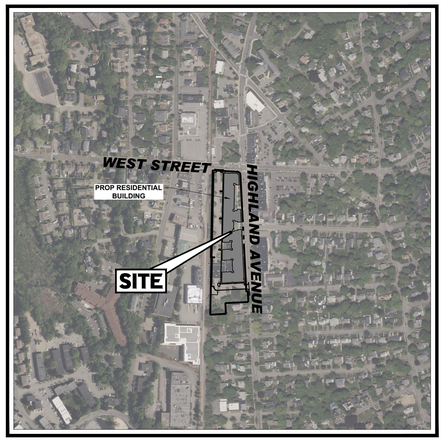
ROW JURISDICTION

♦TRAFFIC, STORMWATER, WATER & SEWER
DEPARTMENT OF PUBLIC WORKS (DPW)
500 DEDHAM AVENUE
NEEDHAM, MA 02492
PHONE: (781) 455-7550

THE ABOVE REFERENCED DOCUMENTS ARE INCORPORATED BY REFERENCE AS PART OF THESE PLANS, HOWEVER, BOHLER ENGINEERING DOES NOT CERTIFY THE ACCURACY OF THE WORK REFERENCED OR DERIVED FROM THESE DOCUMENTS, BY OTHERS.



USGS MAP
SCALE: 1" = 1,000'
SOURCE: USGS



AERIAL MAP
SCALE: 1" = 400'
SOURCE: GOOGLE

SHEET INDEX

SHEET TITLE	SHEET NUMBER
COVER SHEET	C-101
GENERAL NOTES AND LEGEND	C-102
SITE PLAN	C-301
GRADING AND DRAINAGE PLAN	C-401
UTILITY PLAN	C-501
EROSION & SEDIMENT CONTROL PLAN	C-801
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS	C-802
CONSTRUCTION DETAILS	C-901 - C-902
LANDSCAPE PLAN	L-100
LIGHTING PLAN	L-200
LANDSCAPE DETAILS	L-300 - L-302
REFERENCE PLANS	
BOUNDARY, TOPOGRAPHIC & UTILITY SURVEY	1 SHEET

OWNER
HCRI MASSACHUSETTS PROPERTIES TRUST II
4500 DORR STREET
TOLEDO, OH 43615

DEVELOPER
GREYSTAR DEVELOPMENT EAST, LLC
1 FEDERAL STREET, SUITE 1604
BOSTON, MASSACHUSETTS 02110
CONTACT: RYAN SOULS
(857) 254-1329

GENERAL NOTE
IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REVIEW ALL OF THE DRAWINGS AND SPECIFICATIONS ASSOCIATED WITH THIS PROJECT FOR THE PURPOSE OF BECOMING FAMILIAR WITH THE SCOPE OF WORK REQUIRED. IF THE CONTRACTOR DISCOVERS ANY CONFLICTS TO THE SPECIFICATIONS OR RUN CABLE CODES, IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE PROJECT ENGINEER OF RECORD IN WRITING PRIOR TO THE START OF CONSTRUCTION. FAILURE BY THE CONTRACTOR TO NOTIFY THE PROJECT ENGINEER SHALL CONSTITUTE ACCEPTANCE OF FULL RESPONSIBILITY BY THE CONTRACTOR TO COMPLETE THE SCOPE OF THE WORK AS DEFINED BY THE DRAWINGS AND IN FULL CONFORMANCE WITH LOCAL REGULATIONS AND CODES.

PREPARED BY

BOHLER

CONTACT: ZACHARY RICHARDS, 617-849-8040

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABILITY CONSULTING
PERMITTING SERVICES
TRANSPORTATION SERVICES
THE INFORMATION, DESIGN AND CONCEPTS SET FORTH ON THESE PLANS ARE AND SHALL REMAIN THE PROPERTY OF BOHLER AND SHALL NOT BE USED IN WHOLE OR IN PART FOR ANY PROJECT OTHER THAN THE PROJECT FOR WHICH THEY WERE PREPARED AND DEVELOPED UNLESS AUTHORIZED IN WRITING BY BOHLER. © 2025 BOHLER

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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ENTITLEMENT SET

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMS/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVL-CNDS

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
www.BohlerEngineering.com

Z.L. RICHARDS
ZACHARY L. RICHARDS
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 61548
COMMONWEALTH OF MASSACHUSETTS

SHEET TITLE:

COVER SHEET

SHEET NUMBER:

C-101

ORG. DATE - 08/12/2025

\\BOHLERENG.NET\SHARES\MA-PROJECTS\2025\MAB250036.00\CAD\DRAWINGS\PLAN SET\SCIVIL SITE PLANS\P-CIVIL-CNDS-MAB250036.00-- ---LAYOUT: C-101 COVER

GENERAL NOTES

(Rev. 1/2023)

1. THESE PLANS ARE SOLELY BASED ON INFORMATION THE OWNER AND OTHERS PROVIDED TO BOHLER, LLC. (HEREIN 'BOHLER') PRIOR TO THE DATE ON WHICH THE PROFESSIONAL OF RECORD AND BOHLER PREPARED THESE PLANS. THE CONTRACTOR MUST FIELD VERIFY ALL EXISTING CONDITIONS AND IMMEDIATELY NOTIFY BOHLER , IN WRITING, IF ANY ACTUAL SITE CONDITIONS DIFFER FROM THOSE SHOWN ON THESE PLANS, OR IF THE PROPOSED WORK CONFLICTS WITH ANY OTHER SITE FEATURES.
2. THE CONTRACTOR MUST STRICTLY COMPLY WITH THESE NOTES AND ALL SPECIFICATIONS/REPORTS CONTAINED HEREIN. THE CONTRACTOR MUST ENSURE THAT ALL SUBCONTRACTORS FULLY AND COMPLETELY CONFORM TO AND COMPLY WITH THESE REQUIREMENTS. THESE NOTES, AND THE REQUIREMENTS ARTICULATED IN THE NOTES CONTAINED IN ALL THE OTHER DRAWINGS THAT COMPRISE THE PLAN SET OF DRAWINGS. ADDITIONAL NOTES AND SPECIFIC PLAN NOTES MAY BE FOUND ON THE INDIVIDUAL PLANS. THESE GENERAL NOTES APPLY TO THIS ENTIRE DOCUMENT PACKAGE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW ALL CONSTRUCTION CONTRACT DOCUMENTS INCLUDING, BUT NOT LIMITED TO, ALL OF THE DRAWINGS AND SPECIFICATIONS ASSOCIATED WITH THE PROJECT WORK SCOPE, PRIOR TO THE INITIATION AND COMMENCEMENT OF CONSTRUCTION.
3. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR MUST COORDINATE WITH THE PROFESSIONAL OF RECORD AND BOHLER THAT THE LATEST EDITION OF THE DOCUMENTS AND/OR REPORTS REFERENCED WITHIN THE PLAN REFERENCES ARE BEING USED FOR CONSTRUCTION. THIS IS THE CONTRACTOR'S SOLE AND COMPLETE RESPONSIBILITY.
4. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR MUST ENSURE THAT ALL REQUIRED PERMITS AND APPROVALS HAVE BEEN OBTAINED. NO CONSTRUCTION OR FABRICATION IS TO BEGIN UNTIL THE CONTRACTOR HAS RECEIVED AND THOROUGHLY REVIEWED THE CONDITIONS OF APPROVAL TO ALL PERMITS AND OTHER DOCUMENTS REQUIRED BY APPLICABLE GOVERNMENTAL AUTHORITIES AND HAS ALSO CONFIRMED THAT ALL NECESSARY AND REQUIRED PERMITS HAVE BEEN OBTAINED. THE CONTRACTOR MUST HAVE COPIES OF ALL PERMITS AND APPROVALS ON SITE AT ALL TIMES.
5. THE CONTRACTOR MUST ENSURE THAT ALL WORK IS PERFORMED IN ACCORDANCE WITH THESE PLANS, SPECIFICATIONS/REPORTS AND CONDITIONS OF APPROVAL, AND ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, RULES, REGULATIONS, CODES, ORDINANCES AND STANDARDS OF ALL GOVERNMENTAL ENTITIES WITH JURISDICTION OVER THIS PROJECT, AND ALL PROVISIONS IN AND CONDITIONS OF THE CONSTRUCTION CONTRACT BETWEEN THE OWNER/DEVELOPER AND THE CONTRACTOR PERFORMING THE WORK.
6. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR MUST COORDINATE THE BUILDING LAYOUT BY CAREFULLY REVIEWING THE MOST CURRENT ARCHITECTURAL, CIVIL AND STRUCTURAL CONSTRUCTION DOCUMENTS FOR ALL IMPROVEMENTS INCLUDING, BUT NOT LIMITED TO, MECHANICAL, ELECTRICAL, PLUMBING AND FIRE SUPPRESSION PLANS, WHERE APPLICABLE). THE CONTRACTOR MUST IMMEDIATELY NOTIFY OWNER, ARCHITECT AND PROFESSIONAL OF RECORD AND BOHLER, IN WRITING, OF ANY DISCREPANCIES OR AMBIGUITIES WHICH EXIST BETWEEN THESE PLANS AND ANY OTHER PLANS THAT COMPRISE THE CONSTRUCTION DOCUMENTS.
7. CONTRACTOR MUST REFER TO AND ENSURE COMPLIANCE WITH THE APPROVED ARCHITECTURAL/BUILDING PLANS OF RECORD FOR EXACT LOCATIONS AND DIMENSIONS OF ENTRY/EXIT POINTS, ELEVATIONS, PRECISE BUILDING DIMENSIONS, AND EXACT BUILDING UTILITY LOCATIONS.
8. THE CONTRACTOR MUST STRICTLY COMPLY WITH ALL RECOMMENDATIONS AND REQUIREMENTS SET FORTH IN THE GEOTECHNICAL REPORT OF CONSTRUCTION. THE CONTRACTOR MUST IMMEDIATELY NOTIFY PROFESSIONAL OF RECORD AND BOHLER, IN WRITING, IF ANY CONFLICTS, DISCREPANCIES, OR AMBIGUITIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION. NO EXTRA COMPENSATION WILL BE PAID TO THE CONTRACTOR FOR WORK WHICH HAS TO BE RE-DONE OR REPAIRED DUE TO DIMENSIONS, MEASUREMENTS OR GRADES SHOWN INCORRECTLY ON THESE PLANS PRIOR TO NOTIFICATION OF SAME AND RECEIPT OF AUTHORIZATION OF SAME AND (B) PROFESSIONAL OF RECORD AND BOHLER, THEREAFTER, PROVIDING THE CONTRACTOR WITH WRITTEN AUTHORIZATION TO PROCEED WITH SUCH ADDITIONAL WORK.
9. THE CONTRACTOR MUST VERIFY ALL DIMENSIONS AND MEASUREMENTS INCLUDED ON DESIGN DOCUMENTS HEREIN AND MUST NOT SCALE OFF THE DRAWINGS DUE TO POTENTIAL PRINTING INACCURACIES. ALL DIMENSIONS AND MEASUREMENTS MUST BE CHECKED AND CONFIRMED BY THE GENERAL CONTRACTOR PRIOR TO PREPARATION OF SHOP DRAWINGS, FABRICATION/ORDERING OF PARTS AND MATERIALS AND COMMENCEMENT OF SITE WORK. SITE PLAN DRAWINGS ARE NOT INTENDED AS SURVEY DOCUMENTS. DIMENSIONS SUPERSEDE GRAPHICAL REPRESENTATIONS. THE CONTRACTOR MUST MAKE CONTRACTOR'S OWN MEASUREMENTS FOR LAYOUT OF IMPROVEMENTS.
10. THE OWNER AND CONTRACTOR MUST BE FAMILIAR WITH AND RESPONSIBLE FOR THE PROCUREMENT OF ANY AND ALL CERTIFICATIONS REQUIRED FOR THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY.
11. WHEN INCLUDED AS ONE OF THE REFERENCED DOCUMENTS, THE GEOTECHNICAL REPORT, SPECIFICATIONS AND RECOMMENDATIONS SET FORTH THEREIN ARE A PART OF THE REQUIRED CONSTRUCTION DOCUMENTS AND, IN CASE OF CONFLICT, DISCREPANCY OR AMBIGUITY, SHALL TAKE PRECEDENCE OVER THE MORE STRINGENT REQUIREMENTS AND/OR RECOMMENDATIONS CONTAINED IN: (A) THE PLANS; AND (B) THE GEOTECHNICAL REPORT AND RECOMMENDATIONS. MUST TAKE PRECEDENCE UNLESS SPECIFICALLY NOTED OTHERWISE. THE CONTRACTOR MUST NOTIFY THE PROFESSIONAL OF RECORD AND BOHLER, IN WRITING, OF ANY SUCH CONFLICT, DISCREPANCY OR AMBIGUITY BETWEEN THE GEOTECHNICAL REPORT AND PLANS AND SPECIFICATIONS, PRIOR TO PROCEEDING WITH THE APPLICABLE CONSTRUCTION. IN THE EVENT THE GEOTECHNICAL REPORT WAS NOT OBTAINED, THEN THE CONTRACTOR MUST FOLLOW AND COMPLY WITH ALL OF THE REQUIREMENTS OF ANY AND ALL MUNICIPAL, COUNTY, STATE, AND FEDERAL LAWS AND APPLICABLE SPECIFICATIONS WHICH HAVE JURISDICTION OVER THE PROJECT.
12. PROFESSIONAL OF RECORD AND BOHLER ARE NEITHER LIABLE NOR RESPONSIBLE FOR ANY SUBSURFACE CONDITIONS AND FURTHER, HAS NO LIABILITY FOR ANY HAZARDOUS OR UNFAVORABLE SUBSURFACE CONDITIONS THAT MAY BE ENCOUNTERED ON THE SITE.
13. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING WHEN AND WHERE SHORING IS REQUIRED AND FOR INSTALLING ALL SHORING REQUIRED DURING EXCAVATION (IF TO BE PERFORMED IN ACCORDANCE WITH CURRENT OSHA STANDARDS) AND ADDITIONAL PRECAUTIONS REQUIRED TO BE TAKEN TO ASSURE THE STABILITY OF ADJACENT, NEARBY AND CONTIGUOUS STRUCTURES AND PROPERTIES. ALL OF THIS WORK IS TO BE PERFORMED AT CONTRACTOR'S SOLE COST AND RISK.
14. THE CONTRACTOR MUST EXERCISE EXTREME CAUTION WHEN PERFORMING ANY WORK ACTIVITIES ADJACENT TO PAVEMENT, STRUCTURES, ETC. WHICH ARE TO REMAIN EITHER FOR AN INTERIM, PHASE OF THE PROJECT OR FOR THE FINAL CONDITION. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR TAKING ALL APPROPRIATE MEASURES REQUIRED TO ENSURE THE STRUCTURAL STABILITY OF SIDEWALKS AND PAVEMENT, UTILITIES, BUILDINGS, AND PARTICIPANTS AND NON-PARTICIPANTS ON THE PROJECT SITE AND ADJACENT PROPERTIES AND ANY OTHER PERSONS OR ANYONE INVOLVED WITH THE PROJECT.
15. DEBRIS MUST NOT BE BURIED ON THE SUBJECT SITE. ALL DEMOLITION AND CONSTRUCTION WASTES, UNSUITABLE EXCAVATED MATERIAL, EXCESS SOIL AND DEBRIS (SOLID WASTE) MUST BE DISPOSED OF IN ACCORDANCE WITH THE REQUIREMENTS OF ANY AND ALL MUNICIPAL, COUNTY, STATE, AND FEDERAL LAWS AND APPLICABLE CODES WHICH HAVE JURISDICTION OVER THE PROJECT.
16. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO MAINTAIN RECORDS TO DEMONSTRATE PROPER AND FULLY COMPLIANT DISPOSAL ACTIVITIES, TO BE PROMPTLY PROVIDED TO THE OWNER UPON REQUEST.
17. THE CONTRACTOR MUST REPAIR, AT CONTRACTOR'S SOLE COST, ALL DAMAGE DONE TO ANY NEW OR EXISTING CONSTRUCTION OR PROPERTY DURING THE COURSE OF CONSTRUCTION, INCLUDING BUT NOT LIMITED TO DRAINAGE, UTILITIES, PAVEMENT, STRIPING, CURB, ETC. AND MUST BEAR ALL COSTS ASSOCIATED WITH SAME TO INCLUDE, BUT NOT BE LIMITED TO, INSURANCE DEDUCTIBLES AND CONSTRUCTION MATERIALS. THE CONTRACTOR IS RESPONSIBLE FOR AND MUST REPLACE ALL SIGNAL INTERCONNECTION CABLE, WIRING CONDUITS, AND ANY UNDERGROUND ACCESSORY EQUIPMENT DAMAGED DURING CONSTRUCTION AND MUST BEAR ALL COSTS ASSOCIATED WITH SAME. THE DAMAGED OF ANY SUCH NEW OR EXISTING CONSTRUCTION OR PROPERTY MUST RESTORE SUCH CONSTRUCTION OR PROPERTY TO A CONDITION EQUIVALENT TO OR BETTER THAN THE CONDITIONS PRIOR TO COMMENCEMENT OF THE CONSTRUCTION ACTIVITIES. THE CONTRACTOR MUST ENSURE ALL LOCAL, STATE, FEDERAL REGULATIONS, STATUTORY REQUIREMENTS AND STUBTES. THE CONTRACTOR MUST BEAR ALL COSTS ASSOCIATED WITH SAME. THE CONTRACTOR MUST PROMPTLY, DOCUMENT DAMAGE AND NOTIFY, IN WRITING, THE OWNER AND THE CONSTRUCTION MANAGER PRIOR TO THE START OF CONSTRUCTION.
18. THE PROFESSIONAL OF RECORD AND BOHLER ARE NOT RESPONSIBLE FOR AND HAVE NO CONTRACTUAL, LEGAL OR OTHER RESPONSIBILITIES FOR JOB SITE SAFETY JOB SITE SUPERVISION, OR ANYTHING RELATED TO SAME. THE PROFESSIONAL OF RECORD AND BOHLER HAVE NOT BEEN RETAINED TO PERFORM OR TO BE RESPONSIBLE FOR JOB SITE SAFETY, BEING WHOLLY OUTSIDE OF PROFESSIONAL SCOPE OF SERVICES. ALL RECORD'S AND BOHLER SERVICES AS RELATED TO THE PROJECT. THE PROFESSIONAL OF RECORD AND BOHLER ARE NOT RESPONSIBLE TO IDENTIFY OR REPORT ANY JOB SITE SAFETY ISSUES OR FOR ANY JOB SITE CONDITIONS OF ANY KIND.
19. THE CONTRACTOR MUST IMMEDIATELY IDENTIFY IN WRITING, TO THE PROFESSIONAL OF RECORD AND BOHLER , ANY DISCREPANCIES THAT MAY OR COULD AFFECT THE PUBLIC HEALTH OR GENERAL WELFARE, SAFETY, OR STABILITY OF THE PROJECT, OR ADJACENT PROPERTIES OR CONSTRUCTION WITHOUT PROVIDING PROPER WRITTEN NOTIFICATION AS DESCRIBED ABOVE, IT WILL BE AT THE CONTRACTOR'S OWN RISK AND, FURTHER, THE CONTRACTOR MUST INDEMNIFY, DEFEND AND HOLD HARMLESS THE PROFESSIONAL OF RECORD AND BOHLER FOR ANY AND ALL CLAIMS, LOSSES, DAMAGES, INJURIES, ATTORNEY'S FEES AND THE LIKE WHICH RESULT FROM OR ARE IN ANY WAY RELATED TO SAME INCLUDING, BUT NOT LIMITED TO, ANY THIRD PARTY AND FIRST PARTY CLAIMS.
20. THE PROFESSIONAL OF RECORD AND BOHLER ARE NOT RESPONSIBLE FOR ANY INJURY OR DAMAGES RESULTING FROM THE CONTRACTOR'S FAILURE TO BUILD OR CONSTRUCT IN STRICT ACCORDANCE WITH THE APPROVED PLANS. PRIOR TO COMMENCEMENT OF CONSTRUCTION, LIKE IF THE CONTRACTOR AND/OR OWNER FAIL TO BUILD OR CONSTRUCT IN STRICT ACCORDANCE WITH APPROVED PLANS, RULES, STATUTES, CODES AND THE LIKE. THE CONTRACTOR AND/OR OWNER AGREE TO AND MUST JOINTLY, INDEPENDENTLY, SEPARATELY AND SEVERALLY INDEMNIFY AND HOLD THE PROFESSIONAL OF RECORD AND BOHLER HARMLESS FOR AND FROM ALL INJURIES, CLAIMS AND DAMAGES THAT PROFESSIONAL OF RECORD AND BOHLER MAY ALSO SUFFER AND PAY ANY AND ALL COSTS THAT PROFESSIONAL OF RECORD AND BOHLER INCURS AS A RESULT OF SAID FAILURE.
21. ALL CONTRACTORS MUST CARRY AT LEAST THE MINIMUM AMOUNT OF THE SPECIFIED AND COMMERCIALLY REASONABLE STATUTORY WORKER'S COMPENSATION INSURANCE, EMPLOYER'S LIABILITY INSURANCE AND COMMERCIAL GENERAL LIABILITY INSURANCE (CGL) INCLUDING ALSO ALL UMBRELLA COVERAGES. ALL CONTRACTORS MUST HAVE THEIR POLICIES ENDORSED TO STATE THAT GENERAL LIABILITY INSURANCE AND FUTURE OWNERS, OFFICERS, DIRECTORS, PARTNERS, SHAREHOLDERS, MEMBERS, PRINCIPALS, COMMISSIONERS, AGENTS, SERVANTS, EMPLOYEES, AFFILIATES, SUBSIDIARIES, AND RELATED ENTITIES, AND ITS SUBCONTRACTORS AND SUBCONSULTANTS AT A CONSTRUCTION/PROJECT SITE (HEREIN 'BOHLER PARTIES'). RELIEVES OR WILL RELIEVE THE CONTRACTOR OF AND FROM CONSTRUCTION MEANS, METHODS, SEQUENCE, TECHNIQUES OR PROCEDURES NECESSARY FOR PERFORMING, OVERSEEING, SUPERINTENDING AND COORDINATING THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND COMPLIANCE WITH ALL HEALTH AND SAFETY PRECAUTIONS REQUIRED BY ANY REGULATORY AGENCIES WITH JURISDICTION OVER THE PROJECT AND/OR PROPERTY. BOHLER PARTIES HAVE NO AUTHORITY TO EXERCISE ANY CONTROL OVER (OR ANY RESPONSIBILITY FOR) ANY CONSTRUCTION. THE CONTRACTOR OR ITS EMPLOYEES RELATING TO THEIR WORK AND ANY AND ALL HEALTH AND SAFETY PROGRAMS OR PROCEDURES. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR JOB SITE SAFETY. THE CONTRACTOR MUST INDEMNIFY, DEFEND, PROTECT AND HOLD HARMLESS BOHLER PARTIES FOR AND FROM ANY LIABILITY TO BOHLER PARTIES RESULTING FROM THE CONTRACTOR'S WORK, SERVICES AND/OR VIOLATIONS OF THIS NOTE. THESE NOTES OR ANY NOTES IN THE PLAN SET AND, FURTHER, THE CONTRACTOR MUST NAME BOHLER AS AN ADDITIONAL INSURED UNDER THE GENERAL CONTRACTOR'S POLICIES OF GENERAL LIABILITY INSURANCE AS DEFINCTIBED ABOVE.
22. WHEN IT IS CLEARLY AND SPECIFICALLY WITHIN BOHLER'S SCOPE OF SERVICES CONTRACT WITH THE OWNER/DEVELOPER, BOHLER WILL REVIEW OR TAKE OTHER APPROPRIATE ACTION ON THE CONTRACTOR SUBMITTALS, SUCH AS SHOP DRAWINGS, PRODUCT DATA, SAMPLES, AND OTHER DATA, WHICH THE CONTRACTOR IS REQUIRED TO SUBMIT, BUT ONLY FOR THE LIMITED PURPOSE OF EVALUATING CONFORMANCE WITH THE DESIGN INTENT AND THE INFORMATION SHOWN IN THE CONSTRUCTION CONTRACT DOCUMENTS. CONSTRUCTION MEANS AND METHODS AND/OR TECHNIQUES OR PROCEDURES, COORDINATION OF THE WORK WITH OTHER TRADES, AND CONSTRUCTION SAFETY PRECAUTIONS ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND BOHLER HAS NO RESPONSIBILITY OR LIABILITY FOR SAME. BOHLER WILL PERFORM ITS SHOP DRAWING REVIEW WITH REASONABLE PROMPTNESS, AS CONDITIONS PERMIT. ANY DOCUMENT, DOCUMENTING BOHLER'S REVIEW OF A SPECIFIC ITEM OR LIMITED SCOPE, MUST NOT INDICATE THAT BOHLER HAS REVIEWED THE ENTIRE ASSEMBLY OF WHICH THE ITEM IS A COMPONENT. BOHLER IS NOT RESPONSIBLE FOR ANY DEVIATIONS FROM THE CONSTRUCTION DOCUMENTS. THE CONTRACTOR MUST, IN WRITING, PROMPTLY AND IMMEDIATELY BRING ANY DEVIATIONS FROM THE CONSTRUCTION DOCUMENTS TO BOHLER'S ATTENTION. BOHLER IS NOT REQUIRED TO REVIEW PARTIAL SUBMISSIONS OR THOSE FOR WHICH SUBMISSIONS OF CORRELATED ITEMS HAVE NOT BEEN RECEIVED.
23. IF THE CONTRACTOR DEVIATES FROM THESE PLANS AND/OR SPECIFICATIONS, INCLUDING THE NOTES CONTAINED HEREIN, WITHOUT FIRST OBTAINING THE PRIOR WRITTEN AUTHORIZATION OF THE PROFESSIONAL OF RECORD AND BOHLER FOR ALL DEVIATIONS WITHIN PROFESSIONAL OF RECORD'S SCOPE, THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE PAYMENT OF ALL COSTS INCURRED IN CORRECTING ANY WORK PERFORMED WHICH DEVIATES FROM THE PLANS, ALL FINES AND/OR PENALTIES ASSESSED WITH RESPECT THERETO AND ALL COMPENSATORY OR PUNITIVE DAMAGES RESULTING THEREFROM AND, FURTHER, MUST DEFEND, INDEMNIFY, PROTECT, AND HOLD HARMLESS THE PROFESSIONAL OF RECORD AND BOHLER PARTIES TO THE FULLEST EXTENT PERMITTED UNDER THE LAW, FOR AND FROM ALL FEES, ATTORNEYS' FEES, DAMAGES, COSTS, JUDGMENTS, CLAIMS, INJURIES, PENALTIES AND THE LIKE RELATED TO SAME.
24. THE CONTRACTOR IS RESPONSIBLE FOR A MAINTAINING AND PROTECTING THE TRAFFIC CONTROL PLAN AND ELEMENTS IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REQUIREMENTS, FOR ALL WORK THAT AFFECTS PUBLIC TRAVEL EITHER IN THE RIGHT OF WAY OR ON SITE. THE COST FOR THIS ITEM MUST BE INCLUDED IN THE CONTRACTOR'S PRICE AND IS THE CONTRACTOR'S SOLE RESPONSIBILITY.
25. OWNER MUST MAINTAIN AND PRESERVE ALL PHYSICAL SITE FEATURES AND DESIGN FEATURES DEPICTED ON THE PLANS AND RELATED DOCUMENTS IN STRICT ACCORDANCE WITH THE APPROVED PLANS) AND DESIGN FEATURES. FURTHER, THE PROFESSIONAL OF RECORD AND BOHLER ARE NOT RESPONSIBLE FOR ANY FAILURE TO SO MAINTAIN OR PRESERVE SITE AND/OR DESIGN FEATURES. IF OWNER FAILS TO MAINTAIN AND/OR PRESERVE ALL PHYSICAL SITE FEATURES AND/OR DESIGN FEATURES DEPICTED ON THE PLANS AND RELATED DOCUMENTS, OWNER AGREES TO INDEMNIFY AND HOLD THE PROFESSIONAL OF RECORD AND BOHLER PARTIES, HARMLESS FOR ALL INJURIES, DAMAGES AND COSTS THAT PROFESSIONAL OF RECORD AND BOHLER INCUR AS A RESULT OF SAID FAILURE OR FAILURE TO PRESERVE.
26. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ENSURING THAT ALL CONSTRUCTION ACTIVITIES AND MATERIALS COMPLY WITH AND CONFORM TO APPLICABLE FEDERAL, STATE AND LOCAL RULES AND REGULATIONS, LAWS, ORDINANCES AND CODES, AND ALL APPLICABLE REQUIREMENTS OF THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, (29 U.S.C. 651 ET SEQ.) AS AMENDED, AND ANY MODIFICATIONS, AMENDMENTS OR REVISIONS TO SAME.
27. THE CONTRACTOR MUST STRICTLY COMPLY WITH THE LATEST AND CURRENT OSHA STANDARDS AND REGULATIONS, AND/OR ANY OTHER AGENCY WITH JURISDICTION OVER EXCAVATION AND TRENCHING PROCEDURES. PROFESSIONAL OF RECORD AND BOHLER HAS NO RESPONSIBILITY FOR OR AS RELATED TO EXCAVATION AND TRENCHING PROCEDURES AND WORK.
28. THE CONTRACTOR AND THE OWNER MUST INSTALL ALL ELEMENTS AND COMPONENTS IN STRICT COMPLIANCE WITH AND IN ACCORDANCE WITH MANUFACTURER'S STANDARDS AND RECOMMENDED INSTALLATION CRITERIA AND SPECIFICATIONS. IF THE CONTRACTOR AND/OR OWNER FAIL TO DO SO, THEY AGREE TO JOINTLY, INDEPENDENTLY, SEPARATELY, COLLECTIVELY, AND SEVERALLY INDEMNIFY, DEFEND, PROTECT AND HOLD PROFESSIONAL OF RECORD AND BOHLER PARTIES HARMLESS FOR ALL INJURIES AND DAMAGES THAT PROFESSIONAL OF RECORD SUFFERS AND COSTS THAT PROFESSIONAL OF RECORD INCURS AS A RESULT OF SAID FAILURE.
29. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN AN ON-SITE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IN COMPLIANCE WITH THE ENVIRONMENTAL PROTECTION AGENCY (EPA) REQUIREMENTS OR LOCAL GOVERNING AGENCY FOR SITES WHERE ONE (1) ACRE OR MORE IS DISTURBED BY CONSTRUCTION ACTIVITIES (UNLESS THE LOCAL JURISDICTION REQUIRES A DIFFERENT THRESHOLD). THE CONTRACTOR MUST ENSURE THAT ALL ACTIVITIES, INCLUDING THOSE OF ALL SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE SWPPP, INCLUDING BUT NOT LIMITED TO LOGGING ACTIVITIES (MINIMUM ONCE PER WEEK AND AFTER RAINFALL EVENTS) AND CORRECTIVE MEASURES, AS APPROPRIATE AND FURTHER, THE CONTRACTOR IS SOLELY AND COMPLETELY RESPONSIBLE FOR FAILING TO DO SO.
30. AS CONTAINED IN THESE DRAWINGS AND ASSOCIATED DOCUMENTS PREPARED BY THE PROFESSIONAL OF RECORD AND BOHLER, THE USE OF THE WORDS 'CERTIFY' OR 'CERTIFICATION CONSTITUTE(S) AN EXPRESSION ONLY OF PROFESSIONAL OPINION REGARDING THE INFORMATION WHICH IS THE SUBJECT OF THE PROFESSIONAL OF RECORD'S AND BOHLER KNOWLEDGE OR BELIEF AND IN ACCORDANCE WITH COMMON AND ACCEPTED PROCEDURE CONSISTENT WITH THE APPLICABLE STANDARDS OF PRACTICE, AND DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE OF ANY NATURE OR TYPE, EITHER EXPRESSED OR IMPLIED, UNDER ANY CIRCUMSTANCES.

DEMOLITION NOTES

(Rev. 1/2023)

1. THE GENERAL NOTES MUST BE INCLUDED AS PART OF THIS ENTIRE DOCUMENT PACKAGE AND ARE PART OF THE CONTRACT DOCUMENTS. THE GENERAL NOTES ARE REFERENCED HEREIN, AND THE CONTRACTOR MUST REFER TO THEM AND FULLY COMPLY WITH THESE NOTES. IN THEIR ENTIRETY. THE CONTRACTOR MUST BE FAMILIAR WITH AND ACKNOWLEDGE FAMILIARITY WITH ALL OF THE GENERAL NOTES AND ALL OF THE PLANS' SPECIFIC NOTES.
2. THE CONTRACTOR MUST CONDUCT DEMOLITION/REMOVALS ACTIVITIES IN SUCH A MANNER AS TO ENSURE MINIMUM INTERFERENCE WITH ROADS, STREETS, SIDEWALKS, WALKWAYS, AND ALL OTHER ADJACENT FACILITIES. THE CONTRACTOR MUST OBTAIN ALL APPLICABLE PERMITS FROM THE APPROPRIATE GOVERNMENTAL AUTHORITY(IES) PRIOR TO THE COMMENCEMENT OF DEMOLITION OR REMOVAL OPERATIONS AND MUST BE IN POSSESSION OF SAME
3. WHEN DEMOLITION-RELATED ACTIVITIES IMPACT ROADWAYS AND/OR ROADWAY RIGHT-OF-WAY, THE CONTRACTOR MUST PROVIDE TRAFFIC CONTROL AND GENERALLY ACCEPTED SAFE PRACTICES IN CONFORMANCE WITH THE CURRENT FEDERAL HIGHWAY ADMINISTRATION "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD), AND THE FEDERAL, STATE, AND LOCAL REGULATIONS.
4. THE DEMOLITION (AND/OR REMOVALS) PLAN IS INTENDED TO PROVIDE GENERAL INFORMATION AND TO IDENTIFY ONLY CONDITIONS REGARDING ITEMS TO BE DEMOLISHED, REMOVED, AND/OR TO REMAIN.
5. THE CONTRACTOR MUST REVIEW ALL DEMOLITION DOCUMENTS AND MUST ALSO INCLUDE WITHIN THE DEMOLITION ACTIVITIES ALL INCIDENTAL WORK NECESSARY FOR THE CONSTRUCTION OF THE NEW SITE IMPROVEMENTS.
6. THIS PLAN IS NOT INTENDED TO AND DOES NOT PROVIDE DIRECTION REGARDING THE MEANS, METHODS, SEQUENCING, TECHNIQUES AND PROCEDURES TO BE EMPLOYED TO ACCOMPLISH THE WORK. ALL MEANS, METHODS, SEQUENCING, TECHNIQUES AND PROCEDURES TO BE USED AND TO BE EMPLOYED TO ACCOMPLISH THE WORK SHALL COMPLY WITH ALL STATE, FEDERAL, LOCAL, AND JURISDICTIONAL REQUIREMENTS THE CONTRACTOR MUST COMPLY WITH ALL OSHA AND OTHER SAFETY REGULATIONS AND PROVISIONS NECESSARY TO ENSURE A SAFE WORK SITE FOR THE DURATION OF THE WORK.
7. THE CONTRACTOR MUST PROVIDE ALL "METHODS AND MEANS" NECESSARY TO PREVENT MOVEMENT, SETTLEMENT, OR COLLAPSE OF EXISTING STRUCTURES, AND UTILITIES TO REMAIN. THE CONTRACTOR MUST ENSURE THAT ALL WORK BY THE CONTRACTOR, AT THE CONTRACTOR'S SOLE COST, MUST REPAIR ALL DAMAGE TO ALL ITEMS AND FEATURES THAT ARE TO REMAIN. CONTRACTOR MUST USE NEW MATERIALS FOR ALL REPAIRS. CONTRACTOR MUST ENSURE THAT THE RESTORATION OF ALL ITEMS AND FEATURES REPAIRED TO THEIR PRE-DEMOLITION CONDITION, OR BETTER. CONTRACTOR MUST PERFORM ALL REPAIRS AT THE CONTRACTOR'S SOLE COST.
8. THE PROFESSIONAL OF RECORD AND BOHLER ARE NOT RESPONSIBLE FOR JOB SITE SAFETY OR SUPERVISION. THE CONTRACTOR MUST BE SOLELY RESPONSIBLE WITH THE IMPLEMENTATION AND SAFE MANNER, IN ACCORDANCE WITH ALL OSHA REQUIREMENTS, TO ENSURE PUBLIC AND CONTRACTOR SAFETY AND SAFETY TO ALL PROPERTY ON THE SITE OR ADJACENT OR NEAR TO THE SAME.
9. THE CONTRACTOR IS RESPONSIBLE FOR JOB SITE SAFETY, WHICH MUST INCLUDE, BUT IS NOT LIMITED TO, THE INSTALLATION AND MAINTENANCE OF BARRIERS, FENCING, OTHER SAFEGUARDS AND/OR WARNING DEVICES AS REQUIRED AND NECESSARY TO PROTECT THE PUBLIC FROM AREAS OF CONSTRUCTION AND CONSTRUCTION ACTIVITIES. THE CONTRACTOR MUST SAFEGUARD THE SITE IN SUCH A MANNER AS TO PREVENT UNAUTHORIZED ACCESS TO THE SITE AND THE ENTRY OF ALL UNAUTHORIZED PERSONS AT ANY TIME, TO OR NEAR THE DEMOLITION AREA.
10. PRIOR TO THE COMMENCEMENT OF ANY SITE ACTIVITY AND ANY DEMOLITION ACTIVITY, THE CONTRACTOR MUST, IN WRITING, RAISE ANY QUESTIONS CONCERNING THE ACCURACY OR INTENT OF THESE PLANS AND/OR SPECIFICATIONS, ALL CONCERNS OR QUESTIONS REGARDING ALL CONTRACTOR'S RESPONSIBILITIES UNDER THE APPLICABLE SAFETY STANDARDS, AND COORDINATION AMONG PARTIES IN PERFORMING THE WORK ON THIS PROJECT. ANY SUCH CONCERNS MUST BE CONVEYED TO THE PROFESSIONAL OF RECORD AND BOHLER, IN WRITING AND MUST ADDRESS ALL ISSUES AND ITEMS RESPONDED TO, BY THE PROFESSIONAL OF RECORD AND BY BOHLER, IN WRITING. ALL DEMOLITION ACTIVITIES MUST BE PERFORMED IN ACCORDANCE WITH ALL REQUIREMENTS OF THESE PLANS AND SPECIFICATIONS AND ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS, RULES, REQUIREMENTS, STATUTES, ORDINANCES AND CODES.
11. THE CONTRACTOR MUST BECOME FAMILIAR WITH THE APPLICABLE UTILITY SERVICE PROVIDER REQUIREMENTS AND IS RESPONSIBLE FOR ALL COORDINATION REGARDING UTILITY DEMOLITION AND/OR REMOVAL ACTIVITIES AND SHALL BE THE CONTRACTOR'S POINT OF CONTACT FOR THE PROJECT. THE CONTRACTOR MUST PROVIDE THE OWNER WITH WRITTEN NOTIFICATION THAT THE EXISTING UTILITIES SERVICES HAVE BEEN PROPERLY AND TERMINATED, REMOVED AND/OR ABANDONED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE COMPANY REQUIREMENTS AND ALL OTHER APPLICABLE REQUIREMENTS, RULES, STATUTES, LAWS, ORDINANCES AND CODES.
12. PRIOR TO COMMENCING ANY DEMOLITION, THE CONTRACTOR MUST:
    A. OBTAIN ALL REQUIRED PERMITS AND MAINTAIN THE SAME ON SITE FOR REVIEW BY THE PROFESSIONAL OF RECORD AND ALL PUBLIC AGENCIES WITH JURISDICTION THROUGHOUT THE DURATION OF THE PROJECT, INTO COMPLETION OF THE WORK.
    B. NOTIFY, AT A MINIMUM, THE MUNICIPAL ENGINEER, DESIGN ENGINEER, AND LOCAL SOIL CONSERVATION JURISDICTION, AT LEAST 72 BUSINESS HOURS PRIOR TO THE COMMENCEMENT OF WORK.
    C. INSTALL SOIL EROSION AND SEDIMENT CONTROL MEASURES PRIOR TO SITE DISTURBANCE, AND MAINTAIN SAID CONTROLS UNTIL SITE IS STABILIZED.
    D. CONTACT STATE ONE. THE CONTRACTOR MUST CALL THE STATE ONE-CALL DAMAGE PROTECTION SYSTEM FOR UTILITY MARK OUT, IN ADVANCE OF ANY EXCAVATION.
    E. LOCATE AND PROTECT ALL UTILITIES AND SERVICES, INCLUDING BUT NOT LIMITED TO GAS, WATER, ELECTRIC, SANITARY AND STORM SEWER, TELEPHONE, CABLE, FIBER OPTIC CABLE, ETC. WITHIN AND ADJACENT TO THE LIMITS OF PROJECT ACTIVITIES. THE CONTRACTOR MUST NOTIFY ALL UTILITY COMPANIES AND PARTIES, PRIOR TO THE START OF WORK, TO OBTAIN AN APPROPRIATE UTILITY NOTIFICATION SYSTEM TO LOCATE ALL UNDERGROUND UTILITIES.
    F. PROTECT AND MAINTAIN IN OPERATION ALL ACTIVITIES AND SYSTEMS THAT ARE NOT BEING REMOVED DURING ANY DEMOLITION ACTIVITIES.
    G. ARRANGE FOR AND COORDINATE WITH THE APPLICABLE UTILITY SERVICE PROVIDER(S) FOR THE TEMPORARY OR PERMANENT TER

NAD83

PARKING REQUIREMENTS

ITEM	CODE	PERMITTED	EXISTING	PROPOSED
MIN PARKING STALL SIZE	§ 5.1.3 (f)	9 X 18.5 FT	9 X 18.5 FT	9 X 18.5 FT
MIN COMPACT PARKING STALL SIZE	§ 5.1.3 (e)	8 X 16 FT	N/A	8 X 16 FT
MIN PARALLEL PARKING STALL SIZE	§ 5.1.3 (f)	9 X 22 FT	N/A	N/A
MIN AISLE WIDTH (90 DEG STALLS)	§ 5.1.3 (i)	24 FT	24 FT ±	24 FT
MIN AISLE WIDTH (PARALLEL STALLS)	§ 5.1.3 (i)	12 FT	N/A	N/A
MIN SIDE YARD PARKING SETBACK	§ 5.1.3 (j)	4 FT	8 FT ±	6 FT ±
MIN FRONT YARD PARKING SETBACK	§ 5.1.3 (j)	10 FT	13 FT ±	10 FT
PARKING COUNT	§ 5.1.4	189	115	186 (W)
MAX COMPACT PARKING STALLS	§ 5.1.3 (i)	50% OF TOTAL	N/A	93 SPACES (50%)
BICYCLE SPACES	§ 3.17.6 (f)	189	N/A	189

KEY
(V) VARIANCE
(W) WAIVER

MULTI-FAMILY RESIDENTIAL
REQUIRED CAR SPACES= 1 SPACES PER DWELLING UNIT
189 UNITS * 1 = 189 SPACES

REQUIRED BICYCLE SPACES: 1 BICYCLE SPACE PER DWELLING UNIT
189 DWELLING UNITS = 198 BICYCLE SPACES REQUIRED

PARKING LEGEND

QUANTITY	SYMBOL	TYPE	SIZE
87	XX	PARKING SPACES	9' X 18.5'
6	XX	ACCESSIBLE PARKING SPACES	8' X 18.5'
50	XX	SEMI-COMPACT PARKING SPACES	8' X 18.5'
43	XX	COMPACT PARKING SPACES	8' X 16'

ZONING TABLE

ZONE: ASB-MF - AVERY SQUARE BUSINESS OVERLAY
USE: AFFORDABLE HOUSING

APPLICANT/ OWNER INFORMATION

APPLICANT:	GREYSTAR DEVELOPMENT EAST, LLC ONE FEDERAL STREET SUITE 1804 BOSTON, MA 02110
PROPERTY OWNER:	HCRI MASSACHUSETTS PROPERTIES TRUST II 4500 DORR ST TOLEDO, OH 43615

BULK REQUIREMENTS

ITEM	CODE	PERMITTED	EXISTING	PROPOSED
MIN LOT AREA	§ 3.17.5.1	10,000 SF	187,219 SF ±	NO CHANGE
MIN LOT FRONTAGE	§ 3.17.5.1	80 FT	1,000 FT ±	NO CHANGE
MIN FRONT YARD SETBACK	§ 3.17.5.1	10 FT	9.1 FT (E)	10.9 FT
MAX FRONT YARD SETBACK	§ 3.17.5.1	15 FT[A]	67 FT (E)	70.7% AT <15 FT
MIN SIDE YARD SETBACK	§ 3.17.5.1	10 FT[B,C]	0 FT (E)	11.2 FT
MIN REAR YARD SETBACK	§ 3.17.5.1	20 FT[B,C]	N/A	70.2
MAX PERMITTED HEIGHT (STORIES)	§ 3.17.5.2	3[D]	3	3
MAX PERMITTED HEIGHT (FEET)[E,F]	§ 3.17.5.2	40[D]	30.8 FT	<40 FT
FLOOR AREA RATIO (FAR)	§ 3.17.5.3	1.5[D,H]	0.34	1.09
MAX BUILDING COVERAGE (%)	§ 3.17.5.3	N/A	N/A	N/A
MAX DWELLING UNITS PER ACRE[I]	§ 3.17.5.3	44[I]	N/A	43.97 DWELLING UNITS PER ACRE
KEY = (E) EXISTING NONCONFORMITY				

[A]SEVENTY PERCENT (70%) OF THE MAIN DATUM LINE OF THE FRONT FACADE OF THE BUILDING SHALL BE SET BACK NO MORE THAN 15 FEET, EXCEPT THAT PERIODIC FRONT SETBACKS GREATER THAN FIFTEEN (15) FEET ARE ALLOWED IF ACTIVATED BY COURTYARDS, LANDSCAPING, DRIVE AISLES, AMENITY AREAS, OR OTHER SIMILAR SITE DESIGN FEATURES THAT ENHANCE THE STREETSCAPE. IN THE ASB-MF SUBDISTRICT, THE APPLICANT MAY APPLY FOR A SPECIAL PERMIT FROM THE PLANNING BOARD IF LESS THAN SEVENTY PERCENT (70%) OF THE MAIN DATUM LINE FRONT FACADE OF THE BUILDING IS SET BACK 15 FEET.

[B]THE REQUIREMENT OF AN ADDITIONAL 50-FOOT SIDE OR REAR SETBACK FROM A RESIDENTIAL DISTRICT AS DESCRIBED IN SUBSECTION 4.4.8 SIDE AND REAR SETBACKS ADJOINING RESIDENTIAL DISTRICTS OR SUBSECTION 4.6.5 SIDE AND REAR SETBACKS ADJOINING RESIDENTIAL DISTRICTS SHALL NOT APPLY.

[C]THE REAR AND SIDE SETBACKS ARE 20 FEET ALONG THE MBTA RIGHT-OF-WAY. WITH RESPECT TO ANY LOT PARTIALLY WITHIN AN UNDERLYING RESIDENTIAL DISTRICT, (I) NO BUILDING OR STRUCTURE FOR A MULTI-FAMILY RESIDENTIAL USE SHALL BE PLACED OR CONSTRUCTED WITHIN 110 FEET OF THE LOT LINE OF AN ABUTTING LOT CONTAINING AN EXISTING SINGLE FAMILY RESIDENTIAL STRUCTURE AND (II) EXCEPT FOR ACCESS DRIVEWAYS AND SIDEWALKS, WHICH ARE PERMITTED, ANY PORTION OF THE LOT WITHIN SAID RESIDENTIAL DISTRICT SHALL BE KEPT OPEN WITH LANDSCAPED AREAS, HARDSCAPED AREAS, OUTDOOR RECREATION AREAS (E.G., SWIMMING POOL) AND/OR SIMILAR OPEN AREAS.

[D]IN THE ASB-MF SUBDISTRICT, THE APPLICANT MAY APPLY FOR A SPECIAL PERMIT FROM THE PLANNING BOARD FOR A HEIGHT OF FOUR STORIES AND 50 FEET, PROVIDED THAT THE FOURTH STORY ALONG HIGHLAND AVENUE AND WEST STREET INCORPORATES ONE OR MORE OF THE FOLLOWING DESIGN ELEMENTS: (I) A PITCHED ROOF HAVING A MAXIMUM ROOF PITCH OF 45 DEGREES; (II) A FOURTH STORY RECESSED FROM THE FACE OF THE BUILDING BY A MINIMUM OF 12 FEET; AND/OR (III) SUCH OTHER ARCHITECTURAL DESIGN ELEMENTS PROPOSED BY THE APPLICANT AND APPROVED BY THE PLANNING BOARD DURING THE SPECIAL PERMIT PROCESS.

[E]EXCEPTIONS. THE LIMITATION ON HEIGHT OF BUILDINGS SHALL NOT APPLY TO CHIMNEYS, VENTILATORS, TOWERS, SILOS, SPIRES, STAIR OVERRUNS, ELEVATOR OVERRUNS, MECHANICAL EQUIPMENT, ROOF PARAPETS, ARCHITECTURAL SCREENING, OR OTHER ORNAMENTAL FEATURES OF BUILDINGS, WHICH FEATURES (I) ARE IN NO WAY USED FOR LIVING PURPOSES; (II) DO NOT OCCUPY MORE THAN 25% OF THE GROSS FLOOR AREA OF THE BUILDING AND (III) DO NOT PROJECT MORE THAN 15 FEET ABOVE THE MAXIMUM ALLOWABLE HEIGHT.

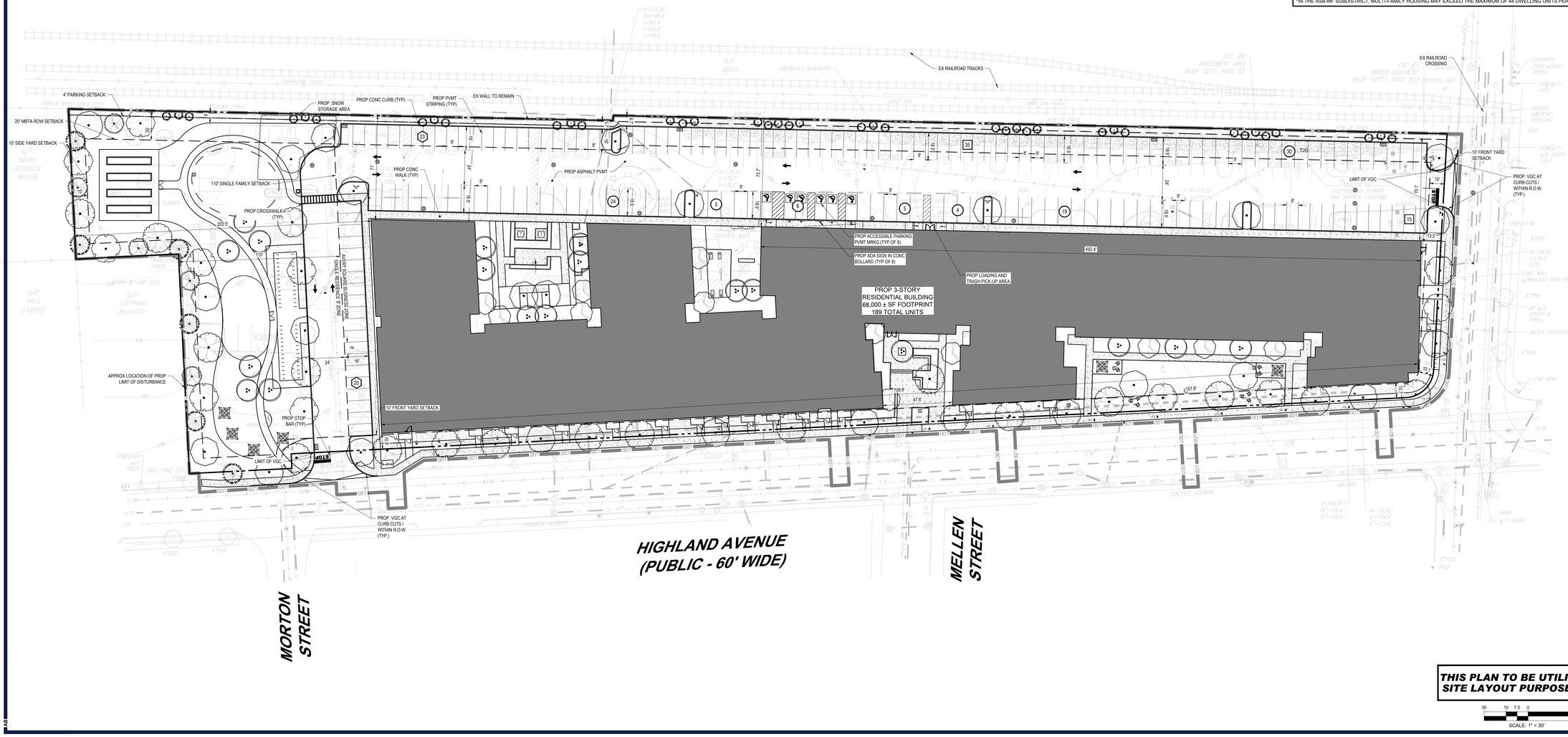
[F]EXCEPTIONS: RENEWABLE ENERGY INSTALLATIONS. THE SITE PLAN REVIEW AUTHORITY MAY WAIVE THE HEIGHT AND SETBACKS IN SUBSECTION 3.17.5.2 BUILDING HEIGHT REQUIREMENTS AND SUBSECTION 3.17.5.1 LOT AREA, FRONTAGE AND SETBACK REQUIREMENTS TO ACCOMMODATE THE INSTALLATION OF SOLAR PHOTOVOLTAIC, SOLAR THERMAL, LIVING, AND OTHER ECO-ROOFS, ENERGY STORAGE, AND AIR-SOURCE HEAT PUMP EQUIPMENT. SUCH INSTALLATIONS SHALL BE APPROPRIATELY SCREENED, CONSISTENT WITH THE REQUIREMENTS OF THE UNDERLYING DISTRICT, SHALL NOT CREATE A SIGNIFICANT DETRIMENT TO ABUTTERS IN TERMS OF NOISE OR SHADOW; AND MUST BE APPROPRIATELY INTEGRATED INTO THE ARCHITECTURE OF THE BUILDING AND THE LAYOUT OF THE SITE.
THE INSTALLATIONS SHALL NOT PROVIDE ADDITIONAL HABITABLE SPACE WITHIN THE DEVELOPMENT.

[G]PARKING AREAS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH SUBSECTION 5.1.3 PARKING PLAN AND DESIGN REQUIREMENTS. THE REMAINING PROVISIONS OF SECTION 5.1 OFF STREET PARKING REGULATIONS SHALL NOT APPLY TO PROJECTS WITHIN THE MULTI-FAMILY OVERLAY DISTRICT.

[H]IN THE ASB-MF SUBDISTRICT, THE FAÇADE(S) OF ALL PARKING GARAGES, STRUCTURED PARKING AND DECK/ROOFTOP PARKING VISIBLE FROM HIGHLAND AVENUE SHALL BE DESIGNED TO BE GENERALLY INDISTINGUISHABLE FROM THE FAÇADE(S) OF THE RESIDENTIAL PORTION OF THE BUILDING(S), AND SHALL ALLOW NO VIEW OF PARKED VEHICLES FROM HIGHLAND AVENUE EXCEPT WHERE SUCH VIEW IS INTERMITTENT AND INCIDENTAL TO THE OPERATION OF THE PARKING AREA, SUCH AS A VIEW AFFORDED BY THE OPENING OF AN AUTOMATED GARAGE DOOR.

[I]THE TOTAL LAND AREA USED IN CALCULATING DENSITY SHALL BE THE TOTAL ACREAGE OF THE LOT ON WHICH THE DEVELOPMENT IS LOCATED.

[J]IN THE ASB-MF SUBDISTRICT, MULTI-FAMILY HOUSING MAY EXCEED THE MAXIMUM OF 44 DWELLING UNITS PER ACRE BY SPECIAL PERMIT.



THIS PLAN TO BE UTILIZED FOR SITE LAYOUT PURPOSES ONLY

30 15 7.5 0 30
SCALE: 1" = 30'

P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-SITE-MAB250036.00.DWG — LAYOUT: C-301 SITE

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
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PROGRAM MANAGEMENT
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PERMITTING SERVICES
TRANSPORTATION SERVICES

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PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-SITE

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT
PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
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Z.L. RICHARDS
ZACHARY L. RICHARDS
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE NO. 49548

SHEET TITLE:

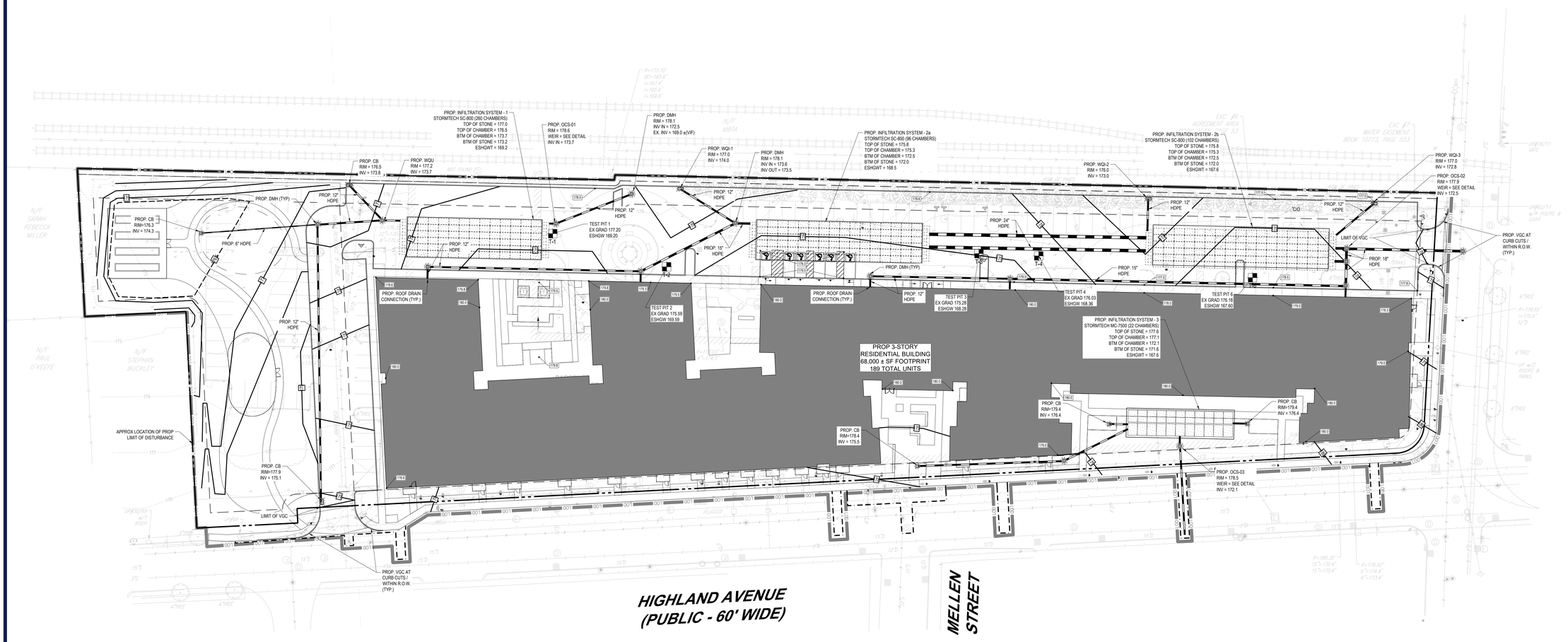
SITE PLAN

SHEET NUMBER:

C-301

ORG. DATE - 08/12/2025

NAD83



THIS PLAN TO BE UTILIZED FOR GRADING AND DRAINAGE PURPOSES ONLY

30 15 7.5 0 30

SCALE: 1" = 30'

Aug 26, 2025
P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-SITE-MAB250036.00-GD-----LAYOUT- C-401 GRDR
WDS

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PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-SITE

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

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45 FRANKLIN STREET, 5th FLOOR
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Z.L. RICHARDS
ZACHARY L. RICHARDS
PROFESSIONAL ENGINEER
No. 61948
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

SHEET TITLE:

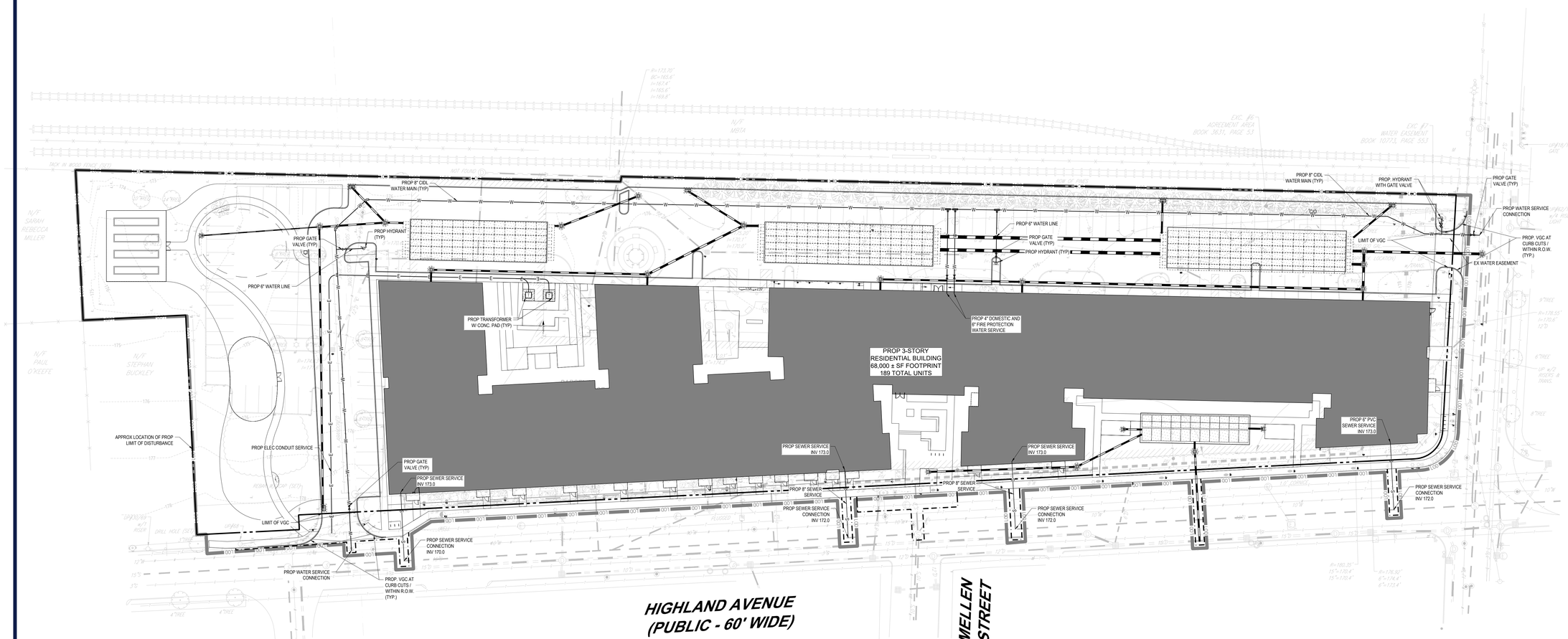
GRADING AND DRAINAGE PLAN

SHEET NUMBER:

C-401

ORG. DATE - 08/12/2025

NAD83



THIS PLAN TO BE UTILIZED FOR UTILITY PURPOSES ONLY

30 15 7.5 0 30

SCALE: 1" = 30'

P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-SITE-MAB250036.00-00-------LAYOUT C-501 UTIL

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
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DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMBJE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-SITE

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
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Z.L. RICHARDS
PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

SHEET TITLE:

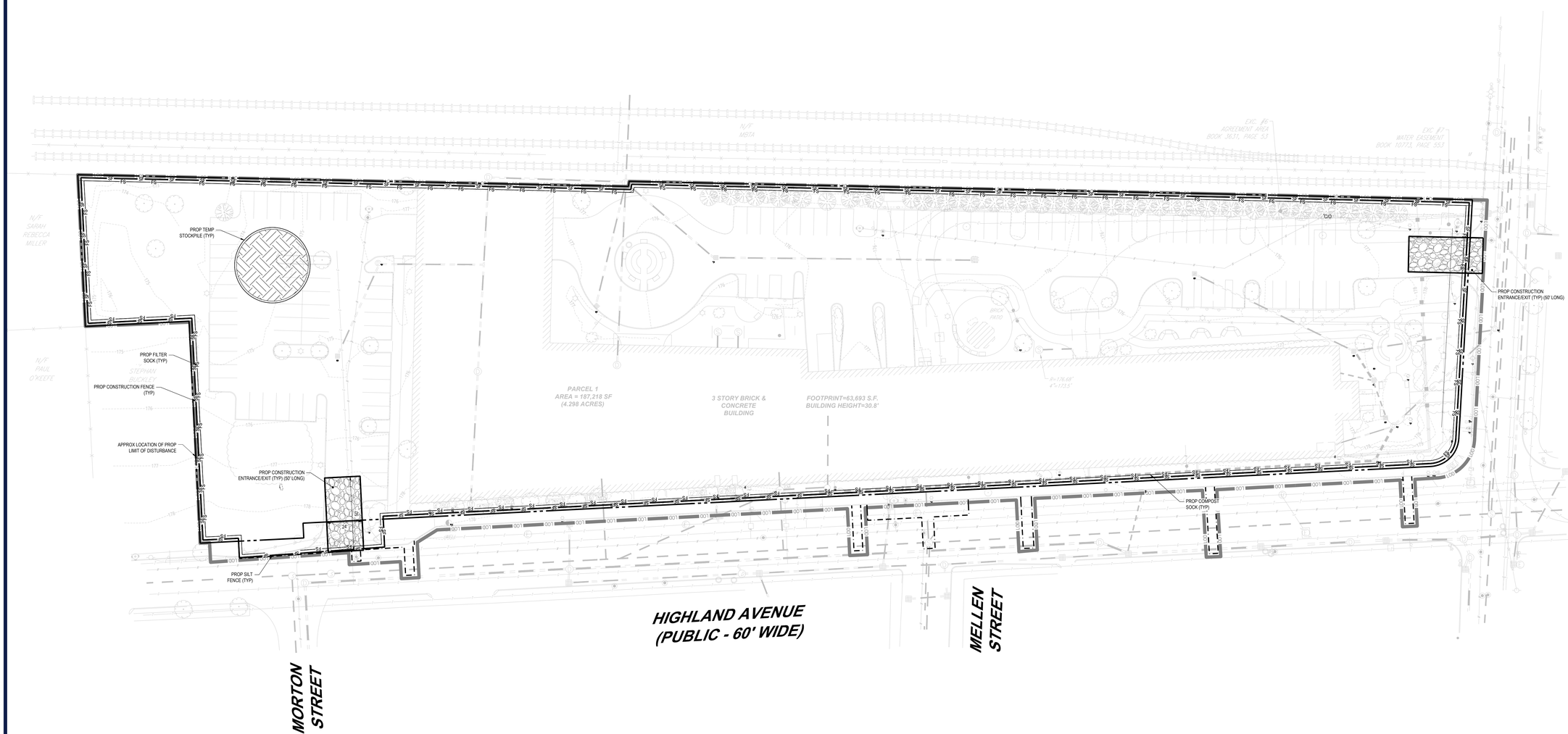
UTILITY PLAN

SHEET NUMBER:

C-501

ORG. DATE - 08/12/2025

NAD83



THIS PLAN TO BE UTILIZED FOR SITE SOIL AND EROSION CONTROL PURPOSES ONLY

REFER TO SOIL EROSION CONTROL NOTES & DETAIL SHEET FOR EROSION NOTES AND DETAILS

30 15 7.5 0 30
SCALE: 1" = 30'

P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-SITE-MAB250036.00.DWG —— LAYOUT: C-801 EROS

BOHLER

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PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-SITE

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
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ZACHARY L. RICHARDS
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PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE NO. 54648

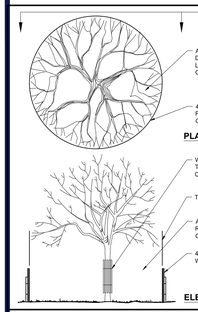
SHEET TITLE:

EROSION & SEDIMENT CONTROL PLAN

SHEET NUMBER:

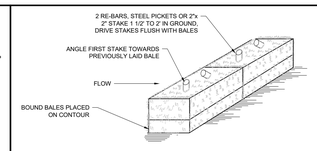
C-801

ORG. DATE - 08/12/2025



TREE PROTECTION DURING SITE CONSTRUCTION

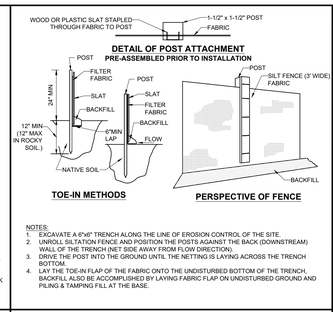
NOT TO SCALE (NE-0030201 - 09/2023)



NOTES:
1. BALES SHALL BE PLACED AT THE TOP OF A SLOPE OR ON THE CONTOUR AND IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. EACH BALE SHALL BE PLACED SO THE BINDINGS ARE HORIZONTAL.
3. BALES SHALL BE SECURELY ANCHORED IN PLACE BY EITHER TWO STAKES OR RE-BARS DRIVEN THROUGH THE BALE. THE FIRST STAKE IN EACH BALE SHALL BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE AT AN ANGLE TO FORCE THE BALES TOGETHER. STAKES SHALL BE DRIVEN FLUSH WITH THE BALE.
4. INSPECTION SHALL BE FREQUENT AND REPAIR REPLACEMENT SHALL BE PROMPTLY AS NEEDED.
5. DRAINAGE AREA NO MORE THAN ¼ AC. PER 100 FEEL OF STRAW BALE DIKE FOR SLOPES LESS THAN 25%.
6. BALES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.

STRAW BALE BARRIER

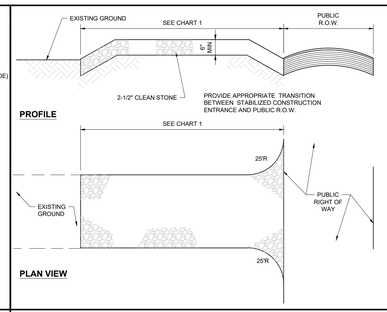
NOT TO SCALE (NE-0030302 - 09/2023)



NOTES:
1. EXCAVATE A 6"x6" TRENCH ALONG THE LINE OF EROSION CONTROL OF THE SITE.
2. UNROLL SILTATION FENCE AND POSITION THE POSTS AGAINST THE BACK (DOWNSTREAM) WALL OF THE TRENCH (NET SIDE AWAY FROM FLOW DIRECTION).
3. DRIVE THE POST INTO THE GROUND UNTIL THE NETTING IS LAYING ACROSS THE TRENCH BOTTOM.
4. LAY THE TOE-IN FLAP OF THE FABRIC ONTO THE UNDISTURBED BOTTOM OF THE TRENCH. BACKFILL ALSO BE ACCOMPLISHED BY LAYING FABRIC FLAP ON UNDISTURBED GROUND AND PILING & TAMPING FILL AT THE BASE.

SILT FENCE

NOT TO SCALE (NE-0040101 - 09/2023)



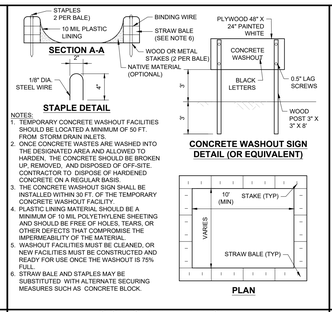
PERCENT SLOPE OF ROADWAY	LENGTH OF STONE REQUIRED	
	COARSE GRAINED SOILS	FINE GRAINED SOILS
0 TO 2%	50 FT	100 FT
2% TO 5%	100 FT	200FT
>5%	ENTIRE ENTRANCE STABILIZED WITH FABC BASE COURSE (1)	

(1) AS PRESCRIBED BY LOCAL ORDINANCE OR OTHER GOVERNING AUTHORITY.

CHART 1

STABILIZED CONSTRUCTION ENTRANCE

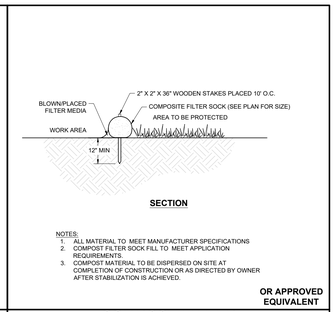
NOT TO SCALE (NE-0020101 - 09/2023)



NOTES:
1. TEMPORARY CONCRETE WASHOUT FACILITIES SHOULD BE LOCATED A MINIMUM OF 50 FT. FROM STORM DRAIN INLETS.
2. ONCE CONCRETE WASTES ARE WASHED INTO THE DESIGNATED AREA AND ALLOWED TO HARDEN, THE CONCRETE SHOULD BE BROKEN UP, REMOVED, AND DISPOSED OF OFF-SITE. CONTRACTOR TO DISPOSE OF HARDENED CONCRETE ON A REGULAR BASIS.
3. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
4. PLASTIC LINING MATERIAL SHOULD BE A MINIMUM OF 10 MIL POLYETHYLENE SHEETING AND SHOULD BE FREE OF HOLES, TEARS, OR OTHER DEFECTS THAT COMPROMISE THE IMPERMEABILITY OF THE MATERIAL.
5. WASHOUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES MUST BE CONSTRUCTED AND READY FOR USE ONCE THE WASHOUT IS 75% FULL.
6. STRAW BALE AND STAPLES MAY BE SUBSTITUTED WITH ALTERNATE SECURING MEASURES SUCH AS CONCRETE BLOCK.

CONCRETE WASTE MANAGEMENT AREA

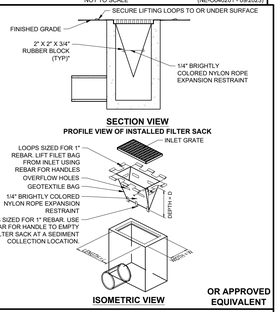
NOT TO SCALE (NE-0020201 - 09/2023)



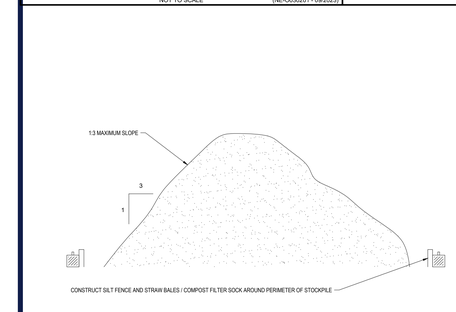
OR APPROVED EQUIVALENT

COMPOST FILTER SOCK

NOT TO SCALE (NE-0040201 - 09/2023)

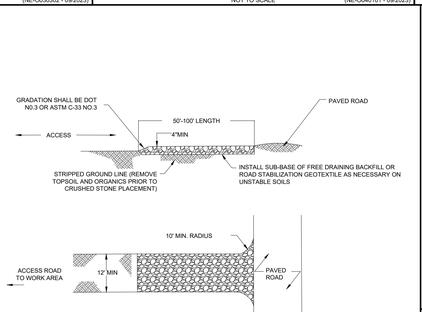


OR APPROVED EQUIVALENT



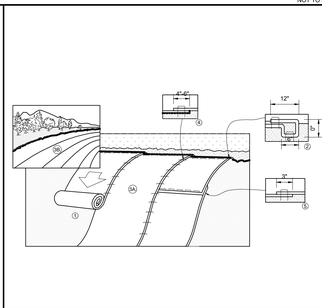
TEMPORARY STOCKPILE

N.T.S.



STABILIZED CONSTRUCTION EXIT

N.T.S.



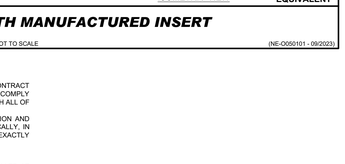
LOW TO MODERATE FLOW GEOTEXTILE FABRIC SPECIFICATION TABLE		
PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	300 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20%
PUNCTURE	ASTM D-4833	120 LBS
MULLEN BURST	ASTM D-3786	600 PSI
TRAPEZOID TEAR	ASTM D-4533	120 LBS
UV RESISTANCE	ASTM D-4355	80%
APPARENT OPENING SIZE	ASTM D-4751	40 US SIEVE
FLOW RATE	ASTM D-4491	40 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	0.55 SEC -1

MODERATE TO HIGH FLOW GEOTEXTILE FABRIC SPECIFICATION TABLE		
PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	265 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	135 LBS
MULLEN BURST	ASTM D-3786	420 PSI
TRAPEZOID TEAR	ASTM D-4533	45 LBS
UV RESISTANCE	ASTM D-4355	90 %
APPARENT OPENING SIZE	ASTM D-4751	20 US SIEVE
FLOW RATE	ASTM D-4491	200 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	1.5 SEC -1

NOTES:
1. REMOVE TRAPPED SEDIMENT WHEN BRIGHTLY COLORED EXPANSION RESTRAINT CAN NO LONGER BE SEEN.
2. GEOTEXTILE SHALL BE A WOVEN POLYPROPYLENE FABRIC THAT MEETS OR EXCEEDS REQUIREMENTS IN THE SPECIFICATIONS TABLE.
3. PLACE AN OIL ADSORBENT PAD OR PILLOW OVER INLET GRATE WHEN OIL SPILLS ARE A CONCERN.
4. INSPECT PER REGULATORY REQUIREMENTS.
5. THE WIDTH, "W", OF THE FILTER SACK SHALL MATCH THE INSIDE WIDTH OF THE GRATED INLET BOX.
6. THE DEPTH, "D", OF THE FILTER SACK SHALL BE BETWEEN 18 INCHES AND 36 INCHES.
7. THE LENGTH, "L", OF THE FILTER SACK SHALL MATCH THE INSIDE LENGTH OF THE GRATED INLET BOX.

EROSION CONTROL BLANKET STEEP SLOPE PROTECTION

NOT TO SCALE (NE-0049901 - 09/2023)



LOW TO MODERATE FLOW GEOTEXTILE FABRIC SPECIFICATION TABLE		
PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	300 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	120 LBS
MULLEN BURST	ASTM D-3786	600 PSI
TRAPEZOID TEAR	ASTM D-4533	120 LBS
UV RESISTANCE	ASTM D-4355	80 %
APPARENT OPENING SIZE	ASTM D-4751	40 US SIEVE
FLOW RATE	ASTM D-4491	40 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	0.55 SEC -1

MODERATE TO HIGH FLOW GEOTEXTILE FABRIC SPECIFICATION TABLE		
PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	265 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20%
PUNCTURE	ASTM D-4833	135 LBS
MULLEN BURST	ASTM D-3786	420 PSI
TRAPEZOID TEAR	ASTM D-4533	45 LBS
UV RESISTANCE	ASTM D-4355	90%
APPARENT OPENING SIZE	ASTM D-4751	20 US SIEVE
FLOW RATE	ASTM D-4491	200 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	1.5 SEC

NOTES:
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3. PLACE AN OIL ADSORBENT PAD OR PILLOW OVER INLET GRATE WHEN OIL SPILLS ARE A CONCERN.
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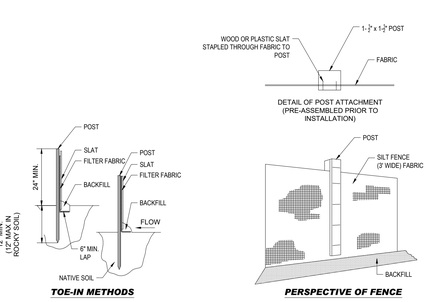
7. THE LENGTH, "L", OF THE FILTER SACK SHALL MATCH THE INSIDE LENGTH OF THE GRATED INLET BOX.

INLET PROTECTION WITH MANUFACTURED INSERT

NOT TO SCALE (NE-0050101 - 09/2023)

TYP. SILTATION FENCE DETAIL

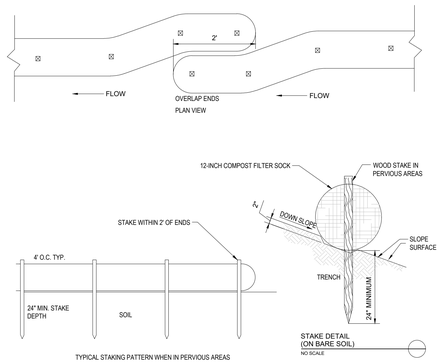
N.T.S.



INSTALLATION:
1. EXCAVATE A 6"x 6" TRENCH ALONG THE LINE OF EROSION CONTROL OF THE SITE.
2. UNROLL SILTATION FENCE AND POSITION THE POSTS AGAINST THE BACK (DOWNSTREAM) WALL OF THE TRENCH (NET SIDE AWAY FROM FLOW DIRECTION).
3. DRIVE THE POST INTO THE GROUND UNTIL THE NETTING IS LAYING ACROSS THE TRENCH BOTTOM.
4. LAY THE TOE-IN FLAP OF THE FABRIC ONTO THE UNDISTURBED BOTTOM OF THE TRENCH, BACKFILL THE TRENCH AND TAMP THE SOIL. TOE-IN CAN ALSO BE ACCOMPLISHED BY LAYING FABRIC FLAP ON UNDISTURBED GROUND AND PILING & TAMP- ING FILL AT THE BASE.

FILTER SACKS (GRATED INLETS)

N.T.S.



COMPOST FILTER TUBE

N.T.S.

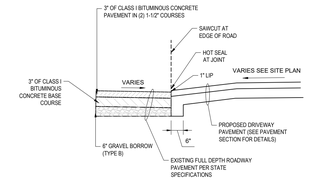
MASSACHUSETTS EROSION AND SEDIMENT CONTROL NOTES

1. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE DONE AS SET FORTH IN THE MOST CURRENT STATE SEDIMENT AND EROSION CONTROL MANUAL.
2. THOSE AREAS UNDERGOING ACTUAL CONSTRUCTION WILL BE LEFT IN AN UNTREATED OR UNVEGETATED CONDITION FOR A MINIMUM TIME. AREAS SHALL BE PERMANENTLY STABILIZED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS. AT A MINIMUM, AREAS SHALL BE PERMANENTLY STABILIZED ACCORDING TO THE CURRENT EDITION OF THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP), OR IN THE ABSENCE OF A SWPPP, THEY SHALL BE PERMANENTLY STABILIZED WITHIN 14 DAYS OF FINAL GRADING AND TEMPORARILY STABILIZED WITHIN 30 DAYS OF INITIAL DISTURBANCE OF THE SOIL. IF THE DISTURBANCE IS WITHIN 100 FEET OF A STREAM OR POND, THE AREA SHALL BE STABILIZED WITHIN 7 DAYS OR PRIOR TO ANY STORM EVENT (THIS WOULD INCLUDE WETLANDS).
3. SEDIMENT BARRIERS (SILT FENCE, STRAW BARRIERS, ETC.) SHOULD BE INSTALLED PRIOR TO ANY SOIL DISTURBANCE OF THE CONTRIBUTING DRAINAGE AREA ABOVE THEM. MULCH NETTING SHALL BE USED TO ANCHOR MULCH IN ALL AREAS WITH SLOPES GREATER THAN 8%.
4. INSTALL SILTATION BARRIER AT TOE OF SLOPE TO FILTER SILT FROM RUNOFF. SEE SILTATION BARRIER DETAILS FOR PROPER INSTALLATION. SILTATION BARRIER WILL REMAIN IN PLACE PER NOTE #5.
5. ALL EROSION CONTROL STRUCTURES WILL BE INSPECTED, REPLACED AND/OR REPAIRED EVERY 7 DAYS AND IMMEDIATELY FOLLOWING ANY SIGNIFICANT RAINFALL OR SNOW MELT OR WHEN NO LONGER SERVICEABLE DUE TO SEDIMENT ACCUMULATION OR DECOMPOSITION. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT. THEY MUST BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY ONE HALF THE HEIGHT OF THE BARRIER. SEDIMENT CONTROL DEVICES SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL AREAS UPSLOPE ARE PERMANENTLY STABILIZED. FOR SEDIMENT CONTROL DEVICES THAT ARE WITHIN AREAS SUBJECT TO CONSERVATION COMMISSION JURISDICTION, THE DEVICES SHALL REMAIN IN PLACE AND BE REMOVED IN ACCORDANCE WITH THE ORDER OF CONDITIONS.
6. NO SLOPES, EITHER PERMANENT OR TEMPORARY, SHALL BE STEEPER THAN TWO TO ONE (2:1) UNLESS OTHERWISE INDICATED ON THE PLANS. EROSION PROTECTION FOR SLOPES GREATER THAN 2:1 SHALL BE DESIGNED BY A GEOTECHNICAL ENGINEER.
7. IF FINAL SEEDING OF THE DISTURBED AREAS IS NOT COMPLETED 45 DAYS PRIOR TO THE FIRST KILLING FROST, USE TEMPORARY MULCH (DORMANT SEEDING MAY BE ATTEMPTED AS WELL) TO PROTECT THE SITE AND DELAY SEEDING UNTIL THE NEXT RECOMMENDED SEEDING PERIOD.
8. TEMPORARY SEEDING OF DISTURBED AREAS THAT HAVE NOT BEEN FINAL GRADED SHALL BE COMPLETED 45 DAYS PRIOR TO THE FIRST KILLING FROST TO PROTECT FROM SPRING RUNOFF PROBLEMS.
9. DURING THE CONSTRUCTION PHASE, INTERCEPTED SEDIMENT SHALL BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL STANDARDS.
10. REVEGETATION MEASURES WILL COMMENCE UPON COMPLETION OF CONSTRUCTION EXCEPT AS NOTED ABOVE. ALL DISTURBED AREAS NOT OTHERWISE STABILIZED WILL BE GRADED, SMOOTHED, AND PREPARED FOR FINAL SEEDING AS FOLLOWS:
   a) SIX INCHES, OR DEPTH SPECIFIED ON THE LANDSCAPE PLAN, OF LOAM WILL BE SPREAD OVER DISTURBED AREAS AND SMOOTHED TO A UNIFORM SURFACE.
   b) APPLY LIMESTONE AND FERTILIZER ACCORDING TO SOIL TEST. IF SOIL TESTING IS NOT FEASIBLE ON SMALL OR VARIABLE SITES, OR WHERE TIMING IS CRITICAL, FERTILIZER MAY BE APPLIED AT THE RATE OF 800 LB PER ACRE OR 18.4 LB PER 1,000 SF USING 10-20-20 OR EQUIVALENT. APPLY GROUND LIMESTONE (EQUIVALENT TO 50% CALCIUM PLUS MAGNESIUM OXIDE) AT A RATE OF 3 TONS PER ACRE (138 LB PER 1,000 SF).
   c) FOLLOWING SEED BED PREPARATION, DITCHES AND BACK SLOPES WILL BE SEEDED TO A MIXTURE OF 47% CREEPING RED FESCUE, 5% REDTOP, AND 48% TALL FESCUE. THE LAWN AREAS WILL BE SEEDED TO A PREMIUM TURF MIXTURE OF 44% KENTUCKY BLUE-GRASS, 44% CREEPING RED FESCUE, AND 12% PERENNIAL RYEGRASS. SEEDING RATE IS 1.03 LBS PER 1,000 SF LAWN. QUALITY SOD MAY BE SUBSTITUTED FOR SEED WHERE SLOPES DO NOT EXCEED 2:1, SOD ON SLOPES STEEPER THAN 3:1 SHOULD BE PEGGED.
   d) STRAW MULCH AT THE RATE OF 70-90 LBS PER 1,000 SF. A HYDRO-APPLICATION OF WOOD OR PAPER FIBER SHALL BE APPLIED FOLLOWING SEEDING. A SUITABLE NON-TOXIC BINDER WILL BE USED ON STRAW MULCH FOR WIND CONTROL.
11. ALL TEMPORARY EROSION CONTROL MEASURES SHALL BE REMOVED ONCE THE SITE IS 70% STABILIZED. FOR EROSION CONTROL MEASURES THAT ARE WITHIN AREAS SUBJECT TO CONSERVATION COMMISSION JURISDICTION, THE MEASURES SHALL REMAIN IN PLACE AND BE REMOVED IN ACCORDANCE WITH THE ORDER OF CONDITIONS.
12. WETLANDS WILL BE PROTECTED WITH BARRIERS CONSISTING OF STRAW BALES, COMPOST TUBES, SILT FENCE OR A COMBINATION THEREOF.
13. ALL AREAS WITHIN 100 FEET OF A FLAGGED WETLAND OR STREAM SHALL HAVE AN EXPOSURE WINDOW OF NOT MORE THAN 7 DAYS.
14. ALL AREAS WITHIN 100 FEET OF A FLAGGED WETLAND OR STREAM SHALL FOLLOW APPROPRIATE EROSION CONTROL MEASURES PRIOR TO EACH STORM IF NOT BEING ACTIVELY WORKED:

LOCATION	MULCH	MULCH RATE (1000 SF)
PROTECTED AREA	STRAW	100 POUNDS
WINDY AREA	SHREDDED OR CHOPPED CORNSTALKS STRAW (ANCHORED)*	185-275 POUNDS 100 POUNDS
MODERATE TO HIGH VELOCITY AREAS OR STEEP SLOPES GREATER THAN 3:1	JUTE MESH OR EXCELSIOR MAT	AS REQUIRED
GREATER THAN 3:1	(REFER TO GEOTECHNICAL REPORT FOR FINAL DESIGN REQUIREMENT)	

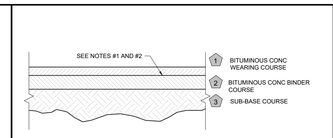
* A HYDRO-APPLICATION OF WOOD OR PAPER FIBER MAY BE APPLIED FOLLOWING SEEDING. A SUITABLE NON-TOXIC BINDER SHALL BE USED TO ADDITIONAL WIND CONTROL.
* MULCH ANCHORING: ANCHOR MULCH WITH PEG AND TWINE (1 SQ. YD/BLOCK); MULCH NETTING (AS PER MANUFACTURER); WOOD CELLULOSE FIBER (750 LBS/ACRE); CHEMICAL TACK (AS PER MANUFACTURER'S SPECIFICATIONS); USE OF A SERRATED STRAIGHT DISK. WETTING FOR SMALL AREAS AND ROAD DITCHES MAY BE PERMITTED.

15. PROPOSED LOCATIONS OF SURFACE STORMWATER MANAGEMENT BASINS CAN BE UTILIZED AS A TEMPORARY SEDIMENT TRAP DURING CONSTRUCTION.SEDIMENT TRAPS SHALL BE SIZED AND CONSTRUCTED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REQUIREMENTS.
   a) TEMPORARY SEDIMENT TRAPS SHALL BE SIZED PER THE CURRENT EDITION OF THE "MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS" AND PROVIDE A MINIMUM OF 1,800 CF PER ACRE OF TRIBUTARY AREA WITH A MAXIMUM TRIBUTARY AREA OF 5 ACRES, MAINTAIN A 2:1 LENGTH TO WIDTH RATIO, AND NOT EXCEED 5 FT IN HEIGHT. UPON SITE STABILIZATION, ACCUMULATED SEDIMENT SHALL BE REMOVED AND THE TEMPORARY SEDIMENT TRAP EXCAVATED TO 1 FOOT BELOW THE TRAP. THE AREA SHALL THEN BE SCARIFIED TO PREVENT COMPACTION AND PROMOTE INFILTRATION, AND GRADED AND STABILIZED IN ACCORDANCE WITH THE GRADING AND LANDSCAPE PLANS.
16. STOCKPILING OF MATERIALS (DIRT, WOOD, CONSTRUCTION MATERIALS, ETC.) MUST REMAIN COVERED AT ALL TIMES TO MINIMIZE ANY DUST PROBLEMS THAT MAY OCCUR WITH ADJACENT PROPERTIES AND TO PROVIDE MAXIMUM PROTECTION AGAINST EROSION RUNOFF.
17. EXISTING CATCH BASIN STRUCTURES SHALL BE PROTECTED UNTIL SUCH TIME AS THEY ARE REMOVED.
18. THE CONTRACTOR MUST PERFORM DEWATERING (IF REQUIRED), IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS. IT IS THE CONTRACTORS RESPONSIBILITY TO OBTAIN AND PAY FOR THE COSTS ASSOCIATED WITH ANY AND ALL NECESSARY DISCHARGE PERMITS ASSOCIATED WITH SAME.
19. THE CONTRACTOR MUST LOCATE CONSTRUCTION WASTE MATERIAL STORAGE AREAS TO MINIMIZE EXPOSURE TO STORMWATER. THE CONTRACTOR MUST IMMEDIATELY PLACE CONSTRUCTION WASTE IN ON-SITE STORAGE CONTAINERS UNTIL THAT CONSTRUCTION WASTE IS READY FOR OFF-SITE DISPOSAL. THE CONTRACTOR MUST MAINTAIN SPILL PREVENTION AND RESPONSE EQUIPMENT AND MAKE SAME CONTINUOUSLY AVAILABLE ON-SITE FOR USE BY THE CONTRACTOR'S EMPLOYEES WHO MUST BE PROPERLY TRAINED IN THE APPLICATION OF SPILL PREVENTION AND RESPONSE PROCEDURES.
20. EROSION CONTROL NOTES DURING WINTER CONSTRUCTION
21. WINTER CONSTRUCTION PERIOD: NOVEMBER 1 THROUGH APRIL 15.
22. WINTER EXCAVATION AND EARTHWORK SHALL BE DONE SUCH THAT THE AMOUNT OF AREA OPEN AT ONE TIME IS MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE AND IN CONFORMANCE WITH THE STORMWATER POLLUTION PREVENTION PLAN SUCH THAT ADEQUATE PROVISIONS ARE EMPLOYED TO CONTROL STORMWATER RUNOFF.
23. CONTINUATION OF EARTHWORK OPERATION ON ADDITIONAL AREAS SHALL NOT BEGIN UNTIL THE EXPOSED SOIL SURFACE ON THE AREA BEING WORKED HAS BEEN STABILIZED SUCH THAT NO LARGER AREA OF THE SITE IS WITHOUT EROSION CONTROL PROTECTION AS LISTED IN ITEM 2 ABOVE.
24. AN AREA SHALL BE CONSIDERED TO HAVE BEEN TEMPORARILY STABILIZED WHEN EXPOSED SURFACES HAVE BEEN EITHER MULCHED WITH STRAW OR STRAW AT A RATE OF 100 LB. PER 1,000 SQUARE FEET (WITH OR WITHOUT SEEDING) OR DORMANT SEEDED, MULCHED AND ADEQUATELY ANCHORED BY AN APPROVED ANCHORING TECHNIQUE.
25. FOR AREAS WHERE CONSTRUCTION ACTIVITIES HAVE CEASED FOR A PERIOD EXCEEDING 14 DAYS BETWEEN THE DATES OF NOVEMBER 1ST AND APRIL 1ST, LOAM OR SEED WILL NOT BE REQUIRED. THE SLOPES SHALL BE FINE GRADED AND EITHER PROTECTED WITH MULCH OR TEMPORARILY SEEDED. IF THE EXPOSED AREA HAS BEEN LOAMED, FINAL GRADED AND IS SMOOTH, THEN THE AREA MAY BE DORMANT SEEDED AT A RATE OF 200-300% HIGHER THAN SPECIFIED FOR PERMANENT SEED AND THEN MULCHED AS APPLICABLE. SLOPES SHALL NOT BE LEFT UNSTABILIZED OVER THE WINTER OR IN AREAS WHERE WORK HAS CEASED FOR MORE THAN 14 DAYS UNLESS TREATED IN THE ABOVE MANNER. UNTIL SUCH TIME AS WEATHER CONDITIONS ALLOW DITCHES TO BE FINISHED WITH THE PERMANENT SURFACE TREATMENT, EROSION SHALL BE CONTROLLED BY THE INSTALLATION OF SEDIMENT BARRIERS OR STONE CHECK



NOTES:
1. TACK COAT RECOMMENDED IF TIMING BETWEEN BINDER AND TOP COURSE INSTALLATION IS GREATER THAN 48 HOURS.
2. SWEEP BINDER COURSE CLEAN OF ALL DEBRIS PRIOR TO PLACING OF TACK COAT AND ASPHALT.
3. REFER TO GEOTECHNICAL REPORT FOR PAVEMENT SPECIFICATIONS AND OTHER REQUIREMENTS, OTHERWISE PAVEMENT BASE AND SUBBASE COURSE SHALL CONFORM TO ALL STATE HIGHWAY DIVISION SPECIFICATIONS.

DRIVEWAY CONSTRUCTION
NOT TO SCALE (NE-S040101 - 10/2024)



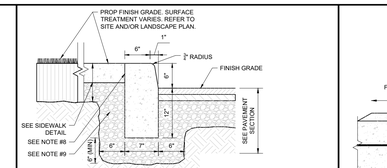
1 BITUMINOUS CONC TOP COURSE (LIGHT DUTY=1") (HEAVY DUTY=1.5") (MA DOT M3.11.4-1)

2 BITUMINOUS CONC BINDER COURSE (LIGHT DUTY=2") (HEAVY DUTY=2.5") (MA DOT M3.11.4-1)

3 GRAVEL BORROW SUB-BASE COURSE (LIGHT DUTY=12") (HEAVY DUTY=12") (MA DOT M2.01.7)

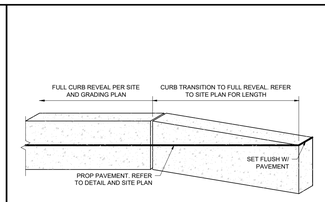
NOTES:
1. IF THE WEARING COURSE IS BEING PLACED MORE THAN 48 HOURS AFTER THE BINDER COURSE, A TACK COAT CONFORMING TO THE STATE DEPARTMENT OF TRANSPORTATION SHALL BE USED TO ENSURE PROPER ADHESION.
2. SWEEP BINDER COURSE CLEAN OF ALL DEBRIS PIROR TO PLACING TACK COAT AND ASPHALT.
3. REFER TO GEOTECHNICAL REPORT FOR PAVEMENT SPECIFICATIONS AND ALL INSTALLATION REQUIREMENTS INCLUDING (BUT NOT LIMITED TO) COMPACTION AND NEED FOR GEOTECHNICAL FABRIC (IF REQUIRED)). IF THERE ARE ANY DISCREPANCIES BETWEEN THIS DETAIL AND THE GEOTECH REPORT, THE GEOTECH REPORT SHALL GOVERN.
4. IN THE ABSENCE OF A GEOTECHNICAL REPORT THE PAVEMENT COURSES SHALL CONFORM TO STATE DOT SPECIFICATIONS.

PAVEMENT SECTION
NOT TO SCALE (MA-S010101 - 05/2025)



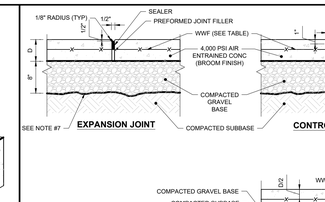
NOTES:
1. CURB SHALL CONSIST OF 4,000 PSI AIR ENTRAINED CONCRETE, EXPOSED EDGES TO HAVE RUBBED FINISH, AND SURFACE SHALL BE TREATED WITH A CONCRETE PENETRANT/SEALER.
2. THE ENDS OF CURB SECTIONS SHALL BE CHAMFERED 1/4 INCH.
3. THE CORNERS OF CURB SECTIONS SHALL MATCH THE ADJACENT CURB IN SIZE, COLOR AND FINISH.
4. CURBS, CURB CORNERS OR EDGING SHALL BE FITTED TOGETHER AS CLOSELY AS POSSIBLE.
5. EXPANSION JOINTS SHALL BE INSTALLED AT A MAXIMUM OF TWENTY FEET (20') ON CENTER USING PREFORMED EXPANSION JOINT FILLER HAVING A THICKNESS OF 1 INCH.
6. PAVEMENT SECTION DEPTHS, MATERIAL, AND SPECIFICATIONS PER PAVEMENT SECTION DETAIL.
7. STRAIGHT CURB SECTIONS CAN BE USED FOR RADII 25' OR GREATER, OTHERWISE, CURVED CURB LENGTHS SHALL BE INSTALLED AT THE SPECIFIED RADIUS PER THE SITE PLAN.
8. PROVIDE 1 INCH EXPANSION JOINT USING PREFORMED EXPANSION JOINT FILLER WHERE ABUTTING CONCRETE SIDEWALK.
9. STONE MATERIAL SHALL BE CONSISTENT WITH THE CRUSHED STONE BASE COURSE REQUIRED FOR THE PAVEMENT SECTION, OR APPROVED EQUIVALENT.

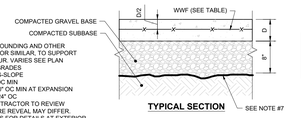
PRECAST CONCRETE CURB
NOT TO SCALE (NE-S020201 - 02/2025)



NOTES:
1. SEE TYPICAL CURB DETAIL AND SITE PLAN FOR CURB TYPE AND TRANSITION CURB LOCATIONS

PRECAST CONCRETE TRANSITION CURB
NOT TO SCALE (NE-S020206 - 09/2023)

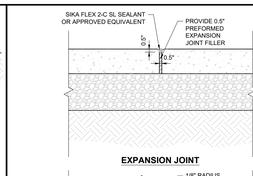




LOCATION	THICKNESS (D)	WWF
SIDEWALK/WALKWAY	4"	6"X6" W2.9XW2.9
DRIVEWAY	6"	6"X6" W4.0XW4.0

NOTES:
1. TO BE USED FOR BUILDING SURROUNDING AND OTHER CONCRETE WALKS. USE CHAIRS, OR SIMILAR, TO SUPPORT REINFORCING STEEL DURING POUR. VARIES SEE PLAN.
2. SEE SITE PLAN FOR WIDTH AND GRADES
3. PROVIDE MINIMUM 1/8"/FT. CROSS-SLOPE
4. PROVIDE CONTROL JOINTS 5'-0" OC MIN.
5. PROVIDE EXPANSION JOINTS 20'-0" OC MIN AT EXPANSION JOINTS. PROVIDE #6 DOWELS @ 24" OC.
6. 6" CURB REVEAL IS TYPICAL. CONTRACTOR TO REVIEW GRADING PLAN FOR AREAS WHERE REVEAL MAY DIFFER.
7. REFER TO ARCHITECTURAL PLANS FOR DETAILS AT EXTERIOR LANDINGS FOR DOORS INCLUDING FROST PROTECTION AND CONNECTION (E.G. DOWELING) TO FOUNDATION

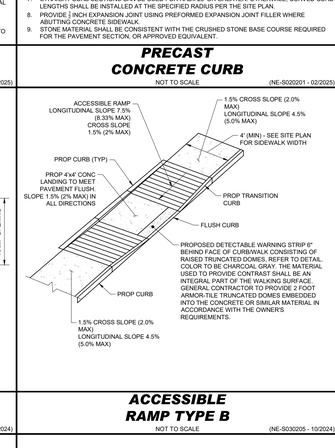
CONCRETE SIDEWALK
NOT TO SCALE (NE-S030201 - 06/2025)



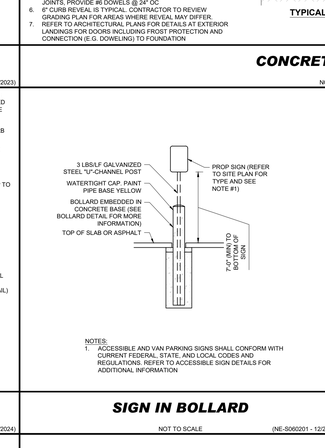
SIDEWALK CONSTRUCTION JOINTS
NOT TO SCALE (BE-S030401 - 08/2023)

DRIVEWAY OPENING
NOT TO SCALE (NE-S040102 - 09/2023)

ACCESSIBLE RAMP TYPE A
NOT TO SCALE (NE-S030204 - 10/2024)

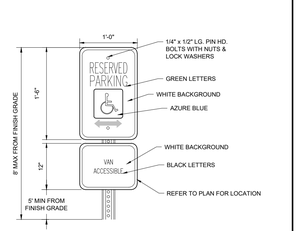


ACCESSIBLE RAMP TYPE B
NOT TO SCALE (NE-S030205 - 10/2024)



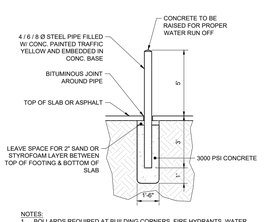
NOTES:
1. ADA RAMP TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST ADA STANDARDS.
2. CONTRACTOR TO CONSTRUCT DETECTABLE WARNINGS WHEN SIDEWALK IS WITHIN PUBLIC ROW AND WHERE SHOWN ON PLANS.
3. DETECTABLE WARNING SURFACES SHALL CONSIST OF RAISED TRUNCATED DOMES WITH A BOTTOM DIAMETER OF NOMINAL 0.9 INCH, A TOP DIAMETER OF 0.4 INCH, A HEIGHT OF NOMINAL 0.2 INCH, A CENTER TO CENTER SPACING OF NOMINAL 2.35 INCH, AND SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES, EITHER LIGHT ON DARK OR DARK ON LIGHT. (SEE DETAIL)
4. TOP OF CURB TO HAVE SAME SLOPE AS ADJACENT CURB RAMP.

ACCESSIBLE RAMP TYPE C
NOT TO SCALE (NE-S030206 - 10/2024)



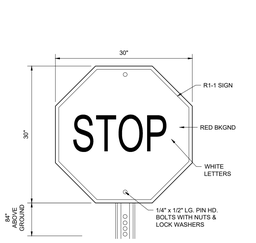
NOTES:
1. ACCESSIBLE AND VAN PARKING SIGNS SHALL CONFORM WITH CURRENT FEDERAL, STATE, AND LOCAL CODES AND REGULATIONS. REFER TO ACCESSIBLE SIGN DETAILS FOR ADDITIONAL INFORMATION

SIGN IN BOLLARD
NOT TO SCALE (NE-S060201 - 12/2024)

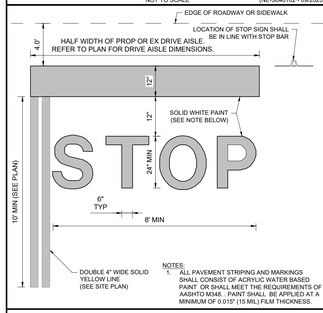


NOTES:
1. BOLLARDS REQUIRED AT BUILDING CORNERS, FIRE HYDRANTS, WATER METER, GAS METER, SPRINKLER RISER, SHOWN TRANSFORMER & ALL UTILITIES AT LOCATIONS SHOWN ON THESE DRAWINGS INTERIOR & EXTERIOR.

BOLLARD
NOT TO SCALE (NE-S070101 - 09/2023)



STOP SIGN
NOT TO SCALE (NE-S060202 - 09/2023)



NOTES:
1. ALL PAVEMENT STRIPING AND MARKINGS SHALL CONSIST OF ACRYLIC WATER BASED PAINT OR SHALL MEET THE REQUIREMENTS OF AASHTO M249. PAINT SHALL BE APPLIED AT A MINIMUM OF 0.015" (15 MIL) FILM THICKNESS.

STOP BAR
NOT TO SCALE (NE-S050301 - 06/2025)

NOTES:
1. ALL TRAFFIC FLOW ARROWS TO BE REFLECTIVE WHITE PAINT PER SPECS.

TRAFFIC FLOW ARROW
NOT TO SCALE (NE-S050302 - 10/2024)

NOTES:
1. ALL PAVEMENT STRIPING AND MARKINGS SHALL CONSIST OF ACRYLIC WATER BASED PAINT OR SHALL MEET THE REQUIREMENTS OF AASHTO M348. PAINT SHALL BE APPLIED AT A MINIMUM OF 0.015" (15 MIL) FILM THICKNESS.

ACCESSIBLE PARKING STALL
NOT TO SCALE (NE-S050101 - 06/2025)

NOTES:
1. LOCATE AT EDGE OF PARKING SPACE UNLESS ACCOMPANIED BY "VAN" LETTERING.
2. DIMENSIONS PER FIGURE 3B-22 PER LATEST EDITION OF MUTCD.
3. ACCESSIBLE PARKING SYMBOL TO CONFORM TO THE STRIPING PAINT SPECIFIED AND SHALL BE CENTERED IN THE STALL.

ACCESSIBLE PARKING SYMBOL
NOT TO SCALE (NE-S050102 - 10/2024)

ACCESSIBLE PARKING SIGNS
NOT TO SCALE (NE-S060101 - 10/2024)

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES

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REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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ALWAYS CALL 811
It's fast. It's free. It's the law.

ENTITLEMENT SET

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVL-CNDS

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
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Z.L. RICHARDS
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 61548

SHEET TITLE:

CONSTRUCTION DETAILS

SHEET NUMBER:

C-901

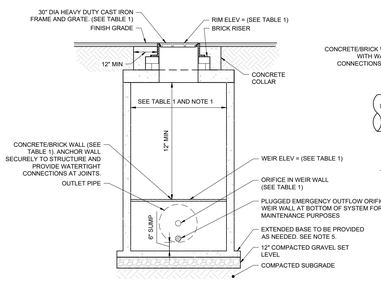
ORG. DATE - 08/12/2025

\\BOHLERENG.NET\SHARES\MA-PROJECTS\2025\MAB250036.00\CAD\DRAWINGS\PLAN SET\B\CIVIL SITE PLANS\P-CIVIL-CNDS-MAB250036.00----LAYOUT C-901 DETL

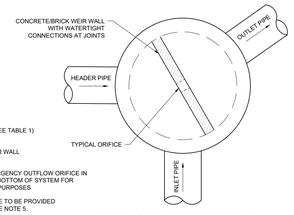
TABLE 1: OCS DETAILS

BASIN #	OCS #	RIM ELEV	WEIR ELEV	WEIR LENGTH (FT)	ORIFICE SIZE (IN)	ORIFICE INV	OUTLET PIPE SIZE (IN)	OUTLET INV
P1	01	178.6	175.3	4	8(H)x30(W)	174.0	12	173.7
P2	02	177.9	173.4	4	N/A	N/A	18	172.5
P3	03	179.5	176.9	4	N/A	N/A	12	172.1

NOTES:
1. CONTRACTOR SHALL REFER TO "TYPICAL DRAIN MANHOLE DETAIL" FOR OUTLET CONTROL STRUCTURE AND NOTES
2. CONTRACTOR TO SUBMIT SHOP DRAWING TO ENGINEER (BOHLER) FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
3. IF COMPONENTS ARE PRECAST AND ATTACHED IN THE FIELD ALL JOINTS TO BE FILLED WITH NON-SHRINK GROUT. ANY BOLTS AND/OR STRAPS SHALL BE STAINLESS STEEL OR HOT DIPPED GALVANIZED.
4. IN LOCATIONS WHERE UTILITY TRENCHING/EXCAVATION ENCOUNTERS SUBGRADE CONDITIONS CONSISTING OF FILL OR UNSUITABLES/ORGANICS, 3'-0" OF MATERIAL SHALL BE OVER-EXCAVATED BELOW THE PIPE/STRUCTURE INVERT. TRENCH SHALL THEN BE BACKFILLED WITH CRUSHED STONE WRAPPED IN FILTER FABRIC.
5. CONTRACTOR SHALL PREPARE BUOYANCY CALCULATIONS AND SUBMIT DETAIL ACCOUNTING FOR PROPER BUOYANCY PROVISIONS BASED ON SITE SPECIFIC GROUNDWATER CONDITIONS.
6. CONTRACTOR SHALL SIZE STRUCTURE AS NECESSARY TO ACCOMMODATE THE PROPOSED PIPE SIZES AND PENETRATIONS USING GEOMETRY SHOWN ON THE GRADING AND DRAINAGE PLANS AS WELL AS INFORMATION PROVIDED IN THIS DETAIL.



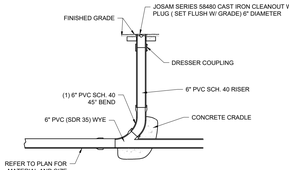
ELEVATION (SECTION A-A)

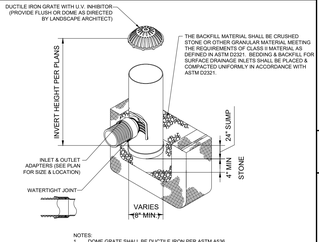


TYPICAL PLAN VIEW (REFER TO PLANS)

OUTLET CONTROL STRUCTURE (OCS) FOR SUBSURFACE SYSTEM(S)

NOT TO SCALE (NE-U010103 - 06/2025)





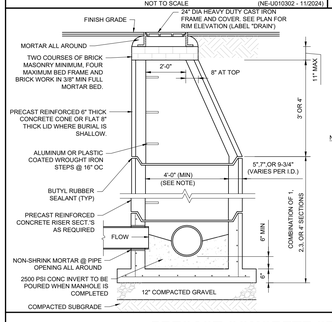
NOTES:
1. DOME GRATE SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. DRAIN PIPE SHOWN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS.
3. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL, N-12 HP, & PVC SEWER).
4. PROVIDE NECESSARY AREA DRAIN DIAMETER TO ACCOMMODATE PROPOSED PIPE CONNECTIONS AS SHOWN ON PLANS.
5. SEE LANDSCAPE ARCHITECT PLANS FOR ADDITIONAL DETAIL

CLEANOUT (IN-LINE)

NOT TO SCALE (NE-U010302 - 11/2024)

AREA DRAIN

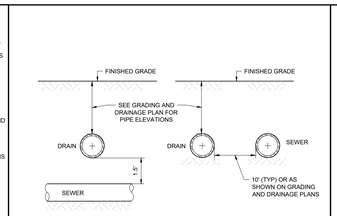
NOT TO SCALE (NE-U010210 - 09/2023)



NOTES:
1. ALL STRUCTURES SHALL BE SUITABLE FOR H-20 LOADING AND SHALL MEET THE REQUIREMENTS OF ASTM C478.
2. CONTRACTOR SHALL SIZE MANHOLE AS NECESSARY TO ACCOMMODATE THE PIPE SIZING AND ORIENTATION USING THE GEOMETRY SHOWN ON THE GRADING AND DRAINAGE PLANS.
3. CONCRETE SHALL BE 4,000 PSI AFTER 28 DAYS
4. REINFORCED STEEL CONFORMS TO ASTM A185 SPEC. 0.12 SQ IN/LINEAL FT AND 0.12 SQ IN (BOTH WAYS) BASE BOTTOM.
5. MANHOLE DESIGN SPECS CONFORM TO ASTM C478 SPEC FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS"

PRECAST CONCRETE STORM DRAIN MANHOLE

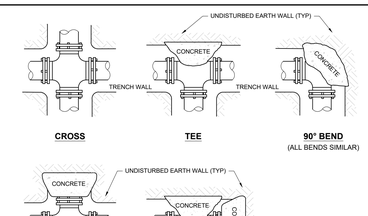
NOT TO SCALE (NE-U010101 - 11/2024)



NOTES:
1. 1.5' VERTICAL SEPARATION SHALL BE PROVIDED BETWEEN DRAINAGE AND SEWER AS DEPICTED IN THIS DETAIL OR SEWER SHALL BE ENCASED IN CONCRETE (SEE CONCRETE ENCASEMENT DETAIL) SECTIONS WHERE SEPARATIONS ARE NOT ACHIEVED.

DRAIN AND SEWER UTILITY CROSSING

NOT TO SCALE (NE-U050103 - 06/2025)

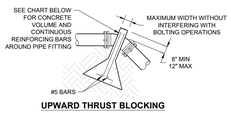


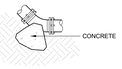
HORIZONTAL THRUST BLOCKING (BLOCKING HEIGHT GREATER THAN PIPE OD) (BLOCKING WIDTH BETWEEN 1 & 2 TIMES HEIGHT)					
REQUIRED SF OF UNDISTURBED EARTH WALL FOR REACTION BACKING					
TYPE OF FITTINGS					
PIPE SIZE	TEE & PLUG	BENDS			
		90°	45°	22 ½°	11 ¼°
3"	1.0	1.0	1.0	1.0	1.0
4"	1.0	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0	1.0
8"	2.5	3.5	1.8	1.0	1.0
10"	4.0	5.5	2.8	1.5	1.0
12"	6.0	8.0	4.0	2.0	1.5

NOTES:
1. DO NOT COVER BELLS OR FLANGES WITH CONCRETE.
2. WRAP ALL FITTINGS WITH VISQUEEN.
3. BACK ALL TEES ACCORDING TO SIZE OF BRANCH.
4. BACKING FUTURE LINE EXTENSIONS SHALL BE SUCH THAT LATER REMOVAL IS POSSIBLE.
5. ALL BENDS WHERE FITTINGS ARE USED, BOTH HORIZONTAL OR VERTICAL SHALL BE BACKED.
6. REACTION BACKING TABLE IS BASED ON 100 PSI AND SOIL BEARING PRESSURE OF 2,000 LBS/SF ADDITIONAL BACKING MAY BE REQUIRED IN SOME AREAS AS DIRECTED BY ENGINEERS.
7. ALL CONCRETE SHALL BE 2500 PSI
8. 18" AND LARGER REQUIRES SPECIFIC ANTI-THRUST DESIGN.

HORIZONTAL THRUST BLOCKING

NOT TO SCALE (NE-U030501 - 11/2024)



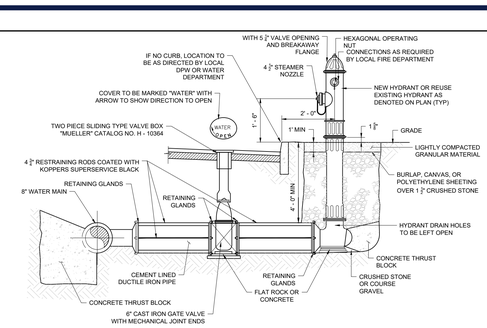


UPWARD THRUST BLOCKING (REQUIRED REINFORCING BARS & CUBIC YARDS OF P.C. CONCRETE											
	90° BEND			45° BEND			22 ½° BEND			11 ¼ BEND		
PIPE SIZE	CONC CY	REINF QTY	REINF SIZE	CONC CY	REINF QTY	REINF SIZE	CONC CY	REINF QTY	REINF SIZE	CONC CY	REINF QTY	REINF SIZE
6"	1.5	3	5	1.5	3	5	1.25	2	5	1.25	2	5
8"	2	3	5	2	3	5	1.5	2	5	1.5	2	5
10"	2.5	3	5	2.5	3	5	2	3	5	2	3	5
12"	3	3	5	3	3	5	2.5	3	5	2.5	3	5

NOTES:
1. DO NOT COVER BELLS OR FLANGES WITH CONCRETE
2. WRAP ALL FITTINGS WITH VISQUEEN.
3. BACK ALL TEES ACCORDING TO SIZE OF BRANCH.
4. BACKING FUTURE LINE EXTENSIONS SHALL BE SUCH THAT LATER REMOVAL IS POSSIBLE.
5. ALL BENDS WHERE FITTINGS ARE USED, BOTH HORIZONTAL OR VERTICAL SHALL BE BACKED.
6. REACTION BACKING TABLE IS BASED ON 100 PSI AND SOIL BEARING PRESSURE OF 2,000 LBS/SF ADDITIONAL BACKING MAY BE REQUIRED IN SOME AREAS AS DIRECTED BY ENGINEERS.
7. ALL CONCRETE SHALL BE 2500 PSI
8. 18" AND LARGER REQUIRES SPECIFIC ANTI-THRUST DESIGN.

HYDRANT AND VALVE INSTALLATION

NOT TO SCALE (NE-U030101 - 11/2024)



TYPICAL UTILITY TRENCH

NOT TO SCALE (NE-U050201 - 09/2024)

PRECAST CONCRETE SANITARY MANHOLE

NOT TO SCALE (NE-U020101 - 11/2024)

VERTICAL THRUST BLOCKING

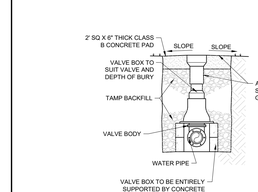
NOT TO SCALE (NE-U030502 - 11/2024)

RECOMMENDED MINIMUM TRENCH WIDTH	
PIPE DIA	MIN TRENCH WIDTH
6"	23"
8"	26"
10"	28"
12"	30"
15"	34"
18"	39"
24"	48"
30"	56"
36"	64"
48"	80"
60"	96"

NOTES:
1. ALL PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321 , "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST ADDITION.
2. MEASURES SHOULD BE TAKEN TO PREVENT MIGRATION OF NATIVE FINES INTO BACKFILL MATERIAL, WHEN REQUIRED.
3. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER, AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.
4. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I, II OR III. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 4"-24" (100mm-600mm); 6" (150mm) FOR 30"-60" (750mm-900mm).
5. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I, II OR III IN THE PIPE ZONE EXTENDING NOT LESS THAN 6" ABOVE CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.
6. MINIMUM COVER: MINIMUM COVER, H, IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" FROM THE TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOTATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER, H, IS 12" UP TO 48" DIAMETER PIPE AND 24" OF COVER FOR 54"-60" DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT.

TAPPING SLEEVE AND GATE VALVE

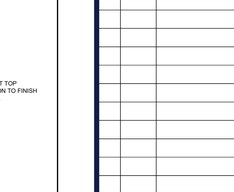
NOT TO SCALE (NE-U030401 - 11/2024)



NOTES:
1. DETAIL FOR GENERAL PURPOSES. GC TO COORDINATE CONNECTION WITH UTILITY COMPANY.

GATE VALVE

NOT TO SCALE (NE-U030201 - 09/2023)

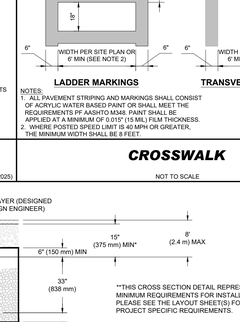


VALVE BOX TO BE ENTIRELY SUPPORTED BY CONCRETE BLOCKS OR BRICKS TO SUIT. VALVE BOX MUST NOT BEAR ON VALVE OR PIPE.

CROSSWALK

NOT TO SCALE (NE-S050401 - 07/2025)

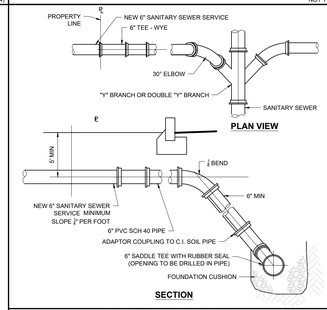
NOTES:
1. ALL STRUCTURES SHALL BE SUITABLE FOR H-20 LOADING AND SHALL MEET THE REQUIREMENTS OF ASTM C478.
2. CONCRETE SHALL BE 4,000 PSI AFTER 28 DAYS.
3. BUTYL RESIN SECTION JOINT CONFORM TO ASTM C990.
4. CONTRACTOR SHALL SIZE STRUCTURE AS NEEDED TO ACCOMMODATE PIPE SIZES AND PENETRATIONS AS SHOWN ON GRADING AND DRAINAGE PLANS.



NOTES:
1. ALL PAVEMENT STRIPING AND MARKINGS SHALL CONSIST OF ACRYLIC WATER BASED PAINT OR SHALL MEET THE REQUIREMENTS PF AASHTO M346. PAINT SHALL BE APPLIED AT A MINIMUM OF 0.015" (15 MIL) FILM THICKNESS.
2. WHERE POSTED SPEED LIMIT IS 40 MPH OR GREATER, THE MINIMUM WIDTH SHALL BE 8 FEET.

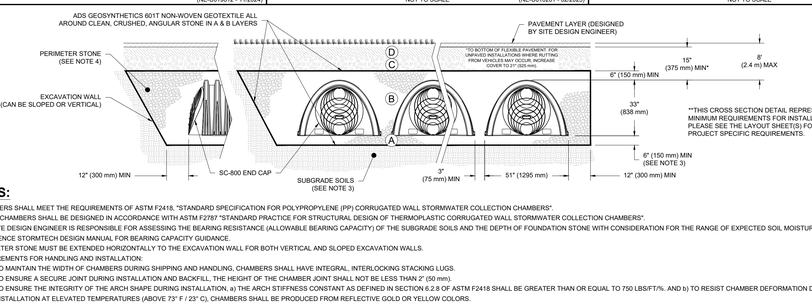
PRECAST CONCRETE DEEP SUMP CATCH BASIN

NOT TO SCALE (NE-U010201 - 02/2025)



HDPE STORM PIPE TRENCH

NOT TO SCALE (NE-U019812 - 11/2024)



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-800 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2" (50 mm).
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 750 LBS/FT/% AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SANITARY MAIN CONNECTION

NOT TO SCALE (NE-U020401 - 09/2023)

STORMTECH SC-800 TYPICAL CROSS SECITON

NOT TO SCALE (NE-U019808 - 09/2023)

NOTES:
1. 10" DOME GRATE DETAIL AS MANUFACTURED BY "ADVANCED DRAINAGE SYSTEMS, INC.", 3300 RIVERSIDE DRIVE, COLUMBUS, OH 43221, (800) 821-6710, OR APPROVED EQUAL.

YARD DRAIN

NOT TO SCALE (NE-U010210 - 09/2023)

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

STORMTECH MC-7200 TYPICAL CROSS SECITON

NOT TO SCALE (NE-U019808 - 09/2023)

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
PLANNING & FEASIBILITY
PERMITTING SERVICES
TRANSPORTATION SERVICES

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REVISIONS

REV	DATE	COMMENT	DRAWN BY CHECKED BY

811 Know what's below. Call before you dig.
ALWAYS CALL 811
It's fast. It's free. It's the law.

ENTITLEMENT SET

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMBJE
DATE:	08/12/2025
CAD I.D.:	P-CIVL-CNDS

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
www.BohlerEngineering.com

Z.L. RICHARDS
ZACHARY L. CRISPIN
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE NO. 55348
PROFESSIONAL ENGINEER

SHEET TITLE:

CONSTRUCTION DETAILS

SHEET NUMBER:

C-902

ORG. DATE - 08/12/2025

\\BOHLERENG.NET\SHARE\MAA-PROJECTS\2025\MAB250036.00\CAD\02-PLANS\P-CIVL-CNDS-MAB250036.00-SD-----34.LAYOUT: C-902 DTEL

NAD83

PLANT SCHEDULE

CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER
CANOPY TREES					
AR	25	ACER RUBRUM	RED MAPLE	2.5"-3" CAL.	B&B
QP	16	QUERCUS PALUSTRIS	PIN OAK	2.5"-3" CAL.	B&B
TA	14	TILIA AMERICANA	AMERICAN LINDEN	2.5"-3" CAL.	B&B
EVERGREEN TREES					
ABC	5	ABIES CONCOLOR	WHITE FIR	6-8	B&B
CT	6	CHAMAECYPARIS THYOIDES	ATLANTIC WHITE CEDAR	6-8	B&B
TOG	39	THUJA OCCIDENTALIS 'GREEN GIANT'	GREEN GIANT ARBORVITAE	6-8	B&B
ORNAMENTAL TREES					
AC	18	AMELANCHIER CANADENSIS	MULTI-STEM SHADBLOW SERVICEBERRY	8-10'	B&B
CFA	12	CORNUS FLORIDA 'APPALACHIAN SNOW'	APPALACHIAN SNOW DOGWOOD	8-10'	B&B

MATERIALS LEGEND

SITE PAVING

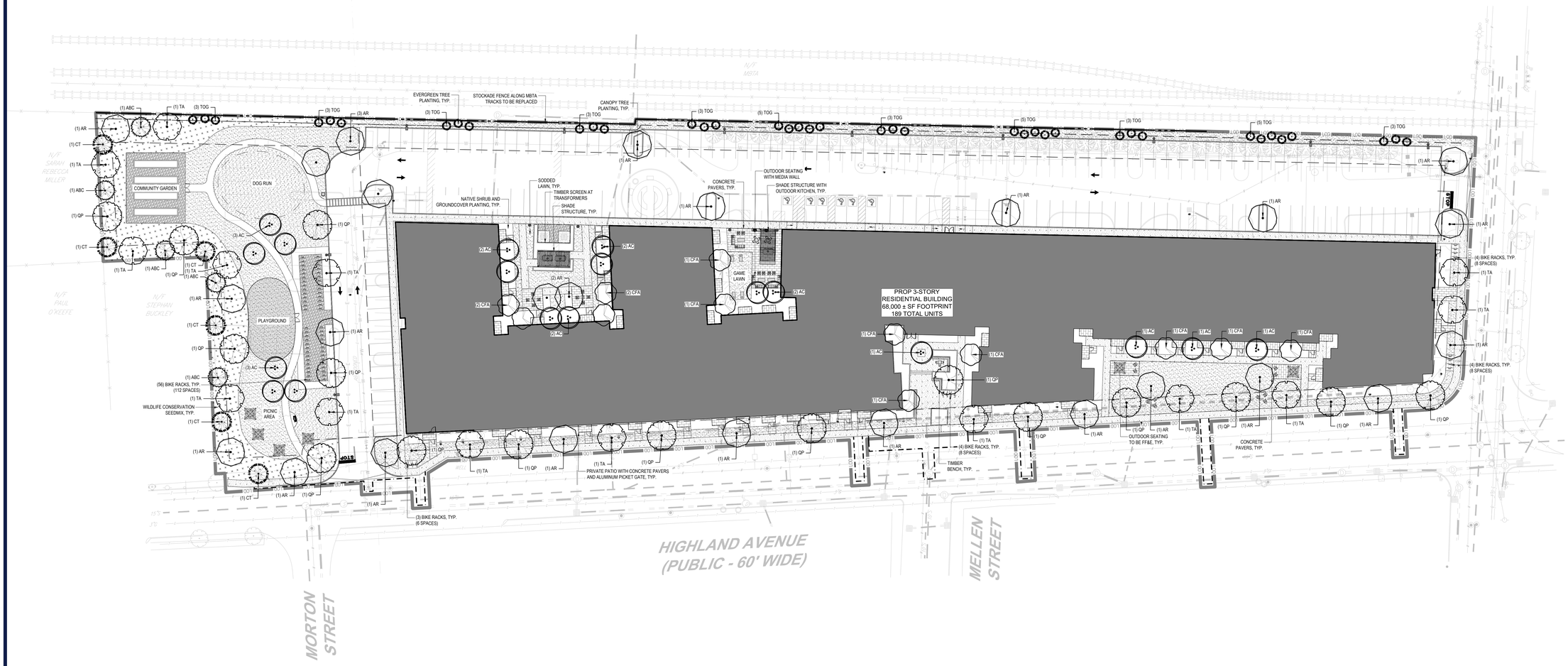
KEY	SYMBOL	DESCRIPTION
SEE CIVIL DRAWINGS		CONCRETE PAVING
1 / L-302		CONCRETE PAVERS
6 / L-300		PEASTONE GRAVEL
8 / L-300		SODDED LAWN

SITE ELEMENTS

5 / L-302		TIMBER SCREEN FENCE WITH GATE
2 / L-302		BLACK ALUM. PICKET FENCE WITH GATE

SITE FURNITURE

2 / L-301		BIKE RACK
3 / L-302		GRILL STATION
4 / L-302		SHADE STRUCTURE
5 / L-301		DOG BAG DISPENSER
FF&E		SECTIONAL SEATING
FF&E		DINING TABLE
FF&E		SQUARE TABLE



NEEDHAM, MA
LANDSCAPE REQUIREMENTS

SECTION	REQUIREMENTS	CALCULATIONS/PROPOSED
§ (K)	LANDSCAPED AREAS - SETBACK AREAS REQUIRED UNDER THE ABOVE PARAGRAPH (J) SHALL BE MAINTAINED AS LANDSCAPED AREAS, EXCEPT WHERE DRIVEWAY OPENINGS OR SIDEWALKS OCCUR. LANDSCAPED AREAS SHALL INCLUDE TREES, SHRUBS, FLOWERS AND GRASS. PLANTING BEDS SHALL BE AT LEAST 4 FEED WIDE. IN ANY PARKING AREA REQUIRING 10 OR MORE SPACES, TEN (10) PERCENT OR MORE OF SUCH AREA SHALL BE MAINTAINED AS LANDSCAPED AREA. IN PARKING AREAS REQUIRING 20 OR MORE SPACES, A MINIMUM OF ONE-QUARTER OF THIS AMOUNT SHALL BE LOCATED IN THE INTERIOR OF THE PARKING AREA. REQUIRED LANDSCAPE SETBACK AREAS SHALL COUNT TOWARDS THE MINIMUM TEN PERCENT REQUIREMENT; PROVIDED, HOWEVER, THAT THE INTERIOR LANDSCAPED AREA REQUIREMENT SHALL BE MET.	2500 SF PARKING AREA / 10 = 250 SF LANDSCAPED AREA REQUIRED
§ (L)	TREES - FOR ALL PARKING AREAS REQUIRING 10 OR MORE SPACES, TREES SHALL BE REQUIRED. ONE TREE SHALL BE PROVIDED FOR EVERY 10 SPACES OR A FRACTION THEREOF. SUCH TREES SHALL BE LOCATED WITHIN OR AROUND THE PARKING AREA SO AS TO SCREEN AND SOFTEN THE VISUAL IMPACT OF PARKED VEHICLES AS MUCH AS POSSIBLE. THEY SHALL BE AT LEAST 2" TRUNK DIAMETER, WITH NOT LESS THAN 40 SQUARE FEET OF UNPAVED SOIL OR OTHER PERMEABLE SURFACE AREA PER TREE. PLANTING BEDS SHALL BE AT LEAST 4 FEET WIDE.	190 PARKING SPACES / 10 = 20 TREES REQUIRED
§ (N)	BICYCLE RACKS - FOR PARKING AREAS OF FORTY OR MORE SPACES, BICYCLE RACKS FACILITATING LOCKING SHALL BE PROVIDED TO ACCOMMODATE ONE BICYCLE PER TWENTY PARKING SPACES REQUIRED, OR FRACTION THEREOF.	190 PARKING SPACES / 20 = 10 BIKE RACKS REQUIRED

THIS PLAN TO BE UTILIZED FOR LANDSCAPE PURPOSES ONLY

30' 15' 7.5' 0 30'
SCALE: 1" = 30'

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
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PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DIST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-LAND

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

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VERMONT No. 01337
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SHEET TITLE:

LANDSCAPE PLAN

SHEET NUMBER:

L-100

ORG. DATE - 08/12/2025

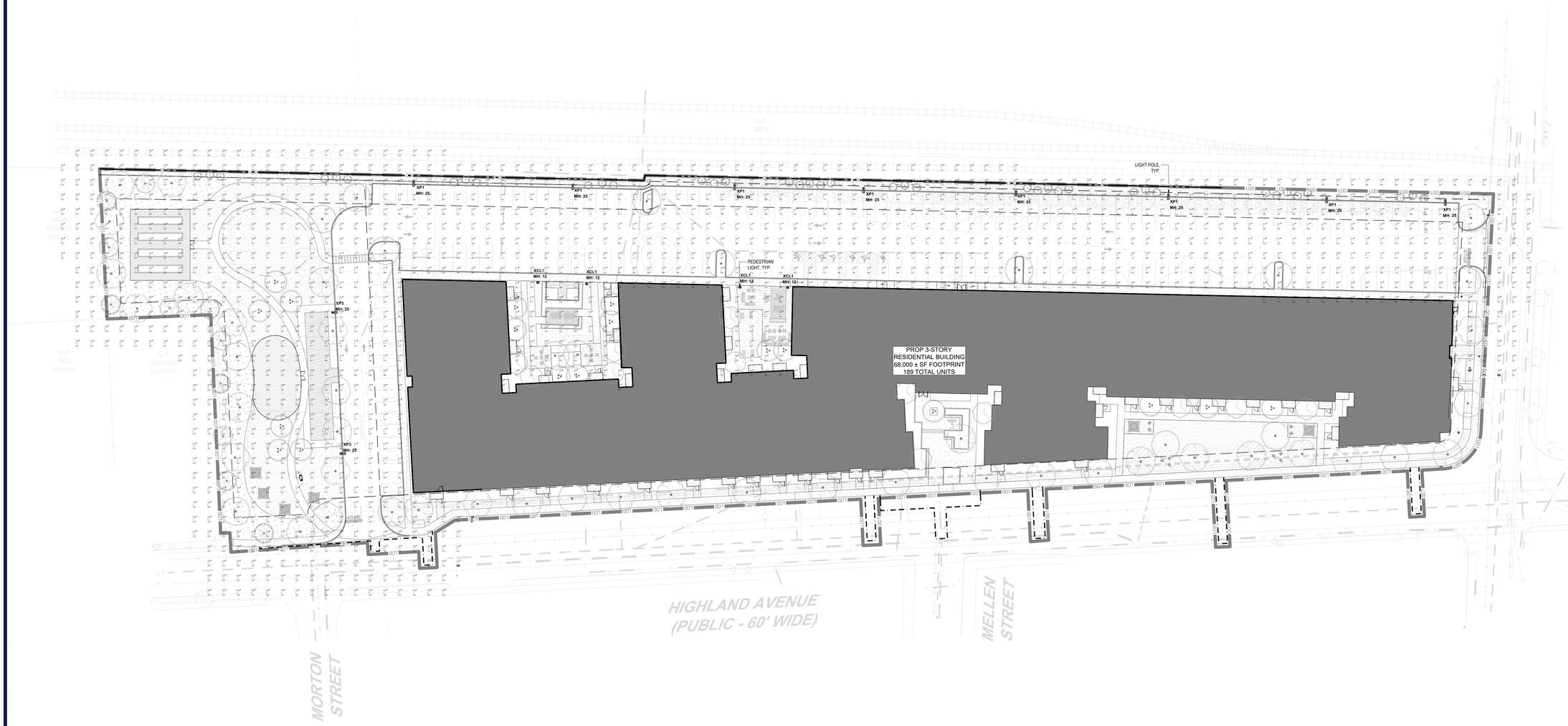
P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-LAND-MAB250036.00-00.DWG — LAYOUT: L-100 | LAND

NAD83

LIGHTING LEGEND

Luminaire Schedule					
Qty	Label	Arrangement	LLF	Description	Lum. Watts
8	XP1	SINGLE	0.900	VP-1-160L-75-3K7-3	72
2	XP3	SINGLE	0.900	VP-1-160L-75-3K7-4F-HSS-90-B	72
4	XCL1	SINGLE	1.000	DW200-12-HO-T3	42.6612

SYMBOL	DESCRIPTION
	STREETLIGHT
	PEDESTRIAN LIGHT POLE



THIS PLAN TO BE UTILIZED FOR LIGHTING PURPOSES ONLY

30' 15' 7.5' 0 30'

SCALE: 1" = 30'

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SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
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PROJECT:

SITE DEVELOPMENT PLANS

FOR

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SHEET TITLE:

LIGHTING PLAN

SHEET NUMBER:

L-200

ORG. DATE - 08/12/2025

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DST

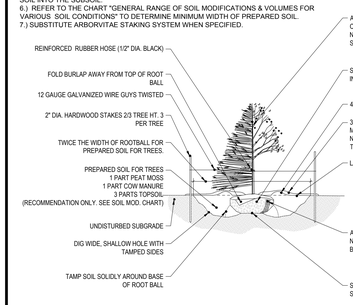
MASSACHUSETTS LANDSCAPE SPECIFICATION

1. SCOPE OF WORK:
   a) THE LANDSCAPE CONTRACTOR SHALL BE REQUIRED TO PERFORM ALL CLEARING, FINISHED GRADING, SOIL PREPARATION PERMANENT SEEDING OR SODDING, PLANTING AND MULCHING INCLUDING ALL LABOR, MATERIALS, TOOLS AND EQUIPMENT NECESSARY FOR THE COMPLETION OF THIS PROJECT, UNLESS OTHERWISE CONTRACTED BY THE GENERAL CONTRACTOR.
2. MATERIALS
   a) GENERAL - ALL HARDSCAPE MATERIALS SHALL MEET OR EXCEED SPECIFICATIONS AS OUTLINED IN THE STATE DEPARTMENT OF TRANSPORTATION'S SPECIFICATIONS.
   b) TOPSOIL - NATURAL, FRIABLE, LOAMY SILT SOIL HAVING AN ORGANIC CONTENT NOT LESS THAN 5%, A PH RANGE BETWEEN 4.5-7.0. IT SHALL BE FREE OF DEBRIS, ROCKS LARGER THAN ONE INCH (1"), WOOD, ROOTS, VEGETABLE MATTER AND CLAY CLODS.
   c) LAWN:
   c)a) ALL DISTURBED AREAS ARE TO BE TREATED WITH A MINIMUM 6" THICK LAYER OF TOPSOIL, OR AS DIRECTED BY THE LOCAL ORDINANCE OR CLIENT, AND SEEDED OR SODDED IN ACCORDANCE WITH THE PERMANENT STABILIZATION METHODS INDICATED ON THE LANDSCAPE PLAN.
   c)b) LAWN SEED MIXTURE SHALL BE FRESH, CLEAN NEW CROP SEED.
   c)c) SOD SHALL BE STRONGLY ROOTED, WEED AND DISEASEPEST FREE WITH A UNIFORM THICKNESS. SOD INSTALLED ON SLOPES GREATER THAN 4:1 SHALL BE PEGGED TO HOLD SOD IN PLACE.
   c)d) MULCH - ALL PLANTING BEDS SHALL BE MULCHED WITH A 3" THICK LAYER OF DOUBLE SHREDDED HARDWOOD BARK MULCH, UNLESS OTHERWISE STATED ON THE LANDSCAPE PLAN AND/OR LANDSCAPE PLAN NOTES / DETAILS.
   d) FERTILIZER:
   d)a) FERTILIZER SHALL BE DELIVERED TO THE SITE MIXED AS SPECIFIED IN THE ORIGINAL UNOPENED STANDARD BAGS SHOWING WEIGHT, ANALYSIS AND NAME OF MANUFACTURER. FERTILIZER SHALL BE STORED IN A WEATHERPROOF PLACE SO THAT IT CAN BE KEPT DRY PRIOR TO USE.
   d)b) FOR THE PURPOSE OF BIDDING, ASSUME THAT FERTILIZER SHALL BE 10% NITROGEN, 6% PHOSPHORUS AND 4% POTASSIUM BY WEIGHT. A FERTILIZER SHOULD NOT BE SELECTED WITHOUT A SOIL TEST PERFORMED BY A CERTIFIED SOIL LABORATORY.
   e) PLANT MATERIAL:
   e)a) ALL PLANTS SHALL IN ALL CASES CONFORM TO THE REQUIREMENTS OF THE "AMERICAN STANDARD FOR NURSERY STOCK" (ANSI Z60.1) LATEST EDITION, AS PUBLISHED BY THE AMERICAN NURSERY & LANDSCAPE ASSOCIATION (FORMERLY THE AMERICAN ASSOCIATION OF NURSERYMEN).
   e)b) IN ALL CASES, BOTANICAL NAMES SHALL TAKE PRECEDENCE OVER COMMON NAMES FOR ANY AND ALL PLANT MATERIAL.
   e)c) PLANTS SHALL BE LEGIBLY TAGGED WITH THE PROPER NAME AND SIZE. TAGS ARE TO REMAIN ON AT LEAST ONE PLANT OF EACH SPECIES FOR VERIFICATION PURPOSES DURING THE FINAL INSPECTION.
   e)d) TREES WITH ABRASION OF THE BARK, SUN SCALDS, DISFIGURATION OR FRESH CUTS OF LIMBS OVER 1½", WHICH HAVE NOT BEEN COMPLETELY CALLUSED, SHALL BE REJECTED. PLANTS SHALL NOT BE BOUND WITH WIRE OR ROPE AT ANY TIME SO AS TO DAMAGE THE BARK OR BREAK BRANCHES.
   e)e) ALL PLANTS SHALL BE TYPICAL OF THEIR SPECIES OR VARIETY AND SHALL HAVE A NORMAL HABIT OF GROWTH: WELL DEVELOPED BRANCHES, DENSELY FOLIATED, VIGOROUS ROOT SYSTEMS AND BE FREE OF DISEASE, INSECTS, PESTS, EGGS OR LARVAE.
   e)f) CALIPER MEASUREMENTS OF NURSERY GROWN TREES SHALL BE TAKEN AT A POINT ON THE TRUNK SIX INCHES (6") ABOVE THE NATURAL GRADE FOR TREES UP TO AND INCLUDING A FOUR INCH (4") CALIPER SIZE. IF THE CALIPER AT SIX INCHES (6") ABOVE THE GROUND EXCEEDS FOUR INCHES (4") IN CALIPER, THE CALIPER SHOULD BE MEASURED AT A POINT 12" ABOVE THE NATURAL GRADE.
   e)g) SHRUBS SHALL BE MEASURED TO THE AVERAGE HEIGHT OR SPREAD OF THE SHRUB, AND NOT TO THE LONGEST BRANCH.
   e)h) TREES AND SHRUBS SHALL BE HANDLED WITH CARE BY THE ROOT BALL.
3. GENERAL WORK PROCEDURES
   a) CONTRACTOR TO UTILIZE WORKMANLIKE INDUSTRY STANDARDS IN PERFORMING ALL LANDSCAPE CONSTRUCTION. THE SITE IS TO BE LEFT IN A CLEAN STATE AT THE END OF EACH WORKDAY. ALL DEBRIS, MATERIALS AND TOOLS SHALL BE PROPERLY STORED, STOCKPILED OR DISPOSED OF.
   b) WASTE MATERIALS AND DEBRIS SHALL BE COMPLETELY DISPOSED OF AT THE CONTRACTOR'S EXPENSE. DEBRIS SHALL NOT BE BURIED, INCLUDING ORGANIC MATERIALS, BUT SHALL BE REMOVED COMPLETELY FROM THE SITE.
4. SITE PREPARATIONS
   a) BEFORE AND DURING PRELIMINARY GRADING AND FINISHED GRADING, ALL WEEDS AND GRASSES SHALL BE DUG OUT BY THE ROOTS AND DISPOSED OF IN ACCORDANCE WITH GENERAL WORK PROCEDURES OUTLINED HEREIN.
   b) ALL EXISTING TREES TO REMAIN SHALL BE PRUNED TO REMOVE ANY DAMAGED BRANCHES. THE ENTIRE LIMB OF ANY DAMAGED BRANCH SHALL BE CUT OFF AT THE BRANCH COLLAR. CONTRACTOR SHALL ENSURE THAT CUTS ARE SMOOTH AND STRAIGHT. ANY EXPOSED ROOTS SHALL BE CUT BACK WITH CLEAN, SHARP TOOLS AND TOPSOIL SHALL BE PLACED AROUND THE REMAINDER OF THE ROOTS. EXISTING TREES SHALL BE MONITORED ON A REGULAR BASIS FOR ADDITIONAL ROOT OR BRANCH DAMAGE AS A RESULT OF CONSTRUCTION. ROOTS SHALL NOT BE LEFT EXPOSED FOR MORE THAN ONE (1) DAY. CONTRACTOR SHALL WATER EXISTING TREES AS NEEDED TO PREVENT SHOCK OR DECLINE.
   c) CONTRACTOR SHALL ARRANGE TO HAVE A UTILITY STAKE-OUT TO LOCATE ALL UNDERGROUND UTILITIES PRIOR TO INSTALLATION OF ANY LANDSCAPE MATERIAL. UTILITY COMPANIES SHALL BE CONTACTED THREE (3) DAYS PRIOR TO THE BEGINNING OF WORK.
5. TREE PROTECTION
   a) CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING TREES TO REMAIN. A TREE PROTECTION ZONE SHALL BE ESTABLISHED AT THE DRIP LINE OR AT THE LIMIT OF CONSTRUCTION DISTURBANCE, WHICHEVER IS GREATER. LOCAL STANDARDS THAT MAY REQUIRE A MORE STRICT TREE PROTECTION ZONE SHALL BE HONORED.
   b) A FORTY-EIGHT INCH (48") HIGH WOODEN SNOW FENCE OR ORANGE COLORED HIGH-DENSITY "VISI-FENCE", OR APPROVED EQUAL, MOUNTED ON STEEL POSTS SHALL BE PLACED ALONG THE BOUNDARY OF THE TREE PROTECTION ZONE. POSTS SHALL BE LOCATED AT A MAXIMUM OF EIGHT FEET (8') ON CENTER OR AS INDICATED WITHIN THE TREE PROTECTION DETAIL.
   c) WHEN THE TREE PROTECTION FENCING HAS BEEN INSTALLED, IT SHALL BE INSPECTED BY THE APPROVING AGENCY PRIOR TO DEMOLITION, GRADING, TREE CLEARING OR ANY OTHER CONSTRUCTION. THE FENCING ALONG THE TREE PROTECTION ZONE SHALL BE REGULARLY INSPECTED BY THE LANDSCAPE CONTRACTOR AND MAINTAINED UNTIL ALL CONSTRUCTION ACTIVITY HAS BEEN COMPLETED.
   d) AT NO TIME SHALL MACHINERY, DEBRIS, FALLEN TREES OR OTHER MATERIALS BE PLACED, STOCKPILED OR LEFT STANDING IN THE TREE PROTECTION ZONE.
6. SOIL MODIFICATIONS
   a) CONTRACTOR SHALL ATTAIN A SOIL TEST FOR ALL AREAS OF THE SITE PRIOR TO CONDUCTING ANY PLANTING. SOIL TESTS SHALL BE PERFORMED BY A CERTIFIED SOIL LABORATORY.
   b) LANDSCAPE CONTRACTOR SHALL REPORT ANY SOIL OR DRAINAGE CONDITIONS CONSIDERED DETRIMENTAL TO THE GROWTH OF PLANT MATERIAL. SOIL MODIFICATIONS, AS SPECIFIED HEREIN, MAY NEED TO BE CONDUCTED BY THE LANDSCAPE CONTRACTOR DEPENDING ON SITE CONDITIONS.
   c) THE FOLLOWING AMENDMENTS AND QUANTITIES ARE APPROXIMATE AND ARE FOR BIDDING PURPOSES ONLY. COMPOSITION OF AMENDMENTS SHOULD BE REVISED DEPENDING ON THE OUTCOME OF A TOPSOIL ANALYSIS PERFORMED BY A CERTIFIED SOIL LABORATORY.
   d) TO INCREASE A SANDY SOIL'S ABILITY TO RETAIN WATER AND NUTRIENTS, THOROUGHLY TILL ORGANIC MATTER INTO THE TOP 6-12". USE COMPOSTED BARK, COMPOSTED LEAF MULCH OR PEAT MOSS. ALL PRODUCTS SHOULD BE COMPOSTED TO A DARK COLOR AND BE FREE OF PIECES WITH IDENTIFIABLE LEAF OR WOOD STRUCTURE. AVOID MATERIAL WITH A PH HIGHER THAN 7.5.
   d)a) TO INCREASE DRAINAGE, MODIFY HEAVY CLAY OR SILT (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) AND/OR AGRICULTURAL GYPSUM. COARSE SAND MAY BE USED IF ENOUGH IS ADDED TO BRING THE SAND CONTENT TO MORE THAN 60% OF THE TOTAL MIX. SUBSURFACE DRAINAGE LINES MAY NEED TO BE ADDED TO INCREASE DRAINAGE.
   d)b) MODIFY EXTREMELY SANDY SOILS (MORE THAN 85%) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX.
7. FINISHED GRADING
   a) UNLESS OTHERWISE CONTRACTED, THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF TOPSOIL AND THE ESTABLISHMENT OF FINE-GRADING WITHIN THE DISTURBANCE AREA OF THE SITE.
   b) LANDSCAPE CONTRACTOR SHALL VERIFY THAT SUBGRADE FOR INSTALLATION OF TOPSOIL HAS BEEN ESTABLISHED. THE SUBGRADE OF THE SITE MUST MEET THE FINISHED GRADE LESS THE REQUIRED TOPSOIL THICKNESS (1"±).
   c) ALL LAWN AND PLANTING AREAS SHALL BE GRADED TO A SMOOTH, EVEN AND UNIFORM PLANE WITH NO ABRUPT CHANGE OF SURFACE AS DEPICTED WITHIN THIS SET OF CONSTRUCTION PLANS, UNLESS OTHERWISE DIRECTED BY THE PROJECT ENGINEER OR LANDSCAPE ARCHITECT.
   d) ALL PLANTING AREAS SHALL BE GRADED AND MAINTAINED TO ALLOW FREE FLOW OF SURFACE WATER IN AND AROUND THE PLANTING BEDS. STANDING WATER SHALL NOT BE PERMITTED IN PLANTING BEDS.
8. TOPSOILING
   a) CONTRACTOR SHALL PROVIDE A 6" THICK MINIMUM LAYER OF TOPSOIL FOR THE NEW ENGLAND SHOWY WILDFLOWER MIX AREA, OR AS DIRECTED BY THE LOCAL ORDINANCE OR CLIENT, IN ALL PLANTING AREAS. TOPSOIL SHOULD BE SPREAD OVER A PREPARED SURFACE IN A UNIFORM LAYER TO ACHIEVE THE DESIRED COMPACTED THICKNESS.
   b) ON-SITE TOPSOIL MAY BE USED TO SUPPLEMENT THE TOTAL AMOUNT REQUIRED. TOPSOIL FROM THE SITE MAY BE REJECTED IF IT HAS NOT BEEN PROPERLY REMOVED, STORED AND PROTECTED PRIOR TO CONSTRUCTION.
   c) CONTRACTOR SHALL FURNISH TO THE APPROVING AGENCY AN ANALYSIS OF BOTH IMPORTED AND ON-SITE TOPSOIL TO BE UTILIZED IN ALL PLANTING AREAS. THE PH AND NUTRIENT LEVELS MAY NEED TO BE ADJUSTED THROUGH SOIL MODIFICATIONS AS NEEDED TO ACHIEVE THE REQUIRED LEVELS AS SPECIFIED IN THE MATERIALS SECTION ABOVE.
   d) THE SPREADING OF TOPSOIL SHALL NOT BE CONDUCTED UNDER MUDDY OR FROZEN CONDITIONS.
   e) CONTRACTOR SHALL TEST AND AMEND EXISTING TOPSOIL AS ADVISED BY A SOIL SCIENTIST FOR THE NEW ENGLAND CONSERVATION MIX AREA AND HYDROSEEDED LAWN AREAS.
9. PLANTING
   a) INSOFAR THAT IT IS FEASIBLE, PLANT MATERIAL SHALL BE PLANTED ON THE DAY OF DELIVERY. IN THE EVENT THAT THIS IS NOT POSSIBLE, LANDSCAPE CONTRACTOR SHALL PROTECT UNINSTALLED PLANT MATERIAL. PLANTS SHALL NOT REMAIN UNPLANTED FOR LONGER THAN A THREE DAY PERIOD AFTER DELIVERY. PLANTS THAT WILL NOT BE PLANTED FOR A PERIOD OF TIME GREATER THAN THREE DAYS SHALL BE HEALED IN WITH TOPSOIL OR MULCH TO HELP PRESERVE ROOT MOISTURE.
   b) PLANTING OPERATIONS SHALL BE PERFORMED DURING PERIODS WITHIN THE PLANTING SEASON WHEN WEATHER AND SOIL CONDITIONS ARE SUITABLE AND IN ACCORDANCE WITH ACCEPTED LOCAL PRACTICE. PLANTS SHALL NOT BE INSTALLED IN TOPSOIL THAT IS IN A MUDDY OR FROZEN CONDITION.
   c) ANY INJURED ROOTS OR BRANCHES SHALL BE PRUNED TO MAKE CLEAN-CUT ENDS PRIOR TO PLANTING UTILIZING CLEAN, SHARP TOOLS. ONLY INJURED OR DISEASED BRANCHING SHALL BE REMOVED.
   d) ALL PLANTING CONTAINERS, BASKETS AND NON-BIODEGRADABLE MATERIALS SHALL BE REMOVED FROM ROOT BALLS DURING PLANTING. NATURAL FIBER BURLAP MUST BE CUT FROM AROUND THE TRUNK OF THE TREE AND FOLDED DOWN AGAINST THE ROOT BALL PRIOR TO BACKFILLING.
   e) POSITION TREES AND SHRUBS AT THEIR INTENDED LOCATIONS AS PER THE PLANS AND SECURE THE APPROVAL OF THE LANDSCAPE ARCHITECT PRIOR TO EXCAVATING PITS, MAKING NECESSARY ADJUSTMENTS AS DIRECTED.
   f) PRIOR TO THE ISSUANCE OF ANY CERTIFICATE OF OCCUPANCY, THE PROPOSED LANDSCAPE, AS SHOWN ON THE APPROVED LANDSCAPE PLAN, MUST BE INSTALLED/COMPLETED AND APPROVED BY THE APPROVING AGENCY. THE APPROVING AGENCY SHALL TAKE INTO ACCOUNT SEASONAL CONSIDERATIONS IN THIS REGARD AS FOLLOWS. THE PLANTING OF TREES, SHRUBS, VINES OR GROUND COVER SHALL OCCUR ONLY DURING THE FOLLOWING PLANTING SEASONS:
   f)a) PLANTS: MARCH 15 TO DECEMBER 15
   f)b) LAWN: MARCH 15 TO JUNE 15 OR SEPT. 1 TO DECEMBER 1
   f)c) PLANTINGS REQUIRED FOR A CERTIFICATE OF OCCUPANCY SHALL BE PROVIDED DURING THE NEXT APPROPRIATE SEASON AT THE MUNICIPALITY'S DISCRETION. CONTRACTOR SHOULD CONTACT APPROVING AGENCY FOR POTENTIAL SUBSTITUTIONS.
   g) FURTHERMORE, THE FOLLOWING TREE VARIETIES ARE UNUSUALLY SUSCEPTIBLE TO WINTER DAMAGE. WITH TRANSPLANT SHOCK AND THE SEASONAL LACK OF NITROGEN AVAILABILITY, THE RISK OF PLANT DEATH IS GREATLY INCREASED. IT IS NOT RECOMMENDED THAT THESE SPECIES BE PLANTED DURING THE FALL PLANTING SEASON.

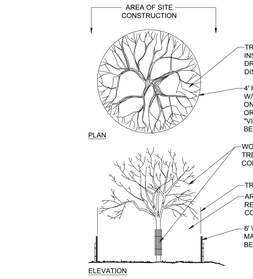
ACER RUBRUM	PLATANUS X ACERIFOLIA
BETULA VARIETIES	POPULUS VARIETIES
CARPINUS VARIETIES	PRUNUS VARIETIES
CRATAEGUS VARIETIES	PYRUS VARIETIES
KOELREUTERIA	QUERCUS VARIETIES
LIQUIDAMBAR STYRACIFLUA	TILIA TOMENTOSA
LIRIODENDRON TULIPIFERA	ZELKOVA VARIETIES

   h) PLANTING PITS SHALL BE DUG WITH LEVEL BOTTOMS, WITH THE WIDTH TWICE THE DIAMETER OF ROOT BALL. THE ROOT BALL SHALL REST ON UNDISTURBED GRADE. EACH PLANT PIT SHALL BE BACKFILLED IN LAYERS WITH THE FOLLOWING PREPARED SOIL MIXED THOROUGHLY:
   h)a) 1 PART PEAT MOSS
   h)b) 1 PART COMPOSTED COW MANURE BY VOLUME
   h)c) 3 PARTS TOPSOIL BY VOLUME
   h)d) 21 GRAMS 'AGRIFORM' PLANTING TABLETS (OR APPROVED EQUAL) AS FOLLOWS:
   h)d)a) 2 TABLETS PER 1 GALLON PLANT
   h)d)b) 3 TABLETS PER 5 GALLON PLANT
   h)d)c) 4 TABLETS PER 15 GALLON PLANT
   h)d)d) LARGER PLANTS: 2 TABLETS PER ½" CALIPER OF TRUNK
   i) FILL PREPARED SOIL AROUND BALL OF PLANT HALF-WAY AND INSERT PLANT TABLETS. COMPLETE BACKFILL AND WATER THOROUGHLY.
   j) ALL PLANTS SHALL BE PLANTED SO THAT THE TOP OF THE ROOT BALL, THE POINT AT WHICH THE ROOT FLARE BEGINS, IS SET AT GROUND LEVEL AND IN THE CENTER OF THE PIT. NO SOIL IS TO BE PLACED DIRECTLY ON TOP OF THE ROOT BALL.
   k) ALL PROPOSED TREES DIRECTLY ADJACENT TO WALKWAYS OR DRIVEWAYS SHALL BE PRUNED AND MAINTAINED TO A MINIMUM BRANCHING HEIGHT OF 7' FROM GRADE.
   l) GROUND COVER AREAS SHALL RECEIVE A ½" LAYER OF HUMUS RAKED INTO THE TOP 1" OF PREPARED SOIL PRIOR TO PLANTING. ALL GROUND COVER AREAS SHALL BE WEEDED AND TREATED WITH A PRE-EMERGENT CHEMICAL AS PER MANUFACTURER'S RECOMMENDATION.
   m) NO PLANT, EXCEPT GROUND COVERS, GRASSES OR VINES, SHALL BE PLANTED LESS THAN TWO FEET (2') FROM EXISTING STRUCTURES AND SIDEWALKS.
   n) ALL PLANTING AREAS AND PLANTING PITS SHALL BE MULCHED AS SPECIFIED HEREIN TO FILL THE ENTIRE BED AREA OR SAUCER. NO MULCH IS TO TOUCH THE TRUNK OF THE TREE OR SHRUB.
   o) ALL PLANTING AREAS SHALL BE WATERED IMMEDIATELY UPON INSTALLATION IN ACCORDANCE WITH THE WATERING SPECIFICATIONS AS LISTED HEREIN.
10. TRANSPLANTING (WHEN REQUIRED)
   a) ALL TRANSPLANTS SHALL BE DUG WITH INTACT ROOT BALLS CAPABLE OF SUSTAINING THE PLANT.
   b) IF PLANTS ARE TO BE STOCKPILED BEFORE REPLANTING, THEY SHALL BE HEALED IN WITH MULCH OR SOIL, ADEQUATELY WATERED AND PROTECTED FROM EXTREME HEAT, SUN AND WIND.
   c) PLANTS SHALL NOT BE DUG FOR TRANSPLANTING BETWEEN APRIL 10 AND JUNE 30.
   d) UPON REPLANTING, BACKFILL SOIL SHALL BE AMENDED WITH FERTILIZER AND ROOT GROWTH HORMONE.
   e) TRANSPLANTS SHALL BE GUARANTEED FOR THE LENGTH OF THE GUARANTEE PERIOD SPECIFIED HEREIN.
   f) F TRANSPLANTS DIE, SHRUBS AND TREES LESS THAN SIX INCHES (6") DBH SHALL BE REPLACED IN KIND. TREES GREATER THAN SIX INCHES (6") DBH MAY BE REQUIRED TO BE REPLACED IN ACCORDANCE WITH THE MUNICIPALITY'S TREE REPLACEMENT GUIDELINES.
11. WATERING
   a) NEW PLANTINGS OR LAWN AREAS SHALL BE ADEQUATELY IRRIGATED BEGINNING IMMEDIATELY AFTER PLANTING. WATER SHALL BE APPLIED TO EACH TREE AND SHRUB IN SUCH MANNER AS NOT TO DISTURB BACKFILL AND TO THE EXTENT THAT ALL MATERIALS IN THE PLANTING HOLE ARE THOROUGHLY SATURATED. WATERING SHALL CONTINUE AT LEAST UNTIL PLANTS ARE ESTABLISHED.
   b) SITE OWNER SHALL PROVIDE WATER IF AVAILABLE ON SITE AT TIME OF PLANTING. IF WATER IS NOT AVAILABLE ON SITE, CONTRACTOR SHALL SUPPLY ALL NECESSARY WATER. THE USE OF WATERING BAGS IS RECOMMENDED FOR ALL NEWLY PLANTED TREES.
   c) IF AN IRRIGATION SYSTEM HAS BEEN INSTALLED ON THE SITE, IT SHALL BE USED TO WATER PROPOSED PLANT MATERIAL, BUT ANY FAILURE OF THE SYSTEM DOES NOT ELIMINATE THE CONTRACTOR'S RESPONSIBILITY OF MAINTAINING THE DESIRED MOISTURE LEVEL FOR VIGOROUS, HEALTHY GROWTH.
12. GUARANTEE
   a) THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL PLANTS FOR A PERIOD OF 1 YEAR FROM APPROVAL OF LANDSCAPE INSTALLATION BY THE APPROVING AGENCY. CONTRACTOR SHALL SUPPLY THE OWNER WITH A MAINTENANCE BOND FOR TEN PERCENT (10%) OF THE VALUE OF THE LANDSCAPE INSTALLATION WHICH WILL BE RELEASED AT THE CONCLUSION OF THE GUARANTEE PERIOD AND WHEN A FINAL INSPECTION HAS BEEN COMPLETED AND APPROVED BY THE OWNER OR AUTHORIZED REPRESENTATIVE.
   b) ANY DEAD OR DYING PLANT MATERIAL SHALL BE REPLACED FOR THE LENGTH OF THE GUARANTEE PERIOD. REPLACEMENT OF PLANT MATERIAL SHALL BE CONDUCTED AT THE FIRST SUCCEEDING PLANTING SEASON. ANY DEBRIS SHALL BE DISPOSED OF OFF-SITE, WITHOUT EXCEPTION.
   c) TREES AND SHRUBS SHALL BE MAINTAINED BY THE CONTRACTOR DURING CONSTRUCTION AND THROUGHOUT THE 90 DAY MAINTENANCE PERIOD AS SPECIFIED HEREIN. CULTIVATION, WEEDING, WATERING AND THE PREVENTATIVE TREATMENTS SHALL BE PERFORMED AS NECESSARY TO KEEP PLANT MATERIAL IN GOOD CONDITION AND FREE OF INSECTS AND DISEASE.
   d) LAWNS SHALL BE MAINTAINED THROUGH WATERING, FERTILIZING, WEEDING, MOWING, TRIMMING AND OTHER OPERATIONS SUCH AS ROLLING, REGARDING AND REPLANTING AS REQUIRED TO ESTABLISH A SMOOTH, ACCEPTABLE LAWN, FREE OF ERODED OR BARE AREAS.
13. CLEANUP
   a) UPON THE COMPLETION OF ALL LANDSCAPE INSTALLATION AND BEFORE THE FINAL ACCEPTANCE, THE CONTRACTOR SHALL REMOVE ALL UNUSED MATERIALS, EQUIPMENT AND DEBRIS FROM THE SITE. ALL PAVED AREAS ARE TO BE CLEANED.
   b) THE SITE SHALL BE CLEANED AND LEFT IN A NEAT AND ACCEPTABLE CONDITION AS APPROVED BY THE OWNER OR AUTHORIZED REPRESENTATIVE.
14. MAINTENANCE (ALTERNATIVE BID):
   a) A 90 DAY MAINTENANCE PERIOD SHALL COMMENCE AT THE END OF ALL LANDSCAPE INSTALLATION OPERATIONS. THE 90 DAY MAINTENANCE PERIOD ENSURES TO THE OWNER/OPERATOR THAT THE NEWLY INSTALLED LANDSCAPING HAS BEEN MAINTAINED AS SPECIFIED ON THE APPROVED LANDSCAPE PLAN. ONCE THE INITIAL 90 DAY MAINTENANCE PERIOD HAS EXPIRED, THE OWNER/OPERATOR MAY REQUEST THAT BIDDERS SUBMIT AN ALTERNATE MAINTENANCE BID FOR A MONTHLY MAINTENANCE CONTRACT. THE ALTERNATE MAINTENANCE CONTRACT WILL ENCOMPASS ANY WORK THAT IS CONSIDERED APPROPRIATE TO ENSURE THAT PLANT AND LAWN AREAS ARE HEALTHY AND MANICURED TO THE APPROVAL OF THE OWNER/OPERATOR.

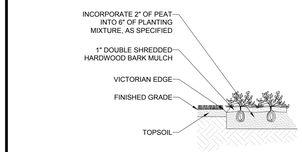
NOTES:
1.) NO SOIL OR MULCH SHALL BE PLACED AGAINST ROOT COLLAR OF PLANT.
2.) REMOVE ALL NON-BIODEGRADABLE MATERIAL AND ROPE FROM TRUNK & TOP OF ROOT BALL. FOLD BURLAP BACK 1/3 FROM ROOT BALL.
3.) PLANTING DEPTH SHALL BE THE SAME AS GROWN IN NURSERY.
4.) THOROUGHLY SOAK THE TREE ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
5.) THE BOTTOM OF PLANTING PIT EXCAVATIONS SHOULD BE ROUGH TO AVOID MATTING OF SOIL LAYERS AS NEW SOIL IS ADDED. IT IS PREFERABLE TO TILL THE FIRST LIFT (2 TO 3 IN.) OF PLANTING SOIL INTO THE SUBSOIL.
6.) REFER TO THE CHART "GENERAL TOPSOIL AND MODIFICATIONS & VOLUMES FOR VARIOUS SOIL CONDITIONS" TO DETERMINE MINIMUM WIDTH OF PREPARED SOIL.
7.) SUBSTITUTE ARBORVITAE STAKING SYSTEM WHEN SPECIFIED.



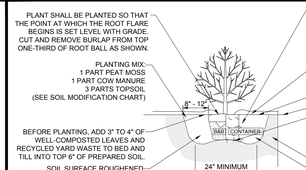
2 TREE PLANTING
NOT TO SCALE



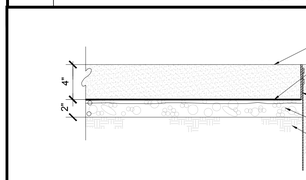
1 TREE PROTECTION DURING SITE CONSTRUCTION
NOT TO SCALE



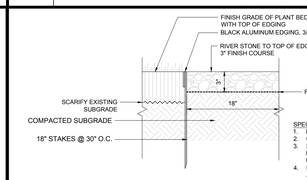
4 GROUNDCOVER PLANTING
NOT TO SCALE



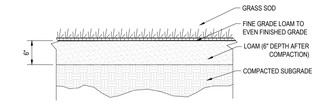
3 SHRUB PLANTING
NOT TO SCALE



6 PEA STONE SURFACING
NOT TO SCALE



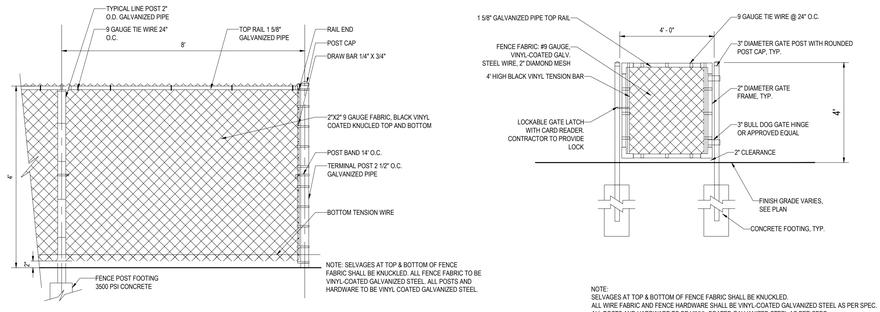
5 RIVER STONE STRIP WITH EDGING
NOT TO SCALE



8 SODDED LAWN
NOT TO SCALE

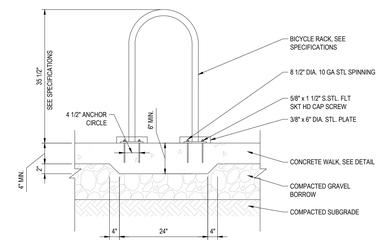
1. PRIOR TO SEEDING, AREA IS TO BE TOPSOILED, FINE GRADED, AND RAKED OF ALL DEBRIS LARGER THAN 2" DIAMETER.
2. PRIOR TO SEEDING, CONSULT MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS.
3. SEEDING RATES:

• PERENNIAL RYEGRASS	1/2 LB/1000 SQ FT
• KENTUCKY BLUEGRASS	1 LB/1000 SQ FT
• RED FESCUE	1/2 LB/1000 SQ FT
• SPREADING FESCUE	1/2 LB/1000



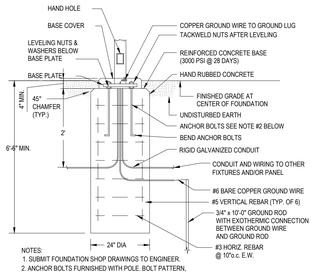
NOTE:
SELVAGES AT TOP & BOTTOM OF FENCE FABRIC SHALL BE KNUCKLED.
ALL WIRE FABRIC AND FENCE HARDWARE SHALL BE VINYL-COATED GALVANIZED STEEL AS PER SPEC.
ALL POSTS AND HARDWARE TO BE VINYL-COATED GALVANIZED STEEL AS PER SPEC.
FABRIC SHALL BE INSTALLED ON THE OUTSIDE OF POST.
WIRE FABRIC TO BE BALCK VINYL-COATED FUSION BONDED.
CONTRACTOR TO SUPPLY SHOP DRAWINGS AND SAMPLES OF ALL FENCE COMPONENTS TO BE APPROVED BY OWNER

1 ***VINYL COATED CHAIN LINK FENCE***
NOT TO SCALE



NOTE:
PROVIDE "HOOP" BICYCLE RACKS MANUFACTURED BY DERO BIKE RACK CO., 5522 LAKELAND AVENUE N., MINNEAPOLIS, MN 55429, 1-888-337-6729. FAX: 612-331-2731 WEBSITE: WWW.DERO.COMA.
1.5" SCHEDULE 40 POWDERCOATED BLACK PIPE (1.90" OD); IN-GROUND MOUNT IS EMBEDDED INTO CONCRETE BASE.

2 ***BIKE RACK***
NOT TO SCALE



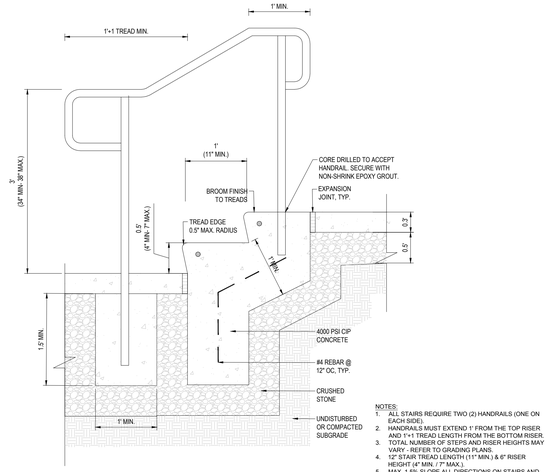
NOTES:
1. SUBMIT FOUNDATION SHOP DRAWINGS TO ENGINEER.
2. ANCHOR BOLTS FURNISHED WITH POLE. BOLT PATTERN,

NOTE: THIS DETAIL IS FOR BID AND BUDGETARY PURPOSES ONLY. CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING A FOUNDATION DESIGN PREPARED BY A QUALIFIED STRUCTURAL ENGINEER CONSIDERING LIGHTING MANUFACTURER REQUIREMENTS, LOCAL WIND LOADS AND SITE SPECIFIC SOIL PARAMETERS.

- SOME SITE CONDITIONS AND/OR LOCATIONS MAY REQUIRE VIBRATION DAMPENING MEASURES AS DETERMINED BY A STRUCTURAL ENGINEER.
- THE STRUCTURAL ENGINEER SHALL BE NOTIFIED OF THE INTENT TO MOUNT ANYTHING TO THE POLE, ASIDE FROM THE LIGHT FIXTURES, INCLUDING BUT NOT LIMITED TO CAMERAS, BANNERS, FLAGS, SIGNAGE, ETC. AS IT WILL IMPACT THE POLE AND FOUNDATION DESIGN.

NOTE:
CONCRETE FOOTING SHALL BE BURIED A MINIMUM OF 4" BELOW GRADE. FOOTING SHALL NOT BE VISIBLE ABOVE GRADE.

3 ***LIGHTPOLE FOOTING***
NOT TO SCALE

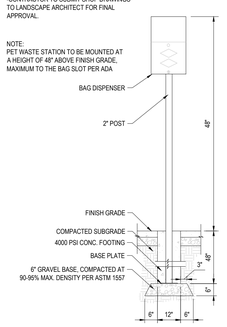


NOTES:
1. ALL STAIRS REQUIRE TWO (2) HANDRAILS (ONE ON EACH SIDE).
2. HANDRAILS MUST EXTEND 1' FROM THE TOP RISER AND 1'+1 TREAD LENGTH FROM THE BOTTOM RISER.
3. TOTAL NUMBER OF STEPS AND RISER HEIGHTS MAY VARY - REFER TO GRADING PLANS.
4. 12" STAIR TREAD LENGTH (11" MIN.) & 6" RISER HEIGHT (4" MIN. / 7" MAX.)
5. MAX. 1.5% SLOPE ALL DIRECTIONS ON STAIRS AND 5'X5' TOP AND BOTTOM LANDINGS.
6. HANDRAIL TO BE POWDERCOATED BLACK.
7. SHOP DRAWINGS REQUIRED.

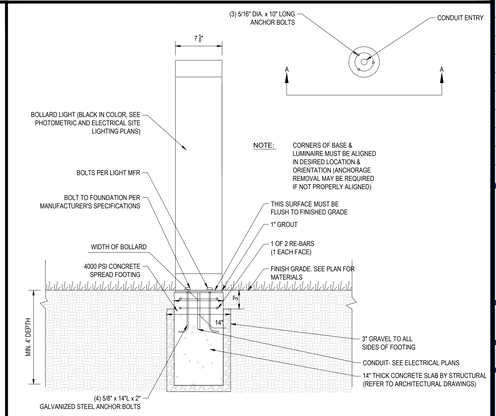
4 ***CONCRETE STAIRS WITH HANDRAIL***
NOTE TO SCALE

ALUMINUM BAG DISPENSER:
H:12.5" X W: 9" X D: 3.5"
-14 GAUGE POWDER COATED GREEN ALUMINUM
-400 BAG CAPACITY W/ TWO DIAMOND SHAPED BAG DISPENSER SLOTS.
-FRONT LOCKING ACCESS PANEL.
-CLEARLY POSTED INSTRUCTIONS.
-CONTRACTOR TO SUBMIT SHOP DRAWINGS TO LANDSCAPE ARCHITECT FOR FINAL APPROVAL.

NOTE:
PET WASTE STATION TO BE MOUNTED AT A HEIGHT OF 48" ABOVE FINISH GRADE. MAXIMUM TO THE BAG SLOT PER ADA



5 ***DOG WASTE BIN***
NOT TO SCALE



NOTE: CORNERS OF BASE & LUMINAIRE MUST BE ALIGNED IN DESIRED LOCATION & ORIENTATION (ANCHORAGE REMOVAL MAY BE REQUIRED IF NOT PROPERLY ALIGNED)

6 ***LIGHT BOLLARD***
NOT TO SCALE

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABILITY SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES
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PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JJE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-LAND

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
www.BohlerEngineering.com

M.J. MRVA
REGISTERED LANDSCAPE ARCHITECT
VERMONT No. 01337
"DRAFT" No. 250433

SHEET TITLE:

LANDSCAPE DETAILS

SHEET NUMBER:

L-301

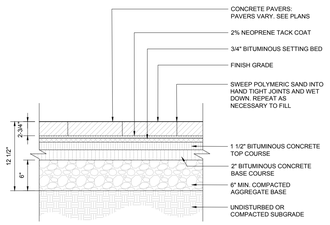
ORG. DATE - 08/12/2025

P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-LAND-MAB250036.00-01----LAYOUT: L-301 DETAILS
DT

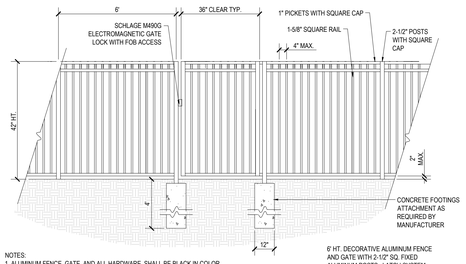
NOTES:
1. SEE SITE PLAN FOR WIDTH AND GRADES
2. PROVIDE MINIMUM 1/8"/FT. CROSS-SLOPE

SPECIFICATION:
1.1. TYPICAL PAVER - PRECAST CONCRETE PAVERS SHALL BE TECHO BLOC SLEEK PAVER (16"X32"), PAVER COLOR SHALL BE 'SILVER GRANITE'.

1.2. ACCENT PAVER - PRECAST CONCRETE PAVERS SHALL BE TECHO BLOC SLEEK PAVER (16"X32"), PAVER COLOR SHALL BE 'CHAMPLAIN GREY'.



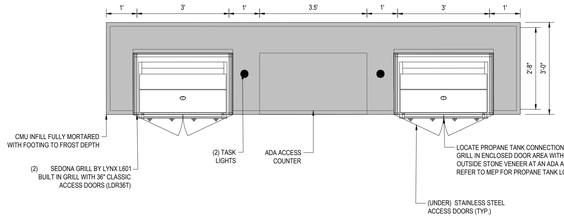
1 ***CONCRETE PAVERS ON BITUMINOUS***
NOT TO SCALE



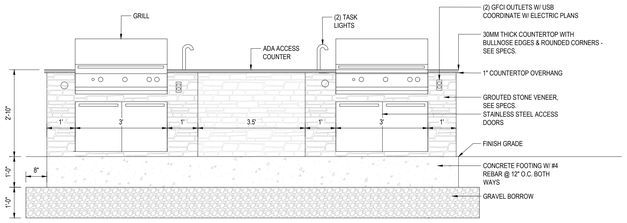
NOTES:
1. ALUMINUM FENCE, GATE, AND ALL HARDWARE SHALL BE BLACK IN COLOR.
2. CONTRACTOR SHALL VERIFY THAT ALL FENCING MEETS APPLICABLE STATE, LOCAL, AND FEDERAL CODES

6' HT. DECORATIVE ALUMINUM FENCE AND GATE WITH 2-1/2" SQ. FIXED ALUMINUM POSTS. LATCH SYSTEM WITH LOCK AND SELF CLOSING MECHANISM FOR EACH GATE

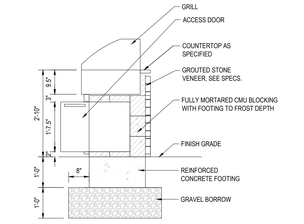
2 ***ALUMINUM PICKET FENCE AT TERRACES***
NOT TO SCALE



LAYOUT PLAN



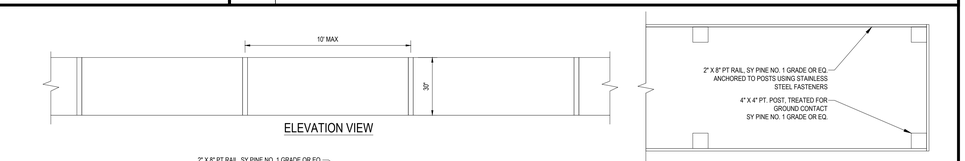
ELEVATION



NOTES:
1. REFER TO MANUFACTURER'S INFORMATION FOR ADDITIONAL REQUIREMENTS AND MEASUREMENTS.
2. CONTRACTOR TO SUBMIT SAMPLES OF ALL MATERIALS TO LANDSCAPE ARCHITECT & OWNER FOR APPROVAL PRIOR TO ORDERING.
3. CONTRACTOR TO NOTIFY LANDSCAPE ARCHITECT OF DISCREPANCIES IN DIMENSIONS & LAYOUT.
4. CONTRACTOR RESPONSIBLE FOR ANY ELECTRICAL FEED LINES & ASSOCIATED WORK REQUIRED.
5. SHOP DRAWINGS REQUIRED.

SECTION

3 ***OUTDOOR KITCHEN AND GRILL***
NOT TO SCALE



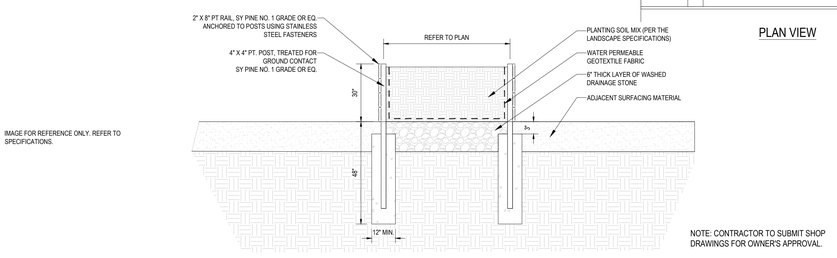
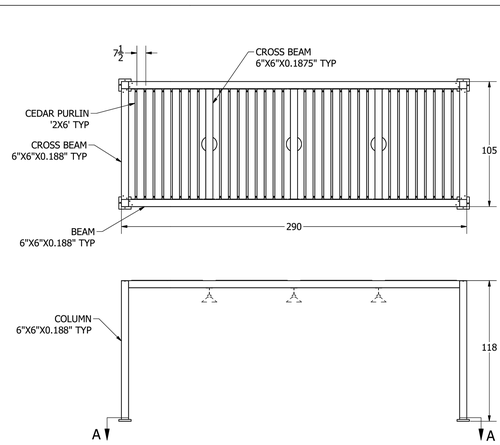


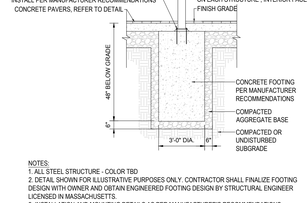
IMAGE FOR REFERENCE ONLY. REFER TO SPECIFICATIONS.

NOTE: CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR OWNER'S APPROVAL.

SECTION VIEW

6 ***LINEAR WOOD PLANTER AT COMMUNITY GARDEN***
NOT TO SCALE





NOTES:
1. ALL STEEL STRUCTURE - COLOR TBD
2. DETAIL SHOWN FOR ILLUSTRATIVE PURPOSES ONLY. CONTRACTOR SHALL FINALIZE FOOTING DESIGN WITH OWNER AND OBTAIN ENGINEERED FOOTING DESIGN BY STRUCTURAL ENGINEER LICENSED IN MASSACHUSETTS.
3. INSTALLATION AND MOUNTING DETAILS AS PER MANUFACTURER'S RECOMMENDATIONS.

NOTES:

1. SITE SPECIFIC ENGINEERING BEYOND THE ANCHOR FASTENERS IS BY OTHERS.

2. UNLESS OTHERWISE SPECIFIED, MATERIAL OF STRUCTURAL COMPONENTS IS ALUMINUM ALLOY 6061-T6.

DESIGNED:	D. BUONITSKY, P. ENG	TOLERANCE: FRACTIONS ± 1/8" ANGLES ± 0.5°	sturdesign www.sturdesign.com
APPROVED:	MIKE SANKEY	UNITS: INCHES (UNLESS OTHERWISE SPECIFIED)	
DATE:	2024-09-16	MATERIAL: Aluminum 6061	
	Layout	WEIGHT ESTIMATE: 1273.0 lbmass	
SIZE: B	SHEET: 1 OF 2	SCALE: 1 / 48	PROJECT: (1706) 582 Kelley
REV: 1	PRODUCT CODE: **VB-105X290-3IR66-IVW26-CV**		PRODUCT: Custom Viso Bold Pergola

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4 ***SHADE STRUCTURE***
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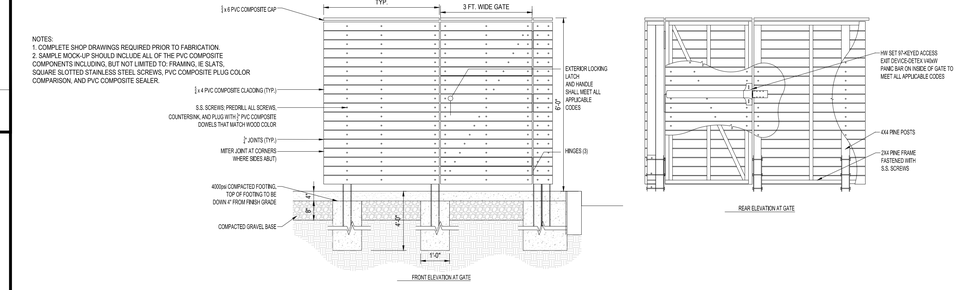

NOTES:
1. COMPLETE SHOP DRAWINGS REQUIRED PRIOR TO FABRICATION.
2. SAMPLE MOCK-UP SHOULD INCLUDE ALL OF THE PVC COMPOSITE COMPONENTS INCLUDING, BUT NOT LIMITED TO: FRAMING, IE SLATS, SQUARE SLOTTED STAINLESS STEEL SCREWS, PVC COMPOSITE PLUG COLOR COMPARISON, AND PVC COMPOSITE SEALER.

5 ***6' HT. TIMBER SCREEN AND GATE***
NOT TO SCALE

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
STRUCTURAL ENGINEERING
PERMITTING SERVICES
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DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-CIVIL-LAND

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
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M.J. MRVA
REGISTERED LANDSCAPE ARCHITECT
COMMONWEALTH OF MASSACHUSETTS
No. 752 REGISTERED
LANDSCAPE ARCHITECT
MICHAEL J. MRVA
VERMONT No. 01337
CAN/CSLA No. 250433

SHEET TITLE:

LANDSCAPE DETAILS

SHEET NUMBER:

L-302

ORG. DATE - 08/12/2025

P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SET\SC\VIL SITE PLAN\SP-CIVIL-LAND-MAB250036.00-SC-----3-LAYOUT-L-302 DETAILS.DWG

\\vhb.com\gbl\proj\Boston\16393.00 Welltower-Needham ALTA\cad\sr\planset\16393.00-ALTA.dwg

Legal Description

THE LAND, TOGETHER WITH THE BUILDINGS AND IMPROVEMENTS THEREON, IN NEEDHAM, NORFOLK COUNTY, MASSACHUSETTS SHOWN AS PARCEL 1 ON THE PLAN ENTITLED, "CONSOLIDATED PLAN OF LAND IN NEEDHAM, MASSACHUSETTS", PREPARED FOR THE OWNER: CONTINUUM CARE CORPORATION, PREPARED BY: VANASSE HANGEN BRUSTLIN, INC., SCALE: 1 INCH = 40 FEET, DATED DECEMBER 7, 1993, RECORDED AS PLAN #26 OF 1994 IN PLAN BOOK 419, FORMERLY SHOWN AS LOTS 3C AND 3D ON THE PLAN ENTITLED "PLAN OF LAND IN NEEDHAM, MASS.," DATED OCTOBER 22, 1992, SCALE 1" = 30', DRAWN BY NEEDHAM SURVEY ASSOCIATES, INC., RECORDED WITH THE NORFOLK COUNTY REGISTRY OF DEEDS AS PLAN #721 OF 1992 IN PLAN BOOK 409.

ACCORDING TO THE PLAN, SAID PARCEL 1 CONTAINS 4.298 ACRES OF LAND.

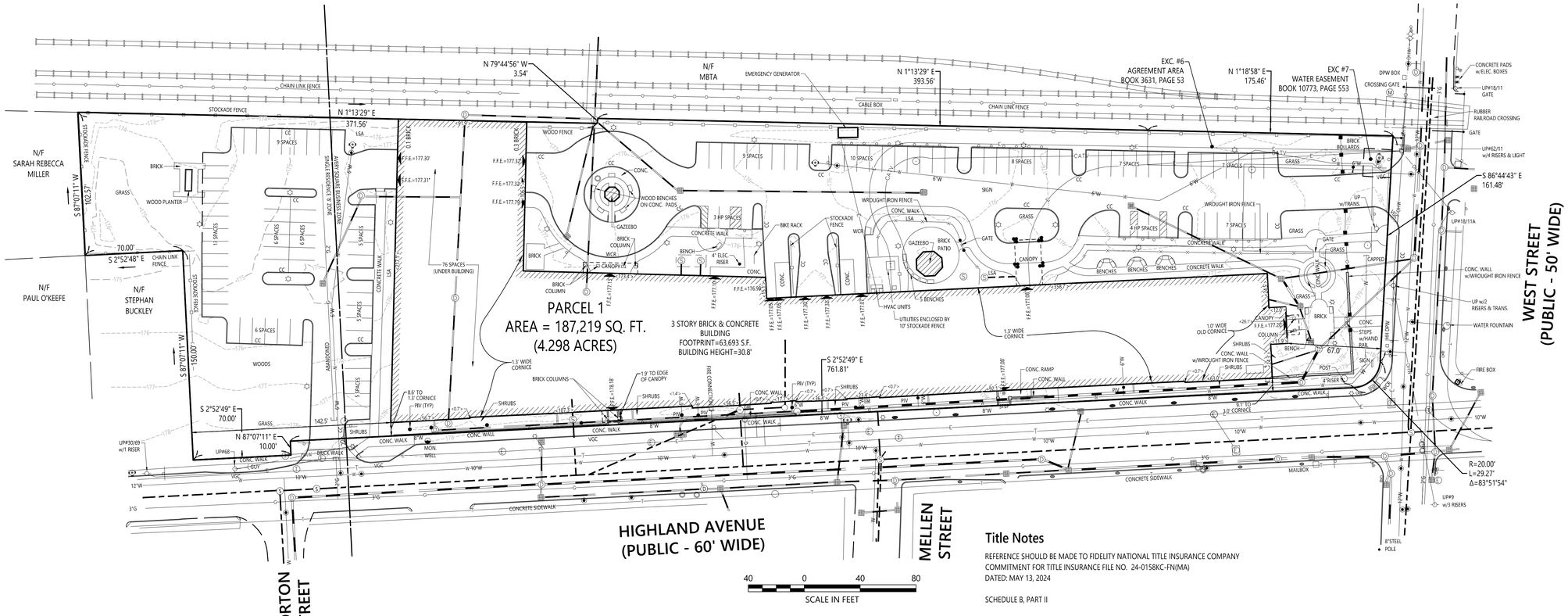
Certification

TO: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;
FIDELITY NATIONAL TITLE INSURANCE COMPANY:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 2-5, 7(a), 7(b)(1), 8, 9, 10, 11(a), 13, 14, 16, 17, 18 & 19 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON MAY 15, 2024.

DATE PROFESSIONAL LAND SURVEYOR

vhb.com
vhb
101 Walnut Street
PO Box 9151
Watertown, MA 02471
617.924.1770



Legend

- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- ELECTRIC MANHOLE
- TELEPHONE MANHOLE
- MANHOLE
- HH HAND HOLE
- WATER GATE
- FIRE HYDRANT
- GAS GATE
- BOLLARD w/LIGHT
- STREET SIGN
- LIGHT POLE
- UTILITY POLE
- GUY POLE
- GUY WIRE
- MONITORING WELL
- FLOOD LIGHT
- W WELL
- MARSH
- F.F.E.=45.27' FINISHED FLOOR ELEVATION
- CNO COULD NOT OPEN
- NPV NO PIPES VISIBLE
- DYL DOUBLE YELLOW LINE
- DWL DASHED WHITE LINE
- SYL SINGLE YELLOW LINE
- LSA LANDSCAPED AREA
- EOP EDGE OF PAVEMENT
- CC CONCRETE CURB
- VGC VERTICAL GRANITE CURB
- SGE SLOPED GRANITE EDGE
- BB BITUMINOUS BERM
- BC BITUMINOUS CURB
- GUARD RAIL
- CHAIN LINK FENCE
- DRAINAGE LINE
- SEWER LINE
- OHW OVERHEAD WIRE
- E UNDERGROUND ELECTRIC
- T TELEPHONE LINE
- G GAS LINE
- W WATER LINE
- STONE WALL
- TREE LINE
- 100'BZ 100-FT BUFFER ZONE
- 100'RA 100-FT RIVER FRONT AREA
- 200'RA 200-FT RIVER FRONT AREA
- AF1-100 LIMIT MEAN ANNUAL HIGH WATER
- BF1-100 LIMIT OF BANK
- WF1-100 VEGETATED WETLAND BOUNDARY

General Notes

1) THE PROPERTY LINES SHOWN ON THIS PLAN ARE BASED UPON AN ACTUAL FIELD SURVEY CONDUCTED BY VHB, INC. IN DECEMBER, 1994, AUGUST, 1995 AND FROM DEEDS AND PLANS OF RECORD, VERIFIED IN FEBRUARY, 2020 AND VERIFIED AGAIN IN MAY, 2024.
2) THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE BASED UPON AN ACTUAL ON-THE-GROUND INSTRUMENT SURVEY PERFORMED BY VHB, INC. IN DECEMBER, 1994, AUGUST, 1995, FEBRUARY, 2020 AND VERIFIED ON MAY 22, 2024. TABLE A - ITEM 8
3) THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES SHOWN ON THIS PLAN ARE BASED ON FIELD OBSERVATIONS AND INFORMATION OF RECORD. THEY ARE NOT WARRANTED TO BE EXACTLY LOCATED NOR IS IT WARRANTED THAT ALL UNDERGROUND UTILITIES OR OTHER STRUCTURES ARE SHOWN ON THIS PLAN. TABLE A - ITEM 11(a)
4) HORIZONTAL DATUM IS BASED ON MASS. GRID SYSTEM, NAD 1983.
5) THE LOT LIES ENTIRELY WITHIN ZONE X (UNSHADED) (AREAS TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AS SHOWN ON THE FLOOD INSURANCE RATE MAP FOR NORFOLK COUNTY, MASSACHUSETTS, MAP NUMBER 25021C0036E, EFFECTIVE DATE JULY 17, 2012. TABLE A - ITEM 3
6) THE LOT LIES WITHIN THE AVERY SQUARE BUSINESS DISTRICT (ASB) AND SIGNAL RESIDENCE - B (SBR) AS SHOWN ON THE THE TOWN OF NEEDHAM, MASSACHUSETTS ZONING MAP LAST REVISED - JULY 21, 2022. DIMENSIONAL REQUIREMENTS FOR A (ASB) & (SRB) AT THE TIME OF THIS SURVEY ARE: TABLE A - ITEM 6(a)

	REQ. (ASB)	REQ. (SRB)	EXISTING
MINIMUM LOT AREA	19,000 S.F.	10,000 S.F.	187,219 S. F.
MINIMUM FRONTAGE	100 FEET	80 FEET	190.75 FEET (WEST ST.)
MINIMUM FRONT YARD SETBACK	10 FEET	20 FEET	67.0FEET (WEST ST.)
MINIMUM SIDE YARD SETBACK	50 FEET	20 FEET	0.1 FEET (MBTA)
MINIMUM REAR YARD SETBACK	N/A*	10 FEET	142.5 FEET
MAXIMUM BUILDING HEIGHT	35 FEET	35 FEET	30.8 FEET
MAXIMUM BUILDING STORIES	4 STORIES	2.5 STORIES	3 STORIES

*REAR SETBACK IS WAIVED WHERE PROPERTIES ABUT RAILROAD OR RAPID TRANSIT RIGHT-OF-WAY.

NO ZONING REPORT HAS BEEN FURNISHED TO VHB.

7) THE SITE HAS DIRECT ACCESS TO WEST STREET AND HIGHLAND AVE. BOTH DEDICATED PUBLIC WAYS
8) THE PROPERTY IS LOCATED AT THE INTERSECTION OF WEST STREET AND HIGHLAND AVE. TABLE A - ITEM 14
9) THE SITE HAS 179 REGULAR PARKING SPACES AND 7 HANDICAP SPACES. TABLE A - ITEM 9
10) NO EVIDENCE OF CURRENT EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS, WERE OBSERVED. TABLE A - ITEM 16
11) NO PROPOSED CHANGES IN EXISTING STREET RIGHT OF WAY LINES, WERE DETERMINED. NO EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION OR REPAIRS, WERE OBSERVED. TABLE A - ITEM 17
12) OFFSITE EASEMENT AND SERVITUDES LISTED IN THE TITLE COMMITMENT REFERENCED HEREON HAVE BEEN PLOTTED. TABLE A - ITEM 18
13) THE PROPERTY IS CONTIGUOUS WITH NO STRIPS, GAPS OR GORES.
14) THE PROPERTIES SHOWN HEREON ARE THE SAME AS DESCRIBED IN THE TITLE COMMITMENT REFERENCED HEREON.

Record Owner

HCRI MASSACHUSETTS PROPERTIES TRUST
100-110 WEST STREET
NEEDHAM, MASS.
MAP 1 BLOCK 1 LOT 1
BOOK 35485, PAGE 99, DOC.#906512

Title Notes

REFERENCE SHOULD BE MADE TO FIDELITY NATIONAL TITLE INSURANCE COMPANY
COMMITMENT FOR TITLE INSURANCE FILE NO. 24-0158KC-FN(MA)
DATED: MAY 13, 2024

SCHEDULE B, PART II

ITEM COMMENT

1-5 NON-SURVEY RELATED ISSUES

6 AGREEMENTS
BOOK 3631, PAGE 53 (PLAN 381 OF 1958)
AFFECTS LOCUS
SHOWN ON PLAN

7 ACCESS AND MAINTENANCE EASEMENT
BOOK 10773, PAGE 553 (PLAN 898 OF 1994)
AFFECTS LOCUS (LABELED WATER EASEMENT AS SHOWN ON REC. PLAN)
SHOWN ON PLAN

8 DEED (STREET PURPOSES)
BOOK 2141, PAGE 225
DOES NOT AFFECT LOCUS
SHOWN ON PLAN AS CURRENT LAYOUT OF HIGHLAND AVE.

9 ORDER OF TAKING (HIGHLAND AVE.)
BOOK 2600, PAGE 534, BOOK 2746, PAGE 234 & BOOK 3129, PAGE 347
DOES NOT AFFECT LOCUS
SHOWN ON PLAN AS CURRENT LAYOUT OF HIGHLAND AVE.

10 SITE PLAN SPECIAL PERMIT
BOOK 10204, PAGE 441, BOOK 10254, PAGE 168, BOOK 10389, PAGE 647, BOOK 10857, PAGE 493, BOOK 11384, PAGE 726 & BOOK 11517, PAGE 633
DOCUMENTS REFER TO LOCUS
NOT SURVEY RELATED

11 PROPOSED WATER EASEMENT (SEE EXC. #7 ABOVE)
PLAN BOOK 427, PLAN 898 OF 1994
AFFECTS LOCUS
SHOWN ON PLAN

LCB Sr Living

100-110 West Street
Needham, Massachusetts

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for | Date

June 10, 2024

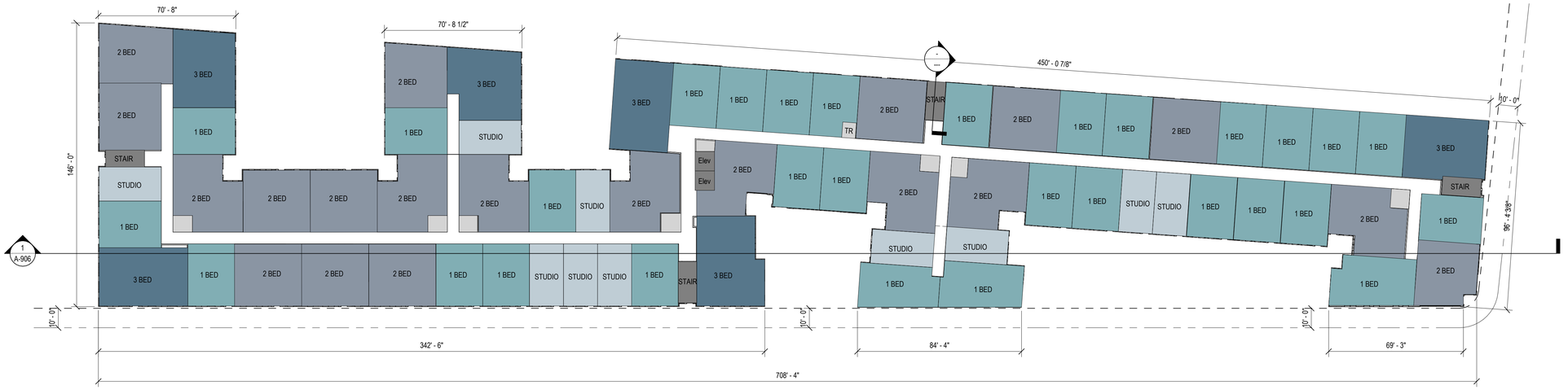
Drawing Title
ALTA/NSPS Land Title Survey

Drawing Number
Sv-1

Sheet 1 of 1

Project Number
14817.00

Saved Wednesday, June 12, 2024 2:11:54 PM RBOUSQUET Plotted Wednesday, June 12, 2024 2:12:22 PM Russell Bousquet

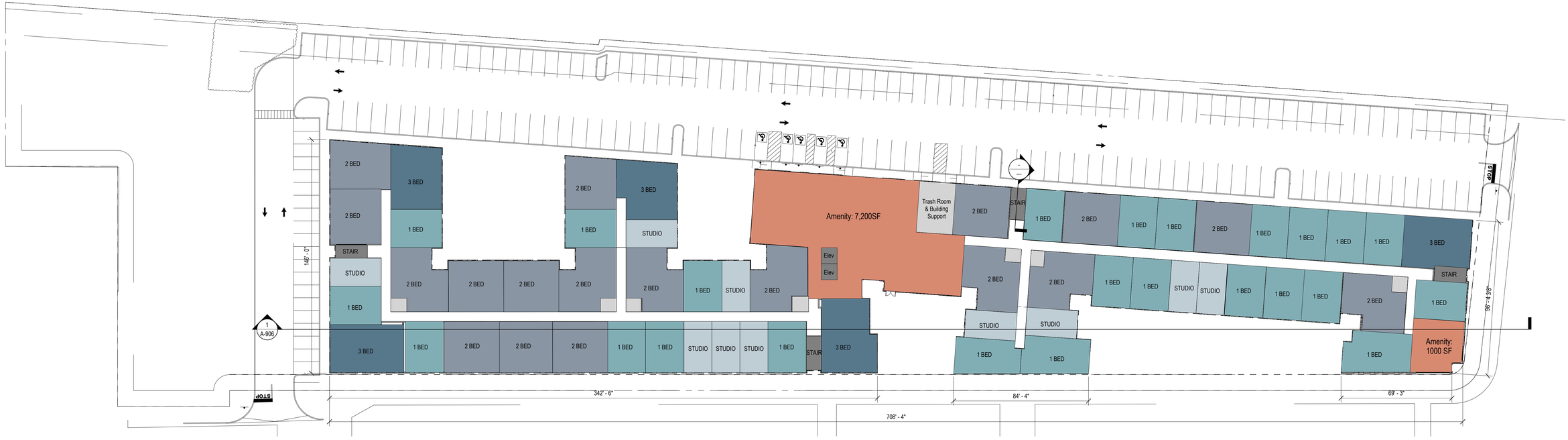


Typical Floor Plan Levels 2 & 3

1" = 30'-0"

2

A-904



Ground Floor Plan

1" = 30'-0"

1

A-904

100 West
100 West Street,
Needham, MA
08 August 2025

FLOOR PLANS

CUBE 3 Studio LLC | 56 High Street | North Andover, MA 01845 | 978.989.9900 | cube3.com

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Enlarged Elevation Along Highland Ave
1/16" = 1'-0"
3
A-905

Enlarged Elevation Along Highland Ave
1/16" = 1'-0"
2
A-905

Elevation Along Highland Ave
1" = 30'-0"
1
A-905

100 West
100 West Street,
Needham, MA
08 August 2025

BUILDING ELEVATIONS

CUBE 3 Studio LLC | 56 High Street | North Andover, MA 01845 | 978.989.9900 | cube3.com

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Proposed Materials Elevation — 3 / A-906
NTS

Elevation Along West St — 2 / A-906
1/16" = 1'-0"

Building Section — 1 / A-906
1" = 30'-0"

100 West
100 West Street,
Needham, MA
08 August 2025

BUILDING ELEVATIONS AND SECTIONS

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DRAINAGE REPORT

For

GREYSTAR™

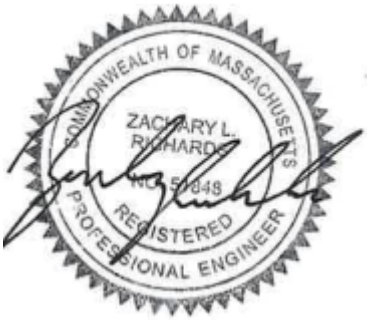
PROPOSED

MULTI-FAMILY DEVELOPMENT

100 WEST STREET, TOWN OF NEEDHAM
NORFOLK COUNTY, MASSACHUSETTS

Prepared by:

BOHLER
45 Franklin Street, 5th Floor
Boston, MA 02110
(617) 849-8040 TEL.



Zachary Richards, PE
Massachusetts P.E. Lic. #51848

BOHLER

August 12, 2025
#MAB250036.00

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- INSPECTION AND MAINTENANCE LOG FORM
- LONG-TERM POLLUTION PREVENTION PLAN
- ILLICIT DISCHARGE STATEMENT
- SPILL PREVENTION
- PROPOSED OPERATION AND MAINTENANCE MAP
- MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS

I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the proposed development at 100 West Street in the Town of Needham. The proposed development consists of a new multi-family building and corresponding parking areas located on the westerly side of Highland Avenue. The site, which contains approximately 4.30 acres of land, contains an existing vacant senior living center.

The proposed project includes the construction of a new 68,200 sf footprint 3-story residential building along with new paved parking areas, landscaping, storm water management components, and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at four (4) "design points" where stormwater runoff currently drains to under existing conditions. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates and volumes for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** and **Table 1.2** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	2.79	0.62	**-2.17**	4.84	3.11	**-1.73**	6.19	4.46	**-1.73**	8.33	5.98	**-2.35**
DP2	5.94	2.78	**-3.16**	9.77	8.15	**-1.62**	12.23	9.24	**-2.99**	16.05	13.56	**-2.49**
DP3	0.45	0.43	**-0.02**	0.71	0.67	**-0.04**	0.87	0.82	**-0.05**	1.12	1.06	**-0.06**
DP4	1.03	0.07	**-0.96**	1.99	0.27	**-1.72**	2.66	0.43	**-2.23**	3.74	0.71	**-3.03**

**Flows are represented in cubic feet per second (cfs)*

Table 1.2: Design Point Volume Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	0.233	0.045	**-0.233**	0.400	0.167	**-0.188**	0.510	0.257	**-0.123**	0.684	0.407	**-0.017**
DP2	0.490	0.195	**-0.349**	0.811	0.527	**-0.471**	1.017	0.752	**-0.547**	1.337	1.112	**-0.664**
DP3	0.037	0.035	**-0.002**	0.059	0.056	**-0.003**	0.073	0.069	**-0.004**	0.095	0.093	**-0.002**
DP4	0.088	0.007	**-0.081**	0.164	0.021	**-0.143**	0.215	0.033	**-0.182**	0.299	0.052	**-0.247**

**Volumes are represented in acre-feet (af)*

II. EXISTING SITE CONDITIONS

The existing building on site follows along the Highland Ave frontage in a north and south orientation. There are existing parking lots to the south and west of the existing building. The parking areas generally overland flow to a series of catch basins and are conveyed to one of the three (3) design points outlined below via underground drainage pipes. The existing building has roof drains that are collected along the Highland Ave side of the building, and the roof drains are conveyed to the north via underground drainage pipes. Slopes on the site range from 1%-20% with on-site elevations ranging from 173 in the southwest corner adjacent to the MBTA tracks to 180 at the northeasterly portion of the property.

Based on the Natural Resource Conservation Service (NRCS), the soils in the area are considered Urban Land (unclassified); however, onsite soil testing was performed by Bohler on May 14th, 2025. Based on the onsite test pit results and NRCS data the project will be analyzed using HSG B (and associated conservative Rawl's rate of 1.02 in/hr) based on the observed sandy loam. Refer to Appendix C for additional information.

For the purposes of this design, and based on the above information, four design points have been selected for analysis. Design Point 1 is an existing 12" drainage pipe that leaves the property to the west. This design point receives flows from the existing parking lot to the south and portions of the existing parking lot to the west of the building. Design Point 2 is the existing 18" drainage main in West Street. This design point receives flows from the existing building and the northern portion of the parking lot to the west of the building. Design Point 3 is the existing 15" drainage main in Highland Avenue. This design point receives flows from the landscape strip between the existing building and the right of way. Desing Point 4 is the southern property line where lawn and parking lot areas overland flow to the south.

Refer to **Table 1.1** and **Table 1.2** for the existing conditions peak rates and volumes of runoff. Refer to Appendix D and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

The proposed project includes the construction of a new 68,200 sf residential building along with new paved parking areas, landscaping, stormwater management components, and associated utilities. The runoff from the site will be collected and conveyed via deep-sump, hooded catch basins and water quality units/inlets prior to connection to the proposed infiltration systems which will ultimately discharge to the existing drainage infrastructure.

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in Section II above. The site was subdivided into four (4) separate sub catchments for the proposed conditions.

Refer to **Table 1.1** and **Table 1.2** for the calculated proposed conditions peak rates and volumes of runoff. For additional hydrologic information, refer to Appendix E and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in **Table 4.1** below for stormwater calculations is based on NOAA. Refer to **Appendix F** for more information.

Table 4.1: NOAA Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.32	5.20	6.38	8.19

*Values derived from NOAA ATLAS on 04/30/2025

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Additionally, the proposed project meets, or exceeds, the MADEP Stormwater Management standards. Compliance with these standards is described further below.

V. STORMWATER MANAGEMENT STANDARDS

MassDEP Stormwater Standards

Standard #1: No New Untreated Discharges

The project has been designed so that proposed impervious areas (including the building roof and paved parking/driveway areas) shall be collected and passed through the proposed drainage system for treatment prior to discharge.

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1**, the development of the site and the proposed stormwater management system have been designed so that post-development peak rates and volumes of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

Standard #3: Recharge

The stormwater runoff from the project will be collected and diverted to one of three proposed infiltration systems. The project as proposed will result in a post-construction impervious area of 152,406 square feet of impervious area which equates to an increase of 22,851 square feet of impervious area. This results in a required recharge volume of 665 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed infiltration systems will provide 17,387 cubic feet of volume below the lowest outlet for groundwater recharge. Refer to **Appendix F** of this report for calculations documenting required and provided recharge volumes.

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing that the proposed Infiltration System - 1 will drain within 11.0 hours, Infiltration System – 2 will drain within 14.7 hours, and Infiltration System – 3 will drain in 43.5 hours are included in **Appendix F** of this report.

A four (4) foot separation to estimated seasonal high groundwater is provided and a groundwater mounding analysis is not required.

Standard #4: Water Quality

Water quality treatment is provided via deep sump catch basins, water quality units/inlets, and three infiltration systems. TSS removal calculations are included in **Appendix F** of this report. The proposed project will result in a post-construction impervious area of 152,406 square feet of impervious area and is required to treat 12,701 cubic feet of water quality volume as defined in

Stormwater Standard 4 and the Town of Needham Stormwater By-Law. The proposed infiltration systems will provide 17,387 cubic feet of volume below the lowest outlet for water quality treatment. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes.

Standard #5: Land Use with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

Not Applicable for this project.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stockpiles and various other techniques as outlined on the erosion and sediment control sheets. Additionally, the project is required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period. The SWPPP will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the project's proponent. Refer to **Appendix H**.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix G** of this report. The O&M Plan outlines procedures and timetables for the long-term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties and an estimated budget for inspections and maintenance.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates and volume of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies, as documented in **Table 6.1** and **Table 6.2** below. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff and substantial infiltration and groundwater recharge, all of which are not achieved under existing conditions. This project as proposed will result in a significant improvement to stormwater runoff from the subject site.

Table 6.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	2.79	0.62	**-2.17**	4.84	3.11	**-1.73**	6.19	4.46	**-1.73**	8.33	5.98	**-2.35**
DP2	5.94	2.78	**-3.16**	9.77	8.15	**-1.62**	12.23	9.24	**-2.99**	16.05	13.56	**-2.49**
DP3	0.45	0.43	**-0.02**	0.71	0.67	**-0.04**	0.87	0.82	**-0.05**	1.12	1.06	**-0.06**
DP4	1.03	0.07	**-0.96**	1.99	0.27	**-1.72**	2.66	0.43	**-2.23**	3.74	0.71	**-3.03**

**Flows are represented in cubic feet per second (cfs)*

Table 6.2: Design Point Volume Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	0.233	0.045	**-0.233**	0.400	0.167	**-0.188**	0.510	0.257	**-0.123**	0.684	0.407	**-0.017**
DP2	0.490	0.195	**-0.349**	0.811	0.527	**-0.471**	1.017	0.752	**-0.547**	1.337	1.112	**-0.664**
DP3	0.037	0.035	**-0.002**	0.059	0.056	**-0.003**	0.073	0.069	**-0.004**	0.095	0.093	**-0.002**
DP4	0.088	0.007	**-0.081**	0.164	0.021	**-0.143**	0.215	0.033	**-0.182**	0.299	0.052	**-0.247**

**Volumes are represented in acre-feet (af)*

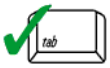
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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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.

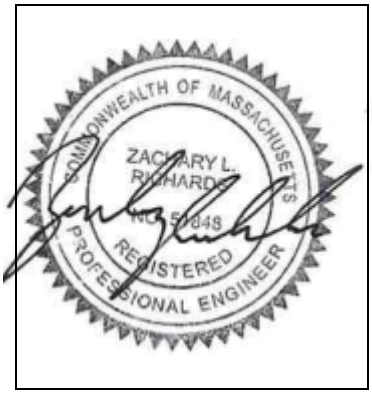
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



08/12/25

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): Subsurface Infiltration Chambers

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.

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

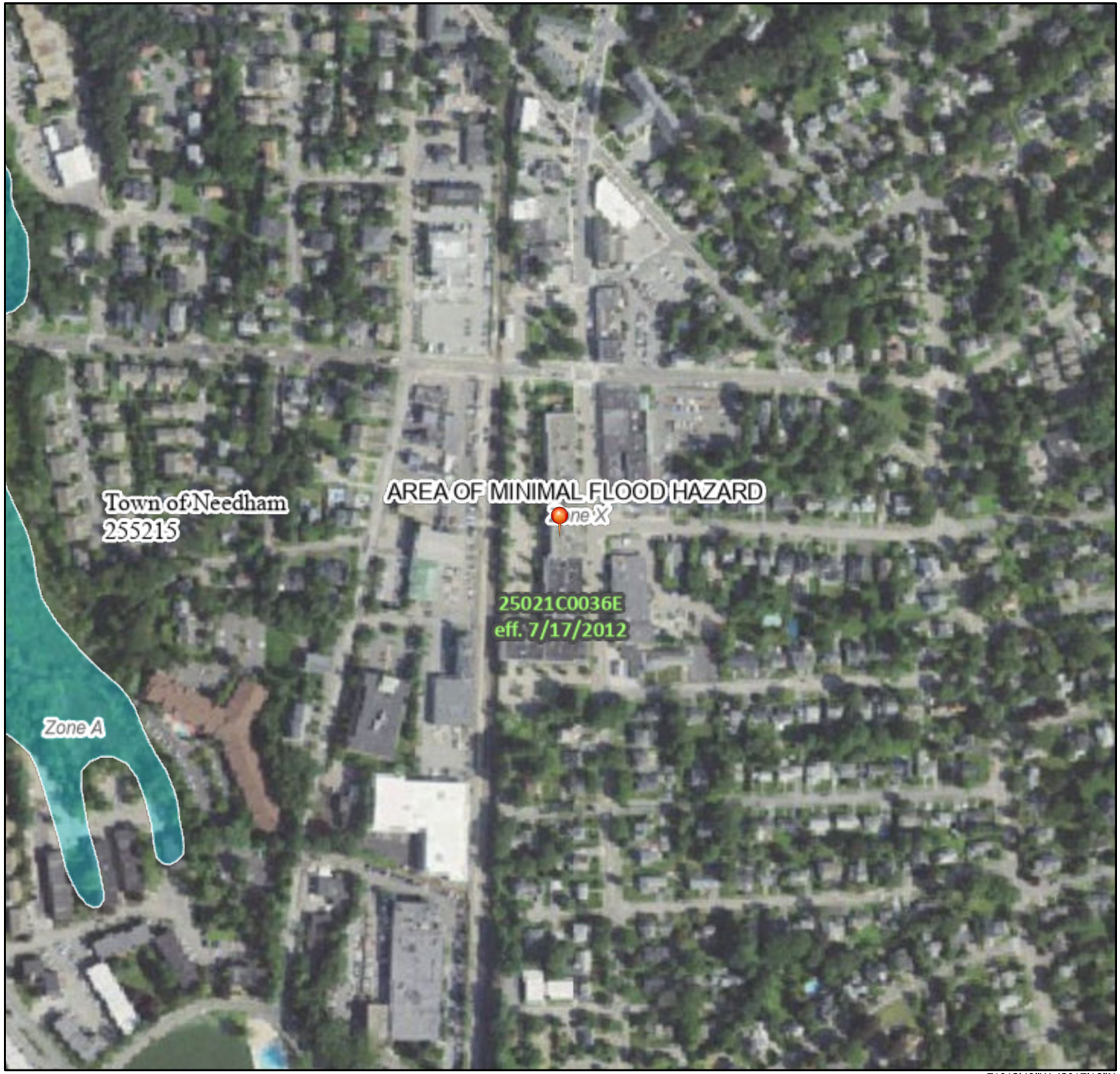
APPENDIX B: PROJECT LOCATION MAPS

- *FEMA FIRMETTE*

National Flood Hazard Layer FIRMette

FEMA

71°14'26"W 42°17'45"N



71°13'49"W 42°17'18"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

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

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

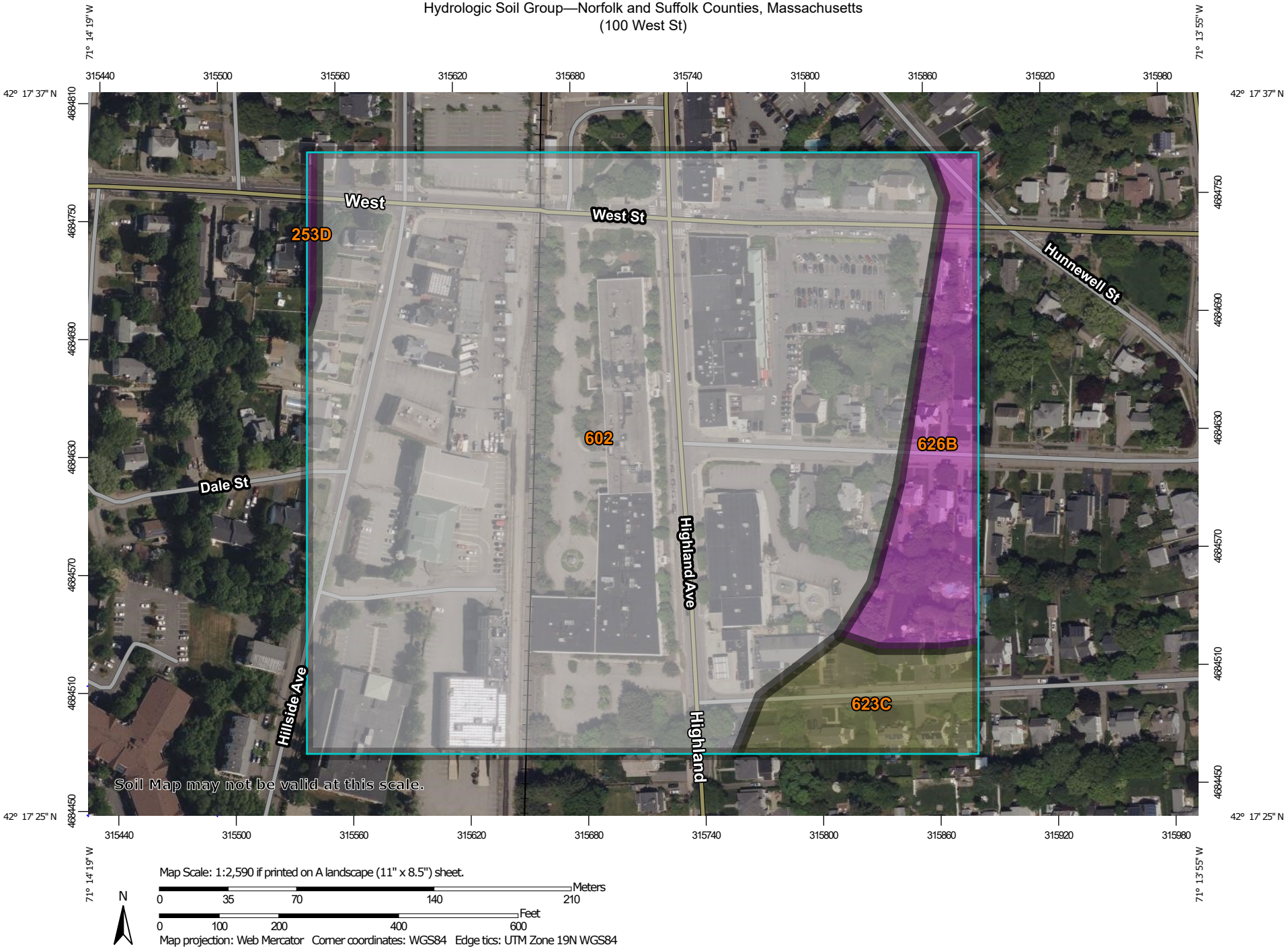
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/25/2025 at 7:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *SOIL TESTING LOGS*

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(100 West St)



Map Scale: 1:2,590 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
253D	Hinckley loamy sand, 15 to 35 percent slopes	A	0.1	0.4%
602	Urban land, 0 to 15 percent slopes		22.2	85.3%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	C/D	1.5	5.6%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	2.3	8.8%
Totals for Area of Interest			**26.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Commonwealth of Massachusetts
City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Greystar
Owner Name

100 West Street
Street Address

Parcel ID: 199/063.0-0037.0000.0
Map/Lot #

Needham
City

MA
State

02494
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — NRCS WebSoil Survey (Source); 602 (Soil Map Unit); Urban land, 0 to 15 percent slopes (Soil Series)

Excavated and filled land
Landform

None specified
Soil Limitations

Not applicable
Soil Parent material

3. Surficial Geological Report — 2018 - Stone and DiGiacomo-Cohen (Year Published/Source); Coarse deposits (Map Unit)

Gravel deposits, sand and gravel deposits,and sand deposits. Gravel deposits are composed of at least 50 percent gravel-size clasts; cobbles and boulders predominate; minor amounts of sand occur within gravel beds, and sand comprises a few separate layers.

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): MA-DVW 10R Dover, MA (05/13/2025) — Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
Site is located in a Zone II Wellhead Protection Area. Monitoring wells located on the property at 100 West Street installed on 04/18/2003 via EEA data portal.

Commonwealth of Massachusetts
City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP #1 (Hole #) | 05/14/2025 (Date) | 7:15 AM (Time) | Overcast; 53º F (Weather) | 42.292005° (Latitude) | -71.23547° (Longitude)

1. Land Use: Parking lot area (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: Parking lot area adjacent to vacant building

2. Soil Parent Material: Glacial stratified deposits | Parking lot area (Landform) | N/A (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >50 feet | Drainage Way >50 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >100 feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 96" Depth to Weeping in Hole | 160" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-3	Asphalt	-	-	-	Cnc :- Dpl: -	-	-	-	-	-	-
3-86	HTM	Sand	N/A	-	Cnc :- Dpl: -	-	50	25	S. Grain	Loose	See notes below.
86-160+	C	Fine Sandy Loam	10YR 5/3	-	Cnc :- Dpl: -	-	15	10	Massive	Friable	-
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Various brick, concrete, rebar, miscellaneous building debris, stones, and boulders observed in this soil layer.

Commonwealth of Massachusetts
City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP #2 (Hole #) | 05/14/2025 (Date) | 8:10 AM (Time) | Overcast; 55º F (Weather) | 42.292005° (Latitude) | -71.23547° (Longitude)

1. Land Use: Parking lot area (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: Parking lot area adjacent to vacant building

2. Soil Parent Material: Glacial stratified deposits | Parking lot area (Landform) | N/A (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >50 feet | Drainage Way >50 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >100 feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 109" Depth to Weeping in Hole 154" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-3	Asphalt	N/A	N/A	-	Cnc :- Dpl: -	-	-	-	-	-	-
3-60	HTM	Sand	N/A	-	Cnc :- Dpl: -	-	25	10	S. Grain	Loose	See notes below.
60-154+	C	Fine Sandy Loam	10YR 5/3	72"	Cnc :10YR 4/6 Dpl:	25	15	10	Massive	Friable	-
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Various brick, concrete, rebar, miscellaneous building debris, stones, and boulders observed in this soil layer.

Commonwealth of Massachusetts
City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP #3 (Hole #) | 05/14/2025 (Date) | 9:10 AM (Time) | Overcast; 56º F (Weather) | 42.292005° (Latitude) | -71.23547° (Longitude)

1. Land Use: Parking lot area (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: Parking lot area adjacent to vacant building

2. Soil Parent Material: Glacial stratified deposits | Parking lot area (Landform) | N/A (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >50 feet | Drainage Way >50 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >100 feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 84" Depth to Weeping in Hole | 84" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-3	Asphalt	-	-	-	Cnc :- Dpl: -	-	-	-	-	-	-
3-84+	HTM	Sand	N/A	-	Cnc :- Dpl: -	-	50	25	S. Grain	Loose	See notes below.
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Various brick, concrete, rebar, miscellaneous building debris, asphalt, stones, and boulders observed in this soil layer.

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP #4 (Hole #) | 05/14/2025 (Date) | 9:45 AM (Time) | Overcast; 57º F (Weather) | 42.292005° (Latitude) | -71.23547° (Longitude)

1. Land Use: Parking lot area (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: Parking lot area adjacent to vacant building

2. Soil Parent Material: Glacial stratified deposits | Parking lot area (Landform) | N/A (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >50 feet | Drainage Way >50 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >100 feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 92" Depth to Weeping in Hole 92" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-3	Asphalt	N/A	N/A	-	Cnc :- Dpl: -	-	-	-	-	-	-
3-92+	HTM	Sand	N/A	-	Cnc :- Dpl: -	-	25	10	S. Grain	Loose	See notes below.
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Various brick, concrete, rebar, miscellaneous building debris, asphalt, stones, and boulders observed in this soil layer.

Commonwealth of Massachusetts
City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP #5 (Hole #) | 05/14/2025 (Date) | 10:30 AM (Time) | Overcast; 58º F (Weather) | 42.292005° (Latitude) | -71.23547° (Longitude)

1. Land Use: Parking lot area (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: Parking lot area adjacent to vacant building

2. Soil Parent Material: Glacial stratified deposits | Parking lot area (Landform) | N/A (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >50 feet | Drainage Way >50 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >100 feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: - Depth to Weeping in Hole - Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	Asphalt	-	-	-	Cnc :- Dpl: -	-	-	-	-	-	-
4-34	HTM	Sand	N/A	-	Cnc :- Dpl: -	-	50	25	S. Grain	Loose	See notes below.
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Test pit was terminated due to refusal. An existing buried concrete foundation section was encountered and prohibited further excavation.

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP #6 (Hole #) | 05/14/2025 (Date) | 10:55 AM (Time) | Overcast; 58º F (Weather) | 42.292005° (Latitude) | -71.23547° (Longitude)

1. Land Use: Parking lot area (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: Parking lot area adjacent to vacant building

2. Soil Parent Material: Glacial stratified deposits | Parking lot area (Landform) | N/A (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >50 feet | Drainage Way >50 feet | Wetlands >100 feet | Property Line >10 feet | Drinking Water Well >100 feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 103" Depth to Weeping in Hole 170" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	Asphalt	N/A	N/A	-	Cnc :- Dpl: -	-	-	-	-	-	-
4-8	HTM	Sand	N/A	-	Cnc :- Dpl: -	-	25	10	S. Grain	Loose	-
8-12	Ab	Loamy Sand	10YR 3/2	-	Cnc :- Dpl: -	-	5	-	Massive	Friable	Roots observed to 10".
12-40	Bw	Loamy Sand	10YR 4/6	-	Cnc :- Dpl: -	-	5	-	Massive	Friable	-
40-170+	C	Sandy Loam	10YR 5/3	-	Cnc :- Dpl: -	-	25	15	Massive	Friable	-
					Cnc : Dpl:						

Additional Notes:
-

Commonwealth of Massachusetts
City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation **Refer to Section C: On-Site Review**

1. Method Used (Choose one): Obs. Hole #_____ Obs. Hole #_____

☐ Depth to soil redoximorphic features _____ inches _____ inches

☐ Depth to observed standing water in observation hole _____ inches _____ inches

☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) _____ inches _____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material **Refer to Section C: On-Site Review**

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☐ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

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City/Town of Needham

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Jared Walsh

Signature of Soil Evaluator

05/14/2025
Date

Jared Walsh / SE License #14670
Typed or Printed Name of Soil Evaluator / License #

11/01/2025
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- *EXISTING CONDITIONS DRAINAGE MAP*
- *EXISTING CONDITIONS HYDROCAD COMPUTATIONS*

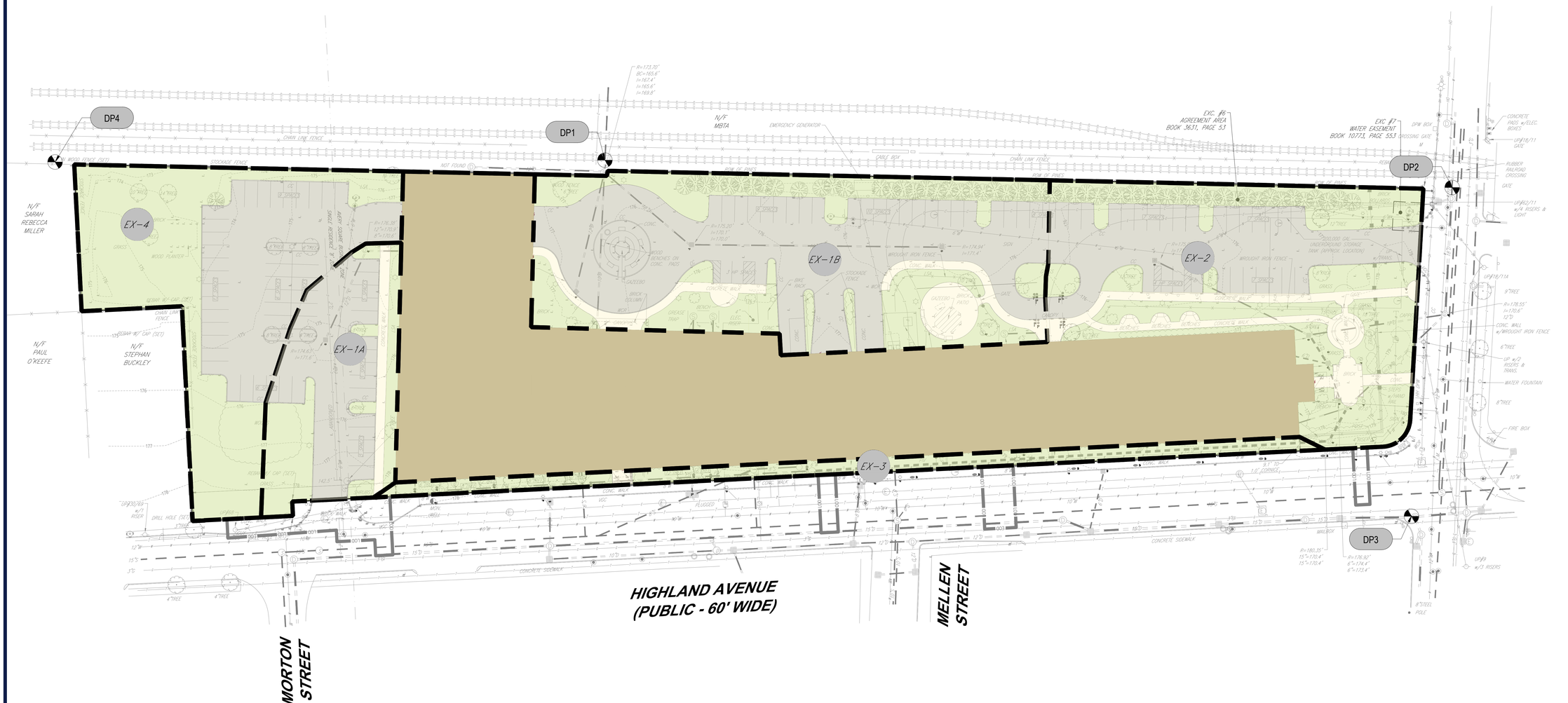
NAD83

LEGEND

EXISTING WATERSHED	
DESIGN POINT	DP1 / DP1
SUBCATCHMENT ID	ED1.1 / ED1.1
SUBCATCHMENT BOUNDARY	
SOIL BOUNDARY WITH NRCS MAP UNIT AND HYDROLOGIC SOIL GROUP RATING	MapUnit A

LEGEND

EXISTING COVER TYPES	
BUILDING	
PAVEMENT	
CONCRETE / WALK / PATIO PAVER / MISC IMPERVIOUS	
GRASS / SOD / LAWN	



30 15 7.5 0 30

SCALE: 1" = 30'

WEST STREET (PUBLIC - 50' WIDE)

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABILITY AND ESG
PERMITTING SERVICES
TRANSPORTATION SERVICES

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REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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PERMIT SET

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST
CHECKED BY:	ZLR/JE
DATE:	07/08/2025
CAD I.D.:	P-GNRL-HYDR

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
www.BohlerEngineering.com

S.P. MARTORANO
DRAFT: 6/30/25
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 45942

SHEET TITLE:

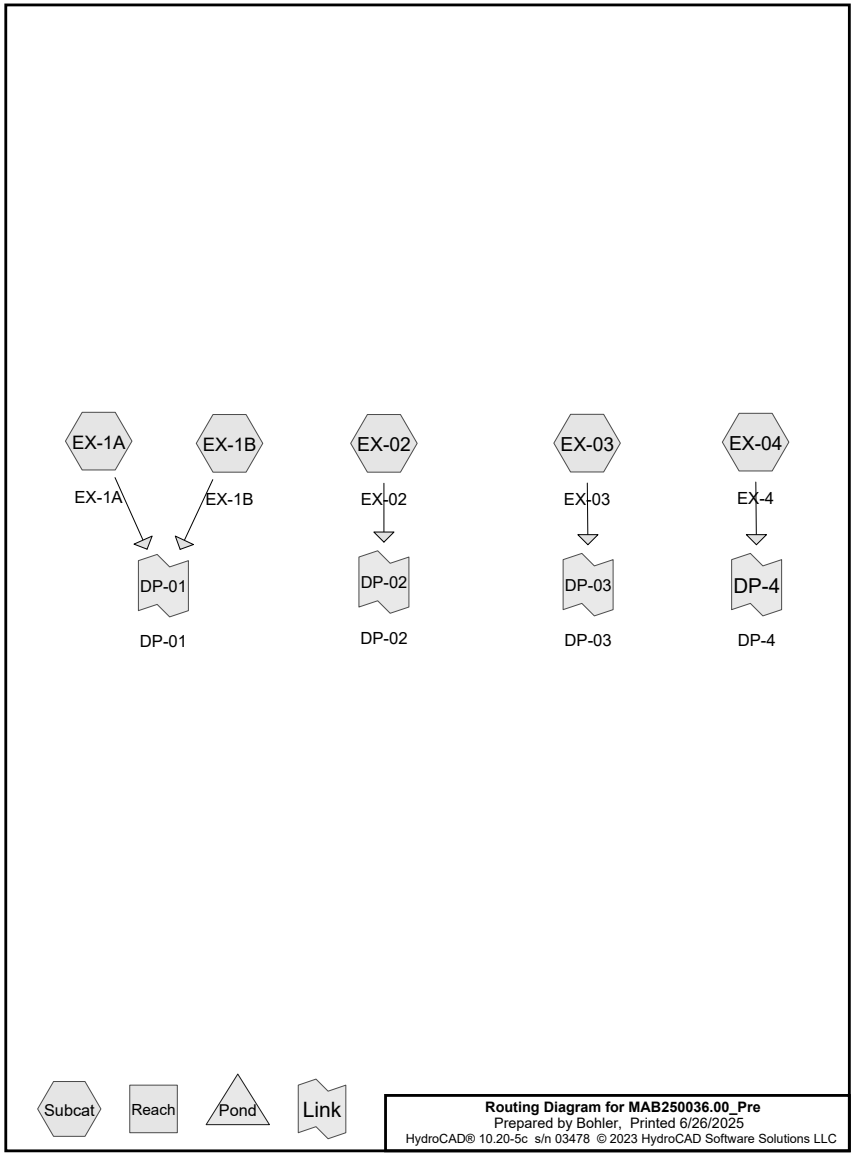
PRE-DEVELOPMENT DRAINAGE MAP

SHEET NUMBER:

1 OF 2

ORG. DATE - 07/08/2025

Jun 30, 2025
P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SET\SP-GNRL-HYDR-MAB250036.00-SA——LAYOUT: C-402 PRE
WORKSPACE



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.191	61	>75% Grass cover, Good, HSG B (EX-02, EX-03, EX-04, EX-1A, EX-1B)
1.645	98	Paved parking, HSG B (EX-02, EX-03, EX-04, EX-1A, EX-1B)
1.462	98	Roofs, HSG B (EX-02)
4.298	**88**	**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-02: EX-02 Runoff Area=97,165 sf 82.66% Impervious Runoff Depth=2.64"
Tc=6.0 min CN=WQ Runoff=5.94 cfs 0.490 af

Subcatchment EX-03: EX-03 Runoff Area=6,311 sf 97.67% Impervious Runoff Depth=3.03"
Tc=6.0 min CN=WQ Runoff=0.45 cfs 0.037 af

Subcatchment EX-04: EX-4 Runoff Area=28,410 sf 43.72% Impervious Runoff Depth=1.63"
Tc=6.0 min CN=WQ Runoff=1.03 cfs 0.088 af

Subcatchment EX-1A: EX-1A Runoff Area=14,138 sf 66.41% Impervious Runoff Depth=2.22"
Tc=6.0 min CN=WQ Runoff=0.72 cfs 0.060 af

Subcatchment EX-1B: EX-1B Runoff Area=41,191 sf 65.65% Impervious Runoff Depth=2.20"
Tc=6.0 min CN=WQ Runoff=2.07 cfs 0.173 af

Link DP-01: DP-01 Inflow=2.79 cfs 0.233 af
Primary=2.79 cfs 0.233 af

Link DP-02: DP-02 Inflow=5.94 cfs 0.490 af
Primary=5.94 cfs 0.490 af

Link DP-03: DP-03 Inflow=0.45 cfs 0.037 af
Primary=0.45 cfs 0.037 af

Link DP-4: DP-4 Inflow=1.03 cfs 0.088 af
Primary=1.03 cfs 0.088 af

Total Runoff Area = 4.298 ac Runoff Volume = 0.848 af Average Runoff Depth = 2.37"
27.71% Pervious = 1.191 ac 72.29% Impervious = 3.107 ac

Summary for Subcatchment EX-02: EX-02

Runoff = 5.94 cfs @ 12.09 hrs, Volume= 0.490 af, Depth= 2.64"
Routed to Link DP-02 : DP-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
16,622	98	Paved parking, HSG B
63,693	98	Roofs, HSG B
16,850	61	>75% Grass cover, Good, HSG B
97,165		Weighted Average
16,850		17.34% Pervious Area
80,315		82.66% Impervious Area

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

Summary for Subcatchment EX-03: EX-03

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 3.03"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
6,164	98	Paved parking, HSG B
147	61	>75% Grass cover, Good, HSG B
6,311		Weighted Average
147		2.33% Pervious Area
6,164		97.67% Impervious Area

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

Summary for Subcatchment EX-04: EX-4

Runoff = 1.03 cfs @ 12.09 hrs, Volume= 0.088 af, Depth= 1.63"
Routed to Link DP-4 : DP-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
15,988	61	>75% Grass cover, Good, HSG B
12,422	98	Paved parking, HSG B
28,410		Weighted Average
15,988		56.28% Pervious Area
12,422		43.72% Impervious Area

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

Summary for Subcatchment EX-1A: EX-1A

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.060 af, Depth= 2.22"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
9,389	98	Paved parking, HSG B
4,749	61	>75% Grass cover, Good, HSG B
14,138		Weighted Average
4,749		33.59% Pervious Area
9,389		66.41% Impervious Area

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.173 af, Depth= 2.20"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
27,040	98	Paved parking, HSG B
14,151	61	>75% Grass cover, Good, HSG B
41,191		Weighted Average
14,151		34.35% Pervious Area
27,040		65.65% Impervious Area

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

Summary for Link DP-01: DP-01

Inflow Area = 1.270 ac, 65.84% Impervious, Inflow Depth = 2.20" for 2YR-STORM event
Inflow = 2.79 cfs @ 12.09 hrs, Volume= 0.233 af
Primary = 2.79 cfs @ 12.09 hrs, Volume= 0.233 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.231 ac, 82.66% Impervious, Inflow Depth = 2.64" for 2YR-STORM event
Inflow = 5.94 cfs @ 12.09 hrs, Volume= 0.490 af
Primary = 5.94 cfs @ 12.09 hrs, Volume= 0.490 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.145 ac, 97.67% Impervious, Inflow Depth = 3.03" for 2YR-STORM event
Inflow = 0.45 cfs @ 12.09 hrs, Volume= 0.037 af
Primary = 0.45 cfs @ 12.09 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: DP-4

Inflow Area = 0.652 ac, 43.72% Impervious, Inflow Depth = 1.63" for 2YR-STORM event
Inflow = 1.03 cfs @ 12.09 hrs, Volume= 0.088 af
Primary = 1.03 cfs @ 12.09 hrs, Volume= 0.088 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-02: EX-02 Runoff Area=97,165 sf 82.66% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=WQ Runoff=9.77 cfs 0.811 af

Subcatchment EX-03: EX-03 Runoff Area=6,311 sf 97.67% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=WQ Runoff=0.71 cfs 0.059 af

Subcatchment EX-04: EX-4 Runoff Area=28,410 sf 43.72% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=WQ Runoff=1.99 cfs 0.164 af

Subcatchment EX-1A: EX-1A Runoff Area=14,138 sf 66.41% Impervious Runoff Depth=3.80"
Tc=6.0 min CN=WQ Runoff=1.24 cfs 0.103 af

Subcatchment EX-1B: EX-1B Runoff Area=41,191 sf 65.65% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=WQ Runoff=3.59 cfs 0.297 af

Link DP-01: DP-01 Inflow=4.84 cfs 0.400 af
Primary=4.84 cfs 0.400 af

Link DP-02: DP-02 Inflow=9.77 cfs 0.811 af
Primary=9.77 cfs 0.811 af

Link DP-03: DP-03 Inflow=0.71 cfs 0.059 af
Primary=0.71 cfs 0.059 af

Link DP-4: DP-4 Inflow=1.99 cfs 0.164 af
Primary=1.99 cfs 0.164 af

Total Runoff Area = 4.298 ac Runoff Volume = 1.433 af Average Runoff Depth = 4.00"
27.71% Pervious = 1.191 ac 72.29% Impervious = 3.107 ac

Summary for Subcatchment EX-02: EX-02

Runoff = 9.77 cfs @ 12.09 hrs, Volume= 0.811 af, Depth= 4.36"
Routed to Link DP-02 : DP-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
16,622	98	Paved parking, HSG B
63,693	98	Roofs, HSG B
16,850	61	>75% Grass cover, Good, HSG B
97,165		Weighted Average
16,850		17.34% Pervious Area
80,315		82.66% Impervious Area

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

Summary for Subcatchment EX-03: EX-03

Runoff = 0.71 cfs @ 12.09 hrs, Volume= 0.059 af, Depth= 4.88"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
6,164	98	Paved parking, HSG B
147	61	>75% Grass cover, Good, HSG B
6,311		Weighted Average
147		2.33% Pervious Area
6,164		97.67% Impervious Area

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

Summary for Subcatchment EX-04: EX-4

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 0.164 af, Depth= 3.01"
Routed to Link DP-4 : DP-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
15,988	61	>75% Grass cover, Good, HSG B
12,422	98	Paved parking, HSG B
28,410		Weighted Average
15,988		56.28% Pervious Area
12,422		43.72% Impervious Area

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

Summary for Subcatchment EX-1A: EX-1A

Runoff = 1.24 cfs @ 12.09 hrs, Volume= 0.103 af, Depth= 3.80"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
9,389	98	Paved parking, HSG B
4,749	61	>75% Grass cover, Good, HSG B
14,138		Weighted Average
4,749		33.59% Pervious Area
9,389		66.41% Impervious Area

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 3.59 cfs @ 12.09 hrs, Volume= 0.297 af, Depth= 3.77"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
27,040	98	Paved parking, HSG B
14,151	61	>75% Grass cover, Good, HSG B
41,191		Weighted Average
14,151		34.35% Pervious Area
27,040		65.65% Impervious Area

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

Summary for Link DP-01: DP-01

Inflow Area = 1.270 ac, 65.84% Impervious, Inflow Depth = 3.78" for 10YR-STORM event
Inflow = 4.84 cfs @ 12.09 hrs, Volume= 0.400 af
Primary = 4.84 cfs @ 12.09 hrs, Volume= 0.400 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.231 ac, 82.66% Impervious, Inflow Depth = 4.36" for 10YR-STORM event
Inflow = 9.77 cfs @ 12.09 hrs, Volume= 0.811 af
Primary = 9.77 cfs @ 12.09 hrs, Volume= 0.811 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.145 ac, 97.67% Impervious, Inflow Depth = 4.88" for 10YR-STORM event
Inflow = 0.71 cfs @ 12.09 hrs, Volume= 0.059 af
Primary = 0.71 cfs @ 12.09 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: DP-4

Inflow Area = 0.652 ac, 43.72% Impervious, Inflow Depth = 3.01" for 10YR-STORM event
Inflow = 1.99 cfs @ 12.09 hrs, Volume= 0.164 af
Primary = 1.99 cfs @ 12.09 hrs, Volume= 0.164 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-02: EX-02 Runoff Area=97,165 sf 82.66% Impervious Runoff Depth=5.47"
Tc=6.0 min CN=WQ Runoff=12.23 cfs 1.017 af

Subcatchment EX-03: EX-03 Runoff Area=6,311 sf 97.67% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=WQ Runoff=0.87 cfs 0.073 af

Subcatchment EX-04: EX-4 Runoff Area=28,410 sf 43.72% Impervious Runoff Depth=3.96"
Tc=6.0 min CN=WQ Runoff=2.66 cfs 0.215 af

Subcatchment EX-1A: EX-1A Runoff Area=14,138 sf 66.41% Impervious Runoff Depth=4.84"
Tc=6.0 min CN=WQ Runoff=1.59 cfs 0.131 af

Subcatchment EX-1B: EX-1B Runoff Area=41,191 sf 65.65% Impervious Runoff Depth=4.81"
Tc=6.0 min CN=WQ Runoff=4.60 cfs 0.379 af

Link DP-01: DP-01 Inflow=6.19 cfs 0.510 af
Primary=6.19 cfs 0.510 af

Link DP-02: DP-02 Inflow=12.23 cfs 1.017 af
Primary=12.23 cfs 1.017 af

Link DP-03: DP-03 Inflow=0.87 cfs 0.073 af
Primary=0.87 cfs 0.073 af

Link DP-4: DP-4 Inflow=2.66 cfs 0.215 af
Primary=2.66 cfs 0.215 af

Total Runoff Area = 4.298 ac Runoff Volume = 1.815 af Average Runoff Depth = 5.07"
27.71% Pervious = 1.191 ac 72.29% Impervious = 3.107 ac

Summary for Subcatchment EX-02: EX-02

Runoff = 12.23 cfs @ 12.09 hrs, Volume= 1.017 af, Depth= 5.47"
Routed to Link DP-02 : DP-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
16,622	98	Paved parking, HSG B
63,693	98	Roofs, HSG B
16,850	61	>75% Grass cover, Good, HSG B
97,165		Weighted Average
16,850		17.34% Pervious Area
80,315		82.66% Impervious Area

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

Summary for Subcatchment EX-03: EX-03

Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.073 af, Depth= 6.05"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
6,164	98	Paved parking, HSG B
147	61	>75% Grass cover, Good, HSG B
6,311		Weighted Average
147		2.33% Pervious Area
6,164		97.67% Impervious Area

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

Summary for Subcatchment EX-04: EX-4

Runoff = 2.66 cfs @ 12.09 hrs, Volume= 0.215 af, Depth= 3.96"
Routed to Link DP-4 : DP-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
15,988	61	>75% Grass cover, Good, HSG B
12,422	98	Paved parking, HSG B
28,410		Weighted Average
15,988		56.28% Pervious Area
12,422		43.72% Impervious Area

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

Summary for Subcatchment EX-1A: EX-1A

Runoff = 1.59 cfs @ 12.09 hrs, Volume= 0.131 af, Depth= 4.84"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
9,389	98	Paved parking, HSG B
4,749	61	>75% Grass cover, Good, HSG B
14,138		Weighted Average
4,749		33.59% Pervious Area
9,389		66.41% Impervious Area

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 4.60 cfs @ 12.09 hrs, Volume= 0.379 af, Depth= 4.81"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
27,040	98	Paved parking, HSG B
14,151	61	>75% Grass cover, Good, HSG B
41,191		Weighted Average
14,151		34.35% Pervious Area
27,040		65.65% Impervious Area

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

Summary for Link DP-01: DP-01

Inflow Area = 1.270 ac, 65.84% Impervious, Inflow Depth = 4.82" for 25YR-STORM event
Inflow = 6.19 cfs @ 12.09 hrs, Volume= 0.510 af
Primary = 6.19 cfs @ 12.09 hrs, Volume= 0.510 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.231 ac, 82.66% Impervious, Inflow Depth = 5.47" for 25YR-STORM event
Inflow = 12.23 cfs @ 12.09 hrs, Volume= 1.017 af
Primary = 12.23 cfs @ 12.09 hrs, Volume= 1.017 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.145 ac, 97.67% Impervious, Inflow Depth = 6.05" for 25YR-STORM event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.073 af
Primary = 0.87 cfs @ 12.09 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: DP-4

Inflow Area = 0.652 ac, 43.72% Impervious, Inflow Depth = 3.96" for 25YR-STORM event
Inflow = 2.66 cfs @ 12.09 hrs, Volume= 0.215 af
Primary = 2.66 cfs @ 12.09 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-02: EX-02 Runoff Area=97,165 sf 82.66% Impervious Runoff Depth=7.19"
Tc=6.0 min CN=WQ Runoff=16.05 cfs 1.337 af

Subcatchment EX-03: EX-03 Runoff Area=6,311 sf 97.67% Impervious Runoff Depth=7.85"
Tc=6.0 min CN=WQ Runoff=1.12 cfs 0.095 af

Subcatchment EX-04: EX-4 Runoff Area=28,410 sf 43.72% Impervious Runoff Depth=5.50"
Tc=6.0 min CN=WQ Runoff=3.74 cfs 0.299 af

Subcatchment EX-1A: EX-1A Runoff Area=14,138 sf 66.41% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=WQ Runoff=2.14 cfs 0.175 af

Subcatchment EX-1B: EX-1B Runoff Area=41,191 sf 65.65% Impervious Runoff Depth=6.45"
Tc=6.0 min CN=WQ Runoff=6.20 cfs 0.508 af

Link DP-01: DP-01 Inflow=8.33 cfs 0.684 af
Primary=8.33 cfs 0.684 af

Link DP-02: DP-02 Inflow=16.05 cfs 1.337 af
Primary=16.05 cfs 1.337 af

Link DP-03: DP-03 Inflow=1.12 cfs 0.095 af
Primary=1.12 cfs 0.095 af

Link DP-4: DP-4 Inflow=3.74 cfs 0.299 af
Primary=3.74 cfs 0.299 af

Total Runoff Area = 4.298 ac Runoff Volume = 2.415 af Average Runoff Depth = 6.74"
27.71% Pervious = 1.191 ac 72.29% Impervious = 3.107 ac

Summary for Subcatchment EX-02: EX-02

Runoff = 16.05 cfs @ 12.09 hrs, Volume= 1.337 af, Depth= 7.19"
Routed to Link DP-02 : DP-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
16,622	98	Paved parking, HSG B
63,693	98	Roofs, HSG B
16,850	61	>75% Grass cover, Good, HSG B
97,165		Weighted Average
16,850		17.34% Pervious Area
80,315		82.66% Impervious Area

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

Summary for Subcatchment EX-03: EX-03

Runoff = 1.12 cfs @ 12.09 hrs, Volume= 0.095 af, Depth= 7.85"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
6,164	98	Paved parking, HSG B
147	61	>75% Grass cover, Good, HSG B
6,311		Weighted Average
147		2.33% Pervious Area
6,164		97.67% Impervious Area

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

Summary for Subcatchment EX-04: EX-4

Runoff = 3.74 cfs @ 12.09 hrs, Volume= 0.299 af, Depth= 5.50"
Routed to Link DP-4 : DP-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
15,988	61	>75% Grass cover, Good, HSG B
12,422	98	Paved parking, HSG B
28,410		Weighted Average
15,988		56.28% Pervious Area
12,422		43.72% Impervious Area

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

Summary for Subcatchment EX-1A: EX-1A

Runoff = 2.14 cfs @ 12.09 hrs, Volume= 0.175 af, Depth= 6.49"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
9,389	98	Paved parking, HSG B
4,749	61	>75% Grass cover, Good, HSG B
14,138		Weighted Average
4,749		33.59% Pervious Area
9,389		66.41% Impervious Area

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 6.20 cfs @ 12.09 hrs, Volume= 0.508 af, Depth= 6.45"
Routed to Link DP-01 : DP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
27,040	98	Paved parking, HSG B
14,151	61	>75% Grass cover, Good, HSG B
41,191		Weighted Average
14,151		34.35% Pervious Area
27,040		65.65% Impervious Area

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

Summary for Link DP-01: DP-01

Inflow Area = 1.270 ac, 65.84% Impervious, Inflow Depth = 6.46" for 100YR-STORM event
Inflow = 8.33 cfs @ 12.09 hrs, Volume= 0.684 af
Primary = 8.33 cfs @ 12.09 hrs, Volume= 0.684 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.231 ac, 82.66% Impervious, Inflow Depth = 7.19" for 100YR-STORM event
Inflow = 16.05 cfs @ 12.09 hrs, Volume= 1.337 af
Primary = 16.05 cfs @ 12.09 hrs, Volume= 1.337 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.145 ac, 97.67% Impervious, Inflow Depth = 7.85" for 100YR-STORM event
Inflow = 1.12 cfs @ 12.09 hrs, Volume= 0.095 af
Primary = 1.12 cfs @ 12.09 hrs, Volume= 0.095 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: DP-4

Inflow Area = 0.652 ac, 43.72% Impervious, Inflow Depth = 5.50" for 100YR-STORM event
Inflow = 3.74 cfs @ 12.09 hrs, Volume= 0.299 af
Primary = 3.74 cfs @ 12.09 hrs, Volume= 0.299 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*

NAD83

LEGEND	
PROPOSED WATERSHED	
DESIGN POINT	DP1 / DP1
SUBCATCHMENT ID	PD1.1 PD1.1
SUBCATCHMENT BOUNDARY	
STORMWATER CONTROL MEASURE OR MODELED DRAINAGE STRUCTURE	P1.1 P1.1

LEGEND	
PROPOSED COVER TYPES	
BUILDING	
PAVEMENT	
CONCRETE / WALK / PATIO PAVERS / MISC IMPERVIOUS	
GRASS / SOD / LAWN	

DP4
DP1
DP2
DP3
PD-4
PR-1
PR-2
P1
P2b
P2a
P3
PD-3A
PD-3B
PD-3B

PROP. 6" HDPE
PROP. 12" HDPE
PROP. 15" HDPE
PROP. 24" HDPE
PROP. 18" HDPE
PROP. VGC AT CURB CUTS / WITHIN R.O.W. (TYP.)
APPROX LOCATION OF PROP LIMIT OF DISTURBANCE
LIMIT OF VGC

N/F SARAH REBECCA MILLER
N/F PAUL O'KEEFE
N/F STEPHAN BUCKLEY
N/F MBTA

HIGHLAND AVENUE (PUBLIC - 60' WIDE)
MORTON STREET
MELLEN STREET
WEST STREET (PUBLIC - 50' WIDE)

SCALE: 1" = 30'

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE ENGINEERING
PERMITTING SERVICES
TRANSPORTATION SERVICES

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REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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ALWAYS CALL 811
It's fast. It's free. It's the law.

PERMIT SET

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PROJECT No.:	MAB250036.00
DRAWN BY:	JGM/DST/CA
CHECKED BY:	AMB/JE
DATE:	08/12/2025
CAD I.D.:	P-GNRL-HYDR

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED
RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
www.BohlerEngineering.com

S.P. MARTORANO
DRAFT: 08/12
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 45942

SHEET TITLE:

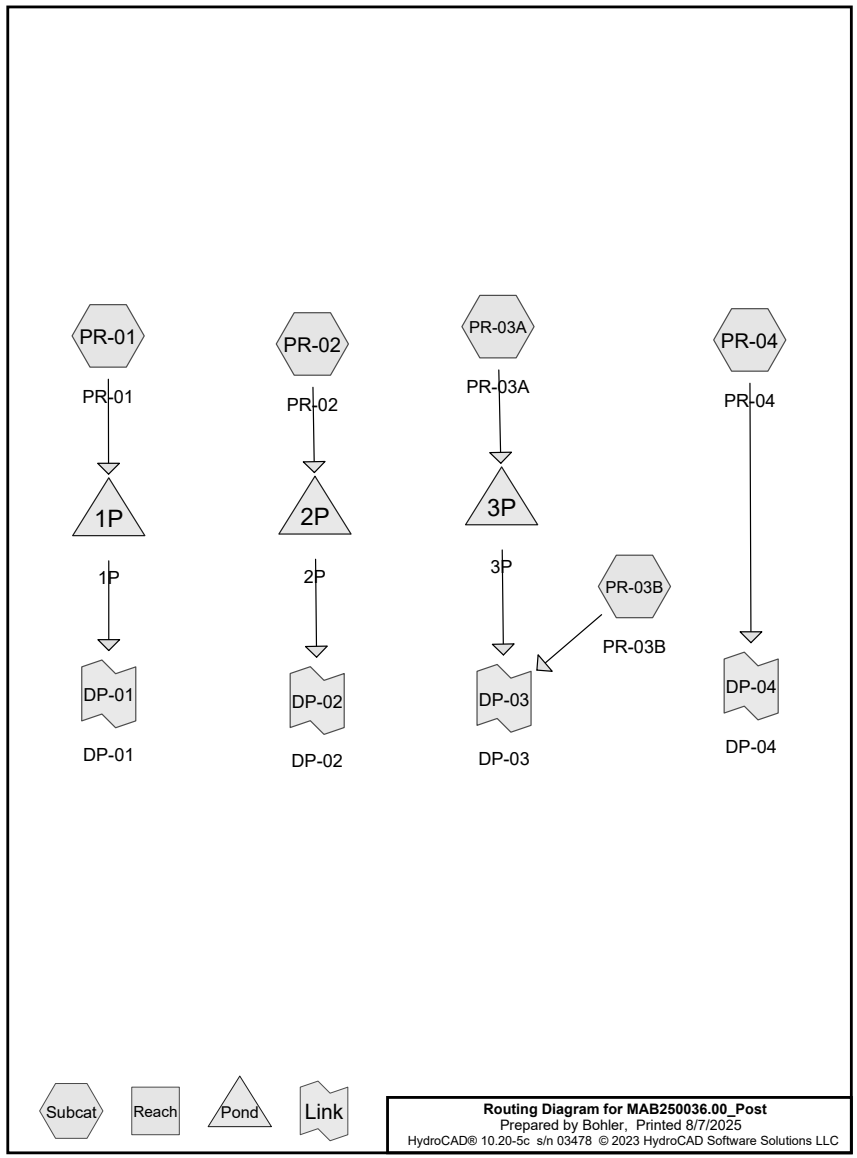
POST-DEVELOPMENT DRAINAGE MAP

SHEET NUMBER:

2 OF 2

ORG. DATE - 08/12/2025

Aug 07, 2025
P:\2025\MAB250036.00\CAD\DRAWINGS\PLAN SET\EP-GNRL-HYDR-MAB250036.00-04-----<LAYOUT: C-403 POST
WCS



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.800	61	>75% Grass cover, Good, HSG B (PR-01, PR-02, PR-04)
1.935	98	Paved parking, HSG B (PR-01, PR-02, PR-03A, PR-03B)
1.564	98	Roofs, HSG B (PR-02)
4.298	**91**	**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-01: PR-01 Runoff Area=51,953 sf 54.04% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=WQ Runoff=2.22 cfs 0.188 af

Subcatchment PR-02: PR-02 Runoff Area=109,027 sf 96.88% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=WQ Runoff=7.67 cfs 0.627 af

Subcatchment PR-03A: PR-03A Runoff Area=12,827 sf 100.00% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=98 Runoff=0.93 cfs 0.076 af

Subcatchment PR-03B: PR-03B Runoff Area=5,882 sf 100.00% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=98 Runoff=0.43 cfs 0.035 af

Subcatchment PR-04: PR-04 Runoff Area=7,548 sf 0.00% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=61 Runoff=0.07 cfs 0.007 af

Pond 1P: 1P Peak Elev=174.18' Storage=3,097 cf Inflow=2.22 cfs 0.188 af
Discarded=0.07 cfs 0.144 af Primary=0.62 cfs 0.045 af Outflow=0.68 cfs 0.188 af

Pond 2P: 2P Peak Elev=173.78' Storage=10,960 cf Inflow=7.67 cfs 0.627 af
Discarded=0.17 cfs 0.428 af Primary=2.78 cfs 0.195 af Outflow=2.95 cfs 0.624 af

Pond 3P: 3P Peak Elev=173.30' Storage=1,710 cf Inflow=0.93 cfs 0.076 af
Discarded=0.04 cfs 0.076 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.076 af

Link DP-01: DP-01 Inflow=0.62 cfs 0.045 af
Primary=0.62 cfs 0.045 af

Link DP-02: DP-02 Inflow=2.78 cfs 0.195 af
Primary=2.78 cfs 0.195 af

Link DP-03: DP-03 Inflow=0.43 cfs 0.035 af
Primary=0.43 cfs 0.035 af

Link DP-04: DP-04 Inflow=0.07 cfs 0.007 af
Primary=0.07 cfs 0.007 af

Total Runoff Area = 4.298 ac Runoff Volume = 0.933 af Average Runoff Depth = 2.60"
18.60% Pervious = 0.800 ac 81.40% Impervious = 3.499 ac

Summary for Subcatchment PR-01: PR-01

Runoff = 2.22 cfs @ 12.09 hrs, Volume= 0.188 af, Depth= 1.90"
Routed to Pond 1P : 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
28,075	98	Paved parking, HSG B
23,878	61	>75% Grass cover, Good, HSG B
51,953		Weighted Average
23,878		45.96% Pervious Area
28,075		54.04% Impervious Area

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

Summary for Subcatchment PR-02: PR-02

Runoff = 7.67 cfs @ 12.09 hrs, Volume= 0.627 af, Depth= 3.01"
Routed to Pond 2P : 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
37,495	98	Paved parking, HSG B
68,127	98	Roofs, HSG B
3,405	61	>75% Grass cover, Good, HSG B
109,027		Weighted Average
3,405		3.12% Pervious Area
105,622		96.88% Impervious Area

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

Summary for Subcatchment PR-03A: PR-03A

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.076 af, Depth= 3.09"
Routed to Pond 3P : 3P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
12,827	98	Paved parking, HSG B
12,827		100.00% Impervious Area

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

Summary for Subcatchment PR-03B: PR-03B

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.035 af, Depth= 3.09"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
5,882	98	Paved parking, HSG B
5,882		100.00% Impervious Area

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

Summary for Subcatchment PR-04: PR-04

Runoff = 0.07 cfs @ 12.12 hrs, Volume= 0.007 af, Depth= 0.49"
Routed to Link DP-04 : DP-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-STORM Rainfall=3.32"

Area (sf)	CN	Description
7,548	61	>75% Grass cover, Good, HSG B
7,548		100.00% Pervious Area

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

Summary for Pond 1P: 1P

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 1.90" for 2YR-STORM event
Inflow = 2.22 cfs @ 12.09 hrs, Volume= 0.188 af
Outflow = 0.68 cfs @ 12.43 hrs, Volume= 0.188 af, Atten= 69%, Lag= 20.3 min
Discarded = 0.07 cfs @ 9.10 hrs, Volume= 0.144 af
Primary = 0.62 cfs @ 12.43 hrs, Volume= 0.045 af
Routed to Link DP-01 : DP-01

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 174.18' @ 12.43 hrs Surf.Area= 2,888 sf Storage= 3,097 cf

Plug-Flow detention time= 285.7 min calculated for 0.188 af (100% of inflow)
Center-of-Mass det. time= 285.9 min (1,060.1 - 774.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.60'	2,738 cf	**30.00'W x 96.28'L x 3.75'H Field A** 10,832 cf Overall - 3,987 cf Embedded = 6,845 cf x 40.0% Voids
#2A	173.10'	3,987 cf	**ADS_StormTech SC-800 +Cap** x 78 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 78 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
		6,725 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**12.0" Round Ex 12" Pipe** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.50' / 167.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	174.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	175.30'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	172.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 9.10 hrs HW=172.64' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.61 cfs @ 12.43 hrs HW=174.18' (Free Discharge)
└**1=Ex 12" Pipe** (Passes 0.61 cfs of 7.42 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 0.61 cfs @ 1.36 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: 2P

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 3.01" for 2YR-STORM event
Inflow = 7.67 cfs @ 12.09 hrs, Volume= 0.627 af
Outflow = 2.95 cfs @ 12.32 hrs, Volume= 0.624 af, Atten= 62%, Lag= 14.2 min
Discarded = 0.17 cfs @ 8.15 hrs, Volume= 0.428 af
Primary = 2.78 cfs @ 12.32 hrs, Volume= 0.195 af
Routed to Link DP-02 : DP-02

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 173.78' @ 12.32 hrs Surf.Area= 7,159 sf Storage= 10,960 cf

Plug-Flow detention time= 344.4 min calculated for 0.624 af (99% of inflow)
Center-of-Mass det. time= 340.7 min (1,097.1 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	6,714 cf	**30.00'W x 238.62'L x 3.75'H Field A** 26,844 cf Overall - 10,058 cf Embedded = 16,786 cf x 40.0% Voids
#2A	172.10'	10,058 cf	**ADS_StormTech SC-800 +Cap** x 198 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 198 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
#3	172.10'	75 cf	**4.00'D x 6.00'H OCS**-Impervious
		16,848 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**18.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 170.60' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	173.40'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 8.15 hrs HW=171.67' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=2.74 cfs @ 12.32 hrs HW=173.78' (Free Discharge)
└**1=Culvert** (Passes 2.74 cfs of 6.48 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.74 cfs @ 1.80 fps)

Summary for Pond 3P: 3P

Inflow Area = 0.294 ac,100.00% Impervious, Inflow Depth = 3.09" for 2YR-STORM event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.076 af
Outflow = 0.04 cfs @ 11.65 hrs, Volume= 0.076 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.65 hrs, Volume= 0.076 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP-03 : DP-03

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 173.30' @ 15.08 hrs Surf.Area= 1,565 sf Storage= 1,710 cf

Plug-Flow detention time= 402.5 min calculated for 0.076 af (100% of inflow)
Center-of-Mass det. time= 402.6 min (1,158.3 - 755.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	2,582 cf	**19.42'W x 79.97'L x 6.75'H Field A** 10,482 cf Overall - 4,027 cf Embedded = 6,454 cf x 40.0% Voids
#2A	172.35'	4,027 cf	**ADS_StormTech MC-7200 +Cap** x 22 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 22 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	172.00'	88 cf	**4.00'D x 7.00'H DMH**
		6,697 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 171.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	176.90'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.65 hrs HW=172.00' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=171.60' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-01: DP-01

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 0.45" for 2YR-STORM event
Inflow = 0.62 cfs @ 12.43 hrs, Volume= 0.045 af
Primary = 0.62 cfs @ 12.43 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 0.94" for 2YR-STORM event
Inflow = 2.78 cfs @ 12.32 hrs, Volume= 0.195 af
Primary = 2.78 cfs @ 12.32 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.429 ac,100.00% Impervious, Inflow Depth = 0.97" for 2YR-STORM event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.035 af
Primary = 0.43 cfs @ 12.09 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-04: DP-04

Inflow Area = 0.173 ac, 0.00% Impervious, Inflow Depth = 0.49" for 2YR-STORM event
Inflow = 0.07 cfs @ 12.12 hrs, Volume= 0.007 af
Primary = 0.07 cfs @ 12.12 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-01: PR-01 Runoff Area=51,953 sf 54.04% Impervious Runoff Depth=3.37"
Tc=6.0 min CN=WQ Runoff=4.06 cfs 0.335 af

SubcatchmentPR-02: PR-02 Runoff Area=109,027 sf 96.88% Impervious Runoff Depth=4.85"
Tc=6.0 min CN=WQ Runoff=12.17 cfs 1.013 af

SubcatchmentPR-03A: PR-03A Runoff Area=12,827 sf 100.00% Impervious Runoff Depth=4.96"
Tc=6.0 min CN=98 Runoff=1.46 cfs 0.122 af

SubcatchmentPR-03B: PR-03B Runoff Area=5,882 sf 100.00% Impervious Runoff Depth=4.96"
Tc=6.0 min CN=98 Runoff=0.67 cfs 0.056 af

SubcatchmentPR-04: PR-04 Runoff Area=7,548 sf 0.00% Impervious Runoff Depth=1.49"
Tc=6.0 min CN=61 Runoff=0.27 cfs 0.022 af

Pond 1P: 1P Peak Elev=174.53' Storage=3,858 cf Inflow=4.06 cfs 0.335 af
Discarded=0.07 cfs 0.168 af Primary=3.11 cfs 0.167 af Outflow=3.18 cfs 0.335 af

Pond 2P: 2P Peak Elev=174.32' Storage=13,489 cf Inflow=12.17 cfs 1.013 af
Discarded=0.17 cfs 0.456 af Primary=8.15 cfs 0.527 af Outflow=8.31 cfs 0.983 af

Pond 3P: 3P Peak Elev=174.51' Storage=3,226 cf Inflow=1.46 cfs 0.122 af
Discarded=0.04 cfs 0.094 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.094 af

Link DP-01: DP-01 Inflow=3.11 cfs 0.167 af
Primary=3.11 cfs 0.167 af

Link DP-02: DP-02 Inflow=8.15 cfs 0.527 af
Primary=8.15 cfs 0.527 af

Link DP-03: DP-03 Inflow=0.67 cfs 0.056 af
Primary=0.67 cfs 0.056 af

Link DP-04: DP-04 Inflow=0.27 cfs 0.022 af
Primary=0.27 cfs 0.022 af

Total Runoff Area = 4.298 ac Runoff Volume = 1.546 af Average Runoff Depth = 4.32"
18.60% Pervious = 0.800 ac 81.40% Impervious = 3.499 ac

Summary for Subcatchment PR-01: PR-01

Runoff = 4.06 cfs @ 12.09 hrs, Volume= 0.335 af, Depth= 3.37"
Routed to Pond 1P : 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
28,075	98	Paved parking, HSG B
23,878	61	>75% Grass cover, Good, HSG B
51,953		Weighted Average
23,878		45.96% Pervious Area
28,075		54.04% Impervious Area

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

Summary for Subcatchment PR-02: PR-02

Runoff = 12.17 cfs @ 12.09 hrs, Volume= 1.013 af, Depth= 4.85"
Routed to Pond 2P : 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
37,495	98	Paved parking, HSG B
68,127	98	Roofs, HSG B
3,405	61	>75% Grass cover, Good, HSG B
109,027		Weighted Average
3,405		3.12% Pervious Area
105,622		96.88% Impervious Area

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

Summary for Subcatchment PR-03A: PR-03A

Runoff = 1.46 cfs @ 12.09 hrs, Volume= 0.122 af, Depth= 4.96"
Routed to Pond 3P : 3P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
12,827	98	Paved parking, HSG B
12,827		100.00% Impervious Area

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

Summary for Subcatchment PR-03B: PR-03B

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 4.96"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
5,882	98	Paved parking, HSG B
5,882		100.00% Impervious Area

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

Summary for Subcatchment PR-04: PR-04

Runoff = 0.27 cfs @ 12.10 hrs, Volume= 0.022 af, Depth= 1.49"
Routed to Link DP-04 : DP-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-STORM Rainfall=5.20"

Area (sf)	CN	Description
7,548	61	>75% Grass cover, Good, HSG B
7,548		100.00% Pervious Area

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

Summary for Pond 1P: 1P

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 3.37" for 10YR-STORM event
Inflow = 4.06 cfs @ 12.09 hrs, Volume= 0.335 af
Outflow = 3.18 cfs @ 12.16 hrs, Volume= 0.335 af, Atten= 22%, Lag= 4.4 min
Discarded = 0.07 cfs @ 7.55 hrs, Volume= 0.168 af
Primary = 3.11 cfs @ 12.16 hrs, Volume= 0.167 af
Routed to Link DP-01 : DP-01

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 174.53' @ 12.16 hrs Surf.Area= 2,888 sf Storage= 3,858 cf

Plug-Flow detention time= 202.0 min calculated for 0.335 af (100% of inflow)
Center-of-Mass det. time= 201.9 min (974.2 - 772.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.60'	2,738 cf	**30.00'W x 96.28'L x 3.75'H Field A** 10,832 cf Overall - 3,987 cf Embedded = 6,845 cf x 40.0% Voids
#2A	173.10'	3,987 cf	**ADS_StormTech SC-800 +Cap** x 78 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 78 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
		6,725 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**12.0" Round Ex 12" Pipe** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.50' / 167.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	174.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	175.30'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	172.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 7.55 hrs HW=172.64' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=3.04 cfs @ 12.16 hrs HW=174.52' (Free Discharge)
└**1=Ex 12" Pipe** (Passes 3.04 cfs of 7.63 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 3.04 cfs @ 2.32 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: 2P

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 4.85" for 10YR-STORM event
Inflow = 12.17 cfs @ 12.09 hrs, Volume= 1.013 af
Outflow = 8.31 cfs @ 12.17 hrs, Volume= 0.983 af, Atten= 32%, Lag= 5.3 min
Discarded = 0.17 cfs @ 6.20 hrs, Volume= 0.456 af
Primary = 8.15 cfs @ 12.17 hrs, Volume= 0.527 af
Routed to Link DP-02 : DP-02

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 174.32' @ 12.17 hrs Surf.Area= 7,159 sf Storage= 13,489 cf

Plug-Flow detention time= 236.7 min calculated for 0.983 af (97% of inflow)
Center-of-Mass det. time= 218.4 min (967.0 - 748.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	6,714 cf	**30.00'W x 238.62'L x 3.75'H Field A** 26,844 cf Overall - 10,058 cf Embedded = 16,786 cf x 40.0% Voids
#2A	172.10'	10,058 cf	**ADS_StormTech SC-800 +Cap** x 198 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 198 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
#3	172.10'	75 cf	**4.00'D x 6.00'H OCS**-Impervious
		16,848 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**18.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 170.60' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	173.40'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 6.20 hrs HW=171.67' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=8.11 cfs @ 12.17 hrs HW=174.31' (Free Discharge)
└**1=Culvert** (Inlet Controls 8.11 cfs @ 4.59 fps)
  └**2=Broad-Crested Rectangular Weir** (Passes 8.11 cfs of 11.43 cfs potential flow)

Summary for Pond 3P: 3P

Inflow Area = 0.294 ac,100.00% Impervious, Inflow Depth = 4.96" for 10YR-STORM event
Inflow = 1.46 cfs @ 12.09 hrs, Volume= 0.122 af
Outflow = 0.04 cfs @ 10.55 hrs, Volume= 0.094 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.55 hrs, Volume= 0.094 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP-03 : DP-03

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 174.51' @ 16.50 hrs Surf.Area= 1,565 sf Storage= 3,226 cf

Plug-Flow detention time= 567.1 min calculated for 0.094 af (77% of inflow)
Center-of-Mass det. time= 484.3 min (1,231.7 - 747.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	2,582 cf	**19.42'W x 79.97'L x 6.75'H Field A** 10,482 cf Overall - 4,027 cf Embedded = 6,454 cf x 40.0% Voids
#2A	172.35'	4,027 cf	**ADS_StormTech MC-7200 +Cap**x 22 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 22 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	172.00'	88 cf	**4.00'D x 7.00'H DMH**
		6,697 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 171.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	176.90'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 10.55 hrs HW=172.00' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=171.60' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Link DP-01: DP-01

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 1.68" for 10YR-STORM event
Inflow = 3.11 cfs @ 12.16 hrs, Volume= 0.167 af
Primary = 3.11 cfs @ 12.16 hrs, Volume= 0.167 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 2.53" for 10YR-STORM event
Inflow = 8.15 cfs @ 12.17 hrs, Volume= 0.527 af
Primary = 8.15 cfs @ 12.17 hrs, Volume= 0.527 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.429 ac,100.00% Impervious, Inflow Depth = 1.56" for 10YR-STORM event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 0.056 af
Primary = 0.67 cfs @ 12.09 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-04: DP-04

Inflow Area = 0.173 ac, 0.00% Impervious, Inflow Depth = 1.49" for 10YR-STORM event
Inflow = 0.27 cfs @ 12.10 hrs, Volume= 0.022 af
Primary = 0.27 cfs @ 12.10 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-01: PR-01 Runoff Area=51,953 sf 54.04% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=WQ Runoff=5.31 cfs 0.433 af

Subcatchment PR-02: PR-02 Runoff Area=109,027 sf 96.88% Impervious Runoff Depth=6.02"
Tc=6.0 min CN=WQ Runoff=15.01 cfs 1.256 af

Subcatchment PR-03A: PR-03A Runoff Area=12,827 sf 100.00% Impervious Runoff Depth=6.14"
Tc=6.0 min CN=98 Runoff=1.80 cfs 0.151 af

Subcatchment PR-03B: PR-03B Runoff Area=5,882 sf 100.00% Impervious Runoff Depth=6.14"
Tc=6.0 min CN=98 Runoff=0.82 cfs 0.069 af

Subcatchment PR-04: PR-04 Runoff Area=7,548 sf 0.00% Impervious Runoff Depth=2.26"
Tc=6.0 min CN=61 Runoff=0.44 cfs 0.033 af

Pond 1P: 1P Peak Elev=174.68' Storage=4,162 cf Inflow=5.31 cfs 0.433 af
Discarded=0.07 cfs 0.177 af Primary=4.46 cfs 0.257 af Outflow=4.53 cfs 0.433 af

Pond 2P: 2P Peak Elev=174.74' Storage=15,053 cf Inflow=15.01 cfs 1.256 af
Discarded=0.17 cfs 0.467 af Primary=9.24 cfs 0.752 af Outflow=9.41 cfs 1.219 af

Pond 3P: 3P Peak Elev=175.38' Storage=4,250 cf Inflow=1.80 cfs 0.151 af
Discarded=0.04 cfs 0.097 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.097 af

Link DP-01: DP-01 Inflow=4.46 cfs 0.257 af
Primary=4.46 cfs 0.257 af

Link DP-02: DP-02 Inflow=9.24 cfs 0.752 af
Primary=9.24 cfs 0.752 af

Link DP-03: DP-03 Inflow=0.82 cfs 0.069 af
Primary=0.82 cfs 0.069 af

Link DP-04: DP-04 Inflow=0.44 cfs 0.033 af
Primary=0.44 cfs 0.033 af

Total Runoff Area = 4.298 ac Runoff Volume = 1.941 af Average Runoff Depth = 5.42"
18.60% Pervious = 0.800 ac 81.40% Impervious = 3.499 ac

Summary for Subcatchment PR-01: PR-01

Runoff = 5.31 cfs @ 12.09 hrs, Volume= 0.433 af, Depth= 4.36"
Routed to Pond 1P : 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
28,075	98	Paved parking, HSG B
23,878	61	>75% Grass cover, Good, HSG B
51,953		Weighted Average
23,878		45.96% Pervious Area
28,075		54.04% Impervious Area

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

Summary for Subcatchment PR-02: PR-02

Runoff = 15.01 cfs @ 12.09 hrs, Volume= 1.256 af, Depth= 6.02"
Routed to Pond 2P : 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
37,495	98	Paved parking, HSG B
68,127	98	Roofs, HSG B
3,405	61	>75% Grass cover, Good, HSG B
109,027		Weighted Average
3,405		3.12% Pervious Area
105,622		96.88% Impervious Area

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

Summary for Subcatchment PR-03A: PR-03A

Runoff = 1.80 cfs @ 12.09 hrs, Volume= 0.151 af, Depth= 6.14"
Routed to Pond 3P : 3P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
12,827	98	Paved parking, HSG B
12,827		100.00% Impervious Area

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

Summary for Subcatchment PR-03B: PR-03B

Runoff = 0.82 cfs @ 12.09 hrs, Volume= 0.069 af, Depth= 6.14"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
5,882	98	Paved parking, HSG B
5,882		100.00% Impervious Area

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

Summary for Subcatchment PR-04: PR-04

Runoff = 0.44 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 2.26"
Routed to Link DP-04 : DP-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-STORM Rainfall=6.38"

Area (sf)	CN	Description
7,548	61	>75% Grass cover, Good, HSG B
7,548		100.00% Pervious Area

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

Summary for Pond 1P: 1P

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 4.36" for 25YR-STORM event
Inflow = 5.31 cfs @ 12.09 hrs, Volume= 0.433 af
Outflow = 4.53 cfs @ 12.14 hrs, Volume= 0.433 af, Atten= 15%, Lag= 3.3 min
Discarded = 0.07 cfs @ 6.70 hrs, Volume= 0.177 af
Primary = 4.46 cfs @ 12.14 hrs, Volume= 0.257 af
Routed to Link DP-01 : DP-01

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 174.68' @ 12.14 hrs Surf.Area= 2,888 sf Storage= 4,162 cf

Plug-Flow detention time= 167.2 min calculated for 0.433 af (100% of inflow)
Center-of-Mass det. time= 167.9 min (938.9 - 771.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.60'	2,738 cf	**30.00'W x 96.28'L x 3.75'H Field A** 10,832 cf Overall - 3,987 cf Embedded = 6,845 cf x 40.0% Voids
#2A	173.10'	3,987 cf	**ADS_StormTech SC-800 +Cap** x 78 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 78 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
		6,725 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**12.0" Round Ex 12" Pipe** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.50' / 167.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	174.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	175.30'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	172.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 6.70 hrs HW=172.64' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=4.43 cfs @ 12.14 hrs HW=174.67' (Free Discharge)
└**1=Ex 12" Pipe** (Passes 4.43 cfs of 7.71 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 4.43 cfs @ 2.66 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: 2P

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 6.02" for 25YR-STORM event
Inflow = 15.01 cfs @ 12.09 hrs, Volume= 1.256 af
Outflow = 9.41 cfs @ 12.19 hrs, Volume= 1.219 af, Atten= 37%, Lag= 6.4 min
Discarded = 0.17 cfs @ 4.75 hrs, Volume= 0.467 af
Primary = 9.24 cfs @ 12.19 hrs, Volume= 0.752 af
Routed to Link DP-02 : DP-02

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 174.74' @ 12.19 hrs Surf.Area= 7,159 sf Storage= 15,053 cf

Plug-Flow detention time= 200.3 min calculated for 1.219 af (97% of inflow)
Center-of-Mass det. time= 181.9 min (927.4 - 745.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	6,714 cf	**30.00'W x 238.62'L x 3.75'H Field A** 26,844 cf Overall - 10,058 cf Embedded = 16,786 cf x 40.0% Voids
#2A	172.10'	10,058 cf	**ADS_StormTech SC-800 +Cap** x 198 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 198 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
#3	172.10'	75 cf	**4.00'D x 6.00'H OCS**-Impervious
		16,848 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**18.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 170.60' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	173.40'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 4.75 hrs HW=171.67' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=9.22 cfs @ 12.19 hrs HW=174.73' (Free Discharge)
└**1=Culvert** (Inlet Controls 9.22 cfs @ 5.22 fps)
└**2=Broad-Crested Rectangular Weir** (Passes 9.22 cfs of 20.47 cfs potential flow)

Summary for Pond 3P: 3P

Inflow Area = 0.294 ac,100.00% Impervious, Inflow Depth = 6.14" for 25YR-STORM event
Inflow = 1.80 cfs @ 12.09 hrs, Volume= 0.151 af
Outflow = 0.04 cfs @ 9.90 hrs, Volume= 0.097 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.04 cfs @ 9.90 hrs, Volume= 0.097 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP-03 : DP-03

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 175.38' @ 17.39 hrs Surf.Area= 1,565 sf Storage= 4,250 cf

Plug-Flow detention time= 565.7 min calculated for 0.097 af (64% of inflow)
Center-of-Mass det. time= 461.8 min (1,206.0 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	2,582 cf	**19.42'W x 79.97'L x 6.75'H Field A** 10,482 cf Overall - 4,027 cf Embedded = 6,454 cf x 40.0% Voids
#2A	172.35'	4,027 cf	**ADS_StormTech MC-7200 +Cap** x 22 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 22 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	172.00'	88 cf	**4.00'D x 7.00'H DMH**
		6,697 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 171.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	176.90'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 9.90 hrs HW=172.01' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=171.60' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-01: DP-01

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 2.58" for 25YR-STORM event
Inflow = 4.46 cfs @ 12.14 hrs, Volume= 0.257 af
Primary = 4.46 cfs @ 12.14 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 3.61" for 25YR-STORM event
Inflow = 9.24 cfs @ 12.19 hrs, Volume= 0.752 af
Primary = 9.24 cfs @ 12.19 hrs, Volume= 0.752 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.429 ac,100.00% Impervious, Inflow Depth = 1.93" for 25YR-STORM event
Inflow = 0.82 cfs @ 12.09 hrs, Volume= 0.069 af
Primary = 0.82 cfs @ 12.09 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-04: DP-04

Inflow Area = 0.173 ac, 0.00% Impervious, Inflow Depth = 2.26" for 25YR-STORM event
Inflow = 0.44 cfs @ 12.10 hrs, Volume= 0.033 af
Primary = 0.44 cfs @ 12.10 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-01: PR-01 Runoff Area=51,953 sf 54.04% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=WQ Runoff=7.29 cfs 0.591 af

SubcatchmentPR-02: PR-02 Runoff Area=109,027 sf 96.88% Impervious Runoff Depth=7.81"
Tc=6.0 min CN=WQ Runoff=19.36 cfs 1.630 af

SubcatchmentPR-03A: PR-03A Runoff Area=12,827 sf 100.00% Impervious Runoff Depth=7.95"
Tc=6.0 min CN=98 Runoff=2.31 cfs 0.195 af

SubcatchmentPR-03B: PR-03B Runoff Area=5,882 sf 100.00% Impervious Runoff Depth=7.95"
Tc=6.0 min CN=98 Runoff=1.06 cfs 0.089 af

SubcatchmentPR-04: PR-04 Runoff Area=7,548 sf 0.00% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=61 Runoff=0.71 cfs 0.052 af

Pond 1P: 1P Peak Elev=174.91' Storage=4,623 cf Inflow=7.29 cfs 0.591 af
Discarded=0.07 cfs 0.184 af Primary=5.98 cfs 0.407 af Outflow=6.05 cfs 0.591 af

Pond 2P: 2P Peak Elev=176.90' Storage=16,833 cf Inflow=19.36 cfs 1.630 af
Discarded=0.17 cfs 0.478 af Primary=13.56 cfs 1.112 af Outflow=13.73 cfs 1.589 af

Pond 3P: 3P Peak Elev=176.92' Storage=5,759 cf Inflow=2.31 cfs 0.195 af
Discarded=0.04 cfs 0.100 af Primary=0.03 cfs 0.003 af Outflow=0.07 cfs 0.104 af

Link DP-01: DP-01 Inflow=5.98 cfs 0.407 af
Primary=5.98 cfs 0.407 af

Link DP-02: DP-02 Inflow=13.56 cfs 1.112 af
Primary=13.56 cfs 1.112 af

Link DP-03: DP-03 Inflow=1.06 cfs 0.093 af
Primary=1.06 cfs 0.093 af

Link DP-04: DP-04 Inflow=0.71 cfs 0.052 af
Primary=0.71 cfs 0.052 af

Total Runoff Area = 4.298 ac Runoff Volume = 2.557 af Average Runoff Depth = 7.14"
18.60% Pervious = 0.800 ac 81.40% Impervious = 3.499 ac

Summary for Subcatchment PR-01: PR-01

Runoff = 7.29 cfs @ 12.09 hrs, Volume= 0.591 af, Depth= 5.95"
Routed to Pond 1P : 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
28,075	98	Paved parking, HSG B
23,878	61	>75% Grass cover, Good, HSG B
51,953		Weighted Average
23,878		45.96% Pervious Area
28,075		54.04% Impervious Area

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

Summary for Subcatchment PR-02: PR-02

Runoff = 19.36 cfs @ 12.09 hrs, Volume= 1.630 af, Depth= 7.81"
Routed to Pond 2P : 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
37,495	98	Paved parking, HSG B
68,127	98	Roofs, HSG B
3,405	61	>75% Grass cover, Good, HSG B
109,027		Weighted Average
3,405		3.12% Pervious Area
105,622		96.88% Impervious Area

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

Summary for Subcatchment PR-03A: PR-03A

Runoff = 2.31 cfs @ 12.09 hrs, Volume= 0.195 af, Depth= 7.95"
Routed to Pond 3P : 3P

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
12,827	98	Paved parking, HSG B
12,827		100.00% Impervious Area

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

Summary for Subcatchment PR-03B: PR-03B

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.089 af, Depth= 7.95"
Routed to Link DP-03 : DP-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
5,882	98	Paved parking, HSG B
5,882		100.00% Impervious Area

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

Summary for Subcatchment PR-04: PR-04

Runoff = 0.71 cfs @ 12.10 hrs, Volume= 0.052 af, Depth= 3.59"
Routed to Link DP-04 : DP-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-STORM Rainfall=8.19"

Area (sf)	CN	Description
7,548	61	>75% Grass cover, Good, HSG B
7,548		100.00% Pervious Area

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

Summary for Pond 1P: 1P

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 5.95" for 100YR-STORM event
Inflow = 7.29 cfs @ 12.09 hrs, Volume= 0.591 af
Outflow = 6.05 cfs @ 12.15 hrs, Volume= 0.591 af, Atten= 17%, Lag= 3.5 min
Discarded = 0.07 cfs @ 5.20 hrs, Volume= 0.184 af
Primary = 5.98 cfs @ 12.15 hrs, Volume= 0.407 af
Routed to Link DP-01 : DP-01

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 174.91' @ 12.15 hrs Surf.Area= 2,888 sf Storage= 4,623 cf

Plug-Flow detention time= 131.8 min calculated for 0.591 af (100% of inflow)
Center-of-Mass det. time= 131.8 min (900.9 - 769.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.60'	2,738 cf	**30.00'W x 96.28'L x 3.75'H Field A** 10,832 cf Overall - 3,987 cf Embedded = 6,845 cf x 40.0% Voids
#2A	173.10'	3,987 cf	**ADS_StormTech SC-800 +Cap** x 78 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 78 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
		6,725 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**12.0" Round Ex 12" Pipe** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.50' / 167.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	174.00'	**30.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	175.30'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	172.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 5.20 hrs HW=172.64' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=5.96 cfs @ 12.15 hrs HW=174.90' (Free Discharge)
└**1=Ex 12" Pipe** (Passes 5.96 cfs of 7.84 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 5.96 cfs @ 3.58 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: 2P

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 7.81" for 100YR-STORM event
Inflow = 19.36 cfs @ 12.09 hrs, Volume= 1.630 af
Outflow = 13.73 cfs @ 12.17 hrs, Volume= 1.589 af, Atten= 29%, Lag= 4.8 min
Discarded = 0.17 cfs @ 3.30 hrs, Volume= 0.478 af
Primary = 13.56 cfs @ 12.17 hrs, Volume= 1.112 af
Routed to Link DP-02 : DP-02

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 176.90' @ 12.16 hrs Surf.Area= 7,159 sf Storage= 16,833 cf

Plug-Flow detention time= 164.2 min calculated for 1.587 af (97% of inflow)
Center-of-Mass det. time= 149.2 min (891.6 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	6,714 cf	**30.00'W x 238.62'L x 3.75'H Field A** 26,844 cf Overall - 10,058 cf Embedded = 16,786 cf x 40.0% Voids
#2A	172.10'	10,058 cf	**ADS_StormTech SC-800 +Cap** x 198 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 198 Chambers in 6 Rows Cap Storage= 3.4 cf x 2 x 6 rows = 41.0 cf
#3	172.10'	75 cf	**4.00'D x 6.00'H OCS**-Impervious
		16,848 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**18.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 170.60' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	173.40'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 3.30 hrs HW=171.67' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=13.11 cfs @ 12.17 hrs HW=176.66' (Free Discharge)
└**1=Culvert** (Inlet Controls 13.11 cfs @ 7.42 fps)
  └**2=Broad-Crested Rectangular Weir** (Passes 13.11 cfs of 78.09 cfs potential flow)

Summary for Pond 3P: 3P

Inflow Area = 0.294 ac,100.00% Impervious, Inflow Depth = 7.95" for 100YR-STORM event
Inflow = 2.31 cfs @ 12.09 hrs, Volume= 0.195 af
Outflow = 0.07 cfs @ 16.00 hrs, Volume= 0.104 af, Atten= 97%, Lag= 235.0 min
Discarded = 0.04 cfs @ 9.00 hrs, Volume= 0.100 af
Primary = 0.03 cfs @ 16.00 hrs, Volume= 0.003 af
Routed to Link DP-03 : DP-03

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 176.92' @ 16.00 hrs Surf.Area= 1,565 sf Storage= 5,759 cf

Plug-Flow detention time= 555.5 min calculated for 0.104 af (53% of inflow)
Center-of-Mass det. time= 428.4 min (1,169.3 - 740.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	171.60'	2,582 cf	**19.42'W x 79.97'L x 6.75'H Field A** 10,482 cf Overall - 4,027 cf Embedded = 6,454 cf x 40.0% Voids
#2A	172.35'	4,027 cf	**ADS_StormTech MC-7200 +Cap**x 22 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 22 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	172.00'	88 cf	**4.00'D x 7.00'H DMH**
		6,697 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	172.10'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.10' / 171.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	176.90'	**4.0' long Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	171.60'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 9.00 hrs HW=172.00' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.02 cfs @ 16.00 hrs HW=176.92' (Free Discharge)
└**1=Culvert** (Passes 0.02 cfs of 6.20 cfs potential flow)
└**2=Broad-Crested Rectangular Weir**(Weir Controls 0.02 cfs @ 0.35 fps)

Summary for Link DP-01: DP-01

Inflow Area = 1.193 ac, 54.04% Impervious, Inflow Depth = 4.10" for 100YR-STORM event
Inflow = 5.98 cfs @ 12.15 hrs, Volume= 0.407 af
Primary = 5.98 cfs @ 12.15 hrs, Volume= 0.407 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-02: DP-02

Inflow Area = 2.503 ac, 96.88% Impervious, Inflow Depth = 5.33" for 100YR-STORM event
Inflow = 13.56 cfs @ 12.17 hrs, Volume= 1.112 af
Primary = 13.56 cfs @ 12.17 hrs, Volume= 1.112 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-03: DP-03

Inflow Area = 0.429 ac,100.00% Impervious, Inflow Depth = 2.59" for 100YR-STORM event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 0.093 af
Primary = 1.06 cfs @ 12.09 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-04: DP-04

Inflow Area = 0.173 ac, 0.00% Impervious, Inflow Depth = 3.59" for 100YR-STORM event
Inflow = 0.71 cfs @ 12.10 hrs, Volume= 0.052 af
Primary = 0.71 cfs @ 12.10 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *NOAA RAINFALL DATA*

Proposed Multi-Family Development
100 WEST STREET
Needham, MA
Bohler Job Number: MAB250036.00
August 12, 2025

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	2.975
Proposed Site Impervious Area (ac)	3.499
Proposed Increase in Site Impervious Area (ac)	0.524
Recharge Volume Required (cf)	**665**

Total Recharge Volume Required (cf)	**665**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**3.499**
%Impervious Directed to Infiltration BMP	100%
Adjustment Factor	1.00
Adjusted Total Recharge Volume Required (cf)	**665**

Provided Recharge Volume*	
Infiltration System - 1	2,692
Infiltration System - 2	8,948
Infiltration System - 3	5,747
Total Recharge Volume Provided (cf)	**17,387**

Provided greater than or Equal to Required

*Volume provided below lowest outlet in cubic feet (cf)

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MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - Infiltration System - 1	
Volume below outlet pipe (Rv) (cf)	2,692
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	2,889
Drawdown time (Hours)*	**11.0**
Drawdown Time - Infiltration System - 2	
Volume below outlet pipe (Rv) (cf)	8,948
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	7,159
Drawdown time (Hours)**	**14.7**
Drawdown Time - Infiltration System - 3	
Volume below outlet pipe (Rv) (cf)	5,747
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	1,553
Drawdown time (Hours)**	**43.5**

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

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MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	152406
Required Water Quality Volume (cf)	**12,701**
*Water Quality volume runoff is equal to 1.0 inches of runoff times the total impervious area of the post development project site.	

Water Quality Volume Provided*	
Infiltration System - 1	2,692
Infiltration System - 2	8,948
Infiltration System - 3	5,747
Total Provided Water Quality Volume (cf)	**17,387**

Required Water Quality Volume Provided

*Volume provided below lowest outlet pipe in cubic feet (cf)

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Proposed Multi-Family Development
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Needham, MA
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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Catch Basin to Water Quality Unit (typ.)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded CB	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Unit	**0.60**	**0.75**	**0.45**	**0.30**
Infiltration Basin	**0.80**	**0.30**	**0.24**	**0.06**
		Total TSS Removal =	**94%**	

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

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Proposed Multi-Family Development
100 WEST STREET
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August 12, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Water Quality Inlet (typ.)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Water Quality Inlet	**0.60**	**1.00**	**0.60**	**0.40**
Infiltration Basin	**0.80**	**0.40**	**0.32**	**0.08**
		Total TSS Removal =	**92%**	

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

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Stage-Area-Storage for Pond 1P: 1P

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
172.60	**2,888**	0
172.65	2,888	58
172.70	2,888	116
172.75	2,888	173
172.80	2,888	231
172.85	2,888	289
172.90	2,888	347
172.95	2,888	404
173.00	2,888	462
173.05	2,888	520
173.10	2,888	578
173.15	2,888	698
173.20	2,888	819
173.25	2,888	939
173.30	2,888	1,059
173.35	2,888	1,179
173.40	2,888	1,298
173.45	2,888	1,416
173.50	2,888	1,535
173.55	2,888	1,653
173.60	2,888	1,770
173.65	2,888	1,887
173.70	2,888	2,004
173.75	2,888	2,120
173.80	2,888	2,235
173.85	2,888	2,350
173.90	2,888	2,465
173.95	2,888	2,579
174.00	2,888	2,692
174.05	2,888	2,805
174.10	2,888	2,918
174.15	2,888	3,029
174.20	2,888	3,140
174.25	2,888	3,251
174.30	2,888	3,360
174.35	2,888	3,469
174.40	2,888	3,577
174.45	2,888	3,685
174.50	2,888	3,791
174.55	2,888	3,897
174.60	2,888	4,002
174.65	2,888	4,106
174.70	2,888	4,209
174.75	2,888	4,311
174.80	2,888	4,413
174.85	2,888	4,513
174.90	2,888	4,612
174.95	2,888	4,709
175.00	2,888	4,806
175.05	2,888	4,902
175.10	2,888	4,996
175.15	2,888	5,088
175.20	2,888	5,179
175.25	2,888	5,269
175.30	2,888	5,356
175.35	2,888	5,442
175.40	2,888	5,526
175.45	2,888	5,607
175.50	2,888	5,685
175.55	2,888	5,760
175.60	2,888	5,831
175.65	2,888	5,899
175.70	2,888	5,964
175.75	2,888	6,027
175.80	2,888	6,088
175.85	2,888	6,147
175.90	2,888	6,205
175.95	2,888	6,263
176.00	2,888	6,321
176.05	2,888	6,378
176.10	2,888	6,436
176.15	2,888	6,494
176.20	2,888	6,552
176.25	2,888	6,610
176.30	2,888	6,667
176.35	2,888	**6,725**

Stage-Area-Storage for Pond 2P: 2P

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
171.60	**7,159**	0
171.70	7,159	286
171.80	7,159	573
171.90	7,159	859
172.00	7,159	1,145
172.10	7,159	1,432
172.20	7,159	2,036
172.30	7,159	2,638
172.40	7,159	3,236
172.50	7,159	3,830
172.60	7,159	4,420
172.70	7,159	5,006
172.80	7,159	5,586
172.90	7,159	6,162
173.00	7,159	6,731
173.10	7,159	7,296
173.20	7,159	7,853
173.30	7,159	8,404
173.40	7,159	8,948
173.50	7,159	9,484
173.60	7,159	10,012
173.70	7,159	10,531
173.80	7,159	11,040
173.90	7,159	11,538
174.00	7,159	12,025
174.10	7,159	12,499
174.20	7,159	12,959
174.30	7,159	13,402
174.40	7,159	13,825
174.50	7,159	14,224
174.60	7,159	14,587
174.70	7,159	14,918
174.80	7,159	15,228
174.90	7,159	15,519
175.00	7,159	15,807
175.10	7,159	16,095
175.20	7,159	16,382
175.30	7,159	16,670
175.40	7,159	16,814
175.50	7,159	16,815
175.60	7,159	16,817
175.70	7,159	16,818
175.80	7,159	16,819
175.90	7,159	16,820
176.00	7,159	16,822
176.10	7,159	16,823
176.20	7,159	16,824
176.30	7,159	16,826
176.40	7,159	16,827
176.50	7,159	16,828
176.60	7,159	16,829
176.70	7,159	16,831
176.80	7,159	16,832
176.90	7,159	16,833
177.00	7,159	16,834
177.10	7,159	16,836
177.20	7,159	16,837
177.30	7,159	16,838
177.40	7,159	16,839
177.50	7,159	16,841
177.60	7,159	16,842
177.70	7,159	16,843
177.80	7,159	16,844
177.90	7,159	16,846
178.00	7,159	16,847
178.10	7,159	**16,848**

Stage-Area-Storage for Pond 3P: 3P

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
171.60	1,553	0
171.70	1,553	62
171.80	1,553	124
171.90	1,553	186
172.00	**1,565**	248
172.10	1,565	312
172.20	1,565	375
172.30	1,565	439
172.40	1,565	536
172.50	1,565	668
172.60	1,565	800
172.70	1,565	931
172.80	1,565	1,062
172.90	1,565	1,193
173.00	1,565	1,323
173.10	1,565	1,453
173.20	1,565	1,583
173.30	1,565	1,712
173.40	1,565	1,840
173.50	1,565	1,969
173.60	1,565	2,096
173.70	1,565	2,223
173.80	1,565	2,350
173.90	1,565	2,476
174.00	1,565	2,601
174.10	1,565	2,726
174.20	1,565	2,850
174.30	1,565	2,973
174.40	1,565	3,096
174.50	1,565	3,217
174.60	1,565	3,338
174.70	1,565	3,458
174.80	1,565	3,577
174.90	1,565	3,695
175.00	1,565	3,813
175.10	1,565	3,929
175.20	1,565	4,044
175.30	1,565	4,157
175.40	1,565	4,270
175.50	1,565	4,381
175.60	1,565	4,491
175.70	1,565	4,600
175.80	1,565	4,707
175.90	1,565	4,813
176.00	1,565	4,917
176.10	1,565	5,019
176.20	1,565	5,119
176.30	1,565	5,217
176.40	1,565	5,313
176.50	1,565	5,407
176.60	1,565	5,497
176.70	1,565	5,585
176.80	1,565	5,669
176.90	1,565	5,747
177.00	1,565	5,820
177.10	1,565	5,890
177.20	1,565	5,957
177.30	1,565	6,023
177.40	1,565	6,087
177.50	1,565	6,150
177.60	1,565	6,214
177.70	1,565	6,277
177.80	1,565	6,340
177.90	1,565	6,404
178.00	1,565	6,467
178.10	1,565	6,530
178.20	1,565	6,594
178.30	1,565	6,657
178.40	1,565	6,689
178.50	1,565	6,691
178.60	1,565	6,692
178.70	1,565	6,693
178.80	1,565	6,694
178.90	1,565	6,696
179.00	1,565	**6,697**

NOAA Atlas 14, Volume 10, Version 3
Location name: Needham Heights, Massachusetts, USA*
Latitude: 42.292°, Longitude: -71.2355°
Elevation: 178 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.310 (0.245-0.392)	0.381 (0.300-0.482)	0.496 (0.390-0.631)	0.592 (0.463-0.757)	0.723 (0.546-0.974)	0.821 (0.608-1.13)	0.925 (0.665-1.34)	1.05 (0.707-1.54)	1.23 (0.797-1.88)	1.38 (0.874-2.16)
10-min	0.440 (0.347-0.555)	0.539 (0.425-0.682)	0.702 (0.552-0.892)	0.837 (0.654-1.07)	1.02 (0.774-1.38)	1.16 (0.861-1.61)	1.31 (0.943-1.89)	1.48 (1.00-2.19)	1.74 (1.13-2.66)	1.96 (1.24-3.06)
15-min	0.517 (0.408-0.653)	0.634 (0.500-0.803)	0.826 (0.649-1.05)	0.985 (0.770-1.26)	1.20 (0.910-1.62)	1.37 (1.01-1.89)	1.54 (1.11-2.22)	1.75 (1.18-2.57)	2.05 (1.33-3.14)	2.30 (1.46-3.60)
30-min	0.707 (0.558-0.893)	0.868 (0.685-1.10)	1.13 (0.890-1.44)	1.35 (1.06-1.73)	1.65 (1.25-2.23)	1.88 (1.39-2.59)	2.12 (1.52-3.06)	2.40 (1.62-3.54)	2.82 (1.83-4.32)	3.18 (2.01-4.98)
60-min	0.896 (0.708-1.13)	1.10 (0.869-1.39)	1.44 (1.13-1.83)	1.72 (1.34-2.20)	2.10 (1.59-2.83)	2.39 (1.77-3.30)	2.69 (1.94-3.89)	3.06 (2.06-4.50)	3.60 (2.33-5.51)	4.06 (2.57-6.35)
2-hr	1.15 (0.916-1.45)	1.43 (1.13-1.80)	1.88 (1.48-2.37)	2.25 (1.77-2.86)	2.76 (2.10-3.71)	3.14 (2.34-4.33)	3.55 (2.58-5.13)	4.06 (2.75-5.93)	4.84 (3.15-7.35)	5.51 (3.50-8.55)
3-hr	1.34 (1.07-1.68)	1.66 (1.32-2.08)	2.18 (1.73-2.75)	2.62 (2.06-3.31)	3.22 (2.46-4.30)	3.66 (2.74-5.02)	4.14 (3.02-5.96)	4.74 (3.22-6.90)	5.67 (3.69-8.57)	6.48 (4.12-9.99)
6-hr	1.74 (1.39-2.16)	2.14 (1.72-2.67)	2.81 (2.24-3.51)	3.36 (2.66-4.22)	4.12 (3.16-5.46)	4.67 (3.52-6.37)	5.28 (3.88-7.55)	6.04 (4.12-8.72)	7.22 (4.72-10.8)	8.24 (5.25-12.6)
12-hr	2.23 (1.80-2.75)	2.73 (2.20-3.37)	3.55 (2.85-4.40)	4.23 (3.38-5.28)	5.17 (3.99-6.80)	5.86 (4.43-7.91)	6.61 (4.86-9.34)	7.53 (5.16-10.8)	8.95 (5.87-13.3)	10.2 (6.50-15.4)
24-hr	2.69 (2.18-3.30)	3.32 (2.69-4.07)	4.35 (3.51-5.36)	5.20 (4.18-6.45)	6.38 (4.96-8.34)	7.24 (5.51-9.72)	8.19 (6.06-11.5)	9.36 (6.43-13.3)	11.2 (7.36-16.5)	12.8 (8.19-19.2)
2-day	3.06 (2.50-3.72)	3.84 (3.14-4.68)	5.12 (4.17-6.27)	6.19 (5.00-7.62)	7.66 (5.99-9.98)	8.73 (6.70-11.7)	9.92 (7.42-13.9)	11.4 (7.88-16.1)	13.9 (9.16-20.3)	16.0 (10.3-23.8)
3-day	3.34 (2.74-4.06)	4.19 (3.44-5.09)	5.58 (4.55-6.80)	6.73 (5.45-8.25)	8.31 (6.53-10.8)	9.46 (7.29-12.6)	10.7 (8.07-15.0)	12.4 (8.57-17.4)	15.1 (9.98-21.9)	17.5 (11.3-25.8)
4-day	3.62 (2.98-4.38)	4.49 (3.69-5.44)	5.93 (4.85-7.20)	7.11 (5.78-8.70)	8.75 (6.89-11.3)	9.94 (7.67-13.2)	11.3 (8.48-15.7)	13.0 (8.99-18.1)	15.8 (10.4-22.8)	18.2 (11.8-26.9)
7-day	4.37 (3.61-5.26)	5.28 (4.36-6.36)	6.78 (5.57-8.19)	8.02 (6.55-9.74)	9.72 (7.68-12.5)	11.0 (8.49-14.4)	12.3 (9.30-17.0)	14.1 (9.81-19.6)	17.0 (11.3-24.3)	19.5 (12.6-28.4)
10-day	5.07 (4.21-6.08)	6.01 (4.98-7.21)	7.54 (6.22-9.08)	8.81 (7.22-10.7)	10.6 (8.37-13.5)	11.8 (9.18-15.5)	13.3 (9.98-18.1)	15.0 (10.5-20.7)	17.8 (11.9-25.4)	20.2 (13.1-29.4)
20-day	7.12 (5.95-8.48)	8.14 (6.78-9.70)	9.79 (8.13-11.7)	11.2 (9.20-13.4)	13.0 (10.4-16.4)	14.5 (11.2-18.6)	16.0 (11.9-21.2)	17.7 (12.4-24.1)	20.1 (13.5-28.4)	22.1 (14.4-31.9)
30-day	8.82 (7.39-10.5)	9.89 (8.27-11.7)	11.6 (9.69-13.9)	13.1 (10.8-15.7)	15.1 (12.0-18.7)	16.6 (12.8-21.0)	18.1 (13.5-23.8)	19.8 (13.9-26.7)	22.0 (14.8-30.8)	23.7 (15.4-33.9)
45-day	10.9 (9.20-12.9)	12.1 (10.1-14.3)	13.9 (11.6-16.5)	15.4 (12.8-18.4)	17.5 (14.0-21.6)	19.2 (14.8-24.1)	20.8 (15.4-26.9)	22.3 (15.8-30.0)	24.3 (16.4-33.8)	25.7 (16.8-36.5)
60-day	12.7 (10.7-15.0)	13.9 (11.7-16.4)	15.8 (13.2-18.7)	17.4 (14.5-20.7)	19.5 (15.6-24.0)	21.3 (16.5-26.6)	22.9 (17.0-29.4)	24.4 (17.3-32.6)	26.2 (17.7-36.3)	27.4 (17.9-38.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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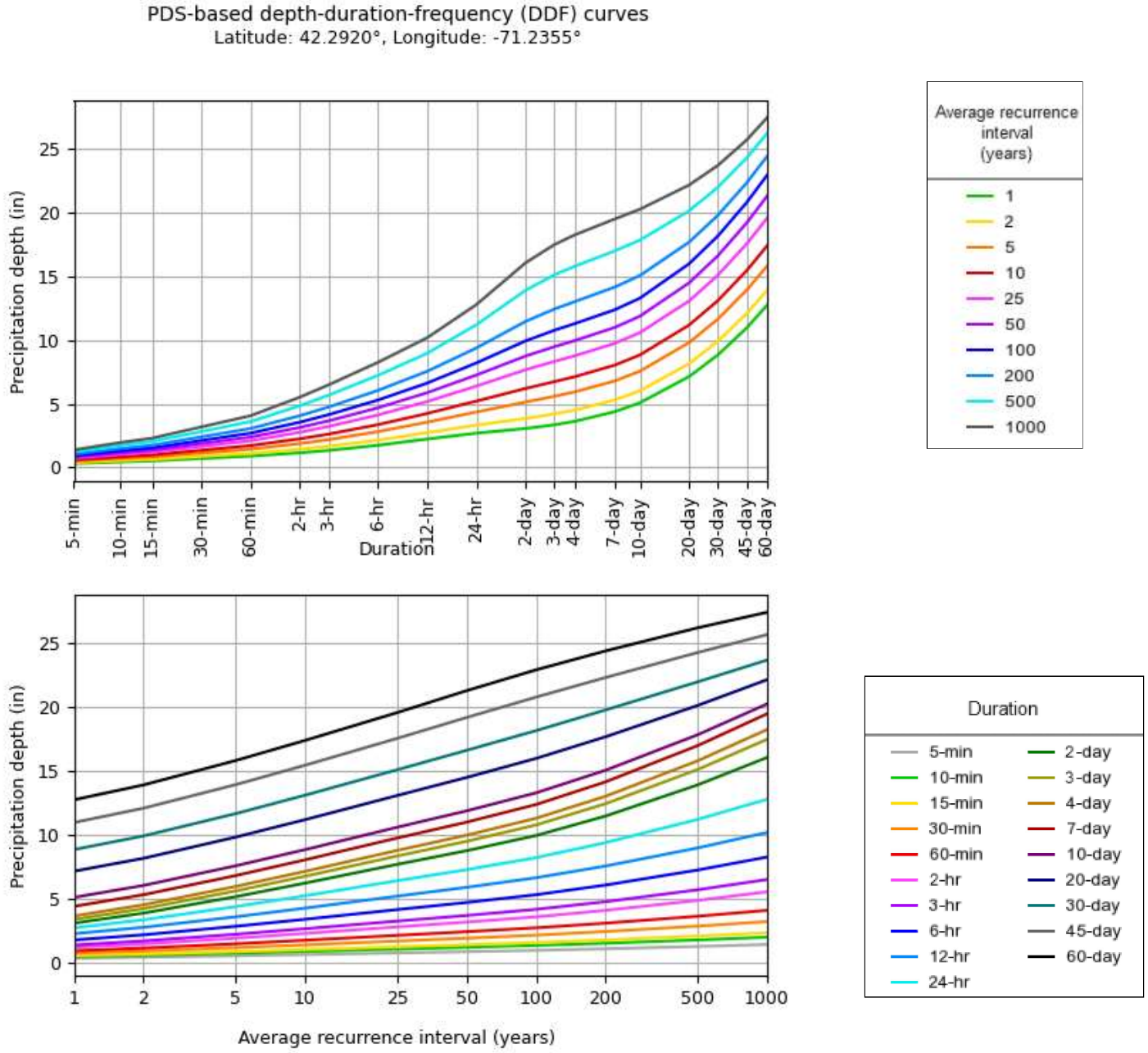
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Wed Apr 30 12:48:45 2025

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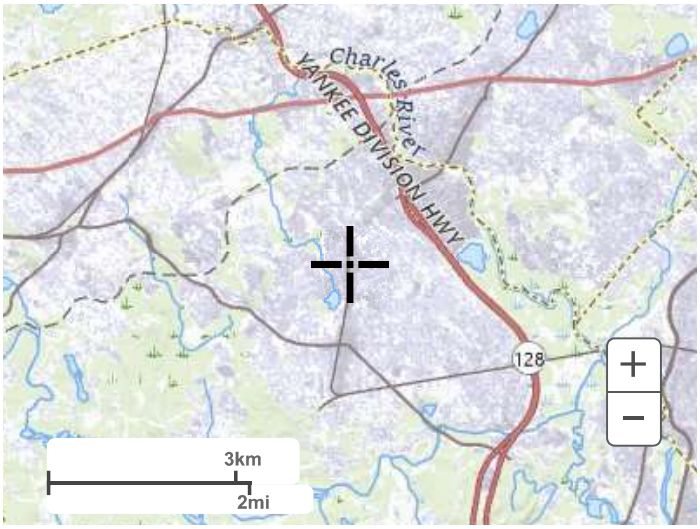
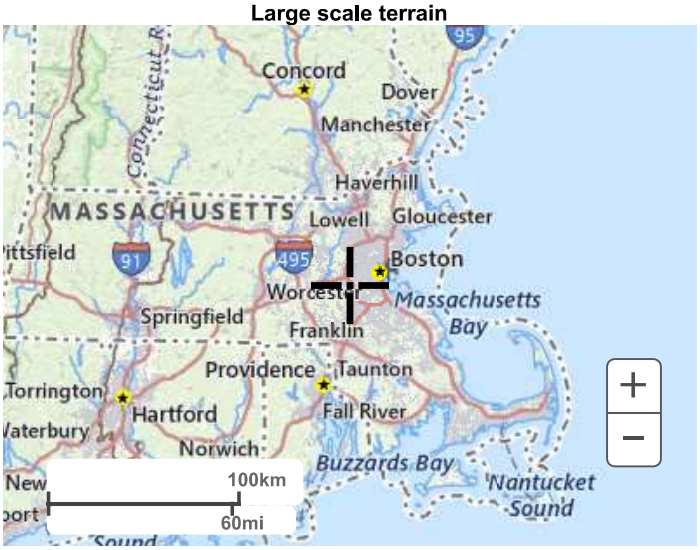
Maps & aerials

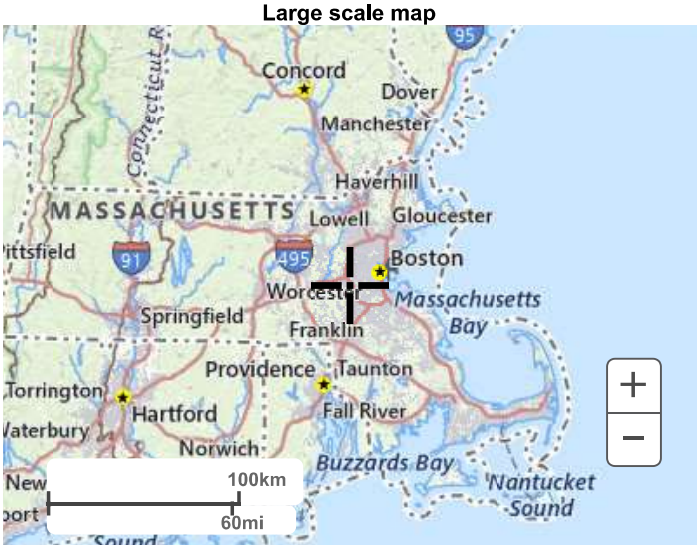
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX G: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*
- *PROPOSED OPERATION AND MAINTENANCE MAP*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

GS Construction Northeast, LLC
100 West Street
Needham, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

GS Construction Northeast, LLC
One Federal Street, Suite 1804
Boston, MA

RESPONSIBLE PARTY POST CONSTRUCTION:

GS Construction Northeast, LLC
One Federal Street, Suite 1804
Boston, MA

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP). Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots: Sweep at least two (2) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

   Approximate Maintenance Budget: $1,000/year

2. Catch basins, yard drains, trench drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.

Approximate Maintenance Budget: $500/year per structure.

3. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).

   Approximate Maintenance Budget: $1,000/year per unit.

4. Underground Infiltration Basins: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. The outlet of the basin, if any, shall be inspected for erosion and sedimentation, and riprap shall be promptly repaired in the case of erosion. Sediment collecting in the bottom of the basin shall be inspected twice annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the basin. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

   Approximate Maintenance Budget: Cleaning - $1,000/year, Inspection - $200/year

All components of the stormwater system will be accessible by the owner or their assignee.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

GS Construction Northeast, LLC
100 West Street
Needham, MA

RESPONSIBLE PARTY:

GS Construction Northeast, LLC
One Federal Street, Suite 1804
Boston, MA

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Underground Infiltration Basin:	
Water Quality Units:	
Other:	
Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):	

Catch Basins:
Underground Infiltration Basin:
Water Quality Units:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM			
100 West Street ***Needham, MA***			
Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

GS Construction Northeast, LLC
100 West Street
Needham, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

GS Construction Northeast, LLC
One Federal Street, Suite 1804
Boston, MA

RESPONSIBLE PARTY POST CONSTRUCTION:

GS Construction Northeast, LLC
One Federal Street, Suite 1804
Boston, MA

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

- No outdoor maintenance or washing of vehicles allowed.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.
- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.
- Plants shall be pruned as necessary.
- The use of fertilizers will be kept at a level consistent with typical residential use. Fertilizer will be applied a maximum of once to twice per year during the initial planting and stabilization of landscaped areas. Once plants are established and growing well fertilizer will be applied judiciously.
- The use of pesticides will be kept at a level consistent with typical residential use. Where possible mechanical methods (i.e. pest traps) or biological methods (i.e. beneficial insects) of pest control shall be implemented. If pesticides (insecticide, herbicide, and fungicide) are required to be used, a pesticide which poses the lowest risk to public health and the environment shall be used.
- Pet waste shall be disposed of in accordance with local regulations. Pet waste shall not be disposed of in a storm drain or catch basin.
- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter into the soil, leaving behind sand and debris which can be removed in the springtime.
- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams, or other water bodies).
- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.
- The amount of sand and deicing chemicals shall be kept at the minimum amount required to provide safe pedestrian and vehicle travel.
- Deicing chemicals are recommended as a pretreatment to storm events to minimize the amount of applied sand.
- The primary agents used for deicing at parking lots, sidewalks and the access roads shall consist of salt alternatives such as calcium carbonate ($CaCO_3$) or potassium chloride (KCl) or sodium chloride.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan:

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

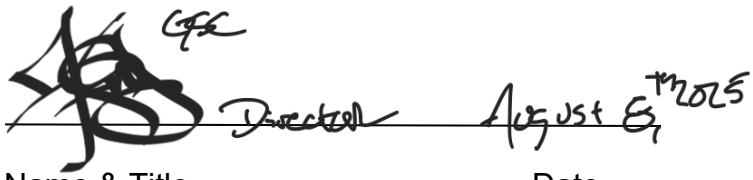
Discuss the Spill Prevention and Response Procedures:

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:



Name & Title Date

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

100 West Street
Needham, Massachusetts

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Town of Needham Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Town of Needham Health Department at 781-455-7940 and the Town of Needham Conservation Commission at 781-455-7550.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town of Needham Health Department and Conservation Commission.

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

_____

_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCY PHONE: (888) 372-7341

BMP LEGEND

- DEEP SUMP HOODED CATCH BASIN
- OUTLET CONTROL STRUCUTRE
- WATER QUALITY UNIT/INLET
- SUBSURFACE INFILTRATION SYSTEM
- OUTFALL

PROP. WATER QUALITY UNIT

PROP. OUTLET CONTROL STRUCUTRE

PROP. WATER QUALITY INLET

PROP. WATER QUALITY INLET

PROP. OUTLET CONTROL STRUCUTRE

PROP. OUTLET CONTROL STRUCUTRE

PROP. SUBSURFACE INFILTRATION SYSTEM (TYP.)

PROP. DEEP SUMP HOODED CATCH BASIN (TYP)

PROP. INFILTRATION SYSTEM - 1
STORMTECH SC-800 (200 CHAMBERS)
TOP OF STONE = 177.0
TOP OF CHAMBER = 176.5
BTM OF CHAMBER = 173.7
BTM OF STONE = 173.2
ESHGWT = 169.2

PROP. OCS-01
RIM = 178.6
WEIR = SEE DETAIL
INV IN = 173.7

PROP. DMH
RIM = 178.1
INV IN = 172.5
EX. INV = 169.0 (W/F)

PROP. WQ-1
RIM = 177.0
INV = 174.0

PROP. DMH
RIM = 178.1
INV IN = 173.6
INV OUT = 173.5

PROP. INFILTRATION SYSTEM - 2a
STORMTECH SC-800 (96 CHAMBERS)
TOP OF STONE = 175.5
TOP OF CHAMBER = 176.3
BTM OF CHAMBER = 172.5
BTM OF STONE = 172.0
ESHGWT = 168.5

PROP. WQ-2
RIM = 176.0
INV = 173.0

PROP. INFILTRATION SYSTEM - 2b
STORMTECH SC-800 (102 CHAMBERS)
TOP OF STONE = 175.8
TOP OF CHAMBER = 175.3
BTM OF CHAMBER = 172.5
BTM OF STONE = 172.0
ESHGWT = 168.4

PROP. CB
RIM = 177.0
INV = 172.8

PROP. OCS-02
RIM = 177.9
WEIR = SEE DETAIL
INV = 172.5

PROP. CB
RIM = 178.5
INV = 173.8

PROP. WQU
RIM = 177.2
INV = 173.7

PROP. DMH (TYP.)

PROP. CB
RIM=176.3
INV = 174.3

PROP. ROOF DRAIN CONNECTION (TYP.)

PROP. 3-STORY RESIDENTIAL BUILDING 68,000 ± SF FOOTPRINT 189 TOTAL UNITS

PROP. INFILTRATION SYSTEM - 3
STORMTECH MC-7500 (22 CHAMBERS)
TOP OF STONE = 177.6
TOP OF CHAMBER = 177.1
BTM OF CHAMBER = 172.1
BTM OF STONE = 171.6
ESHGWT = 167.6

PROP. CB
RIM=178.4
INV = 175.5

PROP. CB
RIM=176.4
INV = 176.4

PROP. CB
RIM=176.4
INV = 176.4

PROP. OCS-03
RIM = 178.5
WEIR = SEE DETAIL
INV = 172.1

PROP. VGC AT CURB CUTS / WITHIN R.O.W. (TYP.)

PROP. CB
RIM=177.9
INV = 175.1

APPROX LOCATION OF PROP LIMIT OF DISTURBANCE

LIMIT OF VGC

N/F SARAH REBECCA MILLER

N/F PAUL O'KEEFE

N/F STEPHAN BUCKLEY

N/F MBTA

EXC. EA AGREEMENT AREA 53

EXC. EA WATER EASEMENT BOOK 10774 PAGE 553

HIGHLAND AVENUE (PUBLIC - 60' WIDE)

MELLEN STREET

MORTON STREET

STREET 50' WIDE)

(PU

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROJECT MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SUPPORT
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REVISIONS

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PROJECT No.: MAB250036.00
DRAWN BY: JGM/DST/CA
CHECKED BY: AMB/JE
DATE: 08/12/2025
CAD I.D.: P-CIVIL-SITE

PROJECT:

SITE DEVELOPMENT PLANS

FOR

GREYSTAR

PROPOSED RESIDENTIAL DEVELOPMENT

PARCEL ID: 199/063.0-0037-0000.0
100 WEST STREET
NORFOLK COUNTY
TOWN OF NEEDHAM
MASSACHUSETTS

BOHLER
45 FRANKLIN STREET, 5th FLOOR
BOSTON, MA 02110
Phone: (617) 849-8040
www.BohlerEngineering.com

SHEET TITLE:

BMP MAP

SHEET NUMBER:

ORG. DATE - 08/12/2025

Aug 07, 2025
P:\PROJECTS\MAB250036.00\CAD\CIVIL\SITE PLANS\P-CIVIL-SITE-MAB250036.00-BMP.dwg — Layout: C-BMP
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CONTECH®
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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

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

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.